Condensation Risk Assessment in Glazing Design

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by Karol Kazmierczak, CSI, CDT, AIA, ASHRAE, LEED AP

A condensation risk assessment on building enclosure details can be used to gather information on potential condensate formation, suggesting ways to improve design. These evaluations indicate whether water condensation will form within a particular construction detail, providing the average design conditions listed in the specifications are met.

In the assessment, a thermal simulation yields a 'worst-case' temperature map that can be compared with the dewpoints obtained by water vapor pressure analysis. The process may involve one or more iterations to verify subsequent design modifications.

Condensation forms when the temperature of the analyzed layer is at or below the dewpoint temperature. For simplicity's sake, only two extreme cases are analyzed: winter conditions for heated spaces and summer conditions for cooled spaces. Typically, the primary concern of the winter analysis is thermal insulation. The primary concern of the summer analysis, on the other hand, is the air seal and the adequacy of a mechanical system.

As the overall quality of construction increases, issues once regarded as marginal begin to surface. One of these is the 'pure' condensation primarily caused by diffusion, as opposed to air leakage. A glazing design typically provides a sufficient air seal to postpone leak-related concerns until the construction phase.

This article deals exclusively with winter condensation. Summer condensation seldom presents a problem because the condensation forming on the exterior surface is managed by the same means as rainwater. However, winter condensation forming on interior surfaces is much tougher to control.

Are condensation risk assessments necessary?

As long as it does not create conditions for accelerated deterioration from moisture, condensation can be acceptable. In other words, the belt of water droplets occasionally appearing on the edge of a glass pane may be a visual annoyance, but provided the condensate is temporary in nature (*i.e.* it stays limited to its original location before entirely evaporating), it is not a critical failure.

In Figure 1, condensation is forming on glass and its frame. Adjacent materials (*i.e.* metal, glass, and rubber) should be water-resistant. Consequently, there is an emphasis on ventilation. Curtain wall designers often look to drainage as a primary means to ensure the condensate (or its freezing) does not damage adjacent materials sensitive to moisture; the additional benefit is increased control of incidental rainwater leakage.

Whether a condensation analysis is necessary depends on the project. A sound design following the principles of building envelope creation may not need a detailed condensation risk assessment. Unfortunately, as it happens, most designs violate the rules of continuity along with the descending permeability of façade layers.

Figure 1

Images courtesy Karol Kazmierczak

Condensation formation on glass and frame.

Continuity

The principle of continuity says the elements performing essential functions must be kept continuous throughout an enclosure, no matter which vertical or horizontal section of building envelope is analyzed. A discontinuity causes a functional failure. The typical example is a misalignment of the thermal insulation layer resulting in an increased risk of condensation at the offset area. The area of misalignment frequently happens to contain highly conductive bridging elements (*e.g.* metal studs).

The solution is simple, but the execution is difficult: keep the layers continuous. A good façade consultant should be able to explain available technology and draw alternative

Figure 2

Airtightness is seldom achievable—the typical warranty on an insulated glazing unit (IGU) seal is 10 years.

Figure 3

This photo depicts the disintegration of a sealed exterior wall surface in a heating climate (New York).

solution details of the seemingly inevitable penetrations, offsets, and misalignments.

Descending permeability

The principle of descending permeability says the layers forming the enclosure must be placed in order of their permeability—from highest to lowest, starting on the colder side of the partition. In other words, a properly layered assembly should allow moisture to evaporate by the same means it lets the moisture in: the pressure differential.

A hermetic assembly is an overused exception to this rule, frequently defeated by the reality of a construction site. Even insulated glass units (IGUs), which are manufactured under a strict quality regime otherwise unachievable in a field, start leaking air from the day they are assembled, carrying only a 10-year long warranty that reflects the minimum life span estimate (Figure 2).

Figure 4

The disintegration of a sealed interior wall surface in a cooling climate (Alabama).

Examples of permeability violations

There are numerous cases where the principle of descending permeability has been violated, including glazed brick walls, miscellaneous surface sealers, and vinyl wallpaper.

In a heating climate, barrier wall designers tend to seal the exterior wall surfaces with water- and freeze-proof materials that are less permeable than the interior layers. This results in condensate entrapment in the heated building's assembly that may even endanger public safety, as illustrated by the photograph of a spalling glazed brick wall in Figure 3.

In a cooling climate, the reverse configuration (equally inappropriate) involves a low-perm (*e.g.* vinyl) wallpaper, as in Figure 4. In a warm climate, the solution is simple: eliminate the vinyl and pressurize the building. In a cold and mild climate, there are two alternative solutions:

- an interior vapor retarder (this calls for meticulous field quality control); or
- a ventilated exterior layer (*i.e.* a rainscreen assembly—a better but more expensive solution).

Other architectural examples illustrative of descending permeability principles (and the implications of their violation) follow.

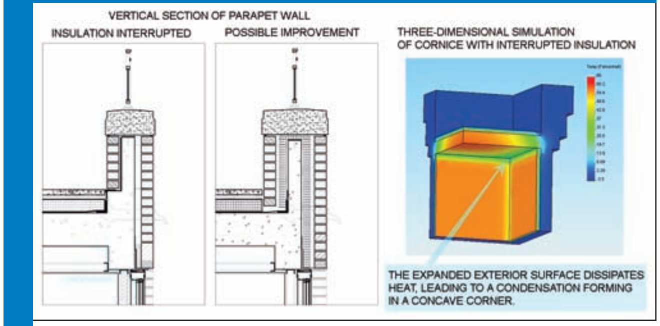
Roofs

The design/construction community has already discovered the destructiveness of thermally inducted movements of structural decks caused by interior insulation. However, many architects in heating climates are still tempted to place insulation (typically the least permeable façade layer) on the interior, warm side of walls, and create associated misalignments, interruptions, and discontinuities along the connections of roofs, interior walls, and slabs.

As a result, one of the most severe conditions is associated with the roof-wall perimeter transitions (Figure 5), particularly at the corners, where there are several factors simultaneously conspiring to cause condensation:

- the diminished air circulation on the warmer side (especially when covered with a ceiling);
- expanded exterior surface dissipating heat;
- diminished interior surface supplying heat; and
- heavy cold-bridging by construction.

Figure 5



This roof/wall transition has particularly bad condensation occurring at corners.

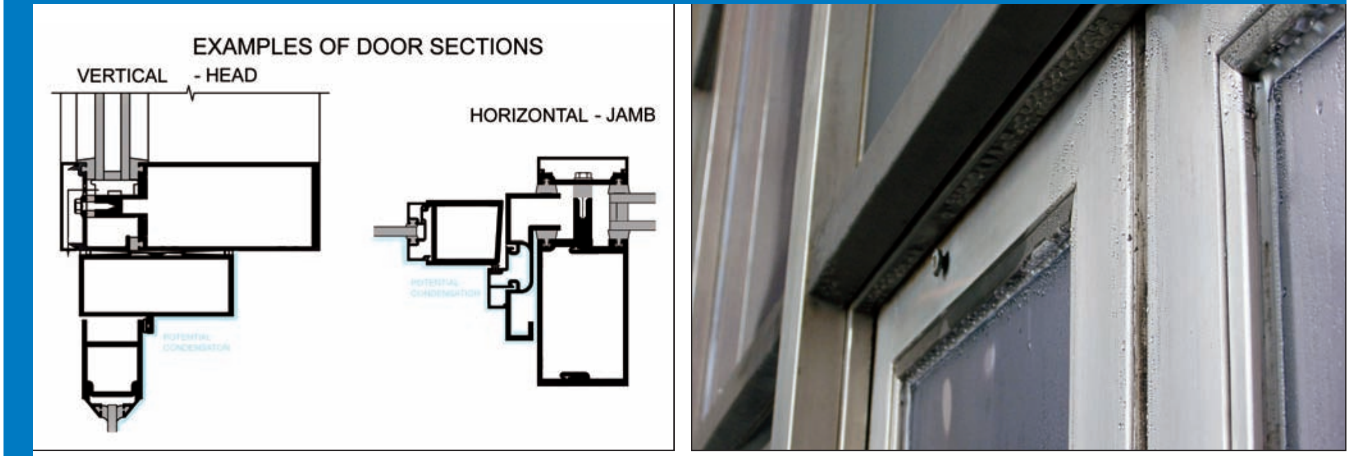
Doors

Figure 6 (page 98) illustrates door details in a curtain wall, along with the resulting condensation on the interior door's surfaces. The doors exhibit heavy condensation, which is particularly troubling in rooms equipped with multiple sets of doors habitually kept closed in winter (*e.g.* restaurant garden.) Figure 7 (page 98) shows a thermally broken door, properly integrated into a curtain wall's glazing pocket. The thermal insulation layer is uninterrupted on all analyzed sections.

Transoms

Figure 8 (page 98) offers another example of a confusing solution, adapted from an American architectural textbook without sufficient explanation of its exclusive warm climate applicability. The illustration on the right shows the example

Figure 6



The photo above shows cold doors in insulated curtain walls, along with the resulting condensation on their interior surface.

of the intermittent plastic clips used on the interior side of the transom. In a cold climate, a warm, moist air can enter behind the snap-on aluminum cover through both the intermittent clips and the discontinuities of the cover. Then, a water vapor contained in the air condenses (or freezes, as in this case) on the non-insulated aluminum surface.

The results of a thermal simulation of a similar transom profile in Figure 9 (page 100)—designed for a particularly cold part of Virginia—show the temperature at this surface is –7.3 C (18.8 F).

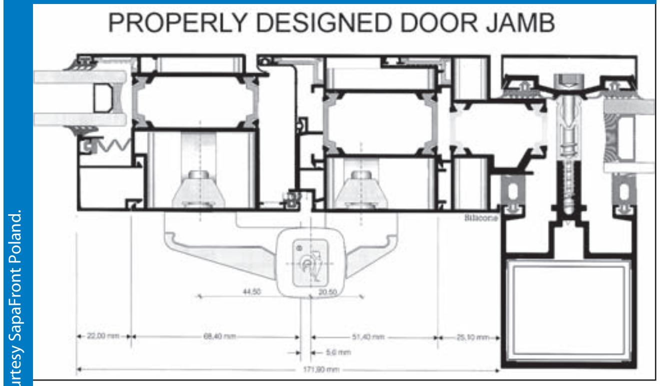
When should the assessment occur?

A preliminary condensation risk review should take place as early as possible in the construction design stage. The best design is one that does not need detailed condensation risk simulations. If at a certain stage there is a suspicion condensation may become a problem, the expensive simulations would probably describe the situation scientifically, but the solution would still remain the same: change the design.

The process is sometimes specified in lieu of American Architectural Manufacturers Association (AAMA) 1503, *Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors, and Glazed Wall Sections,* and performed during an early construction phase by a consultant hired by a glazing subcontractor. Consequently, the necessity of design modification may come as a late and unpleasant surprise for both the designer-of-record and the design-build team, potentially delaying fabrication and construction, as well as generating a claim for additional time and costs.

A subcontractor may have a legitimate complaint against the design-team-of-record when no earlier assessments were performed to check the soundness of an architectural design.

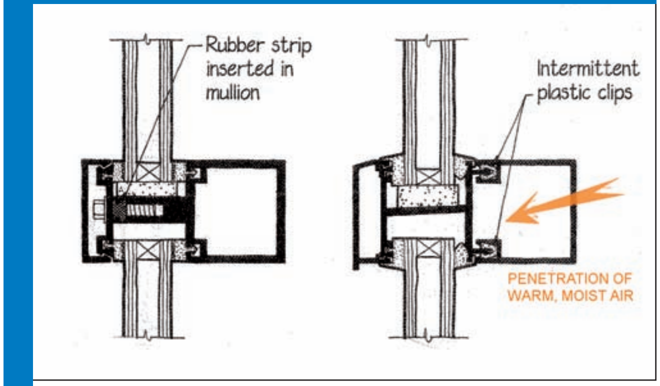
Figure 7



This thermally broken door is properly integrated with a curtain wall.

Figure courtesy SapaFront Poland.

Figure 8



Not all 'thermally improved' aluminum assemblies are designed as equals. See also Figure 9 (page 100).

Figure courtesy Edward Allen's *Architectural Detailing: Function, Constructibility, Aesthetics* (1993). Reprinted with permission of John Wiley & Sons Inc.

Some may request an engineering change order. At this stage, it is also too late for any changes to the adjacent assemblies—they often remain unreported because they are located outside the glazing subcontractor's scope.

This potential unpleasant situation is best averted by performing on initial condensation risk review at the early stages of the construction design stage, when the lesser dimensional relationships are defined on basis of conceptual details.

The consultant may first give general guidance on the principles of building enclosure design, and then once the first set of details is finished, may run inexpensive, simplified thermal simulations of the most suspicious details, saving the design team from a potential embarrassment of change orders down the road. A design team that ambitiously designs custom façades on a regular basis may need to employ or train someone to perform such assessments in-house.

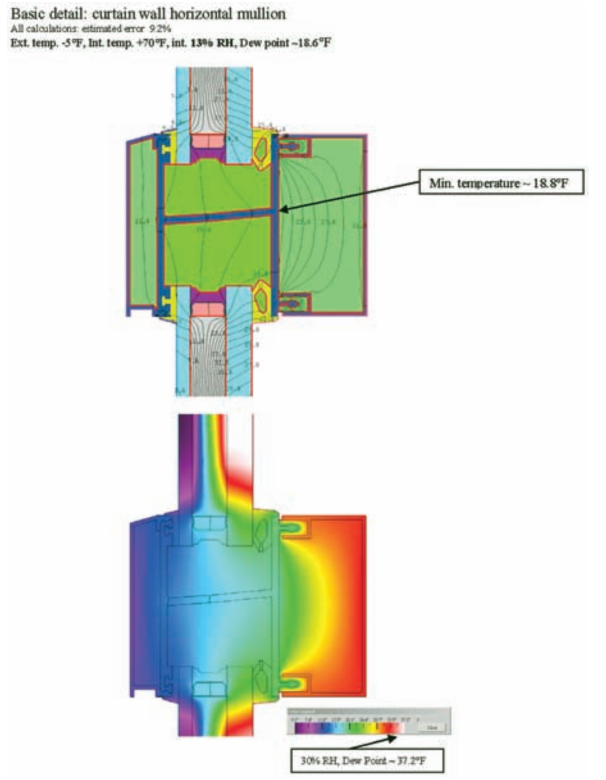
Limitations of typical assessments

When it comes to reading assessment reports, it is important to remember "low risk of condensation" does not mean it will never form during the building's life. The average design conditions listed in the architectural specifications are not necessarily maintained in the center of their range in real life. Some conditions—alone or in combination—that can possibly lead to condensation are discussed in the following paragraphs. (To overcome some of these limitations, additional analyses may be performed for the worst-case scenarios based on the lowest construction tolerances and harshest recorded weather events.)

External temperatures falling below the design temperature.
Certain locales may experience more extreme conditions than the ones statistically determined for the whole region on the basis of an average 50-year period. The building owner may have a good knowledge of local conditions if he or she lives in the area.

High winds, exceeding the design velocity, in conjunction with, at, or near design temperature.
Exterior airflow chills the exterior surface; wind speed varies with location, exposure, and height. A good indication is the structural wind pressure map prepared in accordance with the wind tunnel tests or American Society of Civil Engineers (ASCE) 7, *Minimum Design Loads for Buildings and Other Structures*. The numbers represent the 50-year occurrence,

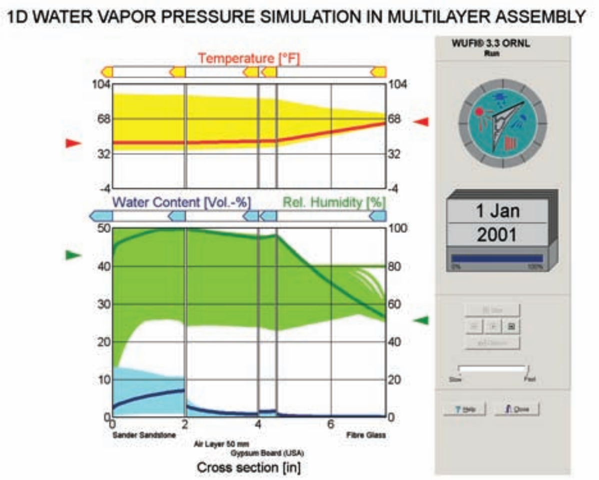
Figure 9



The thermal analysis of a curtain wall transom shows frosting on the surface exposed to the warm, moist interior air.

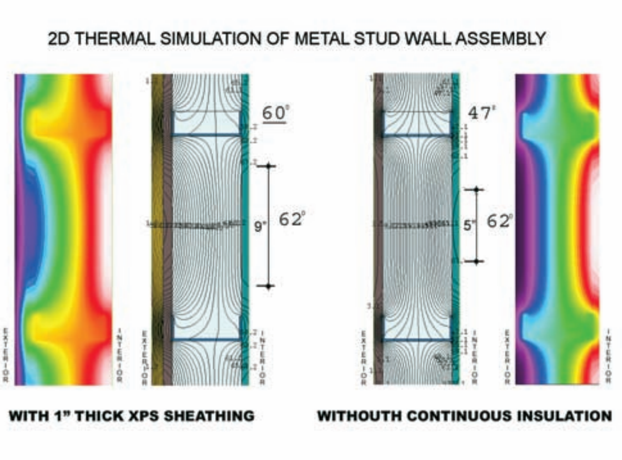
so an appropriate adjustment is necessary to avoid overdoing the design. However, a typical 20-km/h (12.5-mph) wind speed used in simulations is seldom adequate.

Figure 11



This screen shot shows a one-dimensional, transient analysis of water vapor transport and storage.

Figure 10



Two-dimensional simulations overlook the third dimension.

Upper and lower bound combinations of interior temperature and humidity ranges within a mechanical adjustment tolerance.
A humidistat or design humidifier may have a tolerance of about ±3 percent. Variations of interior temperature and increase of humidity may also be caused by human activities (*e.g.* washing or cooking) A dehumidifier is rare in a winter mechanical design because there is no expected latent load; the supplied exterior air is typically drier than needed. Coordination with the mechanical design is crucial.

Upper and lower bound combinations of interior temperature/humidity ranges outside mechanical adjustment tolerance.
This can occur when there is no thermostat or humidistat (or the device is malfunctioning).

Low or null air speed adjacent to the interior surfaces of the exterior enclosure caused either by error or lack of mechanical design, its malfunction, or a physical obstruction.
In a design using convection as the primary means of energy supply, an interior airflow provides energy necessary to keep surfaces above the dewpoint. A pocket of 'dead air' may cause a drop in temperature.

Variations from a computer model.
A true construction detail is usually different from an idealized computer model. There are many variables, such as:

- construction tolerances;
- materials' characteristics, both original and in use (*e.g.* surface cleanliness);
- workmanship; and
- psychometric conditions inside and outside a building enclosure.

Limitations of basic computer simulation methods

Aside from hand calculations, several popular computer programs can help a designer assess condensation risk. Most have certain limitations and need to be used judiciously.

On the low end, several free programs can simulate a two-dimensional section of an assembly. Therm, developed and freely distributed by Lawrence Berkeley National Laboratory (LBNL) has been approved by the National Fenestration Rating Council (NFRC) for analyses in lieu of physical testing.[1] However, the two-dimensional, steady-state program has four main limitations:

1. 2D simulation overlooks the world's three-dimensional nature. It assumes an analyzed section continues endlessly. Interruptions, anchors, splices, corners, and members lying behind or in front of the section plane are not simulated. (In Figure 10, a 2D simulation is illustrated through the verification of cold-bridging caused by metal studs in a multi-layer wall assembly.)
2. Steady-state simulation assumes environmental conditions are held steady (unlike the transient nature of the real world). Daily and annual temperature swings, humidity/wind variations, and rain cooling are not simulated. This means the assemblies with the high heat storage capacity (*e.g.* masonry walls, heavy precast panels, concrete slabs) are incorrectly simulated. Further, it overlooks daily condensate formation—morning dew underside metal copings and sills that tend to wet materials lying directly underneath, for example.
3. These simulations rely on simplified radiation and convection computational algorithms—neither radiation nor convection are modeled, but they are rather calculated based on assumptions. Heat sources and fans are among the off-limits assemblies.
4. Material permeability and water vapor diffusion, both steady-state and transient, are not simulated. A simplified analysis of this kind can be performed in WUFI-ORNL/IBP software, as illustrated in Figure 11.[2]

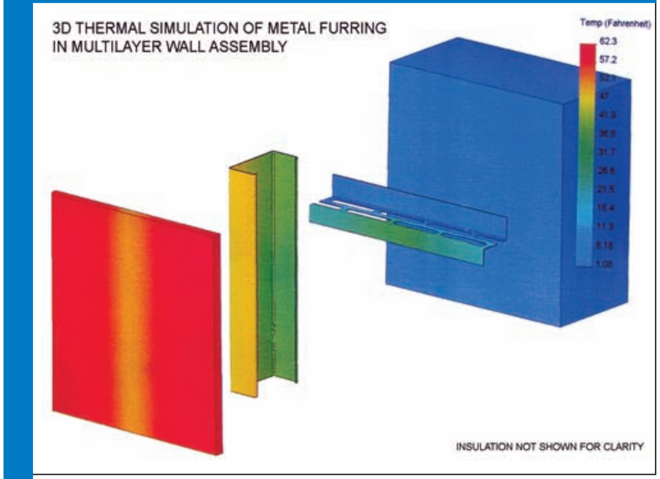
Advanced computer simulations

The aforementioned limitations are addressed by the advanced computer simulation software, which can offer the following advantages.

Transient analysis

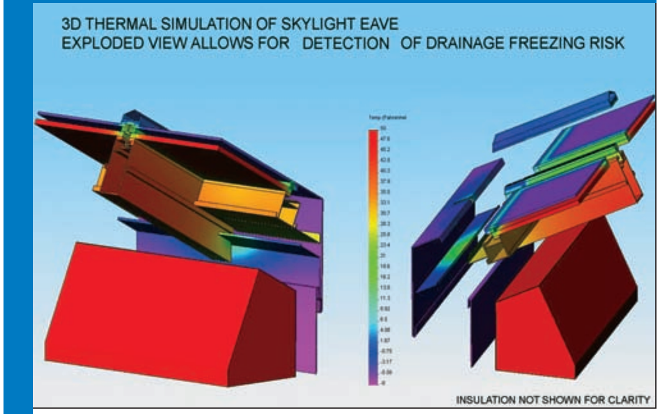
Transient (as opposed to steady-state) analysis is akin to a movie illustrating the temperature swing. It will produce more reliable results for high-heat-storage components (*e.g.* masonry and concrete walls) than the steady-state simulations, which tend to exaggerate their behavior.

Figure 12



This illustrates three-dimensional verification of the mitigation of the cold-bridging by the perpendicular configuration of metal studs and furring.

Figure 13



Three-dimensional verification of the resulting temperature at the drainage outlet. Green color shows the water discharge will freeze.

Transient analyses are indispensable for climates with high daily swings and low annual swings; they provide a tool for passive solar heating assessment.

3D modeling

Figure 12 shows the verification of cold-bridging caused by the metal furring supporting gypsum wallboard on the interior surface of an exterior precast cladding. The double metal furring installed as perpendicular to each other has less impact than a single furring. The figure shows an exploded view, and the insulation is hidden for clarity. A similar simulation performed in a 2D program would not allow for such verification. The 3D analysis in Figure 13 allows the detection of drainage path clogging by a condensate freezing at the exterior discharge area of a skylight eave's sill.

Radiation modeling

Another attribute of advanced programs is radiation modeling and simulations (as opposed to estimating). This is illustrated in Figure 14 by the shining metal pitcher standing on the windowsill. The low emissivity of the copper surface shields radiant heat from the room interior, leaving a distinct steamy shade on the glass.

Figure 14

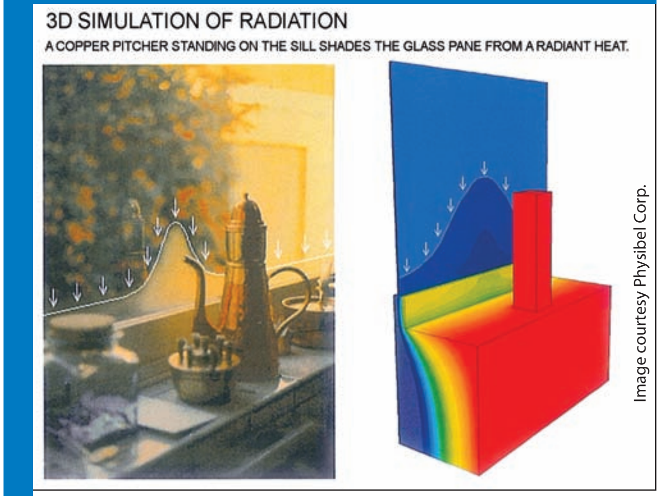
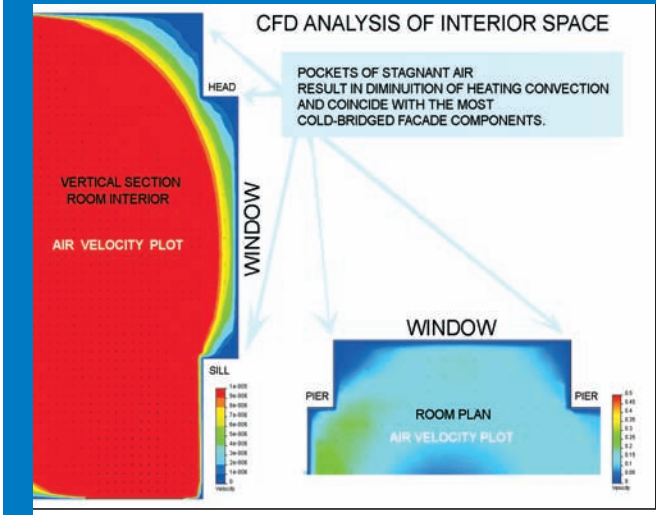


Image courtesy Physibel Corp.

The metal pitcher standing on the windowsill shields radiant heat from the room interior, leaving a distinct steamy shade on the glass.

Figure 15



Computational fluid dynamics (CFD) analyses will reveal areas of low convection.

Computational fluid dynamics

Computational fluid dynamics (CFD) convection simulations (as opposed to estimating) are another component of advanced programs. Figure 15 illustrates the drop of convection heating at window and ceiling perimeters, which forms pockets of stagnant air; coincidently, these areas are most prone to cold-bridging.

Water vapor diffusion analyses are needed in assemblies not containing at least one impermeable screen at any analyzed wall fragment. While it is available, most glazing analyses do not need detailed CFD hygrothermal analysis because the materials involved (*e.g.* glass and metals) are impermeable, and the analysis cannot fully estimate discrepancies between the design and as-build condition, which strongly influence water vapor diffusion.

Codes and Legislation

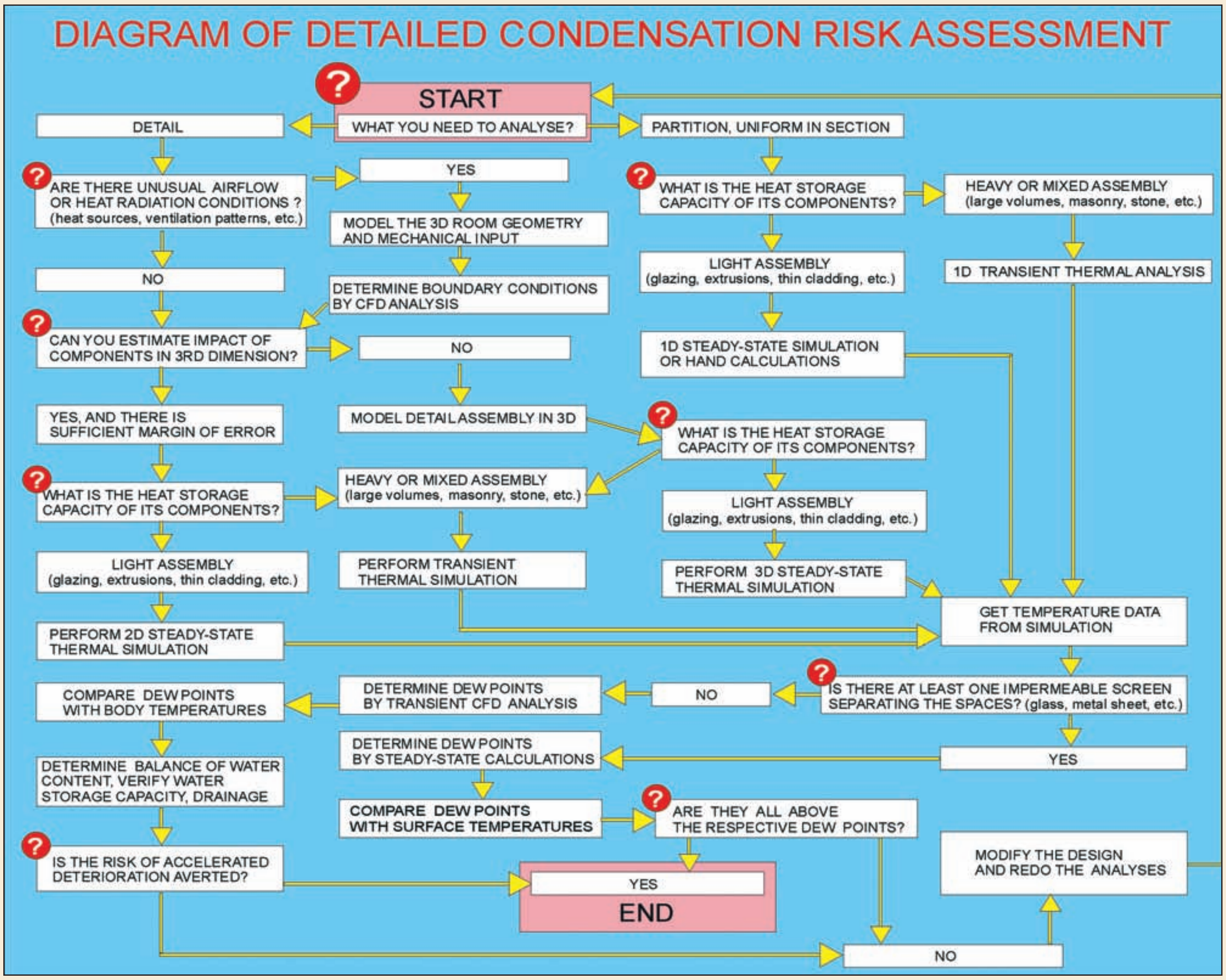
The 2006 *International Building Code (IBC)* contains two provisions for condensation prevention. Both Section 1301 of Chapter 13 (Energy Efficiency) and Section 1403 of Chapter 14 (Exterior Walls) refer to the *International Energy Conservation Code (IECC)*, which in turn contains separate requirements for residential and commercial buildings: 502.1.1 and 802.1.2, respectively. *IECC* also provides the American Society of Heating, Refrigerating, and Air-conditioning Engineers (ASHRAE) 90.1-2004, *Energy Standard for Buildings Except Low-rise Residential Buildings*, as an alternative path of compliance for commercial buildings.

Selecting the proper software

The long learning curve and the high cost of these advanced programs usually prove prohibitive for an average architect. Further, the required customization, mechanical knowledge, limited data exchange, and model size make them exclusive tools. The engineering costs that may be justified by the returns expected on mass-produced items do not apply in the construction industry where projects are individually designed and built. “What Do You Need?” (page 104) provides a simplified decision-making diagram for determining which computer simulations are necessary for a particular project.

What Do You Need?

This flowchart can help when it comes time to determine which simulations are necessary for a project.



Specifying against condensation

A quick scan of typical warranties shows many curtain wall manufacturers specifically and expressly exclude the responsibility for frost and condensation. Consequently, it is up to the designer to specify a proper glazing assembly.

It is crucial to verify the requirements are achievable. Manufacturers of most off-the-shelf products have them already tested. The designer-of-record should request and review AAMA 1503 test reports before the product is chosen. He or she should only accept the reports when the following requirements are jointly met:

- exterior design temperature is equal to or higher than the one specified in the testing standard (–17.8 C [0 F]);
- interior design temperature is equal to or greater than the one specified in the test (21 C [69.8 F]);
- design wind speed is equal/lower than 6.7 m/s (15 mph); and
- temperatures read by all the thermocouples located on the frame are equal to or above the design dewpoint.

The typical interior design temperature is in the range of 22.2 to 23.9 C (72 to 75 F). A higher interior ambient temperature produces a higher dewpoint temperature. It also slightly warms the interior surface, but in a much less proportional and predictable way. A better glass should be specified if the designed glass has a lower U-value than the one used at the test, or the temperature read by any thermocouple located on the glass is below the design dewpoint.

In case the design configuration varies from the one already tested (*e.g.* a curtain wall contains an untested door), or any significant modifications are made to the

Recommended Reading

- Joseph Lstiburek and John Carmody's *Moisture Control Handbook: Principles and Practices for Residential and Small Commercial Buildings* (John Wiley & Sons, 1994); and
- *ASHRAE Handbook of Fundamentals* (American Society of Heating, Refrigerating, and Air-Conditioning Engineers, 2005).

Examples of sound façade details can be found in:

- Friedbert Kind-Barkauskas et al's *Concrete Construction Manual* (Birkhauser, 2002);
- Gunter Pfeifer et al's *Masonry Construction Manual* (Birkhauser, 2001);
- Thomas Herzog's *Façade Construction Manual* (Birkhauser, 2004);
- Christian Schittich et al's *Glass Construction Manual* (Birkhauser, 1999);
- Christian Schittich's *In Detail: Building Skins—Concepts, Layers, Materials* (Birkhauser, 2001); and
- the monthly English edition of magazine titled *Detail* (Institut fuer Internationale Architecktur-Dokumentation GmbH&Co).

Of course, additional worthwhile reading materials are available free of charge via the Internet. Visit the Web page of Canada's University of Waterloo (www.civil.uwaterloo.ca/beg/Publications.htm), along with John Straube's www.balancedsolutions.com. Another rich library of free scientific articles is also available at the Web page of the National Research Council of Canada's Institute of Research in Construction at irc.nrc-cnrc.gc.ca.

tested product (*e.g.* extended decorative exterior trim), a thermal simulation or test is needed to re-verify the design. A thermal computer simulation is typically less expensive than a laboratory test.

Either thermal tests or simulations should be specified if the product was not tested before (*e.g.* custom or modified glazing assemblies) or the design temperatures unfavorably differ from the ones specified in AAMA 1503.

A properly performed condensation risk assessment of the glazing should model all adjacent conditions based on shop drawings and actual materials, rather than the architectural drawings. Specifications of adjacent mechanical equipment should be referenced in order to allow proper bid documentation packaging.

The designer-of-record should always request the detailed explanations of assumptions, copies of drawings used for modeling, list of physical characteristics of

Re-thinking Green

Is the prevention of condensation a way of helping keep a building green? While most people seem to think so, the answer is typically the opposite. When condensation risk is at stake, energy conservation is often a cost.

Figure A

Image courtesy Physibel Corp.

Radiation simulation shows how the radiant energy is distributed on the receiving surfaces. The majority of the energy expended on the condensation prevention is dissipated to the exterior.

Figure B

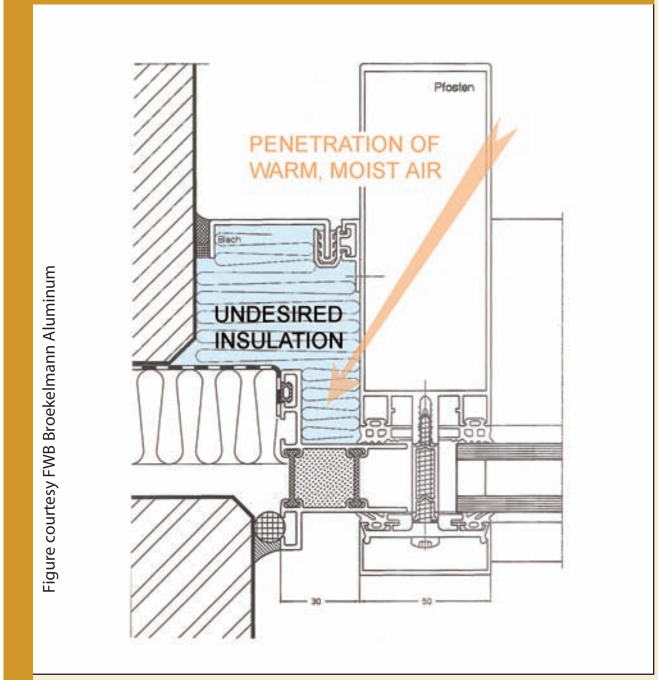


Figure courtesy FWB Broekelmann Aluminum

An increase of insulation may cost undesirable condensation.

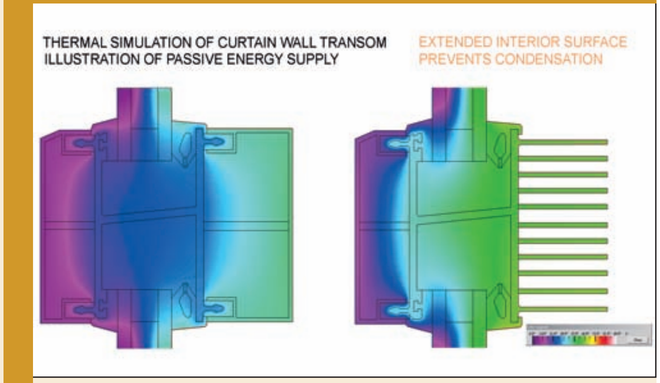
There are two basic approaches to anti-condensation design: either increase thermal insulation or increase the heat supply. The latter is the reason why heat sources are located close to exterior fenestration. While they warm the building shell, they also consume both the ozone layer and the owner's operation budget (See Figure A.)

Too much insulation, otherwise desirable from an energy conservation standpoint, may prevent the supply of energy and cause condensation. Figure B shows the insulation added on the vapor retarder's warmer side needs a second layer of vapor retarder to prevent condensation.

In a sophisticated glazing design, the initial construction cost may overshadow a lifetime cost. An expensive whole-glass construction may easily be more than $500/sf; the annual price tag of the energy supplied to the heat tracing to eliminate the unsightly condensation at the glass edges seems negligible in comparison.

At the low end, a similar approach may be practiced by extending the developed interior surfaces to increase the energy supply to under-insulated assemblies. (See Figure C.) Unfortunately, many designers perversely extend the exterior surfaces of walls, sacrificing both the energy conservation and condensation resistance on the altar of subjectively perceived beauty. ◆

Figure C



Increase in heat loss prevents local condensation.

materials used for modeling, and boundary conditions. The materials' assignment should be declared on graphics, and the definition of unacceptable condensation must be clarified.

The architect should demand the psychrometric design conditions (*i.e.* temperatures, air speeds, and humidities) from the mechanical engineer and provide them in the specification for the glazing subcontractor design-build team.

On the other hand, for installations of fenestration in typical mechanical and weather conditions when the detailed tests or simulations are not specified, the condensation resistance factor (CRF) should be made clear.

When to Engage a Condensation Risk Consultant

There are various situations when hiring an out-of-house consultant may be necessary. These can range from complicated, unusual designs to the need to endure particularly harsh climate conditions. Each case has to be approached individually.

Many designers and owners engage consultants for peer review as part of due diligence on regular basis. Designers typically find consultation sessions very educative, and this knowledge allows them to make informed future hiring decisions based on a project complexity level. An increase of the quota of science and technology in the academic architectural education programs would help the future generations of architects make educated decisions with regard to building physics.

Of course, the next question concerns where to find a condensation risk consultant. These professionals are not classified in the Yellow Pages, so the best advice is to look for references. One good place to check is through one's local Building Enclosure Council (BEC). Visit www.bec-national.org/boardchairs.html for a listing of chapters across the United States.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Condensation risk can be complicated for non-specialist design professionals. Engaging the help of a third-party consultant can help.

Understanding condensation resistance factor

Condensation resistance factor is a dimensionless number indirectly representing a weighted average interior surface temperature of a window assembly. The larger the CRF number, the greater the resistance to condensation. It helps to remember the average interior surface temperature expressed in degrees of Fahrenheit could be approximately derived from CRF by multiplying the condensation resistance factor by 0.7. For example, CRF 50 translates into approximately 35 F (1.67 C.)

It often conveys a disturbing message that some thermocouples might read an even lower temperature during the test, but to find out, one has to request and read a detailed test report. (These documents need to be ordered in advance because they are not typically supplied by default.)

Intended for comparison of the typical off-the-shelf fenestration assemblies, CRF nevertheless heavily relies on the glass quality and is almost useless in a detailed condensation assessment for custom fenestration or a custom psychometric set of parameters (*e.g.* different exterior design temperature).

CRF is determined by the testing specified in the AAMA 1503. Another similar measure is the Temperature Index I defined by Canadian Standards Association (CSA) A 440-90, *Windows,* and A 440.1-91. Further, NFRC has come up with a similar standard NFRC 500, *Procedure for Determining*


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As other aspects of construction improve, condensation becomes a prevalent concern. Design professionals should understand basic building science and follow sound façade engineering principles before engaging a consultant for assistance in the project.

Fenestration. Most differences lie in the method applied to weighting the average temperature.

Manufacturers feel compelled to list two types of CRF: one for glass (CRF_g), and one for the frame (CRF_f). Apparently, the latter better describes assembly quality and helps with the comparison among fenestration products. Comparing $CRF_{g,}$ a designer should verify whether the specified glass and spacer are equal or better than the ones originall tested..

Conclusion

As other aspects of construction improve, condensation becomes a prevalent concern. Risk of condensation should be lowered by obeying basic façade engineering principles during the design phase. Fortunately, numerous aids are available to a conscientious designer. Industry standards can also help navigate the choice and specification of products and tests.

Condensation risk may be identified at the design stage with aid of various computer tools, according to the need. Thanks to the advancements in technology, condensation risk assessment is gradually becoming more available. Whenever in doubt, the designer may employ a building enclosure consultant with the requisite specialized tools and experience.

Notes

[1] Visit www.windows.lbl.gov/software/therm.

[2] Visit www.ornl.gov/sci/btc/apps/moisture.

Additional Information

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Curtain walls

Abstract

The purpose of the condensation risk assessment of building enclosure details is to gather information on potential condensate formation, helping improve design. It indicates whether water condensation will form within a particular construction detail. However, this particular area of building science is not well understood by design/construction professionals. This article provides a snapshot to better one's comprehension

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