The Code Corner

RLGA Technical Services

No. 40 — Summer 2012

Construction Documents Revisited

2012 International Building Code

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The topic of construction documents was addressed in a previous article of *The Code Corner*[1]. However, the message of that article was the broad subject of construction documents by building code definition and did not broach methods of how to actually communicate code-related information in the documents. This article and a companion article in RLGA's *Keynotes*[2] series will expand on the previous *Code Corner* article by introducing methods to better communicate building code compliance within the drawings and specifications.

Plan reviews can take a few days up to several weeks or months depending on the size of the project. For design professionals, knowing the timeframe for a typical plan review in the jurisdiction of the project is important—it should be considered when developing the design schedule to ensure a realistic date for permit approval. Even though the jurisdiction may indicate a long review time, the entire review period is not devoted to a single set of construction documents—plans examiners are reviewing multiple projects at the same time. Thus, plans examiners can only afford so much time to review a set of construction documents submitted for permit, and the easier it is for the plans examiner to review a set, the quicker the review will be completed.

Consolidate Code-Related Information

Probably the most time-consuming part of a plan review is finding all the pieces of information in the construction documents that support compliance with the building code. The *International Building Code* (IBC) specifies what information is required, but it does not specify *how* that information should be indicated. The plan review process can be streamlined by summarizing detailed construction drawing information on code-specific sheets near the front of the set of documents.

Some jurisdictions may expand upon the basic requirements found in the IBC by establishing a required format for presenting code-related data. An example of this is North Carolina's "Appendix B." Section 104.1.1 of the North Carolina Administrative Code requires that "Construction specifications and drawings, including Appendix B of this code" shall be submitted. The form itself states that the data in the Appendix be reproduced "on the building plans sheet 1 or 2." This standardizes the location and organization of code information, which makes it easier for designers and plans examiners alike.

However, not all jurisdictions are like the State of North Carolina, so this article attempts to bridge that gap by providing guidance on how to show code information in a set of construction documents. The United States National CAD Standard version 5 (NCS) includes a module specifically addressing code information on drawings. NCS Module 8, "Code Conventions," provides recommendations on location, format, and graphic representation of some code-related information. Although the NCS recommendations establish a good baseline from which to start, they do not provide detailed examples of how to address other significant code information required in construction documents.

[1] See *The Code Corner* No. 25 "Construction Documents," June 2007.
[2] See *Keynotes* No. 12 "Specifying for Code Compliance," available in September 2012.

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Code Data on Drawings

If you are a design professional, you have probably designed a project for an existing building, whether it was an alteration or addition. If you were lucky, the owner had record drawings of the original construction—if you were *really* lucky, those drawings had detailed code information. How nice it would be to look at a set of record drawings and be able to determine what codes were applicable and to follow the design team's code application process. That is exactly what the plans examiner is looking for in a set of documents.

The code data sheet (or the first sheet if more than one code data sheet is provided) should provide basic code data, such as the adopted codes applicable to the project, the construction type, the installation of a fire sprinkler system or not, the storage or use of hazardous materials, and the applicable occupancy groups (See Figure 1). If the building is a mixed occupancy, identify the method that will be applied: separated, nonseparated or a combination of both. Applicable incidental uses per Section 509 may be listed, as well as accessory occupancies that comply with Section 508.2. If special requirements of Chapter 4 and Section 510 apply, those can be identified with a brief description. Another item to include in this portion of the code data is a listing of any applicable reference documents, such as approved reports, variances, and code modifications.

Adopted Codes:

2006 International Building Code as amended by the City of Phoenix
2006 International Fire Code as amended by the City of Phoenix
2006 International Mechanical Code as amended by the City of Phoenix
2006 International Energy Conservation Code as amended by the City of Phoenix
2006 Uniform Plumbing Code as amended by the City of Phoenix
2005 National Electrical Code (NFPA 70) as amended by the City of Phoenix

Reference Documents: Fire and Life Safety Report (FLSR) No. 09001

Type of Construction: IIB

Fire Sprinklered Throughout: Yes; Section 903.3.1.1 (NFPA 13-2007)

Basement: No

Occupancy Classifications: Mixed occupancy, nonseparated occupancies, in accordance with Section 508.3.2

Group A-1
Group A-3
Group B
Group S-2

Figure 1 - Basic code data showing information such as a list of adopted codes, construction type, occupancy groups, and the presence of a sprinkler system. Note the inclusion of an approved report as a reference document.

Following the code basics on the same sheet should be detailed information on how the building complies with the broader requirements of allowable height and area (See Figures 2 and 3). The height and area data should include actual floor areas and building height and allowable height and floor areas per Table 503. If increases to allowable areas and height are permitted, show the calculations and compare the allowable numbers to the actual numbers to show compliance. If the building has more than one story, calculations should show that each story is within the allowable area and that the overall building is within the total allowable building area. Since the intent of the code data information is to explain the designer's code application process, each step of all calculations should be shown. This allows the plans examiner to follow step-by-step how the building complies.

Examples of Showing Allowable Height and Area

Actual Floor Areas:

Without Lobby Alternate:

First Floor:	11,881 sq. ft.
Second Floor:	7,180 sq. ft.
Total:	19,061 sq. ft.

With Lobby Alternate:

First Floor:	13,700 sq. ft.
Second Floor:	7,180 sq. ft.
Total:	20,880 sq. ft.

Actual Height: 2 stories; 47 ft.

Tabular Building Height: Table 503.

Allowable Stories:

Group A-1:	2 stories *(Most Restrictive)*
Group A-3:	2 stories
Group B:	4 stories
Group S-2:	4 stories

Maximum Height: 55 ft.

Height Increase:

1 additional story per Section 504.2:

Group A-1:	2 stories + 1 story = 3 stories *(Most Restrictive)*
Group A-3:	2 stories + 1 story = 3 stories
Group B:	4 stories + 1 story = 5 stories
Group S-2:	4 stories + 1 story = 5 stories

3 stories > 2 stories, therefore okay

20 additional feet per Section 504.2:

55 ft. + 20 ft. = 75 ft. > 47 ft., therefore okay

Tabular Allowable Floor Area (A_t): Table 503.

Group A-1:	8,500 sq. ft. *(Most Restrictive)*
Group A-3:	9,500 sq. ft.
Group B:	23,000 sq. ft.
Group S-2:	26,000 sq. ft.

Allowable Area Increases:

Allowable Area (A_a) per Floor Calculation per Section 506.1:

Frontage Increase = 0 (Not required)

Sprinkler Increase (I_s) = 2

$A_a = \{A_t + [A_t \times I_f] + [A_t \times I_s]\}$

$A_a = \{8{,}500 + [8{,}500 \times 0] + [8{,}500 \times 2]\}$

$A_a = \{8{,}500 + 0 + 17{,}000\}$

A_a = 25,500 sq. ft. > 13,700 sq. ft., therefore okay

Figure 2 - The above example shows the presentation of height and area requirements for a building that uses the nonseparated occupancies method. Notice that the most restrictive occupancy group is identified.

Allowable Area Increases: Allowable Area (A_a) per Floor Calculation per Section 506.1:

Frontage Increase (I_f):

$I_f = [F / P - 0.25]\ W / 30$

F = 349 ft.

P = 746 ft.

W = 30 ft.

$I_f = [349 \text{ ft.} / 746 \text{ ft.} - 0.25]\ 30 \text{ ft.} / 30$

$I_f = [0.47 - 0.25]\ 1$

$I_f = 0.22$

Sprinkler Increase (I_s) = 2 (More than one story above grade plane)

Allowable Area Calculation:

$A_a = \{A_t + [A_t \times I_f] + [A_t \times I_s]\}$

A_t = (See "Tabular Allowable Floor Area" above)

$I_f = 0.22$

$I_s = 2$

Group A-1:

$A_a = \{8{,}500 \text{ sq. ft.} + [8{,}500 \text{ sq. ft.} \times 0.22] + [8{,}500 \text{ sq. ft.} \times 2]\}$

A_a = 8,500 sq. ft. + 1,870 sq. ft. + 17,000 sq. ft.

A_a = 27,370 sq. ft.

Group B:

$A_a = \{23{,}000 \text{ sq. ft.} + [23{,}000 \text{ sq. ft.} \times 0.22] + [23{,}000 \text{ sq. ft.} \times 2]\}$

A_a = 23,000 sq. ft. + 5,060 sq. ft. + 46,000 sq. ft.

A_a = 74,060 sq. ft.

Group F-1:

$A_a = \{15{,}500 \text{ sq. ft.} + [15{,}500 \text{ sq. ft.} \times 0.22] + [15{,}500 \text{ sq. ft.} \times 2]\}$

A_a = 15,500 sq. ft. + 3,410 sq. ft. + 31,000 sq. ft.

A_a = 49,910 sq. ft.

Group S-1:

$A_a = \{17{,}500 \text{ sq. ft.} + [17{,}500 \text{ sq. ft.} \times 0.22] + [17{,}500 \text{ sq. ft.} \times 2]\}$

A_a = 17,500 sq. ft. + 3,850 sq. ft. + 35,000 sq. ft.

A_a = 56,350 sq. ft.

Area Ratio Calculations:

First Floor:

Group A-1: 14,240 sq. ft. / 27,370 sq. ft. = 0.52

Group B: 4,531 sq. ft. / 74,060 sq. ft. = 0.06

Group F-1: 4,494 sq. ft. / 49,910 sq. ft. = 0.09

0.52 + 0.06 + 0.09 = 0.67 < 1, therefore, okay

Second Floor:

Group B: 7,428 sq. ft. / 74,060 sq. ft. = 0.10

Group S-1: 1,966 sq. ft. / 56,350 sq. ft. = 0.03

0.10 + 0.03 = 0.13 < 1, therefore, okay

Total Building: (Basement not included)

0.67 + 0.13 = 0.80 < 2, therefore, okay

Figure 3 - The above example shows the allowable area calculations for another building that uses the separated occupancies method. Allowable area calculations are provided for each occupancy group and the actual-to-allowable ratios are calculated for each floor.

In regard to the allowable area increase for frontage, the open space widths and perimeter lengths used to calculate the value of *W* per Section 506.2.1 should be identified on a site plan—preferably a site plan prepared specifically for relaying code information. The open space widths should be identified as such so as not to confuse them with fire separation distances, since these are not necessarily the same.

Since the building height is measured from the grade plane, the grade plane elevation should be calculated and shown on the code sheets if the grade surrounding the building is not relatively level. The grade plane calculation should be included in the same area with the building height calculations. The grade elevation points around the building that are used to determine the grade plane should be identified on the code-related site plan mentioned above.

The next section of code data is the fire resistance criteria for the building. This section does not specifically identify locations for fire-resistive construction in the building (that will be covered later), but is provided to show that the designer understands the fire-resistive requirements of the code. This section will essentially replicate Tables 601 and 602 as they apply to the construction type and occupancies used by the building. This section should also include fire-resistive requirements for specific applications and uses, such as exits, shafts, corridors, incidental uses, control areas, and fire areas, to name a few. To ease the plan review process, references to specific sheets and details can be provided that show specific construction and materials used.

In the same category as fire-resistive construction, but deserving special attention, are the requirements for exterior wall opening protection. Unlike openings in fire-resistive wall and horizontal assemblies, which are prescribed based on an assembly's type and rating, exterior wall openings have area limitations based on fire separation distance.[3] Like open space for a frontage increase, the site plan needs to show fire separation distances for all sides of the building—especially if the distances are less than 30 feet. The fire separation distances are then used in calculations in this section of the code data to determine the allowable areas of protected and unprotected openings per floor. Comparisons of actual opening areas to allowable opening areas should be provided to show compliance.

The next section, means of egress, is probably the most complicated. Means of egress can be shown on the code data sheets in one of three ways: in tabular form, graphically on the drawings, or a combination of both. The combination method probably provides the best means of describing egress compliance, since number-based data are best shown in a table while egress paths and distances are best shown on the floor plans. Regardless of the method used, the following information should be present: occupant load of each space, the number of exits required and provided, exit width required and provided, travel distances, and lengths of common paths of egress travel. Graphic representation of egress on the drawings is discussed later in the article.

Required Fixtures - Male

Occupancy	Occupant Load	Water Closets		Lavatories	
		Rate	Number	Rate	Number
A-1	250	1 per 125	2.00	1 per 200	1.25
A-3	470	1 per 125	3.76	1 per 200	2.35
B	26	1 per 25 for first 50	1.02	1 per 40 for first 80	0.64
S-2	1	1 per 100	0.01	1 per 100	0.01
		Raw Totals	6.79		4.25
		Required	7		5

Figure 4 - Example table on how to show plumbing fixture calculations to determine minimum number of required fixtures. This example only shows the male requirements. A similar table is provided for female fixtures.

Plumbing fixtures are another code requirement that should be summarized in the code data sheet. Minimum plumbing fixture counts are determined using the occupant load determined for the building[4] (See Figure 4) and should be compared to the actual fixture count provided in the design (See Figure 5). If using the urinal substitution for fixtures in male restrooms, show the number within each restroom.

[3] See *The Code Corner* No. 35 "Openings – Part 2," Spring 2011.
[4] See *The Code Corner* No. 33 "Calculating Plumbing Fixture Counts," Fall 2010.

Another code requirement often overlooked in the designer's code data sheets is the calculation for required portable fire extinguishers. If fire extinguishers are required per Section 906.1, then the calculations determining the size and minimum number of required fire extinguishers (See Figure 6) should be provided[5]. To confirm compliance, indicate the number of extinguishers provided and show the location for each on the floor plans. If not readily apparent, travel distances to the fire extinguishers can be shown on the floor plans.

Provided Fixtures

	Water Closets	Urinals	Lavatories
Required Fixtures - Male	**7**	**0**	**5**
Men's Restroom 111	3	2	3
Men's Restroom 216	1	2	3
Family Restroom 112	1	0	1
Provided Fixtures – Male	**5**	**4**	**7**

Figure 5 - Example table comparing the required minimum number of fixtures to those provided. Breaking the provided numbers down by each restroom helps the plans examiner locate the fixtures in the drawings. Note the column for urinals. Another column could be added to provide this calculation.

FIRE EXTINGUISHERS

Table 906.3.1, Ordinary Hazard, 1,500 sq. ft. per Unit of "A"

2A extinguishers provided = 2 x 1,500 sq. ft. = 3,000 sq. ft. per extinguisher

Without Lobby Alternate:

First Floor: 11,881 sq. ft. / 3,000 sq. ft. = 3.96, therefore, 4 extinguishers required (4 provided)

Second Floor: 7,180 sq. ft / 3,000 sq. ft. = 2.39, therefore 3 extinguishers required (4 provided)

With Lobby Alternate:

First Floor: 13,700 sq. ft. / 3,000 sq. ft. = 4.56, therefore, 5 extinguishers required (5 provided)

Second Floor: 7,180 sq. ft / 3,000 sq. ft. = 2.39, therefore 3 extinguishers required (4 provided)

Figure 6 - Example showing one method on how to provide calculations for determining the size and quantity of portable fire extinguishers. Take note that the expected fire hazard ("Ordinary") is indicated.

If the jurisdiction has adopted an energy code, the code data sheets can be called into service to provide the required information. The type of information to be provided in the construction documents can be as simple as the required information per Sections C103.2 and R103.2 of the *International Energy Conservation Code* (IECC) for commercial and residential projects, respectively. Another approach is to reproduce a copy of a report provided by applications such as COMcheck™ for commercial projects and REScheck™ for residential projects (See Figure 7)[6]. These reports can be inserted into the code data sheets or submitted as a separate document. However, providing the information in the code data sheets increases the chance that the energy compliance data will be available for future reference as a record document.

Other code-compliance information specific to a project can also be provided in the code data sheets such as calculation of smoke vent area for stages, compliance with minimum emergency escape and rescue window area, and calculation of refuge area for horizontal exits.

Graphically Shown Code Data

As previously mentioned, some code data are better shown graphically in drawings than in notes or tables—a variation of the old adage that "a picture is worth a thousand words." The drawings used for

[5] See *The Code Corner* No. 31 "Portable Fire Extinguishers," Spring 2010.

[6] The COMcheck™ and REScheck™ programs are developed by the U.S. Department of Energy through the Building Energy Codes Program and are available for free at http://www.energycodes.gov/. The programs provide energy performance compliance based on ICC (International Code Council), ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers), and a variety of jurisdictional energy codes.

code purposes should be tailored to that specific use—extraneous drawing information not applicable to code purposes should be deleted or, for CAD drawings, have unnecessary layers turned off.

Location of fire-resistive construction can be shown on the plans through the use of special line types. The NCS recommends a bold line with one, two, or three diamonds to indicate 1-, 2-, or 3-hour wall construction. However, this method falls short of providing complete information about the wall: is it a fire partition or a fire barrier? Additional information can be added to the line types to provide the necessary information (See Figures 8 and 9).

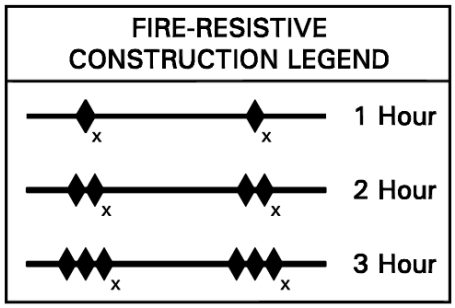
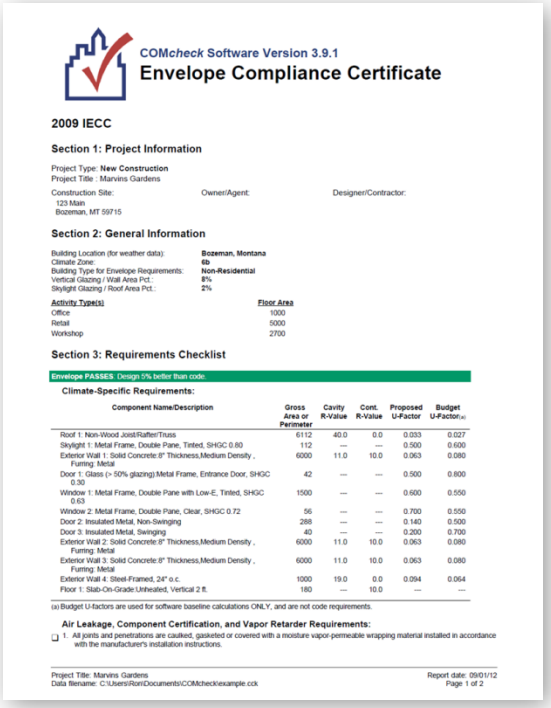


Figure 8 - Line type legend for fire-resistive wall construction. The X by the diamonds is replaced by one of the descriptors that describes the appropriate type of fire-resistive construction.

If fire-resistive construction is used to divide the building into smaller fire areas, then the fire areas can be labeled with an identifier (*e.g.* "Fire Area 1"), most restrictive occupancy group, and floor area. The floor area can be tied to calculations for allowable area, fire sprinkler requirements (to show that a sprinkler system is not required), or any other code requirement that is based on fire area size.

For buildings storing or using hazardous materials, control areas can be shown on the plans, similar to fire areas, along with the separating fire-resistive construction. Each control area can be graphically shown with an identifier that ties each control area to a table listing hazardous materials proposed for the control area with allowable and actual quantities.



COMcheck Software Version 3.9.1

Envelope Compliance Certificate

2009 IECC

Section 1: Project Information

Project Type: New Construction
Project Title : Marvins Gardens

Construction Site:
123 Main
Bozeman, MT 59715

Owner/Agent:

Designer/Contractor:

Section 2: General Information

Building Location (for weather data):	Bozeman, Montana
Climate Zone:	6b
Building Type for Envelope Requirements:	Non-Residential
Vertical Glazing / Wall Area Pct.:	8%
Skylight Glazing / Roof Area Pct.:	2%

Activity Type(s)	Floor Area
Office	1000
Retail	5000
Workshop	2700

Section 3: Requirements Checklist

Envelope PASSES: Design 5% better than code

Climate-Specific Requirements:

Component Name/Description	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Proposed U-Factor	Budget U-Factor(a)
Roof 1: Non-Wood Joist/Rafter/Truss	6112	40.0	0.0	0.033	0.027
Skylight 1: Metal Frame, Double Pane, Tinted, SHGC 0.80	112	---	---	0.500	0.600
Exterior Wall 1: Solid Concrete:8" Thickness,Medium Density , Furring: Metal	6000	11.0	10.0	0.063	0.080
Door 1: Glass (> 50% glazing),Metal Frame, Entrance Door, SHGC 0.30	42	---	---	0.500	0.800
Window 1: Metal Frame, Double Pane with Low-E, Tinted, SHGC 0.63	1500	---	---	0.600	0.550
Window 2: Metal Frame, Double Pane, Clear, SHGC 0.72	56	---	---	0.700	0.550
Door 2: Insulated Metal, Non-Swinging	288	---	---	0.140	0.500
Door 3: Insulated Metal, Swinging	40	---	---	0.200	0.700
Exterior Wall 2: Solid Concrete:8" Thickness,Medium Density , Furring: Metal	6000	11.0	10.0	0.063	0.080
Exterior Wall 3: Solid Concrete:8" Thickness,Medium Density , Furring: Metal	6000	11.0	10.0	0.063	0.080
Exterior Wall 4: Steel-Framed, 24" o.c.	1000	19.0	0.0	0.094	0.064
Floor 1: Slab-On-Grade:Unheated, Vertical 2 ft.	180	---	10.0	---	---

(a) Budget U-factors are used for software baseline calculations ONLY, and are not code requirements.

Air Leakage, Component Certification, and Vapor Retarder Requirements:

☐ 1. All joints and penetrations are caulked, gasketed or covered with a moisture vapor-permeable wrapping material installed in accordance with the manufacturer's installation instructions.

Project Title: Marvins Gardens
Data filename: C:\Users\Ron\Documents\COMcheck\example.cck

Report date: 09/01/12
Page 1 of 2

Figure 7 - Example of an "Envelop Compliance Certificate" produced by the COMcheck™ program. Many jurisdictions that have adopted an energy code will accept these certificates as verification of compliance.

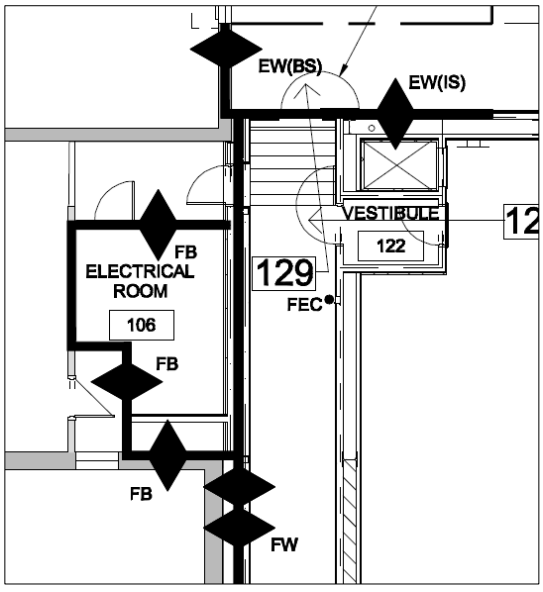


Figure 9 - Application of the fire-resistive wall line types in a code-specific floor plan.

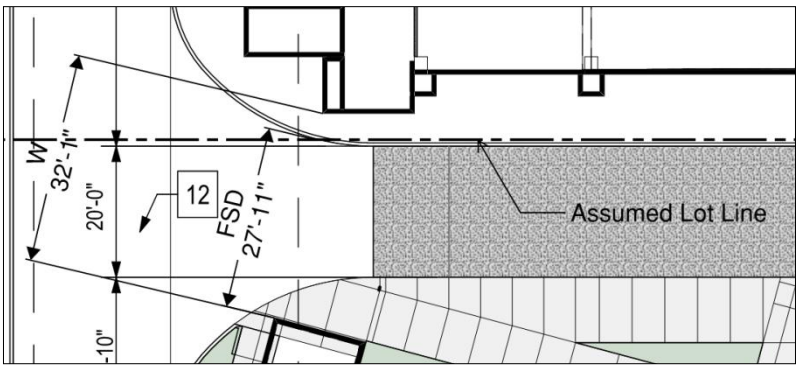


Figure 10 - Portion of a code-specific site plan showing dimensions for open space ("W") and fire separation distance ("FSD"). The building under consideration is to the bottom. Note that the dimensions are measured perpendicular to the face of the building.

Fire separation distances and open space distances (used for the value of *W* in calculating frontage increases) may be different than building location dimensions typically shown on architectural and civil drawings. Fire separation and open space dimensions are measured perpendicular to the building face and not perpendicular to the lot line; therefore, if the building is not square with the surrounding lot lines, separate dimensions should be shown to indicate these dimensions (See Figure 10).

Travel distance and common path of egress travel distance can also be shown graphically on the plans (See Figure 11). The advantage of showing the distances on the plans is that it demonstrates for plans examiners how the distances were measured[7].

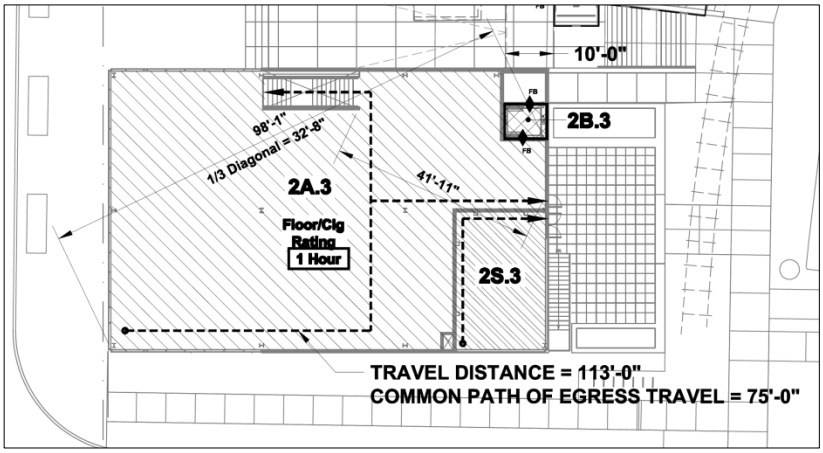


Figure 11 - Portion of a code-specific floor plan showing travel distance and common path of egress travel distance. Also note the dimension for the overall diagonal of the space (and the minimum required exit separation) and the dimension between the exit and exit access stairway.

Tying it All Together

The key to having a successful set of code data sheets is to provide as much information about the project's code compliance up front in the set to avoid having the plans examiner seek the information within the bulk of the remaining drawing sheets. However, replicating in the code data sheets some drawings that are located in other areas of the construction documents, whether modified for their code use or not, may lead to problems. Duplicate information in the construction drawings increases the chance for errors or conflicting information. The design professional should weigh this increased risk against improving the readability of the documents by the plans examiner.

Considering the Construction Specifications Institute's principle of "Say it once and in the right place," the code data sheets can be used as a kind of index—directing the plans examiner to other locations in the construction documents to find code information. Using interior finishes as an example, the code data sheet can state the minimum requirements per the code and then reference the Room Finish

[7] See *The Code Corner* No. 29 "Travel Distance," September 2009.

Schedule for locations of finish materials, which could further state specific paragraphs in the specifications that specify required classifications for finish materials.

Referencing drawings that are further in the set of documents can be used to corroborate code data sheet information. For example, if the code data sheet indicates that "Stairway No. 1" has a width of 54 inches, it can be added to "see Stair Plan 3, Sheet A-402" for actual dimensions.

Since a plans examiner's allotted review time is limited and if the evidence of compliance is not readily apparent in the construction documents, you can be assured that comments will be generated. Information that may have addressed the comment may be in the documents, but if the information is not readily apparent, it may be overlooked. On the other hand, if a noncomplying element is missed during plan review because it was not discernible in the documents, it may be caught by the building inspector during construction, which may be more difficult (and sometimes costly) to resolve at that time than during plan review. Design professionals can help themselves, plans examiners, and the plan review process by taking some additional drawing and specification measures that could shorten the review time and reduce the number of comments.

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