9. Performance Approach

This chapter summarizes the whole building performance approach to compliance. It includes a discussion of computer methods, the procedures involved in determining the energy budget and the proposed building's energy use, and how to plan check performance compliance. The basic procedure is to show that the Time Dependent Valuation (TDV) energy of the proposed design is less than or equal to the TDV energy of the standard design, where the standard design is a building like the proposed design, but one that complies exactly with both the mandatory measures and the prescriptive requirements.

The performance method is the most detailed and flexible compliance path. The energy performance of a proposed building design can be calculated according to actual building geometry and site placement. Credit for certain conservation features, such as a daylit atrium, cannot be taken in the prescriptive approach, but could be evaluated with an approved computer program.

The contents of this chapter are organized as follows:

1. Section 9.1 describes the basic concepts and procedures involved in using the performance approach.
2. Section 9.2 describes analysis procedures used to demonstrate compliance, including the rules used to generate the annual energy budget.
3. Section 9.3 reviews the basic scenarios for compliance, including cases when the permit application includes less than a whole building.
4. Section 9.4 outlines the enforcement and compliance process, including the plan check documents required when using the performance approach.

This chapter is not a substitute for the compliance supplement of any particular approved computer program or for the detail provided in the Nonresidential ACM Manual.

9.1 Performance Concepts

The Warren-Alquist Act requires "performance standards," which establish an energy budget for the building in terms of energy consumption per ft² of floor space. This requires a complex calculation of the estimated energy consumption of the building, and the calculation is best suited for a computer. The Energy Commission uses a public domain computer program to do these calculations. For compliance purposes, it also approves the use of privately developed computer programs as alternatives to the public domain computer program. The public domain computer program and the Commission-approved privately developed programs are officially called alternative calculation methods (ACMs). The rules for approval of privately developed ACMs are contained in the *Residential and Nonresidential Alternative Calculation Method Approval Manuals* that are commonly referred to as "*ACM Manuals*."

It's easiest to talk about these programs as "compliance software," and we will use that term throughout this manual.

9.1.1 Minimum Capabilities

Approved programs must simulate or model the thermal behavior of buildings and the interaction of their space conditioning, lighting and service water heating systems. The calculations include:

1. Heat gain and heat loss through walls, roof/ceilings, doors, floors, windows, and skylights.
2. Solar gain from windows, skylights, and opaque surfaces.
3. Heat storage effects of different types of thermal mass.
4. Building operating schedules for people, lighting, equipment and ventilation.
5. Space conditioning system operation including equipment part load performance.

9.1.2 California Energy Commission Approval

Alternative calculation methods must be approved by the California Energy Commission. Approval involves the demonstration of minimum modeling capabilities required input and output, and adequate user documentation. The program must be able to:

1. Automatically calculate the custom energy budget.
2. Calculate the energy use of the proposed design in accordance with specific fixed and restricted inputs.
3. Print the appropriate standardized compliance forms with the required information and format if and only if a proposed building complies. Other reports that do not resemble forms may be printed for non-complying buildings.

Input and output requirements and modeling capabilities are tested by using the program to calculate the energy use of certain prototype buildings under specific conditions, and the results are compared with the results from a reference computer program, which is DOE-2.1E. These requirements for compliance software are spelled out in detail in the Nonresidential ACM Manual.

9.1.3 Time Dependent Valuation (TDV)

Beginning with the 2005 Standards, the “currency” for assessing building performance is time dependent valued (TDV) energy. TDV energy replaces source energy, which has been the currency since the California Energy Commission first adopted Standards in 1978.

TDV, as the name implies, values energy differently depending on the time it is used. This means that electricity saved on a hot summer afternoon will be worth more in the compliance process than the same amount of electricity saved on a winter morning. The value assigned to energy savings through TDV more closely

reflects the market for electricity, gas, propane and other energy sources and provides incentives for measures, such as thermal storage or daylighting, that are more effective during peak periods.

Reference Joint Appendix JA3 provides more information on TDV energy and detailed TDV data is available from the California Energy Commission upon request. §102 states: "TDV multipliers for propane shall be used for all energy obtained from depletable sources other than electricity and natural gas."

Professional Judgment

Certain modeling techniques and compliance assumptions applied to the proposed design are fixed or restricted. That is, there is little or no freedom to choose input values regarding specific input variables for compliance modeling purposes. However, there remain other aspects of computer modeling for which professional judgment is necessary. In those instances, it must be exercised properly in evaluating whether a given assumption is appropriate.

Enforcement agencies have full discretion to question the appropriateness of a particular input, especially if the user has not substantiated the value with supporting documentation.

Two questions may be asked in order to resolve whether good judgment has been applied in any particular case:

1. Is the approach or assumption used in modeling the proposed design consistent with the approach or assumption used in generating the energy budget?

The rule is to model the proposed design using the same assumption and/or technique used by the program in calculating the energy budget unless drawings and specifications indicate specific differences that warrant conservation credits or penalties.

2. Is a simplifying assumption appropriate for a specific case?

If simplification reduces the energy use of the proposed building when compared to a more explicit and detailed modeling assumption, the simplification is not acceptable.

PERFORMANCE CERTIFICATE OF COMPLIANCE Part 2 of 3 **PERF-1**

Nonresidential Sample Building — DATE 1/18/2005

ANNUAL TDV ENERGY USE SUMMARY (kBtu/sqft-yr)

ENERGY COMPONENT	Standard Design	Proposed Design	Compliance Margin
Space Heating	1.74	3.19	-1.45
Space Cooling	169.80	138.91	30.89
Indoor Fans	89.08	90.51	-1.43
Heat Rejection	0.00	0.00	0.00
Pumps & Misc.	0.00	0.00	0.00
Domestic Hot Water	0.00	0.00	0.00
Lighting	95.52	93.69	1.83
Receptacle	64.25	64.25	0.00
Process	23.03	23.03	0.00
TOTALS:	443.41	413.58	29.83

Percent better than Standard: 6.7% (7.1% excluding process)

BUILDING COMPLIES

GENERAL INFORMATION

Building Orientation	(North) 0 deg	Conditioned Floor Area	4,480 sqft.
Number of Stories	2	Unconditioned Floor Area	0 sqft.
Number of Systems	3	Conditioned Footprint Area	2,880 sqft.
Number of Zones	3	Fuel Type	Natural Gas

	Orientation	Gross Area	Glazing Area	Glazing Ratio
Front Elevation	(North)	800 sqft.	320 sqft.	40.0%
Left Elevation	(East)	1,040 sqft.	320 sqft.	30.8%
Rear Elevation	(South)	1,900 sqft.	260 sqft.	13.7%
Right Elevation	(West)	720 sqft.	0 sqft.	0.0%
Total		4,460 sqft.	900 sqft.	20.2%
Roof		2,880 sqft.	0 sqft.	0.0%

	Standard	Proposed
Lighting Power Density	1.314 W/sqft.	1.330 W/sqft.
Prescriptive Env. Heat Loss	931 Btu/h	1,077 Btu/h
Prescriptive Env. Heat Gain	91,938 Btu/h-F	86,777 Btu/h-F

LEED™ Energy & Atmosphere Credit

Savings vs. Title 24[1] 8.38%

Energy Performance Credit[2] 1 Points

1. excludes process and receptacle 2. see LEED table 8-c or 8-d

Remarks:

Run Initiation Time: 01/18/05 11:45:45 Run Code: 1106077545

EnergyPro 4.0 By EnergySoft User Number: 0000 Job Number: M98000 Page:4 of 21

Figure 9-1 – Annual TDV Energy Use Summary (Sample of PERF-1, Part 2 of 3)
Note: Figure may vary due to different versions.

Example 9-1

Question

If a PERF-1 shows that the proposed energy use of the "HVAC Fans and Pumps" exceeds the standard design energy budget, but the total energy use is less than the energy budget, does the building still comply?

Answer

Yes. More fan energy is being used by the proposed design, but the "Total" proposed energy use is less than the "Total" standard design energy budget, therefore the building complies.

9.2 Analysis Procedure

§141

This section is a summary of the analysis procedures used in demonstrating compliance with approved compliance software (computer programs). Program users and those checking for enforcement should consult the most current version of the compliance software user's manual and/or on-line Help and associated compliance supplements for specific instructions on the operation of the program.

Although there are numerous requirements for each compliance software input, the data entered into each approved computer program may be organized differently from one program to the next. As a result, it is not possible in this summary to present all variables in their correct order or hierarchy for any one program. The aim is simply to identify the procedures used to calculate the standard design energy budget and the TDV energy use of the proposed building.

9.2.1 General Procedure

Any approved computer program may be used to comply with the Standards. The following steps are a general outline of the process:

1. All detailed data for the building component or components must be collected including glazing, wall, door, roof/ceiling, and floor areas, construction assemblies, solar heat gain coefficients, mass characteristics, equipment specifications, lighting, and service water heating information from the drawings and specifications.

   Although most computer programs require the same basic data, some information, and the manner in which it is organized, may vary according to the particular program used. Refer to the compliance supplement that comes with each program for additional details.

   Be sure that the correct climate information has been selected for the building site location (see Reference Joint Appendix JA2). Compliance softwares adjust the climate data for each climate zone based on the rules described in Reference Joint Appendix JA2 and adjusted for local conditions using ASHRAE design data from Joint Appendix 2.

2. The program user chooses construction assemblies from Reference Joint Appendix JA4; however, approved software can make certain modifications to the standard constructions assemblies in Reference Joint Appendix JA4 to accommodate project specific conditions.

3. Prepare an input file that describes the other thermal aspects of the proposed design according to the rules described in the program's compliance supplement.

   Input values and assumptions must correctly correspond to the proposed design and conform to the required mandatory measures.

4. Run the computer program to automatically generate the energy budget of the standard design and calculate the energy use of the proposed design.

Note: When creating any computer input file, use the space provided for the project title information to concisely and uniquely describe the building being modeled. User-designated names should be clear and internally consistent with other buildings being analyzed in the same project. Title names and explanatory comments should assist individuals involved in both the compliance and enforcement process.

9.2.2 Basic Data Entry

The following elements are used by approved computer programs. These elements must be consistent with plans and specifications submitted in the building permit application:

1. **Gross Exterior Surfaces**: All gross exterior surfaces, each with its respective area, orientation and tilt.
2. **Opaque Exterior Walls**: Each opaque exterior wall construction assembly, as well as wall area, orientation and tilt. Heat capacities, or characteristics necessary to determine the heat capacity (conductivity, mass, volume) of opaque exterior walls, must be included.
3. **Doors**: All doors must be included.
4. **Opaque Roofs/Ceilings**: Each opaque exterior roof/ceiling construction assembly, as well as roof/ceiling area, solar reflectance and thermal emittance, orientation and tilt. Heat capacity, or characteristics necessary to determine the heat capacity (conductivity, mass, volume) of opaque exterior roof/ceilings, must be included.
5. **Raised Floors and Slab Floors**: Each floor construction assembly, as well as floor area.
6. **Glass in Walls and Shading**: Each vertical glass area, orientation, tilt, U-factor and solar heat gain coefficient.
7. **Horizontal (Skylight) Glass and Shading**: Each horizontal or skylight glass area, orientation, tilt, U-factor and solar heat gain coefficient.
8. **Ventilation (Outside) Air**: Ventilation (or outside air) values in cfm/ft².
9. **Fan Power**: Fan power must be included. Fan power should be based on either brake horsepower (HP) at ARI conditions, nominal HP at ARI conditions, or brake horsepower at actual operating conditions (modeled horsepower must be substantiated by information contained in the construction documents).
10. **Cooling and Heating Efficiency**: The actual efficiency of the equipment included in the proposed design.
11. **HVAC System Type**: The basic type of the cooling and heating system (multiple zones or single zone) and the heating system fuel type (fossil fuel or electric). Note that some projects may have different system types serving separate zones.
12. **No Heating or Cooling Installed**: If total heating or cooling capacity is not specified, the TDV energy use will be based on a standard design heating or cooling system (§141(b)).

13. **Sensible and Total Cooling System Capacity**: Sensible and total output capacity of the cooling system at ARI conditions.
14. **Heating System Capacity**: The output capacity of the heating system.
15. **Other System Values**: All other space conditioning system components that are used by approved computer programs.

Refer to the ACM Approval Manual for more detailed information on how each of the above values is used by the computer programs.

9.2.3 Calculating TDV Energy

The compliance software calculates TDV energy for three main components: the space conditioning energy use, the lighting energy use, and the service water heating energy use. It does not include energy for plug loads from computers (even though a default value for the internal gains from plug loads are modeled in the hourly computer simulation), vertical transportation, garage ventilation, outdoor lighting or other miscellaneous energy uses.

The key component of calculating the TDV energy use of the proposed building is that if a feature of the building is not included in the building permit application, the energy use of that feature is equal to that of the standard energy budget (§141(b)). That means that if a permit is submitted for a shell building (envelope only), and the performance approach is used to demonstrate compliance, trade-offs cannot be made between the envelope and the mechanical or lighting system.

Space Conditioning Energy Budget

The space conditioning budget is defined in §141(a)1, as "... the TDV energy used for space conditioning in a standard building in the climate zone and city in which the proposed building is located, calculated with a method approved by the Energy Commission..." The space conditioning energy budget is automatically determined from the program user's inputs from the corresponding elements of the proposed design. This budget is automatically re-calculated each time a compliance run is done.

Lighting Energy Budget

The lighting energy budget is defined in §141(a)2, as "...the TDV energy used for lighting in a standard building calculated with a method approved by the Energy Commission..." The budget consists of the lighting power used by a building based on one of the following criteria:

1. When no lighting plans or specifications are submitted for permit, and the occupancy of the building is not known, the standard lighting power density is 1.0 W/ft².
2. When no lighting plans or specifications are submitted for permit and the occupancy of the building is known, the standard lighting power density is equal to the corresponding Watt per ft² value derived in the Complete Building Method of §146(c)1.

3. When lighting plans and specifications are submitted for permit, the standard and proposed lighting power density is equal to the corresponding total allowed lighting power (in watts) calculated using either the Complete Building Method, the Area Category Method, or the Tailored Method [§146(b,c)1, 2 or 3]. A complete set of lighting plans and prescriptive forms are required for use of the Tailored Lighting Method in the performance approach.

For all occupancies except hotel guest rooms and high-rise residential living quarters, the proposed lighting power density is expressed in W/ft². For residential occupancies (hotel guest rooms or high-rise residential buildings), the approved computer program will set the proposed lighting power density and the standard design LPD at the same the value as specified in the ACM Approval Manual.

Service Water Heating Energy Budget

The service water heating energy budget is defined in §141(a)3 as "...the TDV energy used for service water heating in a standard building calculated in the climate zone in which the proposed building is located, calculated with a method approved by the Energy Commission..." The budget consists of the service water heating energy used by a building, assuming the service water heating system meets both the mandatory and prescriptive requirements for water heating.

The service water heating TDV energy use is calculated using a method described in the ACM Manual using the proposed building service water heating system. This system must be consistent with plans and specifications submitted in the building permit application.

For high-rise residential buildings, the water heating TDV energy budget is calculated using the methods and assumptions documented in the Residential ACM Manual. The procedure is the same as for low-rise residential buildings.

9.3 Application Scenarios

The performance approach may be used for whole building permit applications; for permit applications that only involve the building envelope or the mechanical system; or that involve any combination of the building envelope, the mechanical system, and the lighting system together. Lighting cannot be done alone in the performance approach. When less than a whole building is being considered, this is called a permit phase, e.g. the building envelope would be constructed in one permit phase, the mechanical system in another, etc.

9.3.1 Whole Building Compliance

Whole buildings are projects involving buildings where the applicant is applying for permits, and submits plans and specifications for all the features of the building (envelope, mechanical, lighting and service water heating). This could be a first-time tenant improvement that involves envelope, mechanical and lighting compliance; or a complete building, where plans and specifications for the entire building are being submitted for permit.

When a whole building is modeled using the performance approach, trade-offs can be made between the envelope, space conditioning, service water heating, and lighting systems that are included in the permit application.

9.3.2 Compliance by Permit Stage

Compliance with only one or more building permit stages can be done using the performance approach except that electrical lighting cannot be done alone. A permit stage is a portion of a whole building permit: either envelope, mechanical, or electrical. In §141(b) it states that only the features of the building that are included in the building permit application can be modeled. This means that trade-offs in energy use are limited to include only those features included in the building permit application.

There are two basic scenarios that occur when performing compliance by permit stage: modeling future construction features that are not included in the permit application, and modeling existing construction that has complied with the Standards.

Modeling Future Construction by Permit Stage

When a feature of a building is not included in the permit application, it is required to default to a feature automatically determined in the computer program. The defaults vary for envelope, mechanical, and lighting. The ACM Manual and the program vendor's compliance supplement contain additional information on the default values.

The default envelope features do not apply when modeling future construction. Usually, this is the first permit requested and at a minimum this feature must be modeled. The proposed building's envelope features are input and an energy budget is automatically generated based on the proposed building's envelope, and/or space conditioning and lighting system.

The default space conditioning system features are fixed if no space conditioning system exists in the building. A standard package gas/electric unit is assumed for each thermal zone in the proposed design. The package system is sized based on the envelope design and whether it meets the prescriptive requirements. If a space conditioning system is included in the permit application, the default space conditioning system is based on the standard design as determined in the ACM Manual.

The default service water heating system features are fixed based on building occupancy. Default service water heating systems are specified for each occupancy type.

The default lighting system features depend on whether or not the occupancy of the building is known. If the building occupancy is known, the allowed lighting power density is determined using the Complete Building Approach for each zone that the occupancy is known. If the building occupancy is not known, 1.0 W/ft² is assumed for both the proposed energy use and the energy budget.

Modeling Existing Construction by Permit Stage

When a feature of a building is not included in the permit application, and it is an existing building feature, it is required to default to a feature automatically determined in the computer program. The defaults vary for envelope, mechanical, and lighting. The ACM Manual contains additional information on the default values.

The default envelope features are based on the program user's inputs to the computer program. The proposed building's conditioned floor area, glazing, wall, floor/soffit, roof/ceiling, and display perimeter features are input by the program user. The computer program then applies the proposed building's features to the standard design in order to calculate the energy budget. This means that if an application for an envelope permit is not being sought, the computer program will automatically default the features of the standard design to be the same as the features of the proposed design. Only the EXISTING-ENV will be printed to document the existing building.

The default space conditioning system features are fixed based on the building's existing space conditioning system. The program user inputs the existing space conditioning system, including actual sizes and types of equipment. The computer program then applies the proposed building's space conditioning features to the standard design in order to calculate the energy budget. This means that if an application is not being sought for a mechanical permit, the computer program will automatically default the features of the standard design to be the same as the features of the proposed design. No mechanical forms will be printed.

The default service water heating system features are fixed based on building occupancy. Default service water heating systems are specified for each occupancy type. Water heating information will only be listed as "existing".

The default lighting system features are based on the known occupancy of the building. The allowed lighting power density is determined based on the actual lighting power density of the building. The computer program then applies the proposed building's features to the standard design in order to calculate the energy budget. This means that if an application for a lighting permit is not being sought, the computer program will automatically default the features of the standard design to be the same as the features of the proposed design. No LTG form will be printed. All reported lighting will be reported on the PERF-1 Performance Certificate of Compliance.

9.3.3 Additions Performance Compliance

An addition is treated similar to a new building in the performance approach. Since both new conditioned floor area and volume are created with an addition, all systems serving the addition will require compliance to be demonstrated. This means that either the prescriptive or performance approach can be used for each stage of the construction of the addition.

Note: When existing space conditioning or water heating is extended from the existing building to serve the addition: those systems do not need to comply.

Addition Only

Additions that show compliance with the performance approach, independent of the existing building, must meet the requirements for new buildings. In §149(a)2, it states that the envelope and indoor lighting in the conditioned space of the addition, and any newly installed space conditioning or service water heating system serving the addition, must meet the mandatory measures and the energy budget determined in the performance run:

1. If the permit is done in stages, the rules for each permit stage apply to the addition performance run.
2. If the whole addition is included in the permit application, the rules for whole buildings apply.

Existing Plus Addition

Additions may also show compliance by either:

1. Demonstrating that efficiency improvements to the envelope component of the existing building, as well as certain lighting and mechanical improvements, offset substandard addition performance (see §149(a)2Bii), or
2. That the existing building combined with the addition meets the §149(b).

§149(a)2 states that the envelope and indoor lighting in the conditioned space of the addition, and any newly installed space conditioning or service water heating system serving the addition, must meet the mandatory measures just as if it was an addition only. The energy use of the combination of the altered existing building plus the proposed addition shall be equal to or less than the energy use of the existing building with all alterations meeting the requirements of §149(b)2 plus the standard energy budget of an addition that complies with §141.

This approach also allows the applicant to improve the energy efficiency of the existing building so that the entire building meets the energy budget that would apply, if the existing building was unchanged, and the addition complied on its own. Changes to features in the existing building are considered alterations.

No credit is given to an alteration until the improvement meets or exceeds the requirements in §149(b)2B; if the altered component fails to meet the requirements of §149(b)2B, there will be a penalty equal to the difference between the new altered value and the values from §149(b)2B. Once the altered feature meets or exceeds the §149(b)2B requirements, the amount of credit is based on the difference between the new altered value and the original level. The credit that is allowed for trade-off by improving existing building features is limited to the amount the new feature in the existing building exceeds the minimum standard for a new building as described in §149(b)2B. In this analysis, features that are changed in the existing building to an efficiency less than that required by §149(b) will result in an energy penalty.

It is important to note that the term "entire building" means the ensemble of all enclosed space in a building, including the space for which a permit is sought, plus all conditioned and unconditioned space within the structure. However, the inclusion of the unconditioned spaces do not affect the overall performance

budget of the building as the lighting allowances cannot be traded off between the conditioned and unconditioned spaces, and the installed lighting in the unconditioned portion of the building does not affect the heating and cooling budget of the building. To show compliance with this approach you need to follow the instructions in the computer program's compliance supplement.

When using this compliance approach it is important to take into account all changes in the building's features that are removed from or added to the existing building. Documentation of the existing building's features is required to be submitted with the permit application if this method is used.

Example 9-2

Question

3,000 ft² of conditioned space is being added to an existing office building. 60 percent of the lights in the existing office space are being replaced with more efficient fixtures. Can credit be taken for the improved lights in the existing building to comply through the existing-plus-addition performance approach?

Answer

Credit can only be taken for lighting efficiency improvements resulting in a lower lighting power density than is required to meet §146. Otherwise, credit may be taken for improvement(s) to the envelope component only. Lighting in the existing building must meet all prescriptive requirements in this case (more than 50 percent of the lights replaced or the connected load is increased).

9.3.4 Alterations Performance Compliance

Using the performance approach for an alteration is similar to demonstrating compliance with an addition.

Alterations of the Permitted Space

Altered spaces can show compliance with the performance approach independent of the remainder of the existing building, and must meet the requirements for the newly altered components of the buildings as specified in §149(b)2B and C. §149(b)2 states that the envelope and lighting of the alteration, and any newly installed space conditioning or service water heating system serving the alteration, must meet the mandatory measures and the permitted space alone shall comply with the energy budget determined using Energy Commission-approved compliance software.

If the permit is done in stages, the rules for each permit stage apply to the alteration performance run.

Alterations in Existing Buildings

Alterations may also show compliance by demonstrating that efficiency improvements to parts of the existing building, not initially included in the desired alteration offset, decreased performance of the initial alteration compared to an

alteration meeting the prescriptive alteration requirement. §149(a)2 states that envelope, lighting, space conditioning or service water heating system alterations must meet the mandatory measures.

The energy use of the combination of the altered existing building plus the proposed addition shall be equal to or less than the energy use of the existing building with all alterations meeting the requirements of §149(b)2 plus the standard energy budget of an addition that complies with §141. This approach also allows the applicant to improve the energy efficiency of the existing building so that it meets the energy budget that would apply to the entire building if the existing building other than the portion being altered was unchanged. Changes to features in the existing building are considered alterations.

No credit is given to an alteration until the improvement meets or exceeds the requirements in §149(b)2B; if the altered component fails to meet the requirements of §149(b)2B, there will be a penalty equal to the difference between the new altered value and the values from §149(b)2B. Once the altered feature meets or exceeds §149(b)2B requirements, the amount of credit is based on the difference between the new altered value and the original level. Therefore, the credit that is allowed for trade-off by improving existing building features is limited to the amount the new feature in the existing building exceeds the minimum standard for a new building as described in §149(b)2B. In this analysis, features that are changed in the existing building to an efficiency less than that required by §149(b) will result in an energy penalty.

To show compliance with this approach you need to follow the instructions in the computer program's compliance supplement. When using this compliance approach, it is important to take into account all changes in the building's features that are removed from or added to the existing building as a part of the alteration. Documentation of the existing building's features is required to be submitted with the permit application if this method is used.

Existing-Plus-Addition-Plus-Alteration

For additions, the most flexible compliance method is to consider the entire existing building along with the addition (Existing + Addition + Alteration)[17]. The rules for this method are documented in the program vendor's compliance program supplement. Compliance is shown using an approved computer program. Through this method, credit may be taken for energy efficiency features added to the existing building. When prescriptive approach is used, compliance can be demonstrated if the altered component meets or exceeds the requirements of §149(b)1 for that component. When the performance approach is used, the altered component must meet or exceed the requirements in §149(b)2, or another alteration(s) must be made to the existing building, which exceeds the requirements of §149(b)2 that saves the additional energy necessary to at least make up for the alteration(s). Alternatively, when there is an addition, the addition could be designed to exceed prescriptive requirements to offset proposed existing building alterations that do not meet prescriptive requirements. The rest of this section assumes that the performance approach is used to demonstrate compliance. Altered components not meeting the requirements of §149(b)2 will result in an energy "penalty" in the compliance calculation.

[17] This method may also is be used whenever an alteration is made to existing buildings, whether or not there is an addition to the building at the same time.

In general, the following rules apply to Existing + Addition + Alteration:

1. For roof/ceiling insulation, the altered components must meet or exceed the requirements of Tables 143-A, B, or C.
2. For roofing products (cool roofs), the altered components must meet or exceed the requirements of §149(b)1B.
3. For wall insulation, the altered components must meet or exceed the requirements of Standards Tables 143-A, B, or C.
4. For floor/soffit insulation, the altered components must meet or exceed the requirements of Standards Tables 143-A, B, or C.
5. Altered fenestration components must meet or exceed the U-factor and SHGC requirements of Standards Tables 143-A, B, or C, in order to result in an energy "credit" in the performance calculation. The allowed glass area shall be the smaller of the subsections a and b below:
    a. The proposed glass area,
    b. The larger of:
        i. The existing glass area; or
        ii. The area allowed in §143(a)5A.
6. For space conditioning equipment and ducts, the altered components must meet or exceed the requirements of §149(b)1C, §149(b)1Di or §149(b)1Diib, and §149(b)1E.
7. For service water heating systems, the altered components must meet or exceed the requirements of §145.
8. For lighting systems, the altered components must meet or exceed the requirements of §149(b)1F and §149(b)1H.

The proposed design budget is based on the actual value of the altered component(s). If the altered component values (proposed design) meets or exceeds the requirements of §149(b)2B (items 1 through 8 above), then there will be an energy credit for the difference between the proposed design and the standard design, where the standard design is based on the existing condition of that component. The existing condition may be based on documentation at the time of application for the alteration permit. If the altered component does not meet the requirements of §149(b)2B (items 1 through 8 above), there will be an energy penalty for the difference between the proposed design and the standard design, where the standard design is based on having that component meet the requirements in §149(b)2B.

Therefore, it is important to note that the standards budget is calculated in two different ways, depending upon whether the altered component meets or fails to meet the prescriptive requirements for the component that are described in §149(b)2B (items 1 through 8 above):

1. If the altered component meets or exceeds the prescriptive requirements §149(b)2B, the standards budget is based on the actual value for the component; and

2. If the altered component fails to meet the prescriptive requirements, then the standards budget will be based on prescriptive requirements for that component §149(b)2B.

Alterations may include previous improvements that were made to the building after original permit (when the existing building was first constructed). The upgraded efficiency value of that component will be the proposed design and the standard design will be based on the vintage of the original building. The permit applicant must provide evidence that the previous improvements were made subsequent to the original construction of the building. Such evidence may involve receipt, signed statement from previous owners, or in case where previous owners are not available, signed statement of the current owner or other record.

Note that previous improvements that have been used to achieve compliance for previous additions and alterations should not be considered for compliance for subsequent additions and alterations. In this case the efficiency value of the previously altered component should be shown as the standard design. In this case, existing insulation and glazing that are to be considered as unchanged for the purposes of achieving compliance are modeled in both the standard and proposed designs as they presently exist when this can be ascertained, and modeled in both the standard and proposed design as vintage table values when existing conditions are not readily discernible. The compliance software performance program will use the modeled existing component values or the vintage table values to develop the standard budget, based on the information described above. For example, if a 1975 building in climate zone 12 was built with U-factor of 0.60 for fenestration and was subsequently upgraded to 0.47 U-factor, then the compliance software performance program would model the existing condition as U-factor of 0.60 and model the proposed condition as U-factor of 0.47. Consequently, the credit would be relative to the difference between U-factors of 0.60 and 0.47.

Note that if in this example, had the fenestration U-factor had been upgraded to any value greater than 0.47 (for example 0.55), which is the Standards Table 143-A requirement for fenestration U-factor in climate zone 12, the alteration would be subject to a penalty for the difference between U-factors of 0.55 and 0.47.

9.3.5 Alternate Performance Compliance Approach

Any addition, alteration or repair may demonstrate compliance by meeting the requirements applicable to new buildings for the entire building. Using this method, the entire building could be shown to comply in permit stages or as a whole building. The rules for new buildings permit stage compliance, and whole building compliance would apply.

Documentation of the existing building's features is required to be submitted with the permit application if this method is used.

9.4 Enforcement and Compliance

At the time a building permit application is submitted to the enforcement agency, the applicant also submits plans and energy compliance documentation. This section describes the forms and procedures for documenting compliance with the

performance requirements. The ACM Manual has specific and detailed output/reporting requirements for all approved compliance software.

Compliance software output is required to specify the run initiation time, a unique runcode, and the total number of pages of forms printed for each proposed building run on each page whenever a building complies with the Standards and compliance output has been selected. The plan checker is strongly encouraged to verify these output features for a performance compliance submittal to ensure that the submittal is a consistent set of compliance documentation. The ACM Manual forbids compliance software from printing standard compliance forms for a proposed building design that does not comply. The plan checker should pay special attention to the PERF-1 form and the Exceptional Conditions List on Part 2 of that form. Every item on the Exceptional Conditions List deserves special attention and requires additional documentation, such as manufacturer's cut sheets or special features on the plans and in the building specifications.

The compliance software requirements will automatically produce and reiterate the proper set of forms that correspond to the particular proposed building submitted for a permit, but the plan checker should verify the type of compliance and the required forms from the lists below. Whenever an existing building (or building components) is involved in compliance, the plan checker should look for the term EXISTING that identifies EXISTING building components. Similarly if the compliance form indicates a component is REMOVED or ALTERED these changes should be verified. In the types of permit applications where some building components are unknown, the unknown components cannot be entered by the user and cannot be reported on output forms.

The following discussion is addressed primarily to the enforcement agency plan checkers who are examining documents submitted to demonstrate compliance with the Standards, and to the designer preparing construction documents and compliance documentation.

Most compliance forms associated with the computer method approach are generated automatically. These reports are similar in information content and layout to their prescriptive method counterparts.

The following summary identifies the forms that are required for performance compliance. All submittals must contain the following information:

1. Unless minimal efficiency and default capacities are used in the performance analysis, either equipment cut sheets showing rated capacities, fan bhp, and airflow at ARI conditions, or the installation certificate must be provided.
2. Other documentation supporting each non-standard or non-default value used in the performance approach and indicated in the Exceptional Conditions list on the PERF-1 form must also be included.

Other reports that may be generated by a program are:

1. Construction Assemblies Worksheet for adjusting and combining assemblies from Reference Joint Appendix JA4
2. Formatted Copy of Input.

The following computer generated forms are required by the ACM Manual for a permit application:

Whole Building Compliance (the number of parts is the minimum number of pages):

- PERF-1: Performance Certificate of Compliance
- ENV-1C: Envelope Certificate of Compliance (2 parts)
- MECH-1C: Mechanical Certificate of Compliance (1 part)
- MECH-2C: Air System, Water Side System, Service Hot Water & Pool Requirements (3 parts)
- MECH-3C: Mechanical Ventilation (1 part)
- LTG-1C: Lighting Certificate of Compliance (3 parts)

The LTG-4C (Lighting Controls Credit Worksheet) and LTG-6C (Tailored Method Summary and Worksheet) forms may be, and typically will be, submitted by hand. When these pages are hand submitted or submitted independently, they will not be included in the page count automatically generated by the computer for a compliance submittal.

Note: The use of the tailored lighting approach requires independent prescriptive compliance for the lighting system.

Compliance By Permit Stage (the number of form parts are the same as indicated above at Whole Building Compliance).

9.4.1 Approaches

Envelope Only

PERF-1: Performance Certificate of Compliance

ENV-1C: Envelope Certificate of Compliance (2 parts)

Envelope and Mechanical

PERF-1: Performance Certificate of Compliance

ENV-1C: Envelope Certificate of Compliance (2 parts)

MECH-1C: Mechanical Certificate of Compliance (1 part)

MECH-2C: Air System, Water Side System, Service Hot Water & Pool Requirements (3 parts)

MECH-3C: Mechanical Ventilation (1 part)

Mechanical Only

PERF-1: Performance Certificate of Compliance

MECH-1C: Mechanical Certificate of Compliance (1 part)

MECH-2C: Air System, Water Side System, Service Hot Water & Pool Requirements (3 parts)

MECH-3C: Mechanical Ventilation (1 part)

Possibly existing ENV and/or existing LTG forms: (for partial compliance alteration)

Mechanical and Lighting

PERF-1: Performance Certificate of Compliance

MECH-1C: Mechanical Certificate of Compliance (1 part)

MECH-2C: Air System, Water Side System, Service Hot Water & Pool Requirements (3 parts)

MECH-3C: Mechanical Ventilation (1 part)

LTG-1C: Lighting Certificate of Compliance (3 parts)

LTG-4C: Lighting Controls Credit Worksheet (if control credits used)

LTG-6C (3 parts): Tailored Method Summary and Worksheet (if tailored lighting used)

Existing ENV forms: (for partial compliance alteration)

9.4.2 Compliance Forms

ENV-1-C: Envelope Certificate of Compliance

The performance ENV-1C Envelope Compliance Summary form has one part. It summarizes the opaque surfaces including surface type, construction type, area, azimuth, and U-factor. Next it summarizes the fenestration surfaces including fenestration type, area, azimuth, U-factor, frame type and solar heat gain coefficient. Lastly, it includes exterior shading and overhangs including shade type, solar heat gain coefficient, overhang height and overhang width.

For a description of the information contained on the ENV-1C Envelope Compliance Summary, see ENV-1C, Part 2 of 2.

ENV-2-C: Envelope Component Method

The envelope component method can be used when fenestration and skylight areas do not exceed prescriptive limits, when roofing products meets mandatory performance criteria of §118, and when all envelope components meet prescriptive criteria in §143 .

ENV-3-C: Overall Envelope Method

This form is identical to the form required in the prescriptive approach. This form is used when the overall envelope approach is used to show envelope compliance. This allows for trade-offs between different envelope components.

MECH-1-C: Mechanical Certificate of Compliance

The MECH-1C Mechanical Compliance Summary form is in one part.

For a description of the information contained on the MECH-1C Mechanical Certificate of Compliance, consult the computer program's compliance supplement.

MECH-2-C: Air System, Water Side System, Service Hot Water & Pool Requirements

The MECH-2C identifies the mechanical equipment modeled in the alternative computer program to show compliance.

For more information on the MECH-2C, refer to the computer program's compliance supplement.

MECH-3-C: Mechanical Ventilation

The MECH-3C Mechanical Ventilation contains the information on the design outdoor ventilation rate for each space. Refer to the computer program's compliance supplement for more information.

LTG-1-C: Lighting Certificate of Compliance

The LTG-1C Lighting Certificate of Compliance form is a single part form. It is used to describe the lighting fixtures and control devices designed to be installed in the building.

For a description of the information contained on the LTG-1C Lighting Certificate of Compliance, see LTG-1C, Part 2.

If control credits were input by the program user, a copy of the LTG-4C must accompany the permit application. If the tailored method was used, a copy of the LTG-6C must accompany the permit application along with a complete set of lighting plans and specifications.

9.4.3 Performance Inspection

Performance approach inspection is identical to other inspections required by the Standards. For information on inspection of envelope, mechanical and lighting systems, refer to Chapter 2, Compliance and Enforcement.

When tailored lighting is used to justify increases in the lighting load, a lower lighting load cannot be modeled for credit. The standard design building uses the lesser of allowed Watts per ft² or actual lighting power to be installed in the building. The proposed design building uses the actual lighting power to be installed as detailed on the lighting plans. This value must be equal to or greater than the allowed Watts per ft².