Overview of Commercial Envelope Requirements of 2009 IECC
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Rosemarie Bartlett: Welcome, ladies and gentlemen. I'm Rosemarie Bartlett with the Pacific Northwest National Laboratory, and I'd like to welcome you to today's webcast, an Overview of the Commercial Envelope Requirements of the 2009 International Energy Conversation Code brought to you by the U.S. Department of Energy's Building Energy Codes Program.

At this time, all participants are in a listen-only mode.

Before we begin the webcast, we will conduct a polling session. We have one polling question for you today. To answer the question, you'll need to press the numbers on your touchtone phone. Please wait for the entire question to be read before responding. There will be a brief 10-to-15 second period of silence after the question has been asked so that the results can be compiled. Please remain on the line. The question is: How many attendees are at your location viewing the webcast together? Please use the appropriate number on your phone to represent the number of viewers at your site. For example, press one for one viewer, two for two viewers, and so on. Please press nine to represent nine or more viewers. Once again, the question is: How many attendees are at your location viewing the webcast together? Please use the appropriate number on your phone to represent the number viewers at your site. Please answer now by using your touchtone phone. Please remain on the line during the silence while the results are compiled. Thank you. This concludes the polling session.

A few logistical announcements before we begin. You may ask a question at any time during the webcast today by using the Q&A menu on your computer. Questions will not be answered via the computer but will be answered live by the presenter as time allows at the end of the presentation. For those of you who want AIA credit or to generate and print a certificate of completion, a link will be put up at the start of the Q&A portion of the webcast. Please make sure to write down the link very carefully and type it into your browser at the end of the event. Lastly, a copy of the presentation is available, and the link was provided you to in the confirmation email that was sent this morning by ConferencePlus.

We're very happy to have as our speaker today Eric Makela of the Britt/Makela Group. Eric, please begin.

Eric Makela: Thanks, Rose. As Rose has said, my name is Eric Makela, and I will be your instructor for today's session on an Overview of the 2009 Envelope Requirements in the International Energy Conservation Code.

There were a few changes made this year between the 2006 and 2009. We're going to be covering the code as itself, plus the changes that will appear on the 2009. Some of the changes are on the actual ASHRAE Standard that was now referenced in the 2009 IECC, which is going to be ASHRAE 90.1-2007. There were several changes made to the Building Envelope Table Requirements both for Opaque and (inaudible) for the fenestration requirements, and we're going to be covering those.

First of all, I want to talk about the overall structural change of the 2009 IECC for all of the code itself. There was a change that was put in that essentially says that if you comply with Chapter 5 of the IECC for the envelope, you must comply with Chapter of the IECC for both mechanical and listing. Same… And the same way is if you comply with ASHRAE 90.1 2007 for the envelope, then you must also comply with ASHRAE 90.1 2007 for the mechanical lighting requirement. So essentially whatever you pick for one, you must comply with the requirements, and that is the standard of the IECC for everything. And again, this was a major change between the 2006 and 2009. In the past, some designers have chosen to select the ASHRAE requirements for the building envelope requirements and the light - - the mechanical designers have chosen to select the mechanical requirements for an ASHRAE Standard 90.1-2007 and the lighting designers have selected Chapter 5 of the IECC, and that was allowed into the 2006 - - under the 2009 code though that will no longer will be allowed. So this is something to - - that will impact how you demonstrate compliance with the energy code.

When we're talking about commercial buildings, and we're talking for Chapter 5 of the IECC, we're looking at building stock that is essentially considered anything other than one- and two-family residential, R-2, R-3, R-4 three stories or less in height. So an office building, a retail building, an assembly are all considered commercial buildings as are residential four-story and above is considered a commercial building. Anything else that does not fall underneath these categories is considered a residential building, so that includes one- and two-family residential, multi-family three-story or less, townhomes, those things are all considered residential. So it's a clear distinction between commercial and residential.

We're going to be focused today on the envelope requirements as we talked about, and that's going to be essentially Section 502 of the 2009 IECC. As an option, you can use 90.1-2007 Section 5, but we won't be talking about that in today's webcast.

Chapter 5 of the IECC focuses on a specific building stock. Essentially it's for the building envelope requirements it’s a building less than 40% of the gross wall area in vertical fenestration and also less than 3% of the gross roof area in skylights. If you exceed 40% of the gross wall area or 40% and above of the gross wall area, then you have to either use ASHRAE 90.1-2007 for the entire building or you also have the option of using Section 506, which is the total building performance approach located in Chapter 5 of the code. The total building performance approach is a performance-based approach that allows trade-offs between the building envelope, the mechanical system, and the lighting system in the building, and it's a specialized software that you can use. This approach is also available in ASHRAE 90.1-2007. Total building performance approach is typically used for buildings that may comply with lead requirements, lead for new construction uses a similar approach to demonstrate the basic requirements for energy. So those are your options again for buildings that exceed 40% of the gross wall area or 3% of the gross roof area in skylights. Typical building that will probably be somewhere in the 20-to-25% range. A big box store, like is shown on the left-hand side of this picture is probably going to be less than 10% glass area. Obviously the Mandalay Bay on the right-hand side would not be an IECC building. It would have to comply with 90.1-2007 unless you used the performance-based approach.

The code requirements for the building envelope are based on climate zones. The colder the climate or the hotter the climate will basically dictate how much insulation or the type of glass that has to put in the building and the properties of that. So for example, you have Climate Zone 1, which is down here in the tip of Florida, all the way up to Climate Zone 7 in the lower 48, which is upper Minnesota and the northern part of North Dakota. Climate Zone 1 is going to be a hot climate. Climate Zone 7 is going to be a cold climate. Then you have Climate Zone 4, which is on the - - kind of on the West Coast and also through the midrange through the country, that's going to be a moderate climate. If you're down in Las Vegas, you're going to be down in Climate Zone 3. If you're in Seattle, you're going to be in Climate Zone 4. Chicago is going to be a Climate Zone 5. So based on again climate zone, that will dictate the amount of insulation and the type of glazing requirements. You also have the country split up into levels of humidity. You have Marine, which is a Marine C designation; Dry, which is B, which is the Western part of the U.S.; and then you have A Moist, which is the Eastern part of the U.S.; and then you have the Warm-Humid line, which is kind of the Southeast. So going back to our city locations, Seattle is would be in a Climate Zone 4C, which would be a moderate climate, fairly cold climate actually with a Marine type of climate. Las Vegas is down in the tip of Nevada is going to be a Climate Zone 3B. Chicago will be a Climate Zone 5A, so you're getting a little more moist. And then if you're getting down to the end of - - in Dade County area in Florida, you're in Climate Zone 1 and then below the Warm-Humid line or 1A. These will all dictate the insulation requirements and types of glazing that are required in the building to meet the code requirements.

One of the biggest distinctions that was made in the building envelope requirements for the insulation requirements for opaque envelope was the distinction between high-rise residential, which is four-story and above residential and all other residential, which are going to be office, retail, assembly, and those types of uses. And the column was put in there for all climate zones and essentially the requirement for high-rise residential in the 2009 code are going to be more stringent than they were in the 2006 code. The primary reason for - - that this was put into the code is that the energy use for high-rise residential looks a lot like what a low-rise residential multi-family building would look like. In other words, we live in that building during the evening time and we're out of that building during the daytime. For commercial buildings where typically live in the building during the afternoon and morning hours, but we're not in it during the evening time. So the energy schedules for both those buildings are different and was actually fairly cost effective to increase the insulation requirements for high-rise residential buildings. So this was a major submission into the code.

If we look at the table, Table 502.2(1), this is - - represents the insulation values based on the type of assembly in the building. For example, it's split up into roof assembly, walls above grade, walls below grade, floors, and slab-on-grade floors; and then down at the very bottom are doors, which are typically opaque doors whether it be a man door, a solid man door, or roll-up door, but those are opaque door requirements. Each of the categories has different types of assemblies. So for example, your roof assembly will have insulation entirely above deck, which is going to be a built up roof system, metal buildings with R-5 thermal blocks, attic, and other. Based on the roof assembly types, you find the climate zone you're building in. So for example, if we're in Climate Zone 5, a building with insulation entirely above a roof deck would have R-20ci, or continuous insulation. That means insulation not broken up by any framing members. Attic and other, and we'll skip metal buildings for the time being, attic and other will have a requirement of R-38 in the attic and other, so blown in insulation or fiberglass batt in an attic assembly for a commercial building would comply with the code. The metal buildings, which would be - - have an R-19 requirement, and there's a separate table we're going to go to in a few slides, Table 502.2(2), that will actually give us how to meet the roof - - the metal roof assembly requirements. If you can move to the right, you see for metal roof assemblies, the insulation requirements start to double. We have an R-13 plus an R-19 for all other in Group 6. R-13 plus an R-19 for all other in Group 7, and for Group - - Climate Zone 8 rather R-11 plus an R-19. So the farther - - the colder the climate, the more insulation is going to be required for metal buildings. Attic and other will be a similar thing, it's R-38 throughout and R-49 in the colder climates and insulation entirely above the roof deck, the insulation levels to start to increase as you get colder. So you select your assembly type, you select your climate zone and that dictates the amount of - - the R-value of the insulation that's going to be required to be put in. For wall assemblies we have mass wall, metal building wall. Again that corresponds to the metal building for roof assemblies, metal framed building, which would be a steel stud wall in a building, and then wood framed and other. This section of the table is - - works the same way as the roof assembly. The R-values are for insulation R-value in the cavity of - - the cavity itself, except for the mass. The mass wall R-value will actually be the R-value of foam board insulation, for example, that's placed over the face of the mass wall, and mass we'll define that later, but it's essentially a concrete masonry unit wall, tilt-up concrete, those are all considered mass wall assemblies. So the R-5.7ci is continuous insulation over the face of the mass wall system. All of the other ones when we get down to wood framed and other, you can see when you get into Climate Zone 4, they require both cavity insulation and continuous insulation over the face of the studs. Metal building assemblies typically - - or metal framed wall assemblies typically require a continuous insulation even in some of the warmer climates like Climate Zone 2 and Climate Zone 3. So the colder the climates, the thicker the foam board insulation that will be on the outside. Metal buildings will require double insulation levels. We'll take a look at that when we look at Table 502.2(2) a little bit later in the discussion. So select your wall types, select your climate zone and that will dictate the type of insulation, where the insulation must be placed. For walls below grade, a wall below grade, the definition of a wall below grade is slightly different than that of a residential building, which is greater than or equal to 50% below grade. This is 85% or more below grade is considered a below grade wall. In most of the climate zones, you can see the NR, which means there's no insulation required. Except when you get into Climate 4 Marine for Group R occupancies, then you need foam board insulation. And in that case, this is considered a continuous insulation placed over the face of the - - either the tilt up concrete or the poured in place concrete wall or the CEM wall system for the below grade wall. So select again your climate zone and determine what R-value you actually need for that wall assembly. For floors, we have two different types of floor assemblies. One is a mass floor. Now this is not a slab-on-grade, this is actually a raised floor like a floor over a parking garage that might be a solid concrete floor, and the option on that is continuous insulation because that's the only place you can put that insulation. You also have the option of a framed wall or framed floor system, either wood or steel framed, and this is going to be insulating between the framing members. And when we… A little bit later on in the discussion, we'll look at the distinction between a wood framed floor and a steel framed floor because in the colder climate zones, you're required to have more insulation in a steel framed floor assembly than a wood frame floor. So select your floor type and then go ahead and determine your climate zone and that will dictate how much insulation you will need on - - for that assembly. For slab-on-grade floors, this is where one of the changes was made between the 2006 and 2009. Most of the 2006 requirements did not require slab edge insulation for unheated slabs, so that's a slab that essentially has no radiant floor system in or uninsulated ducts, which is probably the majority of the slabs being built right now. And to the 2009 requirements, the no requirement, or the NR, only goes to Climate Zone 4 all other, and everything else for the most part, the slab edge must be insulated to the required R-value and then down or down and out for the required linear length. So for example, Climate Zone 5 Group R would require an R-10 insulation and 24 inches of the insulation. The insulation must start at the top of the slab, cover the slab edge and then continue down to the top of the footing or go horizontally underneath the slab, but you have to have that insulation covering up the face of the slab. That's the critical piece on that. If you have a heated slab, and this is going to be a slab with radiant coils in it or an uninsulated duct work running through the slab, you will always have to insulate the slab edge, and the requirements on that range anywhere from an R-7.5 to Climate Zone 1 up through an R-20 in Climate Zone 8. And then the - - there'll be differences as far as the linear length of insulation for that slab edge too. But again, the slab edge insulation must cover the face of the slab and then either run horizontally underneath the slab or run straight down or you can actually install it horizontally away from the slab edge, so you have a few different ways of installing the slab-on-grade foundation insulation. For opaque doors, the requirement is going to be a U-factor for that door, either a - - depending on whether it's a swinging door or a roll-up door, so again a swinging door might be a metal door, metal man door leading out of the back of a strip shopping center, for example. Roll-up doors might be if you have a conditioned warehouse and you have roll-up doors going into that, those doors would need to meet a U-factor. Typically in warmer climates, the requirements are not very stringent, a U-value of 0.70. Colder climates starting probably in Climate Zone 4, the U-factor for roll-up doors, for example, is a 0.50, which is about an R-2; or for swinging doors, the U-factor would be a 0.70 or in a colder climates a 0.50. So in colder climates, you'll definitely have to insulate the doors. Warmer climates, you'll have to make sure it meets the U-factor. But a U-factor of 1.45 in Climate Zone 1 is not a very stringent requirement, so it shouldn't be a problem to meet the requirements. So this is the R-value table and this only focuses on insulation R-value for the opaque assembly.

The next table that was inserted in the 2009 code is actually an assembly U-factor table, and the assembly U-factor also accounts for framing in the building. So you have… You can… It's insulation plus framing. So if your assembly does not meet the R-value requirements by themselves, you can also calculate out a U-factor for the assemblies. So for example, a metal - - let's see, an insulation entirely above a roof deck is going to be a U-factor in Climate Zone in 5 Group R of 0.48 and that is going to correlate to an R-20 continuous insulation. So you either put in that or you actually calculate the U-factor for the assembly. So this gives you an option if you have a unique assembly type that doesn't quite meet the R-value requirements but overall that assembly will meet the U-factor requirements, and you can actually mix and match this. Parts of the assemblies in the building can meet the R-value requirements for insulation-only. Other parts of the building can actually meet the U-factor requirements for an assembly that can't meet the R-value for insulation. So this gives you another approach that wasn't in the 2006 code requirements.

We talked a little bit about metal wall assemblies and metal roof assemblies, and I want to show you Table 502.2(2), which actually gives you a key on how you build some of the assemblies that require double layers of insulation. So for example, let's say we want to do an R-13 plus an R-13 roof assembly, if we're required to do it in one of the climate zones, the description of that is the first R-value is for faced fiberglass insulation batts draped over purlins. The second R-value is for unfaced fiberglass insulation batts installed parallel to the purlins. A minimum 3.5 thermal spacer block is placed above the purlin/batt, and the roof deck is secured to the purlins. So this gives you a description of how to build an R-13 plus an R-13 roof assembly, or you can do an R-13 plus an R-19, so you would replace the second layer of R-13 with an R-19. So based on the type of assembly requirements for insulation in the R-value table, we can then go into this table to actually determine how we're supposed to build that assembly. Same with walls, when we come down into the wall assembly, we have a few different options down here. If we're required to have an R-13 plus an R-5.6 continuous insulation, for example, it'll say the first R-value is for the faced fiberglass insulation batts installed perpendicular and compressed between metal wall panels and steel framing. The second rated R-value is for continuous rigid insulation installed between the metal wall panel and steel framing or on the interior of the steel framing. So again, this will give you the ability to determine how to install the insulation, give you a full description on how to do that. So the R-value table will tell you how much to put in and this will tell you actually how to install that insulation. The other option you have for metal buildings is to go into the U - - the assembly U-factor table and generate an assembly U-factor for either your wall system or your roof system and meet those requirements instead of going into this R-value table.

For roof assemblies, I want to cover a few specific things that I did not cover when we rapidly went through the R-value Table. For one thing, you can't insulation on top of a dropped ceiling and count it for insulation. The insulation will have to be either placed underneath the roof deck or you need a hard lid underneath that insulation to act as an air barrier, and there's really two reasons that you can't do this. The first reason is the code will require you to seal up the building envelope; and if your insulation is in contact with an assembly, that now becomes your building envelope. So in order to count this drop ceiling as the building envelope, you would need to seal up the ceiling tile and also any penetrations in that ceiling tile like fluorescent lights and things like that. The second part of this is just a maintenance issue. Typically someone might come up and need to do some maintenance work on top of the dropped ceiling. They'll push the tile over, the fiberglass batt will come flying, and I haven't seen anyone yet actually go and retrieve that fiberglass batt and neatly place it back on top of the ceiling tile when they're done with the work. So this just basically says: Don't use the drop ceiling or you can't use a drop ceiling to comply with the code. The insulation either has to be on a hard air barrier or it has to be basically placed up in the - - underneath the roof deck, which is installed up there quite a bit.

This diagram just kind of gives you an idea of how a metal roof system is built. You've got your metal purlins. You've got your thermal blocks on top of the metal purlins. You can see how there's a double layer of insulation, and this is kind of - - we've already covered a lot of this information, but this just kind of summarizes where you may need double layers of insulation. For example, Climate Zone 2 through 8 required two layers of insulation for all other type of assemblies, so all other going to be assembly retail offices types of buildings. And this will tell you Climate Zone 2 through 5 and Marine 4, an R-13 plus an R-13. When you get into colder climates, you'll require an R-11 plus an R-19, for example. As you my notice, there's not a double layer of insulation required for most Group R buildings. Typically you're not going to see metal building assemblies like this used for Group R buildings. It doesn't happen very often, so you're not going to see a high rise metal building, for example, for Group R. So this just summarizes what we talked about in the R-value table slide that we were going through.

For mass walls, I defined mass walls earlier on as concrete masonry unit, tilt-up concrete, those types of assemblies. The code actually defines them as walls weighing at least 35 pounds per square feet of wall surface area or 25 pounds per square feet of wall surface area if the material weight is less than or equal to 120 pounds per cubic feet. This is going to be most tilt-up concrete, CMU, that type of thing will fall underneath the mass walls.

And for mass wall insulation requirements, you're going to put the insulation on the exterior of that mass wall. Now for Group - - for Climate Zones 1 or for Group R and 2 all others, you can actually use integral insulation on the inside of the mass walls, like a CMU block and not have to insulate on the outside. And the criteria is set up here, concrete block walls must comply with ASTM C 90, and ungrouted or partially grouted at 32 inches, ungrouted cells must be filled with insulation material of less than or equal to 0.44 Btus per inch. This just gives you the criteria for when you do not need to put insulation on the exterior of that mass wall. Climate Zone 1 all other, no insulation required for mass walls. So this is essentially the requirements for mass wall assemblies. Now the one thing I do need to talk about here is that installing insulation continuously on the outside of the mass wall is not the only way to do that. You can also frame out on the inside. You can fur out on the inside with metal or wood frame construction and insulate between the framing and comply with the metal or steel frame construction R-value requirements that are in the R-value Table that we looked at. So that's… So you either can insulate continuously on the outside or meet the requirements again by either furring out on the inside or outside, if you wanted to do that, installing insulation between the framing and complying with either the metal or - - the metal framed or wood framed requirements in the R-value Table for the applicable climate zone. So that just gives you another option on how to comply with the mass wall requirements.

For wall R values, wood, metal framed, and other, we talked a little bit about insulation either must be placed continuously on the outside where it's required or you could have continuous or insulation installed between the framing members. The ci or continuous insulation means insulation placed on the face of the studs and not broken up by any framing members, so essentially foam board insulation on the outside of a framed wall. This might be a synthetic stucco system where you're using foam board insulation on there, anything that covers the face of the stud that actually has an R-value of an R-2 or better can be used and comply with this requirement.

For metal building walls, we talked - - we've already hit on this a little bit, but I wanted to bring it up again. Just so you can see the requirements on here. Climate Zone 1 and 2 and R-16; Climate Zone 3 and 4, except Marine, and R-19, and then Climate Zone - - the colder climate zones will require insulation installed between the framing members and also continuous installation on the outside. Now one of the things to realize too is if you have a mass wall system and you are in a cold climate and the mass wall system requires both insulation between framing members and - - or I'm sorry, the framed wall system compiles - - if you have to have both insulation between the framing members and also foam board insulation over the face of the studs, that will have to be installed that way going perspective. If there's a way of trading this off using a tool like COM*check*, for example, you might be able to trade-off the foam board insulation and just have mass wall with the insulation installed between the framing versus having the insulation between the framing and the foam board insulation. I haven't seen too many insulations where you put in both foam board and insulation between the framing on when furring out on a mass wall system. So that's a good opportunity to do a trade-off using a tool like COM*check*.

For floor systems, we talked a little bit about the fact that you can have a mass floor. This floor in the picture right here is actually a concrete a floor over a parking garage, or you can have a framed floor system. Maybe you have a floor cantilevered out over the great outdoors and you need to insulate between the framing on that. For a mass wall - - mass floor system like we're looking at in this picture, really the only place you can insulate on here is on the surface of it or continuous insulation. So the code would require in this particular case that all insulation be placed continuously without being broken up by framing members if possible. Now obviously looking at this floor with the electrical running there, that might be kind of difficult to do, but there are insulations that you can get that can - - spray foam insulations and things like that that you can use in floor assemblies like this. You have to just make sure that you comply with the valuation service reporting and the code - - the valuation service reports and also the IBC as far as placement of any kind of insulation in this kind of an assembly. So for mass walls, you have a couple of options. For steel floor or wood floor type of joist systems, the insulation will be placed between the framing members. I talked a little bit earlier about the fact that for steel framed floor assemblies in some of the colder climates, you're actually required to have higher insulation levels than what is shown on the table and footnote e to Table 502.2(1) requires an R-38 insulation in Climate Zone 6 through 8 for steel framed floor assemblies versus the R-30 insulation for those same - - for a wood framed floor system in those climate zones. So you need to pay attention to the climate zone and also what you're doing for framing to dictate how much insulation needs to be put in. The other thing is the insulation needs to be installed full height, so it can't be compressed. So that means the R-38 insulation is going to need roughly 20 inches if you're doing a fiberglass batt, whereas an R-30 will need 10 inches, so you definitely need to pay attention to the joist system that you're using to make sure that you're getting that insulation again full height in the joist cavity.

For unheated slabs, we've talked about this a little bit. Essentially this was a big difference between the 2006 and 2009. In Climate Zone 6 through 8 for unheated slab, you have to have insulation requirements for all other insulation. For Group R, it's Climate Zone 4 through 8. Again, Group R is going to be high-rise residential. So if you have dwelling units on the first floor, those floors could be very cold if they're slab-on-grade and the slabs are not insulated. So Climate Zone 4 through 8 for Group R, Climate Zone 6 through 6 through 8 for all other. If you have a heated slab, essentially you need to insulate in all climate zones. And again, a heated slab will have a radiant floor system or it could have a uninsulated duct work installed in the slab itself. That makes a slab a heated slab. And in that case, I believe all climate zones, you will have insulate that slab edge, so verify the R-value that you need and also the depth or the lineal length of insulation that you need to install on this. And again, that insulation must be placed over the face of the slab and then you can run it down vertically after that or horizontal under the slab or horizontal away from the slab if you wanted to do that.

So that's the end of the discussion for the opaque assemblies for R-values.

Now we're going to start looking at fenestration or glazing for the building. And there were some changes made to the fenestration requirement table. I've highlighted some of them. We're going to go ahead and walk through this so we can learn how to use this particular table if you're not familiar with it. Here again, you're only allowed 40% maximum window wall ratio for a building. If you have greater than 40%, you either use a performance-based approach in Section 506 or you go to ASHRAE 90.1-2007 and comply with the entire ASHRAE Standard. The categories you have to deal with are based on the type of glazing you have. The first requirement up here is for U-factor and is for framing materials other than metal with or without metal reinforcement or cladding. So this would be vinyl framed windows. In some small office buildings like medical offices and things like that, the windows you install there look a whole lot like residential scale windows. And the R or the U-factor requirements for these window are going to look a whole lot like the requirements for residential. The colder the climate, you're going to - - you'll have more of a low e type of window. So from Climate Zone 5 on down, it's a 0.35 U-factor window. When you get Climate Zone 3 and 4, Climate Zone 3 has a 0.65, Climate Zone 4 is a 0.40 U-factor. Climate Zone 1 is a 1.2, so not a very efficient window. But again, this is Dade County, Florida, and then Climate Zone 2 is a 0.75. So really a double glazed window from about Climate Zone 2 on. So again, this is going to be for a manufactured type of window that you're going to just bring in and install out on site. For the next category is really for site built windows where you bring out the frame, bring out the glazing and you install and build the glass out there, and you have a few different categories on here. One is curtain wall/storefront U-factor, and we'll define a curtain wall/storefront. I've got some… We'll just define that a little bit later in the discussion. But curtain wall/storefront will be - - it's a very common type of site built window; and in this case, the curtain wall/storefront must have an NFRC rated U-factor that meets the U-factor requirements in the table. There is a default table within the code that you can use and you can and you can pick - - select a default value based on the frame type and glazing type to try to meet these requirements. But really when you get after about 0.60 I believe U-factor, you're going to actually to have an NFRC rated product, I believe. I'm not even sure a 0.60. I think 0.60 might be in that table. But the 0.5 to 0.45 and the 0.40 on curtain wall/storefront will all have to be an NFRC rated product in order to meet the requirements in the this table for perspective. Again, the colder the climate, the more stringent the requirements are going to be for glazing U-factor. Entrance door U-factor, again hotter climates a 1.20 down to 0.80 U-factor for colder climates. Typically entrance door U-factors do not have a stringent of requirements primarily because of manufacturing constraints. They have to have the ability to take abuse and that type of thing, so the efficiencies for entrance doors, for glass entrance doors, are not as stringent as for curtain wall or storefront. If you're glazing is - - does not fall underneath the first category of essentially a vinyl framed window or it's not curtain wall/storefront or entrance door, then it falls underneath the all the other U-factor category. And this is going to be metal operable windows, for example, metal fixed windows that are manufactured and brought out onsite, and you can see the requirements on those are a little bit - - actually they kind of fall between the framing materials other than the metal with or without thermal break and the curtain wall/storefront glazing. So sometimes they're comparable, sometimes they're a little bit more stringent or less stringent actually. So the all other is kind of catch all category that was for everything other than the site built windows or the - - for the manufactured windows. Now I have two arrows over Climate Zone 7 and Climate Zone 8 and this is really where the changes were made in the code between the 2006 and 2009. The requirements actually were made more stringent. For curtain wall/storefront, dropping down to 0.40 in Climate Zone 8 and 9. Also in Climates for all other, the requirements drop down to a 0.45 U-factor, so they were made more stringent there. So that's for glazing U-factor, now we're going to get into solar heat coefficient requirements. And the solar heat coefficient is really the - - it's how much solar gain is allowed to pass through a window. The lower the solar gain, the lower the cooling loads are going to be in that space. So if we're down in Las Vegas, for example, we don't want a lot of solar gain passing through the window primarily because it's going to increase our cooling load significantly. But in some areas, in colder areas of the country, we actually might want a lot of solar gain passing through, so it'd actually be… We might get some passive solar benefit for a lot of gain coming through during the wintertime. So the hotter the climate, you can see in Climate Zone 1, for example, the first column of solar heat gain coefficient PF, which is projection factor less than 0.25, the requirement is a 0.25 SHGC. That means that that only allows 25% of the solar gain that strikes that window to pass through the glass. When we go to the other extreme in the same solar heat gain with the same projection factor, and we'll talk about projection factor in a bit, in Climate Zone 8, the solar heat gain coefficient requirement is a 0.45. Essentially what that means is it allows 45% of the solar gain to pass through. In the 2006 code, this was actually a - - I believe an NR, no requirements in the colder climates. What we're seeing right now for cold climate buildings is actually there's a lot more cooling and air conditioning in those buildings and so actually solar gain does a good thing to reduce some of the solar gain to reduce the cooling load in some of the colder temperature buildings or in colder climate zones. Now we can meet the requirements in a couple of different ways for solar heat gain coefficient. One is we can go ahead and install the window with the right properties, the 0.25 or the 0.4. The other way we can go ahead is and put an overhang on that window and the solar heat -- the projection factor is just a measurement of the overhang. It's the ratio of the overhang to that piece of glass, so how well that projection factor is actually going to shade the window, and we'll cover that in the next couple of slides, but I kind of want to walk through the rest of this table just to show you how the table works. If we have an overhang, you can see in Climate Zone 4, for example, there is no requirement for an overhang between with the projection factor of 0.25 to 0.50, so you can see the NR starting there. If you have a longer overhang of a greater than 0.5, the - - again starting on Climate Zone 4, you do not have a requirement for solar heat gain coefficient. If you want clear glass, if you have display glass for retail space, for example, and you want relatively clear glass and not tinted or glass with a low e-coating on that, installing a permanent overhang over that glass will actually allow you to have relatively clear glass, so you can actually see through the display windows into that building. So that would be one reason why you'd want to go ahead and put in a higher SHGC glazing than offset the energy loads on that by putting on an overhang over the glass. For skylights, you're limited to 3% maximum in the roof area, big change between the 2006 and 2009. The 2006 had a criteria for glass skylights and plastic skylights, two different sets of requirements. During the 2009 code change process, this was all put into one set of requirements. So now we just have a criteria for skylights. With skylights you have both a U-factor requirement and also a solar heat gain coefficient requirement. It's very difficult to shade horizontal glass. So if we're in a Climate Zone 1, for example, you can see the solar heat gain coefficient requirement there is a 0.35, so it only allows 35% of the solar gain to come through. As you get into colder climates, you can see in Climate Zone 7 and Zone 8, there isn't a solar heat gain coefficient requirements for those because solar gain in those climates is actually not a bad thing. So this is… So now you have both a U-factor and also an SHGC requirement for skylights, and it's all kind of a one-size fits all. It's going to be for both plastic and also for glass skylights.

Cover a few more distinctions on how to calculate that window wall ratio, for example. We're talking about a 40% window wall ratio and this means we take the total gross wall area and the total gross glass area in that building and you divide glass by wall to come up with window wall ratio. And the wall that we're looking it as above grade walls. So if we have a glass building the Mandalay Bay, for example, that's probably going to be more in the 75-to-80% glass to wall area or window wall ratio range. If we have a big box store, for example, that might be down less than 10% of the window wall ratio or glass to wall area ratio. So this is the one calculation you do need to do to determine how much glass you actually have in that building and can you use Chapter 5 of the IECC or do you need to go into the ASHRAE Standard 90.1-2007 or do you need to use the system performance approach?

We talked about some of the different site built windows. The upper right-hand corner is showing a framing materials other than metal with or without metal reinforcement or cladding. So this would be an example of a building that they just use manufactured windows and install those windows. So a vinyl framed window, for example, that would look a lot like a residential scale window is used in this particular building, that's what would classify for this category. Curtain wall.

Curtain wall is really more of a nonstructural wall - - glass wall system in a commercial building. You can see the curtain wall in the round section of this particular building up here and there will be a specific NFRC or U-factor requirement within the table that you'll need to get an NFRC rating on this product and/or a National Fenestration Rating Council rating in order to show that you're curtain wall product actually meets the requirements within the code.

Other types of glass include storefront. Upper left-hand corner is a typical storefront glazing that you might find in a strip shopping center. That will have a… This is a site built window that will have a U-factor to meet, and again this particular product will have to have an NFRC rated product installed to ensure that it actually meets the U-factor requirements within the code. Entrance doors. The entrance doors that we looked at, the U-factor requirements were not as stringent as the curtain wall/storefront primarily because of they need to take abuse. So the entrance door showing in the bottom right-hand corner, the U-factor requirements on these entrance doors are not going to be as stringent as the curtain wall storefront requirements or some of the other types of requirements in the code.

Operable windows. For metal frame, these are showing metal frame operable windows. This falls underneath the all other category and this is kind of that catch-all category that are - - that if your glass doesn't fall into any of the other categories, you have to go ahead and use. So that's going to include operable windows, fixed windows, non-entrance types of doors that are still glass will fall underneath again this catch-all category of all other, and that will have a specific U-factor requirements. Now I do want to say even though the U-factor requirements on this type of fenestration for all these categories varies based on the type. The solar heat gain coefficient requirements are going to be the same from category-to-category. So if it's a 0.40 for one type of glass, it's a 0.40 for all glass in that particular climate zone. There's no distinction on that.

When we looked at… I briefly described on solar heat gain coefficient, so just to give you an example of some of the different types of solar heat gain coefficient, the upper right-hand corner, the MGM Grand, that's about - - has an SHGC of about 0.14. It's roughly as we can calculate, so that only allows 86… That actually blocks 86% of the solar gain from coming through that glass. The Mandalay Bay on the building down below it, has a solar heat gain coefficient of 0.12 roughly, so that allows 12% of the solar gain that strikes the Mandalay Bay to actually pass through. The glazing down in the bottom right-hand corner, the tinted glazing down there is probably somewhere between a 0.3-to-0.4 based on the glass properties and number of panes of glazing, the type of tint, and things like that. Again, this would be an NFRC rated product. If I take this glass into a default table, which is also included in the IECC, we will not get as low of SHGC range. So this would have to be a tested value. This could range anywhere from a 0.3 to a 0.45, for example, based on the type of glass you put in, the type of tinting, that type of thing. So again, all we're looking at it is how much solar gain is blocked through that glass. The more that's blocked, the more it reduces the solar gain on that building. Now there's always been a question about what do you with - - if you want daylit - - to daylight a building and you can actually get glass, not a code requirement, but you can get windows that have a low solar heat gain coefficient value that a high visible transmittent *[sic]* or visible light transmittant value. So it blocks the solar gain, but it does let the visible light spectrum through that glass. Now this is not a code requirement, but this is something to think about if you want to do daylighting or lighting the inside of the building using natural daylight from the outside.

We talked about - - we used the term projection factor earlier, and a projection factor is essentially the ratio of the overhang to the glass. So if I looked at this diagram, I have two values. I have my A-value, or the horizontal distance between the surface of the window to the farthest most point of the overhang, and my B-value or my B-dimension from the bottom of the window to the bottom most point of the overhang. My projection factor is calculated by dividing the A-dimension, or my horizontal dimension, by my vertical dimension to come up with a number. So for example, if my horizontal dimension is four-feet and my vertical dimension is six-feet, I divide four by six and come up with a projection factor of 0.67, if my math is correct. I then take that projection factor back into the solar heat gain coefficient table that we were looking at earlier under the fenestration and that would fall, that would be greater than a 0.5 projection factor and that would then allow me to install a piece of glass with lower or actually with a less stringent solar heat gain coefficient. So based on the climate zone, instead of, for example, putting in a 0.25 for Climate Zone 1, I can actually install - - let me pull up the table here, I can actually install a 0.40 solar heat gain coefficient for Climate Zone 1 with that kind of an overhang on it. So that allows me to do a trade-off to get a relatively clear glass by installing the overhang. And for example, again, if we're looking at a retail space, if I want to use clear - - relatively clear glass, this would allow me to get relatively clear glass versus putting on something with a 0.25 SHGC, which is a fairly hard glass to see through. So this is how projection factor plays into the compliance with the code. Now the overhangs for this have to be - - they should be a permanent overhang on the building. An awning that retracts, for example, during times of the year is not considered a permanent overhang, so it actually should be a permanent fixed overhang on that building in order to count for compliance with the code.

Okay, that ends the insulation and glazing requirements.

Now we're going to get into the mandatory requirements. We only have a little bit of a material left to cover. We'll get into the mandatory requirements though, and the first of the requirements is going to be for air sealing, and the requirements basically say you must caulk, gasket, or weather strip any penetration in the building envelope. With an approved sealant method, it actually has the ability to expand and contract if it's connecting to similar materials. For example, wood and concrete, they both expand and contract at different rates and the product you use has to be pliable enough that it doesn't break or break down over a period of time. What they're finding right now is actually sealing up the building for commercial buildings is - - does play into a part for energy efficiency for commercial buildings. Some states, for example, already have requirements for continuous air barriers like the State of Massachusetts. So it's essentially getting the building sealed up. We're already bringing in air into the building - - in our ventilation system and so bringing in infiltration or unwanted air makes the mechanical system have to run that much more in order to offset the loads for infiltration. So seal up the building envelope as best possible.

There's also requirements if you have dampers that are integral to the building envelope. In this particular case, the picture you're seeing up, there are dampers into the building envelope. They're relief dampers because if you bring in economizer air, for example, and pressurize the building, you need to relieve that air, and a relief damper is one way of doing it. But you want these dampers shut when the system is not working. That's the whole thing. So you have a couple of options for motorized dampers or for dampers integral to the building envelope. One is it can be a Class 1 motorized leakage rated damper; or for buildings less than three stories in height, they can be a gravity damper that are closed when not needed or not in use. And again, we're just trying to reduce the amount of infiltration air that comes into the building, and this is one way of doing it.

Other ways of reducing infiltration air for condition to loading docks, the code requires loading docks with weather seals. So when you back the tractor up into the loading dock, it actually seals around the back of the tractor and reduces the infiltration load going into that loading dock and this will reduce the energy needed to keep that loading dock at the temperature. There are no set requirements for loading dock weather seals. There's no ASTM testing and that type of thing that's in the code. It basically just says, "Use a weather seal or a loading dock weather seal on this one," but you're trying to reduce infiltration for this particular building.

One of the requirements that's been somewhat contentious since came into the code is requirement for a vestibule, and a lot of designers have actually gone into ASHRAE 90.1 to get out of the vestibule requirements for particular building stock, and that's worked well for them because they've compiled with the envelope requirements for 90.1 and then the lighting and mechanical requirements in Chapter 5 of the IECC. Now if you decide to go into ASHRAE 90.1-2007 for - - to comply with - - basically get out of the vestibule requirements through one of their exemptions, you will now have to comply with all of ASHRAE 90.1. So the allowance has been somewhat taken away, but let's focus right now on just what the requirements are within Chapter 5 of the IECE. What the code says is that if you have a - - essentially the primary entrance door leading from a space greater than or equal to 3,000 square feet, that door must have a vestibule on it. And the doors we're really focused on here are the doors where the general public and the people that work in the building enter and exit that building. This is really the primary focus of the doors that we're focused on. Now the requirements for the doors is the doors have to have self-closing devices, so an automatic sliding door would work or a swinging door with a self-closing device would work on that, and the doors also have to have the ability - - the vestibule has to be designed so that both doors do not have to be opened at the same time to exit and enter the vestibule. So for example in the picture I have here, the door leading from the conditioned space and the door leading to the outside at the other end of the vestibule would not have to be opened at the same time in order for me to pass through. The whole goal of the vestibule is to create and airlock. So you would enter the vestibule, have the door shut behind you and then exit the vestibule and have the doors open in front of you to exit that building. That creates that airlock. The 3,000 square foot requirement on here, essentially there isn't a good definition in the IECC, but probably the best one I can give you right now is the space is defined by surrounding by floor to ceiling partitions. That would define the space. If you have a entrance into that, and we show an entrance into this particular space, if there's a door in that entrance, I would not count the square footage on the other side of that door as part of the conditioned space. If there's no door on that entrance or that opening between the - - what might be a less than 3,000 square foot space and the space next to it, I would go ahead and count that because you will (inaudible) transfer between the two spaces. So this has been - - unfortunately the vestibule requirement in the code is not clear as it should be. I know it's being worked on through the code development process and hopefully will have a little more clarity in future versions of the code. Some of the exceptions, buildings in Climate Zones 1 and 2 do not need a vestibule. Doors from a guest room or dwelling unit, remember this requirement is also for high-rise dwelling units, so if you have a guest room for hotel/motel, for example, with a door leading into a space greater than or equal to 3,000 square feet or a dwelling unit, you're exempt for that. Doors used primarily for vehicular movement, material handling, and adjacent personnel doors are exempt. Also the one bullet I don't have on here are revolving doors. If I have a revolving door, for example, in a lobby of a hotel/motel, you would not have to have a vestibule on that particular door. So there are some exemptions on the vestibules that are in the IECC right now.

Last but not least are the mandatory requirements for can lights or recessed lights that are actually in the building envelope itself. So this is not going to be a can light in a drop ceiling, because remember the drop ceiling cannot be part of the building envelope. This is going to be a can light if I have a sheetrock ceiling with insulation on the top of that and I put my can lights into that sheetrock ceiling, then the can light is going to have to be Type IC rated and sealed and gasketed between the can itself and the sheetrock and it also - - the Type IC rated means that it's rated for insulation contact and the airtight means that the can will not leak, basically it won't leak air through the can itself or has a very minimal amount of air leakage. In this case, 2 cfm of air movement from conditioned space to into the ceiling cavity, so drastically reduces the infiltration through that can and it also allows you to insulate right up around that can. That means that when you're insulting the ceiling assembly, you can actually - - you won't have spaces where the can is inserted. If I had a non-IC rated can light up there, I would have to hold my insulation back a certain distance away from the can, so I'm actually - - would have to eliminate some of the insulation in that ceiling. This would allow you to insulate all the way up around that can. But again, this is only for can lights that in part of the building envelope, so this would be an insulated ceiling with a sheetrock ceiling assembly, for example, and the can would be inserted in that, not on a drop ceiling, so I definitely want to make that distinction.

So what we have talked about today? We've talked about some of the changes in the R-value requirements for the building - - the opaque envelope requirements. We've… I've showed the new U-factor table for assemblies and a way to meet the requirements if your assembly does not quite meet the R-value requirement. We looked at the changes in the fenestration requirement. One of the biggest changes again on that was the skylight requirements are now instead of plastic and glass are going to be just one set of requirements for all types of skylights. We've talked about air leakage, the importance for air leakage and sealing up the building envelope. We looked a little bit about vestibules and meeting some of the vestibule requirements, and we also talked briefly about the weather seal that's required for condition loading docks.

This ends my discussion today, and I hope if you have any questions that you'll feel free to ask them. Thank you.

Rosemarie Bartlett: Well thanks very much, Eric. I'm actually going to jump in and put a slide up on the screen. For all of you that are interested in receiving AIA credit or generating or printing a certificate of completion for yourselves, please write down the link that's appearing on the screen right now, write it down very carefully. It does hyphen in it, and go to your browser at the end of the event today, type that link in and follow through the pages and you'll be able to submit your AIA information to us and/or generate and print a certificate of completion.

So now I think we'll let Eric try to answer as many of the questions that have come in as possible. Eric, take it away.

Eric Makela: Thanks, Rose, and we did get a lot of questions, so I'm going to go ahead and start from the beginning and work our way through the presentation.

The first question is: **Is there a reason why service water heating was not included in the discussion of IECC versus 90.1? It is my understanding that there are four regulated systems.** And that's absolutely correct. Service water heating is actually a separate section in the IECC and also a separate section in 90.1, so that is included in the code requirements. And again as we talked about earlier, if you decide to go to ASHRAE to comply with the service water heating requirements, then you would be required to comply with all the ASHRAE requirements; or if you wanted to stay in the IECC, you would be required to comply with all the IECC requirements if you choose service water heating for the IECC.

Next question is: **Is there a specific angle or vertical fenestration become skylights?** And actually you have to get into IBC and IRC on this, and a skylight is anything greater than 15 degrees from vertical is a skylight. Anything less than 15 degrees from vertical would be considered a window.

Okay, next question: **How do you handle vestibules?** And I wasn't quite sure on this one if we're talking about insulation, type of glazing requirements, and things like that, so I'm going to hit this… Because this came in during the section where we're talking about insulation and glazing, I'll deal with it from that standpoint. Typically it really depends on if the vestibule is conditioned space or non-conditioned space. If you can condition the vestibule and you can condition the vestibule, then you're building envelope is actually the wall assembly, if you will, wall and glass assembly between the conditioned vestibule and the great outdoors and that would not need to comply with the code. If you're vestibule is unconditioned space, so you're not putting any conditioning in there, then you're building envelope is between the conditioned space itself and that inside of the vestibule, the vestibule area, in which case your building envelope then is the glass doors and windows or the doors and windows between the conditioned space and that unconditioned vestibule.

Okay, next question: **What does the ci and the table stand for?** The ci stands for continuous insulation. That's going to apply for roof decks. It's going to apply wall systems. Typically continuous insulation is insulation not broken up by any framing members. This includes foam board insulation typically, but it's placed on the outside of the stud walls or the outside of your mass wall system, but again - - or on top of the roof deck. But again, the key is it's not broken up by framing members.

Next question. **When you have a wall insulation requirement of R-13 plus an R 0.75 continuous insulation, what does this mean?** Essentially the R-13 would be insulation placed between the framing members. So if I had a metal wall system, for example, or using steel studs, I would place the R-13 insulation between - - in the stud cavity itself and the R 0.75 insulation would have to be placed continuously over the face of the stud. That's considered continuous insulation. And when… For perspective requirements, if you have this requirement, you need to install both insulation. You can't just say, for example, I've got an R-20 0.75 insulation I need. I'm going to put that all in the stud cavity, for example. You have to have the foam board. You have to have the R-13. If you do not want to use this approach and you're having a slightly different assembly, you can calculate out an assembly U-factor, and that's what that assembly U-factor table is for, or you can always go into a trade-off approach like COM*check* to try to trade the insulation levels off. So today, we kind of focused on perspective, so there are a few different options on this one.

Next question: **Why in the 90 - - essentially the IECC 2009 U-factor table is Climate Zone 4 Marine Group with Climate Zone 5, which is more stringent?** That question… That's an interesting one. What they're finding is climatically Marine 4, Climate Zone Marine - 4 Marine, is very similar to a Climate Zone 5 as far as heating and cooling degree days and as far as how buildings function. So in the IECC, it's - - those two are grouped together. I did go into ASHRAE 90.1-2007 to see how that was set up, and you're correct that Climate Zone 4 is grouped as all one. Climate Zone 5 is grouped as all one, and there's no - - they're not together at all on that. I did some brief comparison on U-factors and there are some similarities in U-factor between Climate Zone Marine 4 and 5 and the IECC and Climate Zone 4 in ASHRAE Standard 90.1-2007. If… Again from a user standpoint, if you want to go to ASHRAE for a slightly higher U-factor in that climate zone, you can - - that's fine. It's not a problem. Or if you want to stay in the IECC, that's why we have two - - essentially two methods of compliance within the code.

The next question was: **What does the AFTM C 90 stand for?** When we talk about concrete mass walls and we're talking about being able to only put in insulation inserts into the mass walls and not installing any insulation on the outside of the mass walls, the ASTM C 90 is a specification for load bearing concrete masonry units, and that's actually in the reference section in the IECC. So it's basically from a structural standpoint, that was one of the criteria if you wanted to use this.

Vapor retarders. We had a couple of questions about vapor retarders that came up. And essentially vapor retarders are - - we're moved to the IBC, so they are no vapor retarder requirements in the IECC. This was one of the major changes between the 2006 and 2009 code. So if you need to know about vapor retarders, go into the IBC; and if you're in residential and need to know about them, that's now contained in the IRC, so those are no longer in the IECC.

Okay, very good question here. **Mass wall insulation. Does a system such as THERMAX with the insulation continuous on the inside of the concrete tilt-up panel count?** As long as the insulation is continuous, that means it could be placed on the exterior of the wall surface, as long as it's continuous. It can be placed on the interior of the wall surface, so basically on the condition side of that concrete panel; or if you have a panel system where you actually have integral insulation in the panel, that's also considered continuous insulation. So absolutely that would comply with the code.

Okay, next question. **Climate Zone 5 essentially kind of used a core filled insulation for block walls in 5, so can you use a concrete block wall with no insulation on the outside of that wall, no continuous or insulation installed**

between framing, just put the inserts in the wall - - the CMU wall system itself and count that for compliance? Perspectively, you can't, and actually that really went away in the 2006 IECC. It was incredibly difficult to comply with that kind of wall system in the 2006. The only way you can get to do that is if you trade that off, again using a systems performance approach where you're trading off all of the assemblies and lighting and mechanical in the building or you can use - - try to get that to work in a COM*check* approach, so those are really your only options on that. Perspectively though, you're not going to be able to do that.

There was a question about: **How do you qualify for the perspective approach?** And I believe this means how do you go ahead and document that you meant compliance with the perspective approach. I don't believe right now that there are any forms created for compliance with the perspective approach in Chapter 5 of the IECC. I'm not sure if IECC has forms that are available. They may, and it would probably be worth checking with them on their website, the ieccsafe.org website, to see what products they have available out there. But as I know right now, I don't believe there's any actual forms you can fill out to show that you actually meet the perspective approach in the IECC.

Okay, lots of questions on fenestration. **One we already answered as far as when is a skylight a skylight, when is it a window?** And again that's 15 degrees from vertical and greater is considered a skylight and anything less than that is considered vertical glazing.

And I realized I covered how you figure out your window wall ratio or your percent glass to wall area fairly quickly and the calculation is essentially you take - - you determine your total glass area, your total vertical glass area on the building and you divide that by the total gross wall area on the exterior of the building, and this is for above grade walls only. So this is going to include the actual opaque wall assembly. This is going to include the glass area and any door area you have and you divide total gross wall area by total gross - - I'm sorry, total gross glass area by total gross wall area gives your window wall percentage. And again that's only for vertical glazing. Your skylights do not count on that. They've got their own requirements and the fact that they have to be less than or equal to the 3% of the gross roof area to comply perspectively with the code.

Okay, you've probably noticed and I saw a lot of questions coming in about there's no real orientation - - there's no specific requirements based on window orientation in the IECC. Essentially a window facing northeast or west or south is all handled the same and I received several questions on this. So essentially a south facing or north facing or east facing or west facing all have the same U-factor requirement and they all have the same solar heat gain coefficient requirements. ASHRAE 90.1-2007 does split them up. They do… I believe east, west, and south are handled under one requirement and a window facing north is actually for solar heat gain, for example, given a slightly less requirement because it's not going to see the load on that window. But under the IECC, north, south, east, and west, it doesn't matter. It's all handled underneath the same requirements.

Projection factor as far as building orientation. Essentially is there any consideration given for projection factor relative to building orientation or latitude? No. Rationally it doesn't seem quite right, but that's the way the code is structured. So essentially an overhang on a north facing window under the

IECC counts the same as a overhang on the east, west, or north facing window. This was done primarily to keep the code simple. The more complexity we put in there, the more orientation issues we put in there, the more complex the code gets. So this was really intended to keep the code as simple as possible. Again, if you want, I know that ASHRAE on their projection factor calculations, it is based I believe on orientation. I would need to check that to make sure, but I believe you get probably more credit for an overhang on a south window, for example, than you would on a north window. So you can go into ASHRAE if you really want to get more specific on orientations.

Let's see, the next question. **Building wrap materials. Are there code requirements for building wrap materials?** No, there actually are not, and there might be specific requirements on what can be installed in the building, and that's going to be more of a product specific requirement, and you'd have to get into the International Building Code on that one to determine if I put a building wrap on the building, what properties does that building wrap have to have? But from an IECC standpoint, it really doesn't specify. It doesn't give an ASTM standard or it doesn't say it has to qualify, for example, with the air barrier association requirements or that type of thing. So it'd be a product specific requirement based on IBC requirements needing - - trying to install those on a commercial building.

Okay. **Do all windows… Let's see, do all windows… Must all windows comply with the solar heat gain coefficient requirements such as north facing windows?** And the answer to that is yes. Again, they would all… If your requirement is a 0.40, for example, in one climate zone, all of the windows in that building (inaudible) comply perspectively would need to comply with the 0.40 requirement regardless of orientation.

Okay. **Vestibule requires. I actually assumed there would be a lot of vestibule requirement questions, and I'm going to - - I'll take the one that's in front of me right here now. A 5,000 square foot office building, does it need a vestibule?** And this is a very good question. The cutoff on this is actually, you're looking at spaces greater than or equal to 3,000 square feet, and I'm going to… Rose, I'm going to go ahead and pull the slide up on vestibules.

Rosemarie Bartlett: Okay.

Eric Makela: If I can get that. Let me go ahead and click up to that. We're looking at the actual space itself or the entrance door is located. Does the cursor move on here, Rose? I apologize for my lack of technological use on this but…

Rosemarie Bartlett: No, it doesn't, but you can take your cursor where you want it and then click.

Eric Makela: Gotcha. Okay. Anyway, the space we have shown is greater than or equal to 3,000 square feet, and really what we're showing on here is it doesn't matter what the building size is. You could have a 100,000 square foot building, but if the primary entrance door leads into a space that's only 500 square feet and that's your primary entrance, you don't care that the building is 100,000 square feet. So your focus really is on the actual space where the primary entrance door leads into. We could have an office complex, for example, a single story office complex with a 2,500 square foot lobby area with halls leading off that lobby and operable doors that lead into that lobby area, the square footage of the building might be quite large but the actual entrance area itself or the lobby area itself is less than 3,000 square feet and therefore you would not need a vestibule on that particular space. So it really is focused not on square footage of the building, but the actual space itself where the entrance door leads into. And again, the IECC does not do a good job on defining what they're talking about by space. You really need to actually get into the ASHRAE Standard, which gives a little bit more description on how the vestibule is actually defined because this requirement came out of the ASHRAE Standard originally and they look at space really as an area surrounded by floor to ceiling partitions. They don't address the: What do you do about an opening in a - - opening from one space into the other? So if the condition space shown on here were only 2,500 square feet and the space to the right of that is 500 square foot and there's no door on that, do we count the two together to go 3,000 square feet? Not clear in the IECC, not clear in the AHSRAE Standard. A logical assumption on this would be there would be heat transferred between those two spaces and therefore you would count one with the other. But again, it's not in the IECC.

The other question I have right now is: **Does the vestibule need to be conditioned?** And this… There's no requirements really that vestibule be conditioned. You can have a conditioned vestibule or an unconditioned vestibule. So that's not clear in that code. Again, if you have a conditioned vestibule, the vestibule really cannot be greater than 3,000 or it can't be greater than or equal to 3,000 square feet because otherwise you'd end up having to have a vestibule on the vestibule, so it would kind of magnify itself. So your vestibule, if you're going to condition and keep it under 3,000 square feet, so you don't have to continue because that becomes the primary entrance door into a conditioned space leading to the outside and then you'd need a vestibule on that door. So keeping it at less than 3,000 square feet would mean you'd only need to install one vestibule on that building.

Okay, let me go ahead and see what other questions we have here. Talked about vestibules. I believe, Rose, that we were almost out of questions.

Rosemarie Bartlett: Have you been through all the ones that were still in the log?

Eric Makela: I am going through those right now. The last question I have on here is: **If you use a spray foam on a mass wall system, does this essentially mean that you've complied with the air sealing requirements?** And that's an interesting question. Spray foams are being used more in commercial buildings. Essentially a spray foam will seal up the building envelope, so essentially it does - - it will seal any penetrations in the building envelope, which is the key on this whole thing. The one thing you need to make sure of when using products like the spray foam products like this is to ensure that you have a IECC evaluation service report and that report will actually dictate where you can and cannot install spray foam insulation, under what conditions, and also under what type of building stock. And it's important you follow that. Spray foam does do a good job of air sealing. But again from an IBC standpoint, make sure that the spray foam can actually be installed in the building that you're trying to put that in.

So, Rose, that is all the questions I have, so I'm going to turn it back to you.

Rosemarie Bartlett: **Okay, so I see one question that popped in, Eric, that's asking the difference between shading factor and solar heat gain coefficient?**

Eric Makela: Shading factor like shading coefficient, there's solar heat gain coefficient I believe is probably that. A shading factor is the old terminology for use on how much solar gain is allowed to pass through a piece of glass, and that really just… If my understanding is correct on this, that just looked at the actual piece of glass itself and didn't factor in framing emoluments and things like that. The solar heat gain coefficient actually factors in all the framing and everything that goes around that particular window. So typically your solar heat gain coefficient value, a quick calculation is about 0.87 times the shading coefficient will give you the solar heat gain coefficient. Again, that's a very quick calculation to determine the differences between the two. In the code itself, the code actually uses and has been using solar heat gain coefficient for quite awhile and so back I think all the way through - - back into at least the 2003 IECC if not earlier than that. So that's kind of the difference.

The one question I didn't answer on here that I need to go back, and I apologize, but there was a question concerning NFRC rating for site built products. And the question really was: Is getting this difficult, is there's probably with getting it? For site built products for rating with a National Fenestration Rating Council, there is a process in place with NFRC. All site built products must go through that in order to be installed, unless you use the default table within the IECC itself, which essentially says, "If you have a particular frame type and if you have a number of panes of glass, then you will get a default value for the particular product." In some climate zones, that works. In a lot of climate zones, it will not work. For example, in a cold climate zone, if you were putting - - if you want a good thermally efficient window, you will not be able to find a good default value within that table and use that without having the window tested. If you're in a hot climate zone like Las Vegas, for example, where solar heat gain is the driving force, there's also a U-factor or I mean a default table for fenestration, solar heat gain coefficient requirements and you probably will not be able to get a building to comply using that default table, and the values in there are too high. So really you need to get the product rated. There are getting to be more products that are being rated right now through the FNRC process. It has… It's probably one of the least compiled with requirements in the code right now, part of it due to just not a lot of products out there being rated and the other part is due to a lack of information both on the design and enforcement industry on how to enforce this and what they actually have to do. But hopefully the word will get out and the education will get out and we'll get a lot more NRFC rated products actually installed in the building so…

Any other questions on your end, Rose?

Rosemarie Bartlett: Yeah, it looks like a couple others have come in. **Can you have a space in a metal building insulation wall between the continuous insulation layer and the fill layer of insulation?**

Eric Makela: That is a good question, and I don't know that I can answer that. I believe the insulation needs to be in contact, but I'm not… That's something we'd have to check with the metal building industry on as far as thermally how that would work. I was always under the impression that the insulation needed to be in contact with each other because an air space actually allows convective currents to go through there. It's similar to having an air space between the insulation in a floor assembly and having a two-inch air gap between the floor assembly and the subfloor, you end up with an air current in there that can actually reduce the R-value. So I don't believe… I think the insulation has to be in contact with each other.

Rosemarie Bartlett: And then the last question that I have: **Is an air barrier required on ceiling insulation installed between wood tresses with a dropped acoustic ceiling in a commercial building?**

Eric Makela: Okay. This has been an interesting installation that I have seen and been questioned on a few times. Essentially what this is is that you - - if you have a truss system in a small commercial building, some of the installations actually suspend the insulation at the bottom court of that truss and then put a drop ceiling below it. The insulation that's suspended, that's your building envelope and you really need to have an air barrier on that - - underneath that insulation. Your insulation must be in contact with the air barrier. So you need to find a product that can actually install underneath the insulation that can be sealed up. Because again if you don't have an air barrier, it allows heat and cool and air currents to transfer through that insulation. So what you can use on that is sheetrock, for example, putting in sheetrock on the bottom core, underneath core of the truss, laying your insulation on top of that and then putting your drop ceiling below it. That's an option. Others have tried to use foil-backed insulation and actually taping the seams of folk-backed insulation. It has to be taped very well and essentially permanently in order to work. The product… The problem you need - - you face on that is to make sure that that foil backing can actually be installed in a concealed space, and there might be some fire requirements based on the fire ratings that you're putting up there. I've heard of people trying to use poly - - clear poly up in there too, but again, you need to make sure that that product can actually be installed in a concealed space and make sure it's rated for installation in a concealed space. So that kind of insulation, it's a difficult one. The best way to do it from my standpoint is to either install the insulation on top of a hard sheetrock ceiling and drop your drop ceiling below that or to put the insulation actually up underneath the roof deck because your roof deck in that case would be considered an air barrier.

Rosemarie Bartlett: Okay great.

Eric Makela: Great.

Rosemarie Bartlett: Thanks a lot, Eric. Thanks to all of you for attending. The U.S. Department of Energy really appreciates it.

I have a few other questions that have come in very similar to some of our logistical announcements. First off, if you go to the website that's listed on the screen right now, www.energycodes.gov, and in the center of the screen go down to our link to our Resource Center, we actually have prepared some code notes that try to further describe some of the new requirements in the 2009 IECC, so you might want to check those out.

I've also had some questions about whether or not this webcast will be available in video format, and it will be in approximately two weeks, hopefully a week, but give us two weeks just in case. At energycodes.gov, you'll be able to link back to a video version of this webcast.

And lastly, I'm still getting questions about how to get credits and the certificates, so the link that is on the screen right now, you need to write that down, type it into your browser, follow through the pages and you will come to the point where you can enter your name and AIA membership number and/or print - - generate and print a certificate of completion for yourself.

So thanks again for participating in today's webcast brought you to be the U.S. Department of Energy. You may all disconnect.

Please Note: * Proper names/organizations spelling not verified.
[sic] Verbatim, might need confirmation.
- - Indicates hesitation, faltering speech, or stammering.