

CANADIAN COMMISSION ON BUILDING AND FIRE CODES

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**RECOMMENDED DOCUMENTATION REQUIREMENTS
FOR PROJECTS USING ALTERNATIVE SOLUTIONS
IN THE CONTEXT OF OBJECTIVE-BASED CODES**

(Discussion Paper)

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Executive Summary

The introduction of objective-based codes is expected to lead to a gradual increase in proposals of alternative solutions or equivalents to designs and systems specifically described in the codes. Since such proposals are possible under the existing equivalency provisions, the introduction of objective-based codes does not create a new need for the documentation of alternative solutions but has increased awareness of that need.

Documentation can include plans, specifications, correspondence, expert consultant reports, test reports, etc.—all the information necessary to demonstrate that the proposed construction, design or product complies with the applicable codes.

Beyond the purposes of demonstrating compliance and acquiring a building permit, there are other important reasons for requiring that the person applying for a building permit provide project documentation to the authority having jurisdiction and for requiring that the authority having jurisdiction retain that documentation for a substantial period following the construction of the building or facility:

- Most jurisdictions require that a building or facility be maintained in compliance with the codes under which it was built. Project-specific equivalencies and some alternative solutions made possible by objective-based codes may have special maintenance requirements.
- Documentation helps design professionals perform code compliance assessments of existing buildings or facilities before purchase and informs prospective buyers of existing buildings or facilities of any limitations pertaining to their future use or development.
- Documentation provides design professionals with the basic information necessary to design changes to an existing building or facility.
- Documentation of project-specific equivalencies negotiated between the original designer(s) and regulator(s) may provide a record of limitations on the use and/or future development of a building or facility.
- An acceptable solution or alternative solution could be invalidated by a proposed alteration to a building or facility. Designers and regulators must therefore know the details of the particular acceptable solutions or alternative solutions that were integral to the original design. Complete documentation should provide insight as to why one acceptable solution or alternative solution was chosen over another.
- Documentation is the “paper trail” of project-specific equivalencies negotiated between the designer and the regulator and should demonstrate that a rational process led to the acceptance of the equivalency.
- It is possible that over time a particular acceptable solution or alternative solution may be shown to be inadequate. It would be advantageous for a jurisdiction to know which projects

included that acceptable solution or alternative solution as part of their design. Documentation facilitates this type of analysis.

- Project documentation is important information to a forensic team who may be called to investigate an accident or why a design failed to provide the level of performance expected.

This paper, the authors of which include senior regulatory officials in the building, fire and plumbing fields, explores issues surrounding the documentation of alternative solutions, including the types of documentation required and the need for such documentation to be retained and kept available by the authority having jurisdiction.

Procedures used in major Canadian jurisdictions are also outlined.

Preface

The Canadian Commission on Building and Fire Codes has initiated a process to convert Canada's National Code Documents from their present mixture of prescriptive and performance requirements to a form called "objective-based." Objective-based codes will make the objectives and intents behind all requirements clear. It is expected that this will facilitate designers' and builders' proposing alternative solutions to the Codes' prescriptive requirements. The possible increased frequency with which authorities may have to deal with proposed alternative solutions has prompted this review of the role that documentation plays in dealing with alternative solutions.

The authors of this paper have attempted to identify and summarize the important issues related to building project documentation. Particular focus is on the documentation considered necessary to facilitate the review, acceptance, implementation and maintenance of alternative solutions that are expected to become more commonplace with the transition to objective-based codes.

The paper includes suggestions that may address the issues that have been raised. There will no doubt be other ways to address these issues. These ways will emerge through discussion and through the experience of using objective-based codes. For the present, however, this paper and the suggestions offered should not be regarded in concrete terms but as a collection of ideas that may be helpful in making the journey to objective-based codes a smooth one.

The purpose and use of the paper is summarized as follows:

- The paper provides a model for processing site-specific alternative solutions. Municipalities may use this model as a guide to establishing their own internal policies and procedures related to documentation.
- The paper includes some model checklists and guidelines that can assist the design professions in the preparation of design proposals. The intent would be to facilitate a timely review and acceptance of projects that include alternative solutions.
- The paper makes several suggestions as to how the National and/or Provincial codes could address some of the documentation issues both from the standpoint of requirements and/or appendix material.
- Documentation issues should be included in any training program associated with objective-based codes. It may be useful to include this paper as a component of the training programs.

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1. INTRODUCTION

The transition to objective-based codes will be an evolutionary process. While the **structure** of the new codes will be different from that of current codes, the overall **content** will not. The prescriptive requirements contained within the current model codes will still be available to designers. In the short term at least, these prescriptive solutions will be the principal means by which designers achieve code compliance.

Over time, it is expected that in addition to the traditional prescriptive requirements, quantitative performance criteria with accompanying test verification methods will be developed and included in the model codes. This will allow designers, fire protection engineers and/or product manufacturers to develop a variety of solutions to achieve code compliance.

The current code contemplates that from time to time designers and/or product manufacturers may propose an alternative solution to a prescriptive code requirement. This is provided for in Section 2.5., Equivalents, of the Code. For the most part, these equivalent proposals are project specific. Most building authorities have developed in-house review processes to evaluate these proposals and require the proponent of the equivalency to submit sufficient documentation necessary for the regulator to carry out a review of the submission.

Besides the documentation submitted for evaluation purposes, building authorities generally acknowledge the need to record project equivalencies in some fashion. That is, it is necessary to document the important details of the equivalency and to make this information available to others.

As the model codes evolve to include more compliance options (acceptable solutions), it is likely that for more complex projects, designers will opt to use many of the compliance options available. The codes should provide a clear description of the documentation necessary to determine compliance. In addition, it seems evident that more attention will have to be paid to properly documenting what acceptable solutions apply to a specific project.

This paper focuses on the issue of documentation and includes:

- discussion on the current situation with respect to the way alternative solution proposals (equivalencies) are dealt with by building authorities
- a summary of the reasons why code compliance documentation is necessary
- discussion on current code requirements for documentation and suggestions for improvements to documentation
- discussion of issues related to archiving and availability of documentation
- a summary of the issues surrounding documentation and options to address these issues

2. ALTERNATIVE SOLUTIONS

The building and fire codes have never intended to limit the appropriate use of materials, appliances, systems, equipment, methods of design or construction that are not specifically covered in the code. This is stated in Article 2.5.1.1. of the NBC;

“2.5.1.1. Alternate Materials, Appliances, Systems and Equipment Permitted

- 1) The provisions of this Code are not intended to limit appropriate use of materials, appliances, systems, equipment, methods of design or construction procedures not specifically designed herein.”

(This requirement is repeated in Subsection 1.1.2., Equivalents, of the NFC.)

The paper “Acceptance/Approval Methods for Designs, Products and Approaches Now and Under Objective-Based Codes”¹ describes the compliance infrastructure that currently exists within Canada’s building regulatory system.

Under the current system, an equivalent may be best described as a locally acceptable solution to an existing prescriptive or performance code requirement. It is primarily a site specific design solution that is negotiated between the regulator(s) and the designer(s), although in many cases, expert consultants are retained to provide advice to the designer(s). Occasionally the regulator may also seek advice of an expert consultant.

For the most part such equivalencies are evaluated and accepted and/or rejected by an individual building official or by an in-house committee of more senior building officials. In some cases, a proposed equivalent solution may be subject to a more formal review by a “commission” or by a provincial or territorial committee. Such “commissions” or committees are generally comprised of a matrix of individuals that provide broad representation of the building construction industry.

Site specific equivalents are not normally formalized into local building by-laws or provincial codes unless the equivalent to the existing code requirements becomes more widely accepted. In this case, it is in everyone’s best interest to have the solution adopted as a provincial amendment to the national code. Provincial amendments are routinely reviewed at the national level and frequently result in a change to the national code.

Local building and fire officials do get requests to allow a new product or material to be used on a specific project. Such requests are usually handled in a similar fashion to that described above. If broader acceptance is sought, it is left to the proponent of the product or material to pursue such acceptance through the testing agencies or the Canadian Construction Materials Centre (CCMC). *(Some product manufacturers still attempt to persuade regulators to accept their product by citing other jurisdictions where the product has been used. Lobbying the support of locally elected officials is not uncommon.)*

¹ Acceptance/Approval Methods for Designs, Products and Approaches Now and Under Objective-Based Codes, John F. Berndt, John C. Haysom, Russell Thomas, June 12, 1998, prepared for the Task Group on Implementation of Objective-Based Codes of the Canadian Commission on Building and Fire Codes.

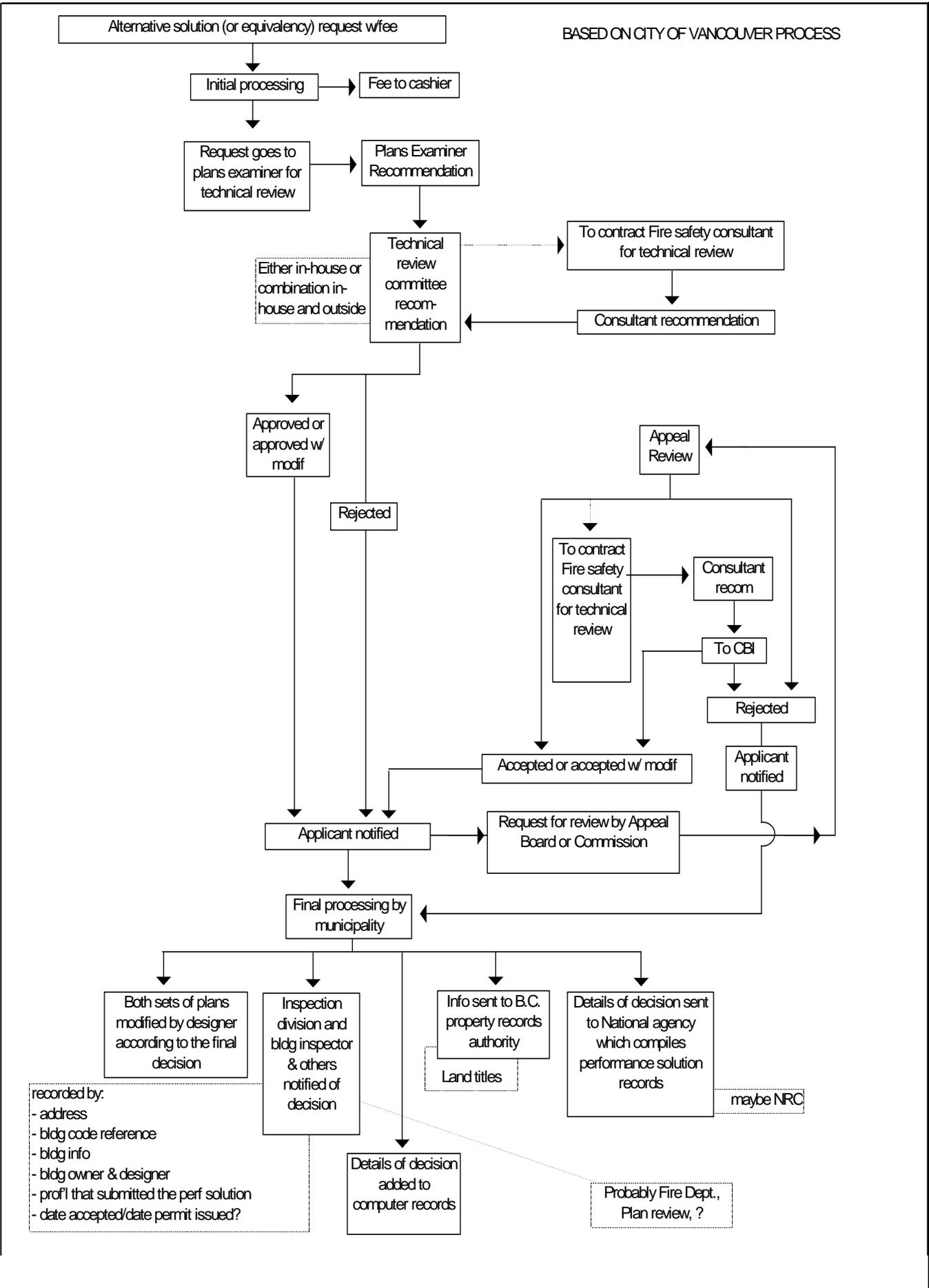
The move to objective-based codes is unlikely to have any initial impact on the way designers and local building officials deal with site specific equivalencies. If anything, the new code structure will assist in the “negotiation” process in that the intent of every existing code requirement will be clearly stated.

There is an expectation that as additional quantitative criteria and verification methods are included in the objective-based codes, the number of alternative solutions proposed by designers could increase dramatically. Whether or not this happens remains to be seen.

Most regulators do agree, however, that there is a need to review and improve current processes for dealing with site specific equivalencies particularly from the standpoint of documentation. They also agree that if the number of alternative solutions proposed and accepted for specific building projects does increase dramatically, then a mechanism or process should be implemented with a view to making a “locally acceptable solution” a “nationally acceptable solution” where this is deemed to be appropriate.

The following flow chart illustrates a process that building authorities could adopt when dealing with alternative solutions to code requirements. The chart is modelled after the procedures developed by the Vancouver building department. The bottom portion of the flow chart extends this process to include the documentation component of alternative solutions.

FLOWCHART FOR PROJECT-SPECIFIC ALTERNATIVE SOLUTION (OR EQUIVALENCY)



3. WHY DOCUMENTATION IS NECESSARY

Documentation of a building project can include plans, specifications, correspondence, expert consultant reports, test reports, etc. Many would say that it includes any and all information necessary to acquire a building permit. In fact, complete documentation should include all information necessary to demonstrate that the proposed construction is “in compliance” with the applicable codes.

Beyond acquiring a building permit and demonstrating that the proposed construction is “in compliance” with the codes of the day, there are other important reasons for providing and retaining project documentation. The following list summarizes these reasons:

- A. Most jurisdictions require that a building must be maintained in compliance with the codes under which it was built. Project specific equivalencies and some acceptable solutions available through objective-based codes may have special maintenance requirements.
 - Documentation communicates this information to building owners and property managers
 - Similarly, this documentation is vital to the regulators who have a mandate to ensure buildings are maintained in compliance with the codes. *(For example, it is not uncommon for a building to become dilapidated, necessitating a fire department order to bring the building back to its original condition.)*
- B. Over time the ownership of a building may change several times. It is becoming more common for prospective purchasers to retain the services of a design professional to undertake a code compliance assessment before purchasing the building. Complete documentation assists design professionals in this undertaking and can ensure prospective purchasers are fully aware of any limitations pertaining to the future use or development of the building.
- C. Project documentation provides design professionals with the basic information necessary to successfully undertake a code conformity assessment of an existing building when designing changes to the building. Changes could include renovations, additions, or changes in occupancy.
 - Documentation of project specific equivalencies negotiated between the original building designer(s) and regulator(s) may limit the use and/or future development of the building.
 - With objective-based codes, designers may be able to chose from a number of acceptable solutions to achieve compliance with a code functional requirement. An acceptable solution could be invalidated by the proposed change to the building. Designers and regulators must therefore know the details of the particular acceptable solutions that were integral to the original design. Complete documentation should provide insight as to why one acceptable solution was chosen over another.

- D. Project specific equivalencies are “negotiated” between the designer and the regulator. Documentation is the “paper trail” and should demonstrate that a rational process took place in arriving at the decision to accept the equivalency.
- E. It is possible that over time a particular acceptable solution may be shown to be inadequate. It would be advantageous for a jurisdiction to know which projects included that acceptable solution as part of the design. Documentation could easily allow this type of analysis to take place.
- F. Project documentation is important information to a forensic team who may be called to investigate an accident or to investigate the reasons why a building design failed to provide the level of performance expected.

4. CURRENT CODE REQUIREMENTS FOR DOCUMENTATION AND SUGGESTIONS FOR IMPROVEMENT

In the current building code, requirements for construction documents are stated in Section 2.3., Plans, Specifications and Calculations and more specifically in Sentences 2.3.1.1.(1) and 2.3.1.2.(1), which state:

“2.3.1.1. Required Information

(1) Sufficient information shall be provided to show that the proposed work will conform to this Code and whether or not it will affect adjacent property.

2.3.1.2. Required Plans

(1) Plans shall be drawn to scale and shall indicate the nature and extent of the work or proposed occupancy in sufficient details to establish that, when completed, the work and the proposed occupancy will conform to the Code.”

Furthermore, the building code requires the submission of additional information when the building project involves equivalencies. This requirement is covered in Sentence 2.5.1.2.(1) which states:

“2.5.1.2. Evidence of Equivalent Performance

(1) Any person desirous of providing an equivalent to satisfy one or more of the requirements of this Code shall submit sufficient evidence to demonstrate that the proposed equivalent will provide the level of performance required by the Code.”

The codes contemplate that building plans, specifications, expert reports, etc, provide sufficient detail to carry out a code compliance assessment. This means that documentation must clearly convey the design intent. It must identify where equivalent solutions were used and should contain sufficient information to support the decision to accept the equivalency. Complete documentation should allow persons other than the original designer(s) and/or regulator(s) to easily determine design intent and assess conformity years after project completion, not just at the time the building permit was applied for and discussions, decisions and documentation are fresh in everyone’s mind.

The codes also intend that designers have the qualifications and skills necessary to undertake the design. In the case of projects involving alternative solutions, authorities having jurisdiction may require designers to submit documentation that demonstrates that they have the qualifications and skills necessary to perform the work.

Project plans are the principal component of the project documentation package and are fundamental to carrying out a code compliance assessment. This will not change with the move to objective-based codes. The plans and accompanying documentation could become even more important because of the expected increased frequency and sophistication of alternative solutions. The transition period affords the opportunity to consider ways of improving the level of code compliance documentation from that which is included on and with current plans. The following suggestions are made:

- A. Designers can assist the code conformity assessment process by including a code analysis directly on the plans. While regulators encourage this practice, it is not presently mandatory. Provincial jurisdictions should consider mandating that a code analysis be required as part of the plan submittal package.
- B. It would be worthwhile to begin to develop a standardized format for the code analysis that is included on the plans. This could be a nationally accepted format.
 - The standardized code analysis will evolve with objective-based codes. It is recognized that documentation of acceptable solutions may take the form of an engineering report(s) that describes what the solution is, why it is needed, and how it fits into the entire design package. The code analysis provided on the design drawing could highlight the features of the acceptable solution and serve as a signpost to the existence of other more detailed documentation.
 - Because today most drawings are produced using computer drawing/design software, it would be an advantage to develop the standardized code analysis package as an add on to CAD software most commonly used by designers.
- C. The more detailed documentation of alternative solutions on the design drawings will most likely take the form of detailed engineering reports.
 - Professional practice guidelines that include an outline and recommended format for these reports should be developed.

In the case of fire protection performance design, the Society of Fire Protection Engineers (SFPE) has developed an ***“Analysis and Design Guide Draft”*** for fire protection performance design. This guideline provides an outline for the content of a “Performance Design Report” which would be prepared by a qualified professional. The guideline also outlines the content of an “Operations and Maintenance Manual” which is also prepared for a project involving performance design. This document is a reference to be used for any modifications to the building, content or processes.

5. AVAILABILITY OF DOCUMENTATION

The importance of complete documentation has been discussed. Equally important, however, is the availability of the documentation. Documentation is of little value unless it is available when needed. Some of the questions that arise in any discussion on the availability of documentation are:

- Who is responsible for storing or archiving documentation?
- How should the documentation be stored?
- Who should be permitted to have access to the documentation?
- How long should documentation be kept before it is destroyed?
- Should the documentation be added to the property title records?

Most, if not all local jurisdictions are bound by municipal by-laws and/or internal record management policies to retain documents related to all building construction for which the municipality issues a building permit. Similarly, provincial archive authorities establish policies for archiving plans and documentation for building projects that the provincial authorities regulate.

Hard copy plans, specifications, correspondence, etc, are the form in which documents are stored in most municipal and provincial “plan rooms”. Microfilm and microfiche are also common methods of archiving information. Some form of the documentation is usually kept in perpetuity, although some jurisdictions have legislation or policy which states how long documents must be kept.

With decreasing resource allocations, many building authorities are finding it difficult to properly archive documents or maintain “plan rooms”. This is particularly true in the case of paper files.

Project specific documentation which could include proprietary design solutions is the property of the building owner(s) and/or the original building designer(s). While this information is accessible to the regulators and professional associations, it is not normally made available to others except by written permission of the building owner(s).

As a final point, plans and other documentation are rarely kept on site after a building is complete. If they are, they are usually not readily available. One way to ensure that new property owners are aware of special construction features (acceptable solutions) is to require that the acceptable solution documentation be recorded with the records of the title to the property.

6. SUMMARY OF ISSUES AND OPTIONS WITH RESPECT TO DOCUMENTATION

From the previous discussion, it is evident that the proper project documentation is important to the total success of a project. It is of particular importance in projects involving alternative solutions. Proper documentation can go a long way to ensuring a speedy review and acceptance of the project by the authority having jurisdiction. It helps to ensure proper implementation of the design thereby eliminating disputes and costly changes during the construction phase. Finally, it can help to ensure continued performance of the building throughout its lifetime.

A number of issues with respect to documentation emerge. These include:

- A. **Qualifications of the Designer**
What documentation is required to demonstrate that a designer is qualified to undertake the work?
- B. **Project Documentation**
What project documentation is required, what is the content and format of this documentation, and at what stages of the project should it be provided?
- C. **Coordination of Project Documentation**
Who should ensure that the design and construction documents are coordinated and complete?
- D. **Availability of Project Documentation**
Who should be responsible for archiving project documentation, in what format should it be stored, where and for how long should it be stored?

These issues are discussed here and options that may be available to address them are presented.

6.1 Qualifications of the Designer

What form of documentation is required to demonstrate that a designer is qualified to undertake the work?

When a building involves alternative solutions, the issue of qualifications of the designer or person taking responsibility for the design is raised. What, if any, documentation is necessary to satisfy the authority having jurisdiction that the designer is qualified to undertake the work?

In many, if not most provinces, provincial registration as a professional engineer or architect would be the only requirement to undertake a design of an alternative solution. It is left to each individual professional engineer or architect, as governed by their respective codes of ethics, to decide whether or not they are qualified to undertake the work. Practice guidelines, as discussed in the previous section, may also provide some further guidance to the individual professional engineer or architect.

Some provincial professional associations and/or authorities having jurisdiction have, or are in the process of establishing, specialist certification programs as a means of further qualifying a professional in a specific area of practice. For example, the City of Vancouver recently established a building envelope specialist certification program. The City, however, recently transferred the responsibility for certification to the Architectural Institute of British Columbia (AIBC). The Association of Professional Engineers and Geoscientists of British Columbia (APEGBC) has approached the AIBC/APEGBC Joint Practice Board to discuss joint administration of the building envelope specialist certification program.

(It would seem that while authorities having jurisdiction may have a role to play in establishing professional certification programs, the administration of these programs is best left to the professional associations.)

The issue of documentation necessary to demonstrate that a designer is qualified to undertake a design of alternative solutions is addressed as follows;

- Require only that the designer satisfy the authority having jurisdiction that he or she is a member in good standing of the provincial engineering or architectural association having jurisdiction. Documentation could be as simple as a letter stating this. If the professional association or local building by-law(s) require specialist certification then the professional would be required to state that they are certified in that speciality.

Alternately,

- In addition to the above, the authority having jurisdiction could require additional documentation in the form of a résumé that –
 - states the academic qualifications of the designer,
 - discusses relevant experience, and
 - provides a list of projects of similar scope and magnitude that the designer has worked on.

(This is normally required by the professional association when an out of province professional applies to become registered in another province.)

There may be cases where an authority having jurisdiction relies on a third party to review and approve an alternative solution. In these circumstances the third party would provide the documentation described above to satisfy the authority having jurisdiction that they are qualified to undertake the work.

Methods of establishing designer qualifications may vary from jurisdiction to jurisdiction. It is recommended that authorities having jurisdiction work closely with the professional associations to arrive at a mutually acceptable solution to this issue.

6.2 Project Documentation

What project documentation is required, what is the content and format for this documentation and at what stages of the project should it be provided?

What constitutes proper documentation will vary from project to project. For many projects, properly prepared plans and specifications alone contain sufficient information for an authority having jurisdiction to establish that the design conforms to the code(s) and for the builder(s) to complete the work according to the design. Requirements for maintenance of the design are usually self evident and it is not necessary to detail them in any formal way.

Projects involving equivalencies or alternative solutions to code requirements are generally more complex, and the plans and specifications must be supplemented by additional documentation. This documentation is usually in the form of an engineering report(s) usually submitted to the authority having jurisdiction prior to, or at the plan review stage. It should facilitate the review and acceptance of the alternative solution aspects of the project by the authority having jurisdiction. Additional information beyond that which is normally supplied on construction plans and in the specifications is often necessary so that the builder(s) can successfully implement the design. Finally, many alternative solutions are significantly affected by changes that may occur to the building and/or by the lack of maintenance of one or more components of the alternative solution. This information must be documented and provided to those charged with the responsibility of maintaining the building.

The documentation necessary for many building projects that do not involve alternative solutions seems to be well established and little change to current practice is required. However, the additional documentation required for projects that do involve alternative solutions does need to be addressed particularly in terms of the content and possible formats for this documentation.

Some options available to address this issue are:

- Encourage professional associations to develop or assist in the development of practice guidelines for the preparation, submission, implementation of alternative solutions.

Many provincial engineering and architectural associations already have policies in place to develop and adopt practice guidelines pertaining to the work of their members. The Society of Fire Protection Engineers (SFPE) has developed an ***“Analysis and Design Guide Draft”*** for performance design that could form the basis of a practice guideline for the performance design of fire protection systems. Similar design guidelines could be developed for other aspects of alternative solutions such as building envelope. These guidelines should define:

- A. the technical content and suggested format for technical reports submitted during the plan review phase,
- B. additional information that should be detailed in the project plans and specifications, and
- C. the content and suggested format for any operations and/or maintenance manuals that accompany a project.

Appendix “A” includes:

- A.1) flowcharts that define the stages of a project when documentation is required and summarized the type of documentation required at each stage
- A.2) an example checklist for the content of a fire protection “Alternative Solution Report” similar to that outlined in the SFPE Design Guide Draft
- A.3) an example checklist for the content of a fire protection “Maintenance and Operations Manual” similar to that outlined in the SFPE Design and Guide Draft

an example checklist for an environmental separation “Alternative Solution Design Report”

- Provide additional requirements in the model codes or alternately in the provincial codes or municipal building by-laws that require proponents of alternative solutions to submit documentation in accordance with the practice guidelines mentioned above.
- Include a requirement in provincial codes or in municipal by-laws to require that a code analysis be included directly on all plans submitted for building permits.

6.3 Coordination of Project Documentation

Who should ensure that the design and construction documents are coordinated and complete?

For large projects that include alternative solutions, there will be a need for a single professional to coordinate all aspects of the design package. R. Weber pointed this out in the paper:

“International Code Council Performance Code: Guideline for Use”.

Weber recommends that:

“A single principal design professional is recommended to ensure that the coordination of each and every aspect of the design package is accomplished.”

A key responsibility of the principal design professional is to:

“Ensure that design/construction documents are coordinated, comprehensively complete, with appropriate delineation between plans and related documents, and contain the necessary support documentation to verify that the design complies with the applicable code provisions.”

The following action could address this issue:

- Municipal building by-laws could include a provision that gives the authority having jurisdiction the power to require that an owner to hire a “principal design professional” to coordinate all aspects of the design package.

6.4 Availability of Project Documentation

Who should be responsible for archiving project documentation, in what format should it be stored, where and for how long should it be stored?

The importance of archiving documentation so that it is available when needed has been previously discussed. Each jurisdiction must address this issue according to legislation and/or policies that are in place to govern the archiving of building permit documents and according to the resources they have available to allocate to this task.

To address the issue of availability of documentation, consideration should be given to the following:

- Because the costs of properly maintaining paper and microfilm/microfiche files will continue to increase, both local and provincial jurisdictions should give consideration to requiring that all plans (or at least plans for major projects) be submitted in an agreed upon electronic format

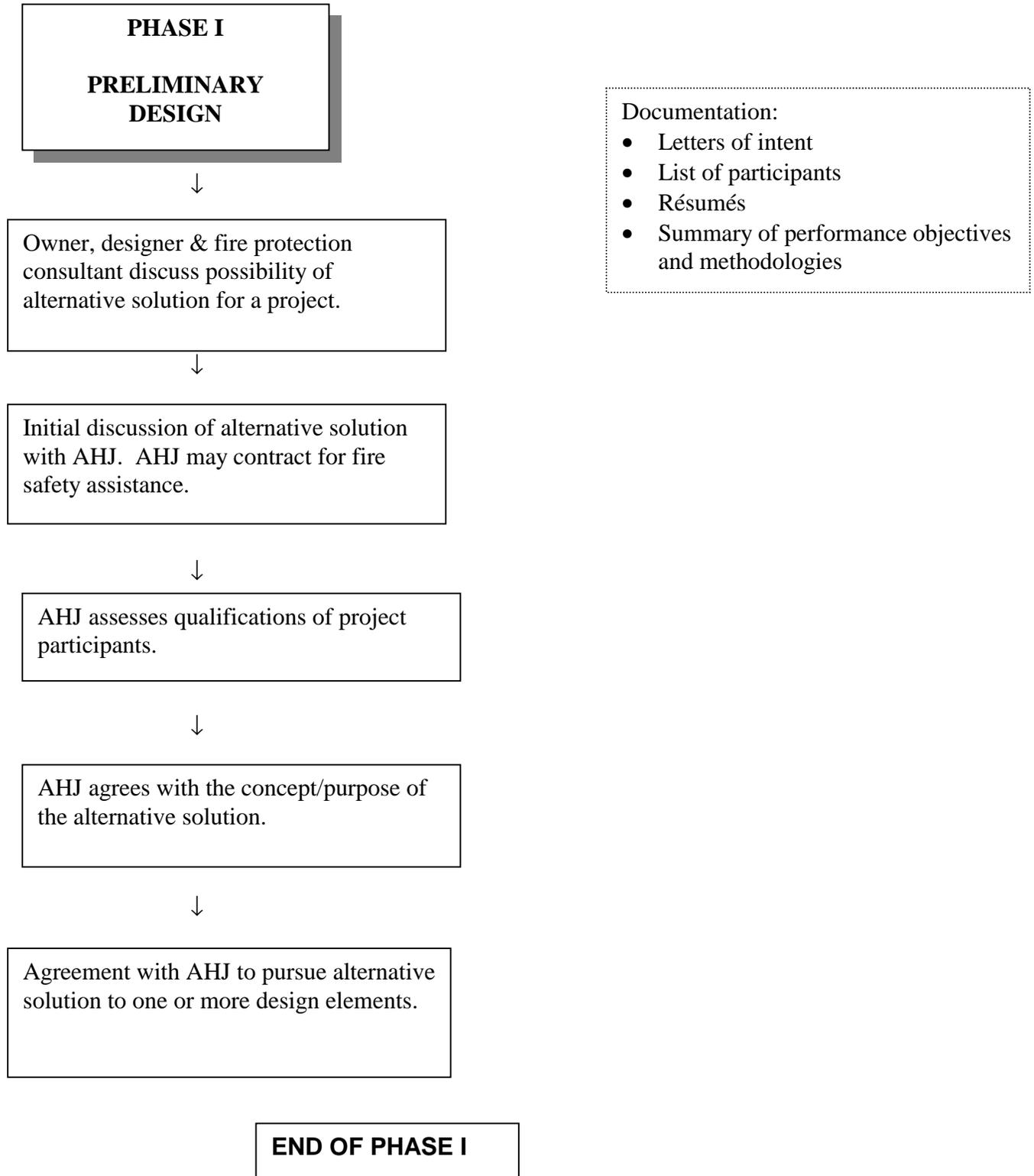
Jurisdictions that are contemplating storing documents in electronic form rather than traditional paper storage must, however, be aware of several potential problems associated with the long term storage of electronic information.

- The storage media may have a limited retention period. Schedules must be set up to regularly copy archived data to new media.
- New releases of software, operating systems and obsolescence of recording hardware could mean that stored data becomes unreadable. It may be necessary to convert existing information into the format of current applications.
- Provincial authorities should review the status of local by-laws and/or policies related to archiving project documentation. Where necessary, appropriate legislation should be put in place to ensure that relevant documentation is archived in a consistent way. This is particularly important in those jurisdictions where the regulatory function is undertaken by the private sector.
- Consideration should be given to requiring that a level of documentation be available on site. This could apply to buildings that are of a certain size and complexity. The documentation could be included in a log book that would be kept in a “building information” box located at or near the fire alarm panel.
- Consideration should also be given to including documentation on alternative solutions with transfer of title to the property.

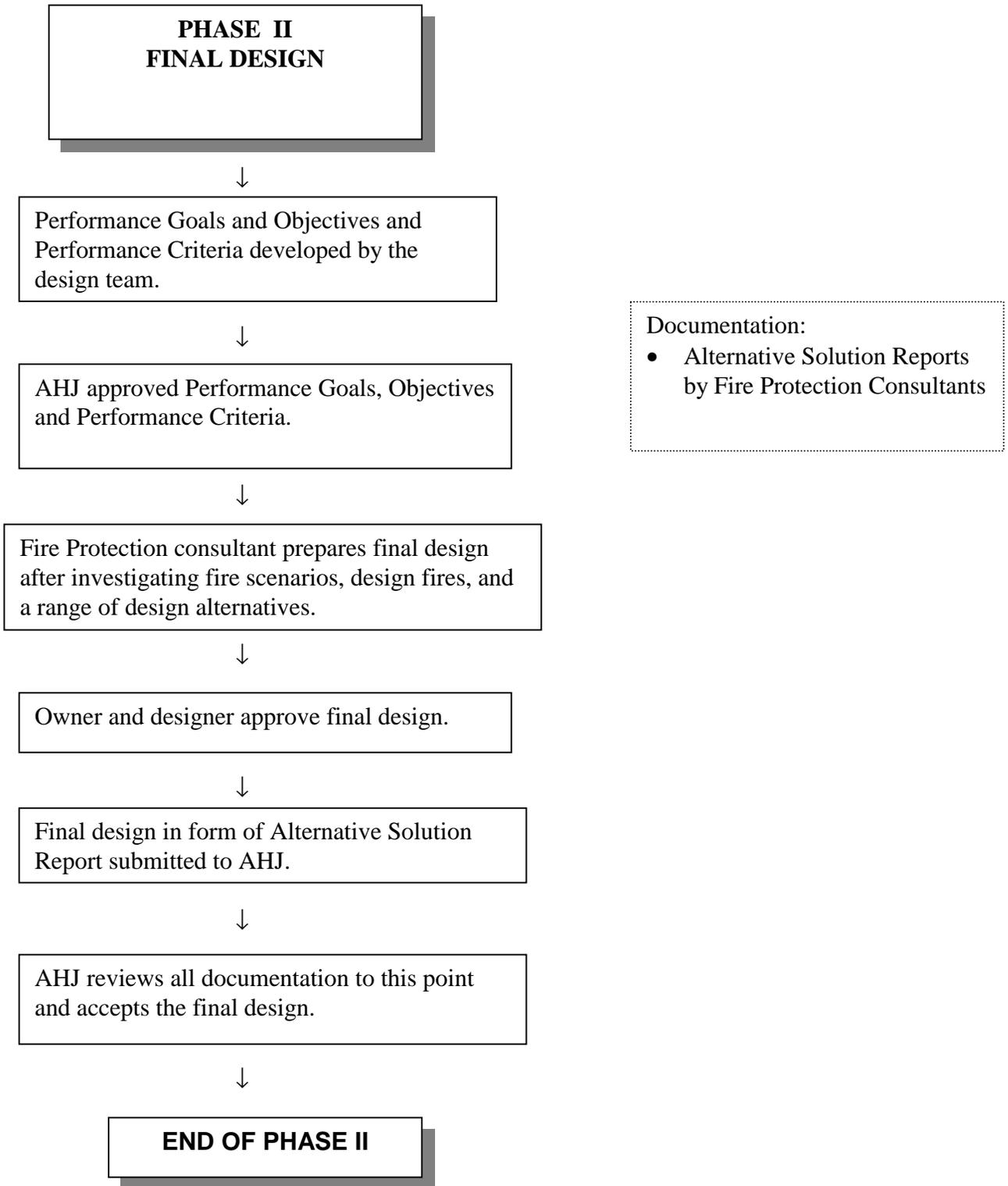
Appendix A

- A.1 Flowchart
- A.2 Example Checklist (*"Fire Protection – Alternative Solution Design Report"*)
- A.3 Example Checklist (*"Fire Protection - Maintenance and Operations Manual"*)
- A.4 Example Checklist (*"Environmental Separation Alternative Solution Design Report"*)

DRAFT FLOWCHARTS FOR IMPLEMENTATION OF
PROJECT SPECIFIC ALTERNATIVE SOLUTIONS (FIRE PROTECTION)



**DRAFT FLOWCHARTS FOR IMPLEMENTATION OF
PROJECT SPECIFIC ALTERNATIVE SOLUTIONS (FIRE PROTECTION)**



**PHASE III
DESIGN
IMPLEMENTATION**



Design drawings and specifications completed to reflect all details of the alternative solution.



AHJ reviews and accepts design drawings and specifications for permit.



Contractor constructs building in accordance with accepted design drawings and specifications. Any changes are approved by the designer and accepted by AHJ.



AHJ requires complete documentation, including as-built plans, documentation of design parameters and documentation of all agreed-upon decisions.



Designer provides AHJ and owner with a Project Operations and Maintenance Manual detailing all critical parameters and any requirements for inspection, testing and/or service to have contained compliance throughout the life of the building.



All documents archived.

Documentation:

- Construction documents, design drawings and specifications
- Final as-built drawings and specifications
- Commissioning Reports
- Letters of Certification
- Operations and Maintenance Manual

END

DRAFT DOCUMENTATION CHECKLIST

A) PROJECT PARTICIPANTS AND QUALIFICATIONS

Please complete the following information:

Owners' Representative	Name of Lead Person	
	Representing	
	Responsibility/Involvement	
	??? Qualifications: Education	
	??? Certification/ Registration/ Licensing	
	Experience relative to the Project	

Designers	Name of Lead Person	
	Representing	
	Responsibility/Involvement	
	Qualifications: Education	
	Certification/ Registration/ Licensing	
	Experience relative to the Project	

Fire Protection Consultant	Name of Lead Person	
	Representing	
	Responsibility/Involvement	
	Qualifications: Education	
	Certification/ Registration/ Licensing	
	Experience relative to the Project	

Authority Having Jurisdiction (AHJ)	Name of Lead Person	
	Representing	
	Responsibility/Involvement	
	Qualifications: Education	
	Certification/ Registration/ Licensing	
	Experience relative to the Project	

Contractor	Name of Lead Person	
	Representing	
	Responsibility/Involvement	
	Qualifications: Education	
	Certification/ Registration/ Licensing	
	Experience relative to the Project	

B) PROJECT INFORMATION

Please describe the following:

- Applicable codes and standards
- Site location
- Fire fighter/ emergency vehicle access
- Climatic conditions
- Water supply
- Physical layout
- Construction type and materials
- Existing/planned fire safety measures
- Project use
- Building major occupancy classification(s)
- Occupant characteristics
- Special hazards
- Acceptable risks/ Probability of critical events
- Building features
- Financial/loss considerations

C) PURPOSE OF THE ALTERNATIVE SOLUTION ANALYSIS

Please describe the following:

- What the analysis intends to accomplish
- Why the analysis is necessary

D) DOCUMENTATION STATEMENTS OF PERFORMANCE GOALS AND OBJECTIVES AND OF PERFORMANCE CRITERIA

Please define the following key elements of the project:

- Fire Safety Goals
- Client Loss Objectives
- Design Objectives
- Performance Criteria
- Safety Factors

E) FIRE SCENARIO DOCUMENTATION

Please describe the effects of the following for all relevant scenarios:

- Pre-fire conditions
- Possible ignition sources and fuels
- Potential for fire spread
- Key loss locations
- Probable/possible condition of occupants
- Factors which may contribute to potential fire spread
- Time of day/year
- Why scenarios not described are considered irrelevant

F) DESIGN FIRE DOCUMENTATION

Please describe the design fires, which were considered. Information should include:

- Design objective heat release rate
- Critical fire size heat release rate
- All factors considered in the life of a design fire (first item burning to point of fire decay)
- Loss threshold conditions

Please demonstrate that the design fires chosen represent the most appropriate fire scenarios for this project.

G) DOCUMENTATION OF DESIGN ALTERNATIVES

Please describe all the fire safety trial designs and how they performed relative to the documented goals and objectives and performance criteria. Compare them against the performance of the prescriptive code requirements.

H) DOCUMENTATION OF FINAL DESIGN

Please provide a thorough evaluation of the final design and a complete description of critical design features.

I) DETAILED DRAWINGS

Please provide one copy of project plans showing all details of the alternative solution.

J) DOCUMENTATION OF ENGINEERING METHODS

Please describe all engineering tools and methods used in the alternative solution analysis. Include:

- Copies of all references (must be acceptable to AHJ)
- Assumptions
- Limitations
- Engineering judgements
- Data
- Procedures
- Computer output (must be acceptable to AHJ)

K) DOCUMENTATION OF TEST, INSPECTION AND MAINTENANCE REQUIREMENTS

Please describe acceptance tests for necessary equipment/systems, as well as any necessary inspection, maintenance and periodic testing. Include any training requirements.

L) DOCUMENTATION OF THRESHOLD CONDITIONS/ DESIGN PARAMETERS

Please describe the threshold conditions used as the basis for the project design (e.g. smoke production, flame spread, occupant load and escape time, fuel loading, required building features, etc.)

M) DOCUMENTATION OF AGREED-UPON DECISIONS

Please summarize all significant decisions relating to the alternative solution design (e.g. meeting minutes, letters, phone communications, etc.)

**Example: - POST CONSTRUCTION DOCUMENTATION CHECKLIST
Maintenance and Operations (Post Construction Fire Protection)**

The following documentation should be included in the Fire Safety Plan required by the Fire Code.

PART I

DOCUMENTATION OF PROJECT CONTACT PEOPLE

A. Owner/Owner's Representatives

- Owner
- Property Manager
- Maintenance Personnel
- Fire Safety Officer(s)
- Building
- Electrical
- Plumbing/Mechanical

B. Designers

- Coordinating Professional
- Architect
- Structural engineer
- Electrical engineer
- Mechanical engineer
- Fire Protection consultant

C. Contractors

- Building
- Electrical
- Plumbing
- Mechanical

D. Representatives of Authority Having Jurisdiction

- Building Plan Review
- Building Inspection
- Fire Code Review and Inspection
- Other

PART II

DOCUMENTATION OF PROJECT INFORMATION

Please describe the following:

1) **Site Plan Information**

- Location of fire department / emergency vehicle access
- Type of water supply
- Location of fire hydrants
- Location of fire department connection(s)
- Location of annunciator panel(s)
- Location of main electrical panel(s)
- Location of emergency generator
- Location of fire pump

2) **Building Information**A) **General**

- Applicable codes and standards
- Building use(s)
 - describe uses and/or provide a tenant plan
 - state the major occupancy classification(s) assumed for the building or parts of the building
- Building size
 - building area
 - building height in storeys
 - below grade storeys
 - high building
- Construction type (combustible and/or non-combustible)
 - describe materials and/or systems used (e.g. reinforced concrete, prestressed concrete, etc.)

B) **Occupant Information**

Describe occupant characteristics (include information on occupants who may require assistance in the event of an emergency)

C) **Floor Information**

Provide a schematic diagram of each floor indicating;

- fire separations,
- demising walls,
- exits,
- fire fighter's elevator,
- elevators other than fire fighter's elevator
- areas of refuge

D) Emergency Systems

Provide information on the following;

- Fire alarm and detection systems
- Automatic fire suppression systems
- Standpipe and hose systems
- Building emergency power
- Fire fighter's elevator
- Smoke control systems

E) Operation of Emergency Systems

Describe operation requirements for all emergency systems.

(e.g. Describe actions to be taken in initiating any smoke control or other fire emergency systems.)

F) Special Hazards

Provide information on any special hazards that exist in the building (type of hazard and location of the hazard)

3) Fire Plan

Part III

DOCUMENTATION OF LOCATIONS WHERE DETAILED DRAWINGS AND SPECIFICATIONS ARE AVAILABLE

Please list all locations where detailed plans and project documentation can be obtained. (e.g. on-site, AHJ, land titles, property manager, designer)

PART IV

DOCUMENTATION OF ALTERNATIVE SOLUTIONS THAT ARE PART OF THE PROJECT

1. Description of Alternative Solutions Implemented in Project

Please provide a thorough evaluation of the final design and a complete description of all critical design features related to any alternative solutions implemented in this project.

2. Test, Inspection and Maintenance Requirements

Please describe acceptance tests for necessary equipment/systems, as well as any necessary inspection, maintenance and periodic testing. Include any training requirements.

3. Documentation of Threshold Conditions/Design Parameters

Please describe the threshold conditions used as the basis for the project design (e.g. smoke production, flame spread, occupant load and escape time, fuel loading, required building features, etc.)

4. Documentation of Agreed upon Decisions

Please summarize all significant decisions relating to the performance aspects of the fire protection design for this project (e.g. meeting minutes, letters, phone communications, etc.)

Example Checklist – ENVIRONMENTAL SEPARATION

PART I

DOCUMENTATION OF PROJECT CONTACT PEOPLE

PEOPLE

A) Owner/Owner's Representatives

- Owner
- Property Manager
- Maintenance Personnel
- Building
- Electrical
- Plumbing/Mechanical

B) Designers

- Co-ordinating Professional
 - Design and working drawings
 - Contract administration
 - Inspections
 - Testing
 - Commissioning
- Architect
- Structural engineer
- Electrical engineer
- Mechanical engineer

C) Contractors

- Building
- Electrical
- Plumbing
- Building Envelope

D) Representatives of Authority Having Jurisdiction

- Building Plan Review
- Building Inspection
- Fire Code Review and Inspection
- Other

PART II**DOCUMENTATION OF PROJECT INFORMATION**

Please describe the following:

1) Drawing Information

- Applicable codes and standards
- Site plan
- Floor plans
- Building sections
- Wall sections
- Drainage Plan
- Window details
- Statement of design concept relative to Part 5 (see example)*
- Outline description of key environmental separation systems and materials including joint methods
- Operating conditions of spaces, air pressure, temperature, relative humidity

*** Example: Statement of Design Concept Relative to Part 5**

The intended operating conditions of the building (state any exceptions for certain spaces) will be between 30% and 55% relative humidity at 21 degrees Celsius. The design air leakage is 0.10 L/(s•m²) at 75 Pa.

The air barrier in the insulated roof membrane assembly will be formed by the metal roof deck together with mechanically fastened gypsum wallboard and fully ballasted EPDM roofing membrane.

The air barrier system in the exterior cavity walls will be achieved by a torched-on modified bitumen membrane system fastened by adhesives to the edges of all wall penetrations.

Roof drainage will be through interior roof drains.

The crawl space will be protected by perimeter subsoil drainage tubing and an interior branch of the same tubing, in zones to three sump pump pits.

Exterior face of all structural grade beams will be protected with trowelled-on damp-proofing.

2) Supporting Information

- Dew-point calculations
- Heat loss/gain calculations
- Wind load calculations

Part III**DOCUMENTATION OF LOCATIONS WHERE DETAILED DRAWINGS AND SPECIFICATIONS ARE AVAILABLE**

Please list all locations where detailed plans and project documentation can be obtained. (e.g. on-site, AHJ, land titles, property manager, designer)

PART IV**DOCUMENTATION OF ALTERNATIVE SOLUTIONS THAT ARE PART OF THE PROJECT**

- 1. Description of Alternative Solutions Implemented in Project**
Please provide a thorough evaluation of the final design and a complete description of all critical design features related to any alternative solutions implemented in this project.
- 2. Test, Inspection and Maintenance Requirements**
Please describe acceptance tests for necessary equipment/systems, as well as any necessary inspection, maintenance and periodic testing. Include any training requirements.
- 3. Documentation of Threshold Conditions/Design Parameters**
Please describe the threshold conditions used as the basis for the project design
- 4. Documentation of Agreed upon Decisions**
Please summarize all significant decisions relating to the performance aspects of the environmental separation design for this project (e.g. meeting minutes, letters, phone communications, etc).

