Mastering Movement™ Academy

Mastering the Physical Movement of Air, Wind, and Water using Architectural Louvers

AIA Continuing Education Provider

Mastering Movement Academy

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Learning Objectives

UPON COMPLETING THIS COURSE, YOU SHOULD BE ABLE TO:

- Explain how to accommodate wind and rain movement and mitigate water entrainment using louvers to protect the health, safety, and welfare of building occupants while not having to compromise on design intentions.
- Understand how to choose the appropriate louver for specific regions/climates and understand the various testing requirements and certification processes.
- Discuss building science terms around louver systems that control the air in the building, and how louvers work, including management of wind and rain (external) and airflow (internal) and the ways in which emerging industry trends lead to occupant health and well-being.
- Seek early engagement of manufacturers to ensure standards are met and the desired aesthetics are achieved using louvers in creative ways.

Course Overview

In this presentation we look at how the earth's elements—specifically wind, air, and water—impact building movement and how the built environment can be responsive to those impacts.

The course will delve into louvers designed for air, wind, and wind-driven rain movement, the different types of louvers available for specification, how to select louvers for your given parameters and climate/region, and how early collaboration with your manufacturer will lead to better architectural design execution.

Course Overview

IN THIS COURSE WE WILL EXPLORE:

- Louvers designed for air, wind, rain, and wind-driven rain movement.
- The different types of louvers available for specification.
- How to select louvers for your given parameters and climate/region.
- How early collaboration with your manufacturer will lead to better architectural design execution.

Louvers Defined

The earth is in constant movement and buildings must be designed to accommodate these external natural elements and also withstand occupant wear and tear.

Louvers Permit Airflow

Louvers permit the flow of air but inhibit the entrance of water and other unwanted elements.

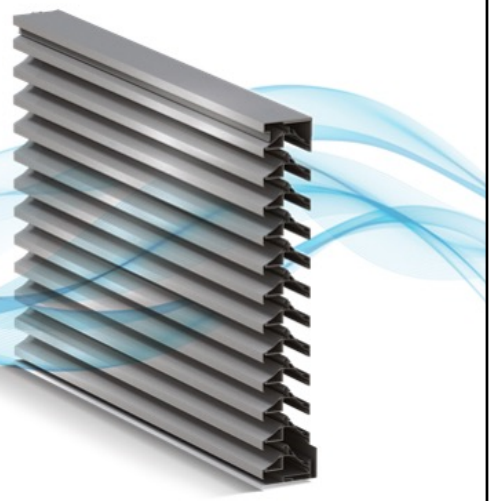
The natural impacts of air, wind, an- wind-driven rain can be managed by specifying architectural louvers based on your project parameters.

When incorporated into the built environment, louvers can:

-Permit fresh, outside air to enter the building through controlled mechanical systems
-Inhibit the entrance of water and other unwanted elements
-Defend against water accumulation that can lead to mold
-Bird screen and blank-off panel accessories can prevent the entry of wildlife and help maintain required building insulation "R" values

Louvers – part of the air handler system

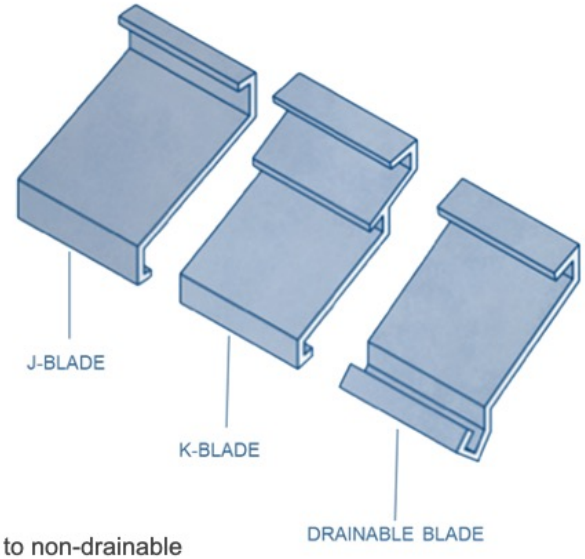
- Air handlers assist movement of air through a louver into a building.
- Louvers are part of a mechanical system.
- Outside air is brought inside, filtered, then picked up by the air handler system, and put through the duct work.



Louvers are an important part of the building's air handler system.

Air entering the building begins by passing through a louver and is moved through the building with the assistance of an air handler.
Outside air is brought inside, filtered, and then passed through the ductwork and is then exhausted through a different area of louvers.
This cycle is repeated and allows for occupant comfort in a conditioned interior environment.

Louvers Humble Beginnings



THE FIRST USE OF ARCHITECTURAL LOUVERS

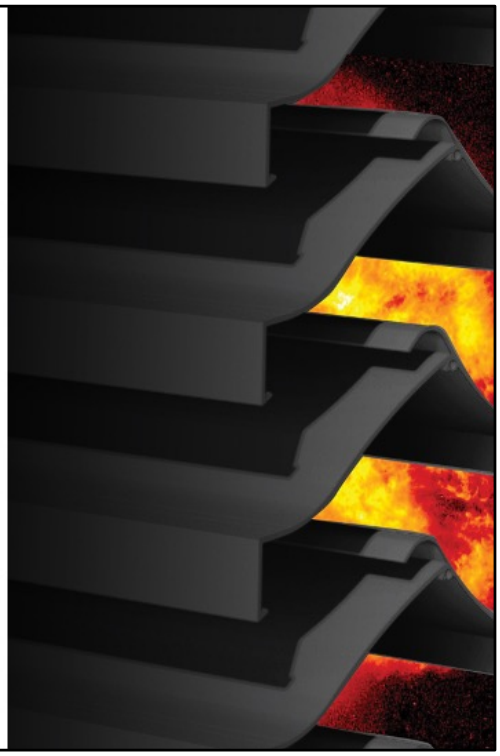
- Traditional “Z” or “J” non-drainable louvers
- Dual drainable blade louver was developed due to non-drainable louvers insufficiency in wind-driven rain conditions

To understand how far we’ve come with louvers today, let’s take a look at what the original louvers looked like.
We will then explore the evolution of louvers to meet the heightened requirements of today's high performance building envelopes.

These original louvers were developed with a simple traditional Z or J blade to manage air flow.
When these louvers proved insufficient in keeping water out in wind-driven rain conditions, the drainable blade louver was developed.

Louver Advancement

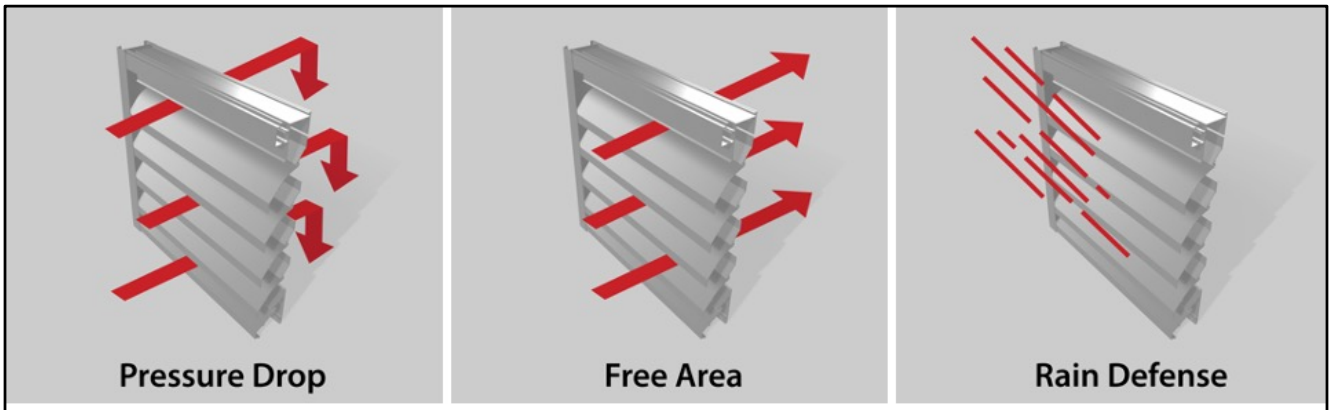
- Non-drainable
- Drainable
- Storm-resistant
- Extreme weather
- Acoustical
- Blast-resistant



Over the years louver engineering has advanced to provide better protection for buildings in severe storm and hurricane prone areas using:
-close blade centerlines- tighter blade spacings
-sophisticated, aerodynamic blade shapes to promote efficient airflow and
-front and rear rain gutters to capture and remove rainwater from the louver before it enters the building.

-Louvers can also be custom engineered to meet the unique performance criteria or aesthetic vision of your project.

The main louver categories today are:
- Non-drainable
- Drainable
- Storm-resistant
- Extreme weather
- Acoustical
- Blast-resistant

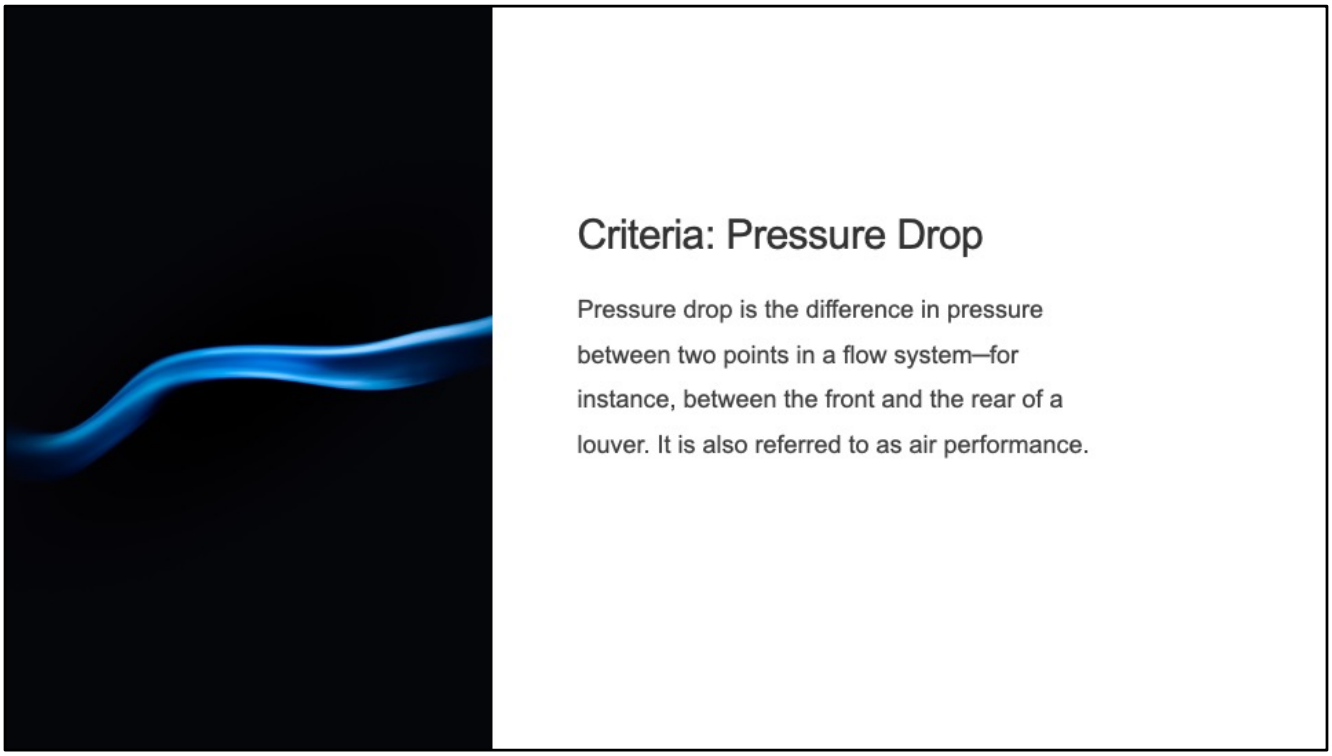


Louver Performance Criteria

Three of the most common performance criteria evaluated for selection of louvers in a given application are shown here.

The three main performance criteria and terms evaluated for louver selection are:
Pressure Drop
Free Area
and
Rain defense

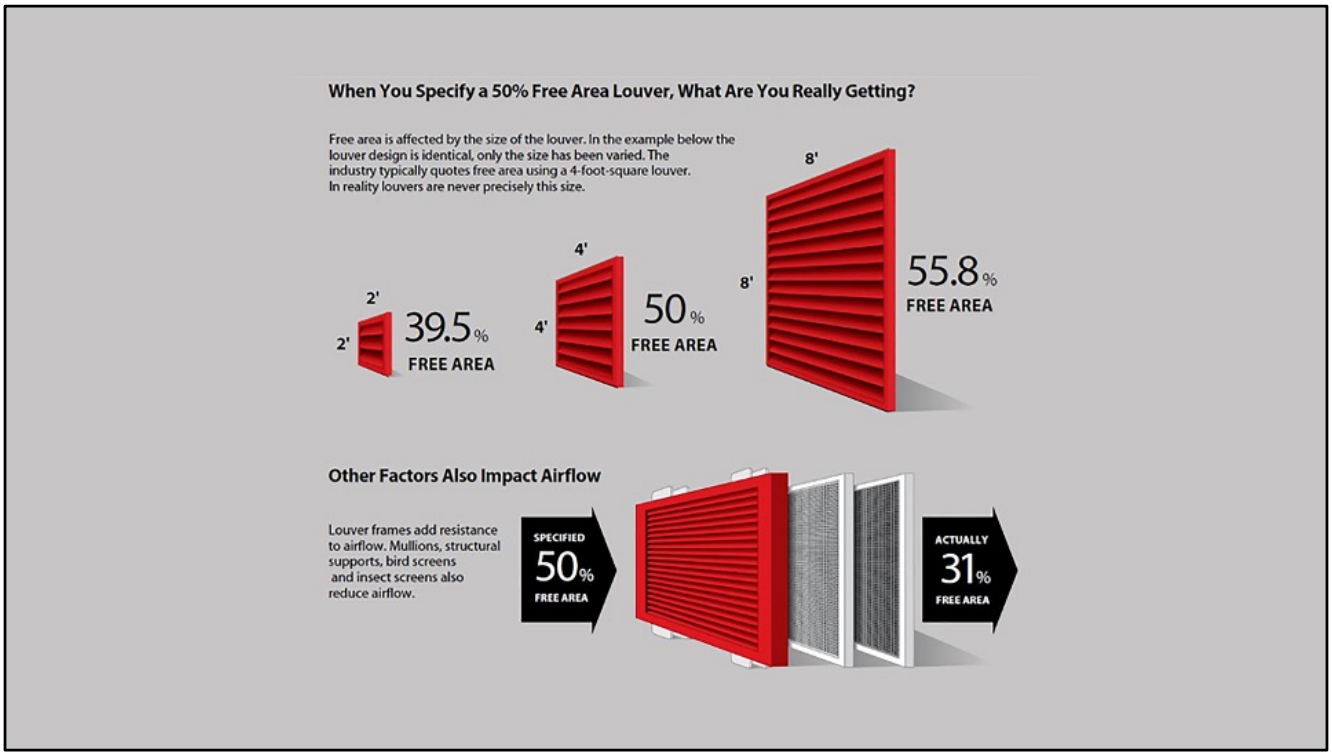
All are important, all are interrelated, and all vary from louver to louver.
We explore these criteria further on the following slides.



Pressure Drop:
Pressure drop is the difference in pressure between two points in a flow system. It is also referred to as air performance. As air is mechanically drawn or pushed through a louver, pressure is created due to the turbulence.
The increasing pressure measurement of this turbulence, or "pressure drop," at higher air velocities is an important part of overall mechanical system design and louver selection and sizing.
Here to elaborate is a louver R+D engineer and AMCA committee member.

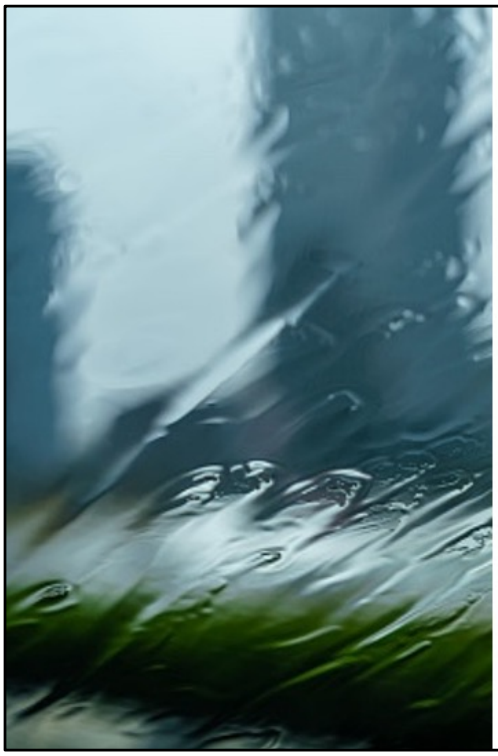
Photo by Marek Piwnicki on Unsplash

Video: Louver Pressure Drop



Free Area (or the unobstructed open area of the louver through which air can pass, typically expressed as a percentage or total available square feet for an area) is another common and important phrase in louver selection terminology.
Generally speaking, a louver with 50% free area is a desirable starting point for mechanical engineers.
However, many factors impact the actual free area of a given louver, including size, louver blade configuration, mullions, structural supports, and the like.
In this example, a specific louver model is shown in three different sizes, however each has a different free area resulting from the actual louver size.
So although free area is an important consideration, and each louver has a benchmark free area based on a standard 4' X 4' test sample, it is not a constant for any specific louver.

Video: Louver Free AreaFree area is the minimum area through which air can pass, usually expressed as a percentage. It is not to be confused with face area, which is the total cross-sectional area of a louver. Generally, the closer blades are together, the better they are for rain defense - but not so much for air flow.
It is important to understand that the free area % listed on manufacturers literature is for a 4'x4' section size.
This % will change as you increase/decrease louver size. If you go smaller than a 4'x4', you will most certainly have a lower % free area.
This is critical when designing mechanical systems utilizing small louvers.
Here is Engineer and AMCA Committee Member Russel Geist again to further explain the details behind free area calculating.



Criteria: Rain Defense

A calculation of the amount of water that passes through a louver while subjected to specific airflow conditions.

Rain Defense:
In order to look at how a louver performs against rain, you need to look at water penetration resistance, which is a calculation of the amount of water that passes through a louver while subjected to specific airflow conditions.

Water penetration resistance is expressed as the weight of water passing through the louver divided by the free area (sq. ft.) at a specified free area velocity.

The maximum velocity rating for water penetration is 6.35 m/s or 1250 fpm.
The baseline pass/fail point for water penetration is .01 ounces per sq. ft. of free area of the test sample.

There are also enhanced levels of water rejection testing which we will explore later.

Louver Standards: AMCA

AMCA – (Air Movement and Control Association International, Inc.) sets testing standards and certifies performance for building products and equipment used for heating, ventilation, and air conditioning.

Original Test – ANSI/AMCA Standard 500- L

Image courtesy AMCA International.

AMCA is the American trade body that sets standards for building products and equipment used for heating, ventilation, and air conditioning.
The original test used – the ANSI/AMCA Standard 500 – L , a water penetration test using still air, is still used today.

In 1999, in response to a demand for greater levels of water protection, AMCA added a new test standard to address concerns of severe weather (wind-driven rain) on louver performance.

Louver Standards: AMCA Certifications

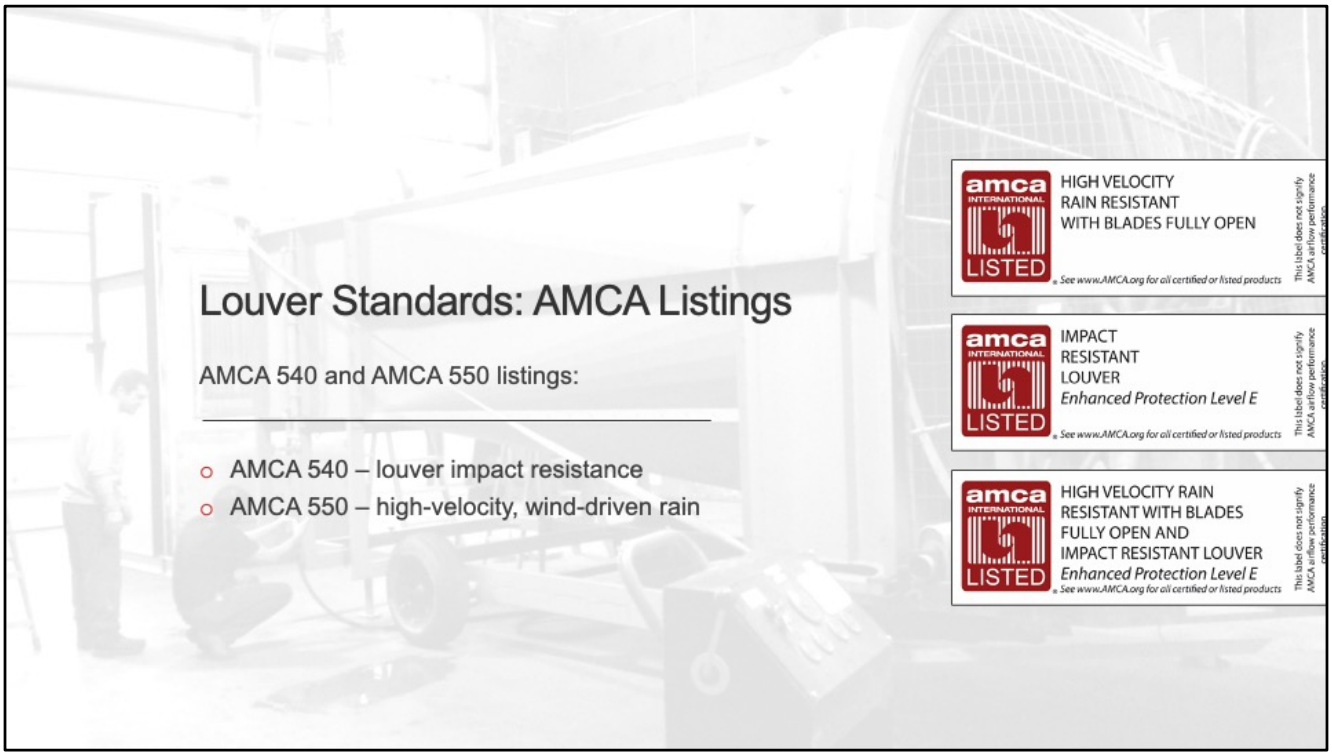
AMCA does testing, certification, and/or listings.

AMCA 500-L addresses:

- Air performance (intake/exhaust pressure drop)
- Still Air Water Penetration (point of beginning water penetration)
- Acoustical performance
- Wind driven rain performance (29.1 mph wind and 3"/hr rainfall rate and/or 50 mph wind and 8"/hr rainfall rate)
- Sand rejection performance

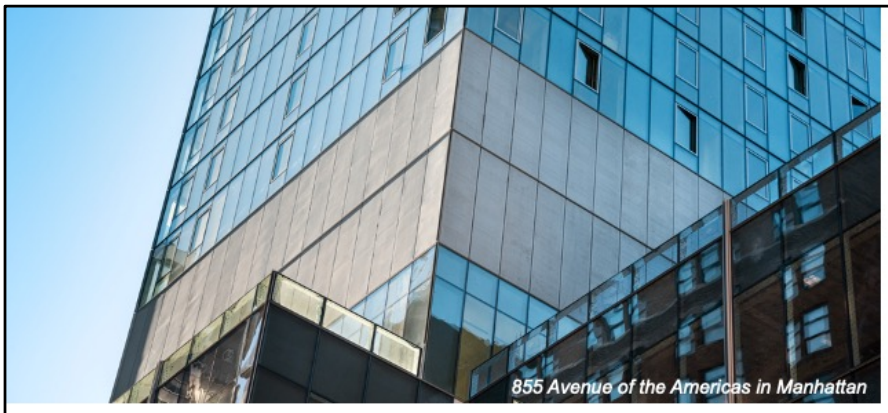
Image courtesy AMCA International.

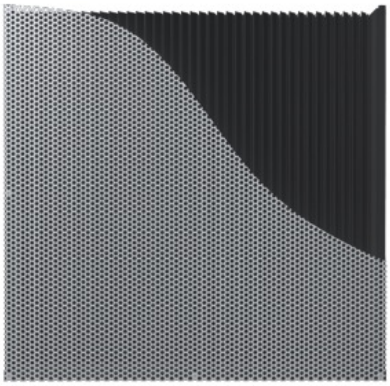
Louvers are tested for any combination of these performances.
Most often, the very minimum performance requirement tested is air performance (pressure drop.)
Additional tests will be conducted on louvers depending on the environmental conditions they are trying to combat.



There are also more recent AMCA listings for tests which were created about ten years ago.
The **AMCA 540 Impact** and **AMCA 550 High Velocity Rain Resistant** tests are two additional listings AMCA provides for louvers besides the AMCA 500-L tests.
We will discuss these later in the presentation.
Here are some examples of the AMCA Labels associated with AMCA 540 and 550 listings.

Labels courtesy of AMCA website





Louver Standards: AMCA Certifications & Listings

Not all louvers are AMCA-certified.

Some manufacturers will test the louvers and louver systems in accordance with AMCA protocol to determine how they perform in unique conditions.

When architects have a decorative element on the face of the louver – perforated or expanded mesh panel, a grille, or decorative tubes – they need to know the performance impact of that element on the louver.
But AMCA standard testing protocols do not allow for the introduction of variable items, or appurtenances, or any other modifications to their test protocols.
This is where project specific independent testing can be a valuable resource to measure what impact that architectural element has on the total performance.

Some manufacturers will conduct in-house testing using AMCA protocol.
In these instances, the louver is still tested according to AMCA 500-L standards with similar equipment as AMCA's.
The test results are documented, however the manufacturer does not offer the AMCA certification.
This "tested in accordance with AMCA" data is acceptable to some clients, especially when validating performance AMCA will not offer testing for.

Louver Standards: Building Codes

Depending on where you build, you'll need to pull local guidelines and code.

Predominant standards are guided by these agencies:

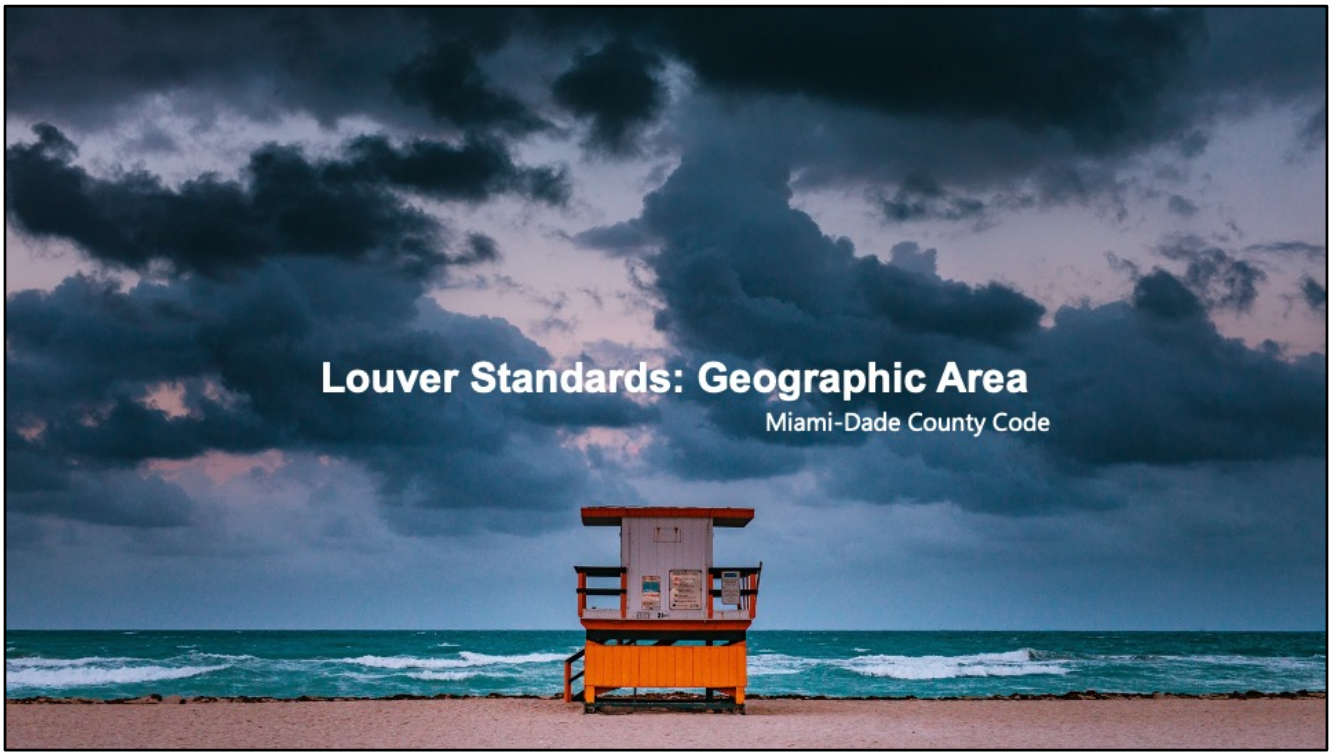
- Miami-Dade County
- International or state building and mechanical codes
- FEMA

Outside of AMCA, there are a few key players that guide testing and certifying louvers based on performance factors. These standards are particularly important to understand in areas prone to hurricanes, typhoons, or other instances where extreme winds may become an issue.

Predominate standards are guided by these agencies:

- Miami-Dade County
- International or state building and mechanical codes
- FEMA

(FEMA- Federal Emergency Management Agency)

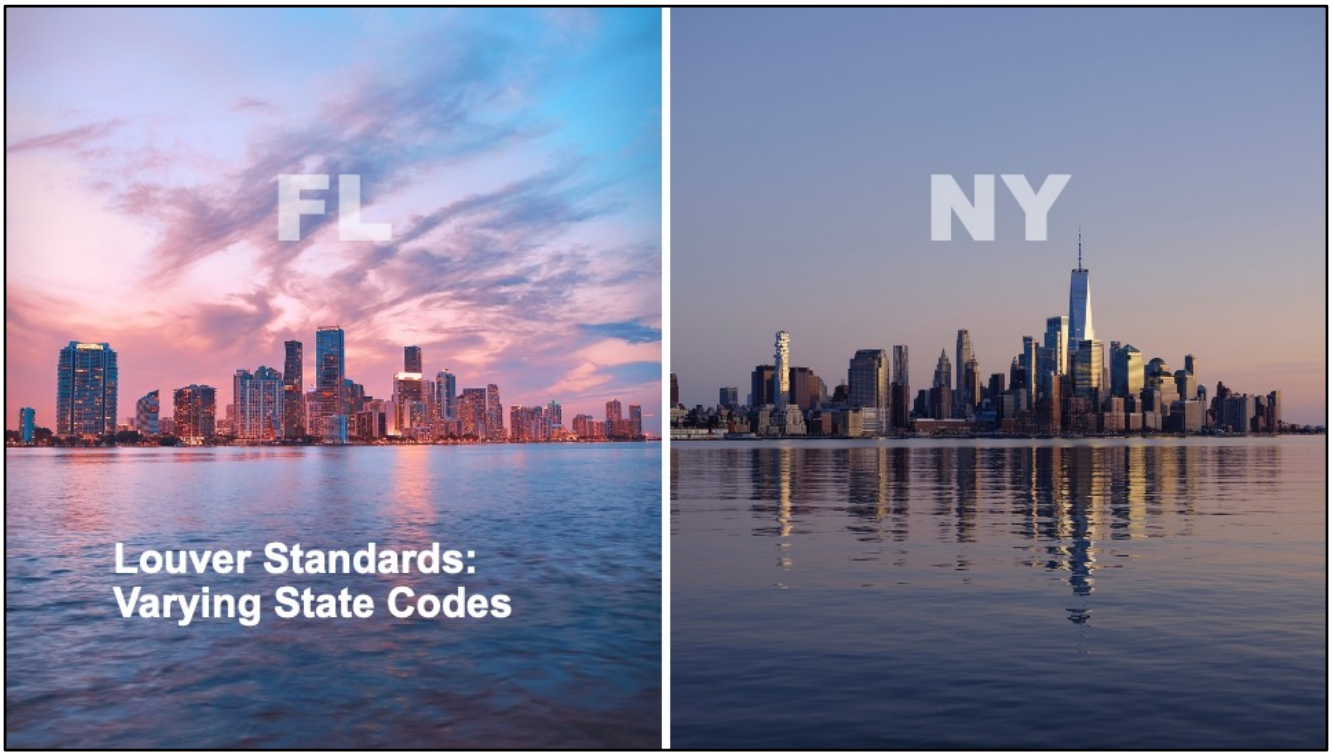


There are codes that come into play in certain geographic areas, such as in Miami-Dade County in Florida. Stricter coding came into affect in 2002 after Hurricane Andrew and serves as the basis of Florida's building code. This Florida Building code superseded local codes, while also incorporating stronger Broward and Miami-Dade County provisions.

The code requires louvers be able to take an impact, but not break off and become a dangerous, mid-air "missile" in a hurricane.

Source: Louvers Checklist: https://www.miamidade.gov/building/library/checklists/louvers.pdf

Photo by Ryan Loughlin on Unsplash



There are cities and states which have their own codes, such as the Florida building code just referenced and New York City. These city codes could all affect a project and your louver selection.
The design team should always ask your client to provide, or otherwise familiarize themselves with, the local codes before specifying a louver for a project.

Photo by Muzammil Soorma on Unsplash
Photo by Julien Maculan on Unsplash

Specifying Louvers

Proper louver specification should contribute to healthier air quality, mitigated water entrainment, and better productivity.

Your project parameters (physical location, climate, intended use, duration of use, etc.) will dictate the type of louver needed for the project.
Proper louver selection and specification can contribute to healthier indoor air quality, mitigated water entrainment, and as studies have shown, better productivity resulting from increased occupant comfort.

Louver Purpose: Function & Aesthetics

While Louvers play a critical role in airflow ***they can also be a striking architectural component in the visual design of a building***.

A successful project is often marked by the ability to align performance with design intent early and by initiating collaboration with the manufacturer to help navigate performance requirements, integrate design goals, and ultimately guide you through proper louver selection and specification.

We will now summarize various performance testing methods, followed by louver types and their performance characteristics.

As we mentioned previously, performance criteria need to be defined before the selecting your louvers.
Your louver manufacturer may have tools and/or calculators to help you determine or review these louver specifications and requirements.

It is crucial is to understand if the geographic area where you are specifying is subject to extreme weather or not.
Weather conditions play an important role in the louver type required to protect the building from water intrusion such as rain and wind driven rain specific to that locale.

You will also need to know what depth of louver you need, dependent on what the louver sits within – curtain wall, glazing, metal panel, etc .

As you navigate the performance criteria you will eventually land on a louver type that best meets the requirements of your project.
There may be several model options that meet the project performance criteria.
These will be further vetted later as the aesthetic needs are added to the mix.

Source: https://www.c-sgroup.com/architectural-louvers/louvers-airflow-tool
Video: Louver Rain Defense

Function: Specifying

- Non-drainable
- Drainable
- Storm-resistant
- Extreme weather
- Acoustical
- Blast-resistant

When you are ready to specify louvers for your project you will typically begin with the categories shown here with your performance criteria in hand.
These product groupings are based on functionality and performance.
You will start with these louver categories:
(Read through the list in the slide above.)

Let's take a closer look at these louver types and when you consider using each one.

Louver Type: Non-Drainable

- Provide high free area
- Economical
- Occasional water penetration is acceptable

The non-drainable louver provides excellent free area and low pressure drop for air performance but it is not a good choice if water penetration is a concern.
It is also typically is the most economical choice since it is so basic in design.

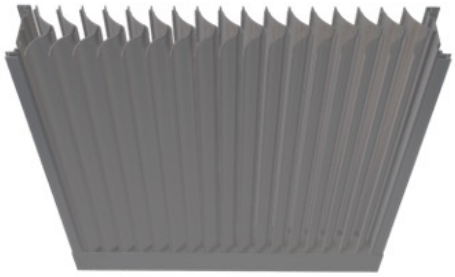
Louver Type: Drainable

- Provide high free area and high airflow with low pressure drop
- Occasional water entry is acceptable

Drainable Louvers provide high free area/high airflow with a low pressure drop, and are a good choice where occasional water entry is acceptable.
They are economical and available in a variety of blade and frame styles including glazed or panel integration with a visible mullion look.

Louver Type: Storm-Resistant

- Effectiveness to resistance of wind-driven rain
- Up to 50 mph winds expected
- 8" of wind-driven rain per hour expected



Example of effectiveness chart

Core Ventilation Rate (m/s):	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
Core Ventilation Rate (ft/min):	0	98	197	295	393	492	591	689	787	886	984
Free Area Velocity (ft/min):	0	159	320	479	638	799	959	1119	1278	1438	1598
Rating Effectiveness @ 29 & 3:	A	A	A	A	A	A	A	A	A	A	A
Effectiveness Ratio @ 29 & 3:									100.0	99.9	99.6
Core Ventilation Rate (m/s):	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
Core Ventilation Rate (ft/min):	0	96	197	288	396	482	588	691	792	888	984
Free Area Velocity (ft/min):	0	156	320	468	643	783	955	1122	1286	1442	1598
Rating Effectiveness @ 50 & 8:	A	A	A	A	A	A	A	A	A	A	A
Effectiveness Ratio @ 50 & 8:										100.0	99.7
Effectiveness Rating:	A = 1 to 0.99		B = 0.989 to 0.95		C = 0.949 to 0.80		D = 0.80 to 0				

Storm Resistant Louvers
-These are louvers designed and tested for heightened levels of wind driven rain.
-Blades can be horizontal in orientation and still offer excellent protection, but maximum protection is attained with a vertical blade orientation, as shown here.

The table below the image contains performance information, with the test criteria along the left side, the incremental air velocity points increasing across the top, and the louver performance rating at those test points expressed as a letter (A through D) under each velocity rate.
In this case, the louver specimen maintains the highest Class A rating (99-100% effective) at all test points for each test.
This performance information is typically called out in the louver specifications.

Every state adopts codes from the International Code Council (ICC).
In May 2002, the ICC (International Code Council) and the NSSA (National Storm Shelter Association) initiated a joint project to write a standard for the design and construction of storm shelters.
Storm Shelter louvers which comply with these code requirements are designed to withstand impact and positive/negative pressures in severe thunderstorms and tornadoes.

Source:

https://www.fema.gov/sites/default/files/2020-07/highlights-icc-500.pdf

Louver Type: Extreme Weather

- Can withstand extreme storms such as tornados, tropical storms, and hurricanes
- Impact resistant
- Minimizes water penetration during extreme weather events to manageable amounts.
- Tests can be performed to TAS standards (Florida), or AMCA test standards (540 and 550)

Extreme weather type louvers :
These are louvers that can offer extreme levels of water protection at up to 110 miler per hour wind speed.
Your client will most likely provide you with local standards that need to be met which your manufacturer can then reference to help you select the proper louver.

FEMA: There are louvers that only have an impact test

Louver Type: Acoustical

- Engineered to minimize noise/sound leaving the building
- Good water penetration protection
- Good airflow performance

Acoustical louvers are engineered to control sound leaving the building.
Acoustical louvers provide moderate water penetration protection and airflow performance.
They are ideal anywhere there is a need to minimize equipment sound levels and where ventilation is needed.
When specifying acoustical louvers, understand that due to their dense blades they have low free areas, so you may need to design more louver space to account for the lower free area.

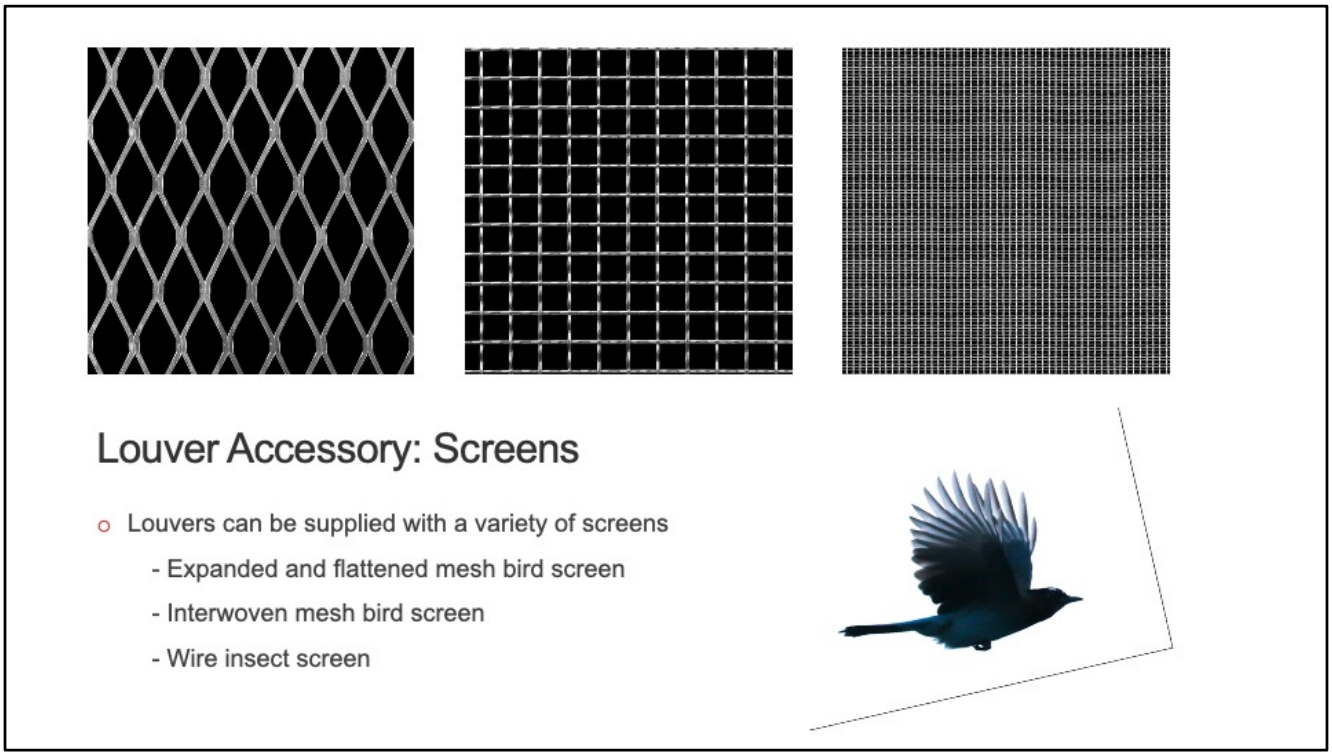
Louver Type: Blast-Resistant

Must remain in their frame and anchored adequately to resist the blast, or a catch device must be utilized to prevent the louver from becoming a projectile.

Blast loads are defined with a blast impulse and a duration.

Government buildings, VA hospitals, computing centers and power plants are particularly vulnerable to explosive threats.
Blast louvers can withstand blasts up to 12 PSI and meet the government requirement which states:
"Louvers must remain in their frame and anchored adequately to resist the blast or employ a catch device to prevent the louver from becoming a projectile."

Blast louvers are designed for a blast occurring outside the building, not from the inside.



Louver Accessories: Bird screen
Bird screen is a common accessory, used to prevent birds and other animals from entering through the louver.

Insect screens can also be incorporated, however can become easily clogged, and should be used only when easy access is available.

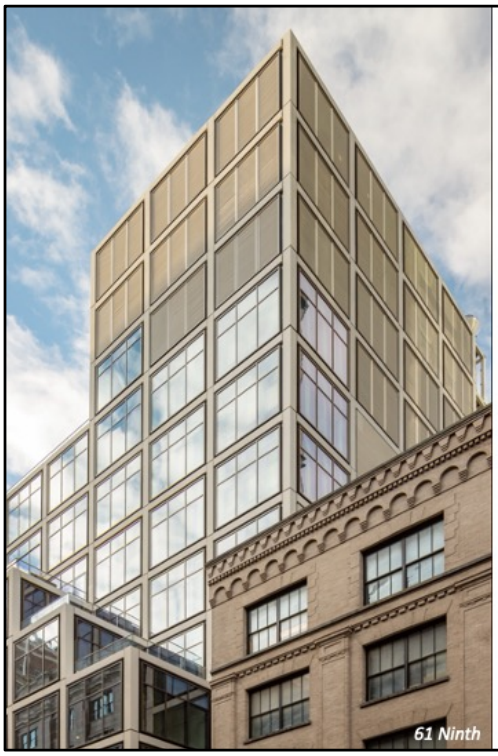
Photo by Patrick Hendry on Unsplash

Louver Accessory: Blank-Offs

- Inactive louver that is sealed and insulated
- Provides continuous sight lines and maintains aesthetics
- Available in multitude of thicknesses depending on required R-value

Louver Accessories: Blank-offs
Blank-off systems may be used when an active louver is not required, but where an aesthetic design is intended.
From the front, these systems look exactly like an active louver, but behind the blades is a sealed and insulated system that does not allow airflow.

Holes can be cut in the system for ductwork that may be integrated in the future if needed.
It is important to specify blank-off systems that are properly sealed to the louver and do not allow water to penetrate.
Insulated blank-off is available in different thicknesses depending on the required R-value.



Specifying Tips

- Free area
- Blade design
- Blade spacing
- Geometry
- Drain pans
- Rear structural supports
- Large louver sections–fewer connections

When specifying architectural louvers there are a few other considerations to keep in mind:

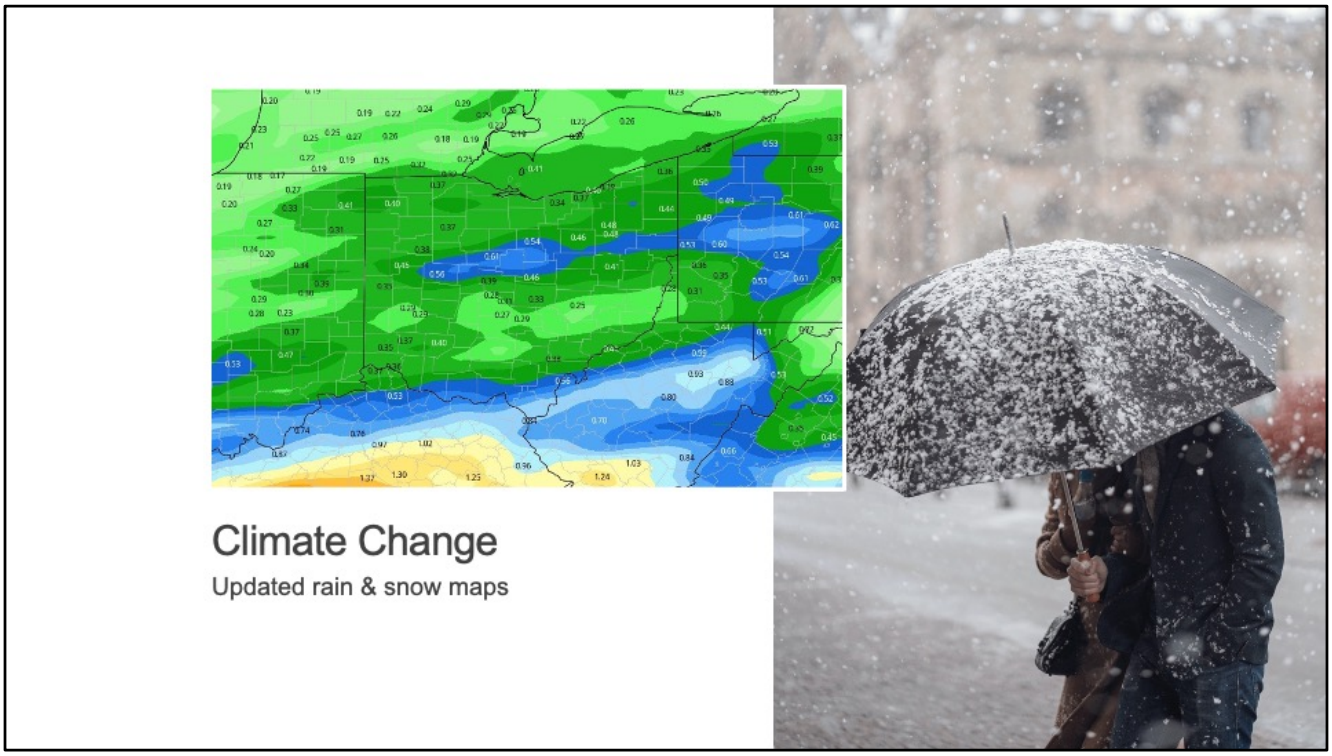
Percentage free area is not an indicator of overall louver performance. It is simply an indicator that the particular model of louver may be suited to handle larger volumes of air.

Blade design has a direct impact on pressure drop.
The more steps, rain hooks, and drainage provisions there are in a blade configuration, the more air performance will be affected negatively.

Blade spacing and geometry, direction of airflow, drain pans, and rear structural supports can also have an effect on water penetration performance.
Consult with your manufacturer to identify any potential areas of concern with your intended design.

Larger size louvers mean fewer "connection points." You can eliminate water entrance points by eliminating connection points. Ask your manufacturer about providing larger louvers engineered to have fewer connection points.

Widen Photo: 61 Ninth_8



Climate change is impacting weather patterns.
Updated rain and snow maps are available in the IBC 2021. These are updated every three years, with the last update in 2021.
For example, Dade County demands more stringent testing for louvers than the Northeast region.
Bringing experts in early ensures you are choosing the right louver to meet safety standards, aesthetic preferences, and performance requirements.

Photo by Craig Whitehead on Unsplash

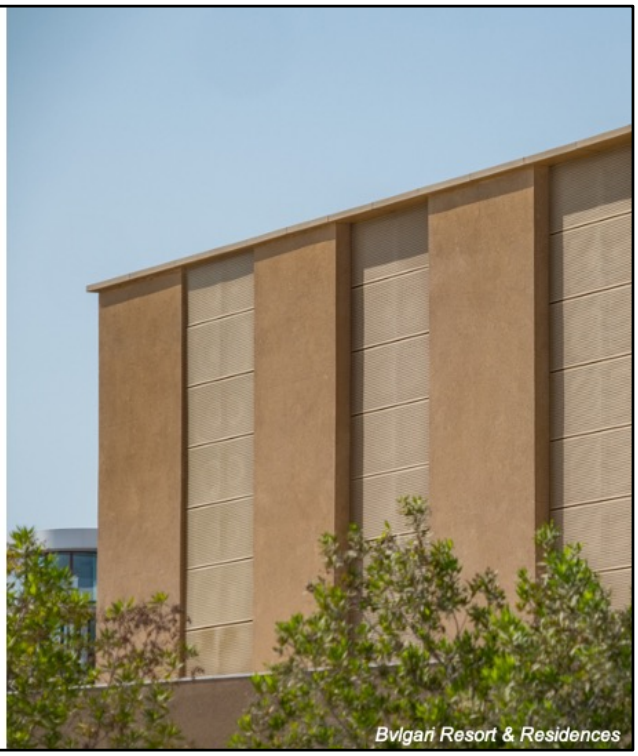
Common Misconceptions

All louvers are created equally.

- There are differences in how louvers function.

Louvers interrupt your design because they are not visually pleasing.

- Louvers can be incorporated into the design to achieve a certain look/design element.
- Louvers can be creatively hidden.



Common misconceptions:
All louvers are created equally.
Louvers provide airflow. They prevent water penetration. And they can add visual interest to a building.
There are scores of different louver types and profiles. Most are unique, having been specifically engineered to meet specific aesthetic or performance requirements, or both.
Navigating the vast array of models to match your needs can be quite daunting.
Fortunately, most manufacturers employ knowledgeable technical representatives to assist you in this process. Remember to take advantage of this valuable consulting service.

Louvers interrupt your design because they are not visually pleasing.
A properly integrated louver system defies traditional design conventions while providing unmatched design flexibility.
Louvers do not need to interrupt your design. In fact, they can enhance it!
In the following slides we will see how louver systems can be partly or completely concealed, or even highlighted as a design element – without sacrificing performance.

Louver Inspiration & Integration

Where aesthetics meet performance.

The use of architectural louvers can complement or even define a design or, if preferred, the louver can blend into the facade, hidden from sight.
This segment explores examples of how louvers were integrated into the built environment to achieve a desired performance and aesthetic.

Integration: Collaboration

- Bring manufacturers in early to establish and validate performance and design requirements.
- Invite all manufacturers to plan and ensure seamless integration of all specified products.

The key to a successful louver design project is bringing the manufacturer in early to help with the design and performance parameters.
This is especially important when incorporating another manufacturer's product (example: securing a louver system within a curtain wall).
Be prepared to have all involved manufacturers at the planning table to ensure seamless integration of all products.

Integration: Ground Level Louver

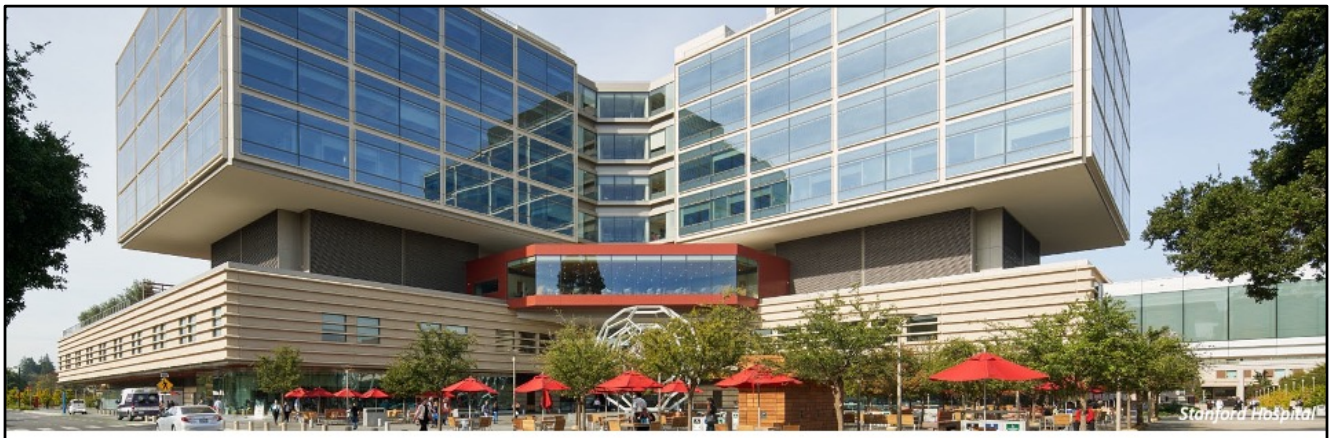
Apple Park & Headquarters Cupertino, CA

- Challenge: Ground level louvers
- Louver specified: Non-storm-resistant louver
- Testing: Manufacturer replicated specific scenarios to develop wind-driven rain tests

When designing the iconic Ring Building, the architect specified **drainable louvers** to be placed **at ground level** to service an underground parking facility.
Because a portion of the building would overhang the louvers, the architect initially believed this would provide adequate protection from water intrusion.

By partnering with a manufacturer early, the louver manufacturer was able to replicate the condition including the creation of a wooden building overhang.
This simulated space was used to conduct in-house louver testing in accordance with wind-driven rain performance standards.
The Result: Mock-up testing demonstrated that the building overhang did not provide adequate coverage and the drainable louvers could not provide enough protection against water intrusion.
These results guided the manufacturer to recommend storm-resistant louvers to prevent interior flooding and water damage during wind-driven rain.
This product change saved the project from **potential costly future water intrusion issues.**

RSH 5700 video on testing.



Integration: Functional Louver & Design

Stanford Hospital
Stanford, CA

- Challenge: Larger Louvers to house/conceal HVAC equipment
- Louver specified: storm-resistant louvers

Exterior louvers were required above the third floor for the purposes of both concealing, and allowing fresh air to flow to, the HVAC equipment.
These louvers were unique in that they were manufactured in **large 17-foot-high and 7-foot-wide pieces** with preassembled mounting brackets.

In order to confirm that these **greatly oversized single units** could be made, shipped, and installed without problems, the manufacturer built a full-size mockup at their plant with the specific mounting bracketry, and then invited the customer to experience the actual installation sequence and visualize the true scope, and to make any modifications that would improve the installation experience well in advance of receiving any material.
The mockup experienced confirmed the installation concept, and the large sections were incorporated yielding significant installation cost savings.

Integration: Data Centers

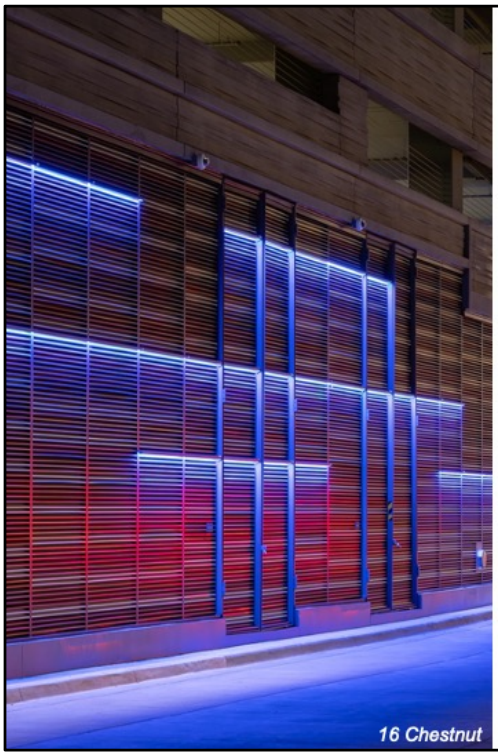
Louvers are key to a successful data center build as these centers require:

- Constant conditioned airflow and numerous ducts for proper air circulation
- Zero water penetration
- Protection from exterior wind, wind-borne debris, and blast loads.

Data Centers:
As the world creates more and more content and data by the second, there are extraordinary companies who must create built environments to safely house and process this data.
These include global social media and data search companies, financial institutions, and governmental military and security agencies.
Requiring vast numbers of servers and backup generator systems, t**hese data supercenters require exacting interior climates in which to function.**
These centers require the highest amount of airflow per sq. ft. of any building type on earth, so airflow properties are critical and any unmitigated water/snow/sand intrusion can be catastrophic.

Not only do the right louvers allow for the stringent and constant airflow requirements of these centers, they also act as a critical barrier to the exterior elements of rain, extreme wind and wind-borne debris, and external blast loads.

Louvers are key part of a successful data center build and play a critical role in the functionality of these centers.

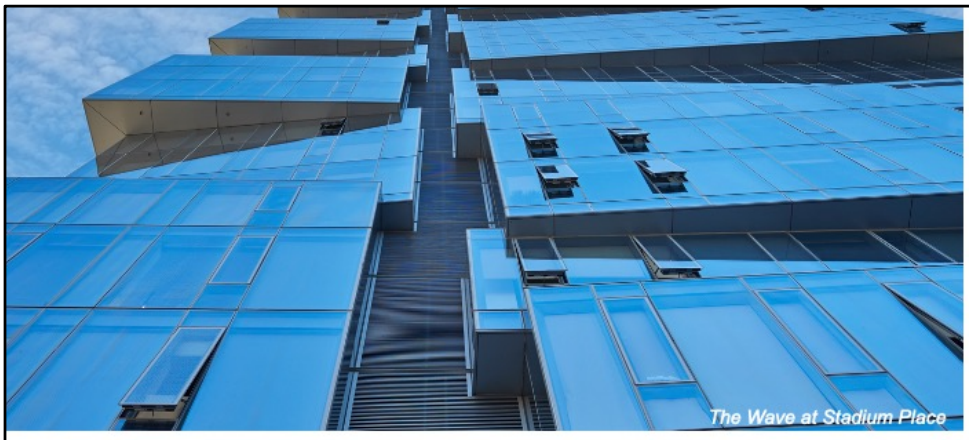


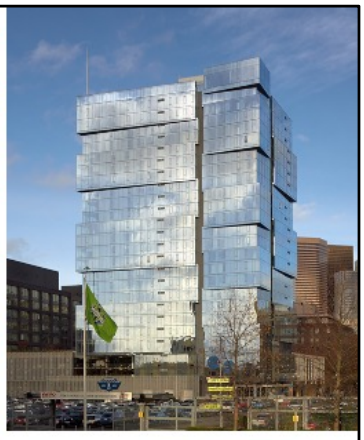
Inspiration: Design Flexibility

- Ask your louver manufacturer what aesthetic options they offer – earlier is always better.
- Options like lighting, conceal screens, and blade adjustments can create a stunning statement for your project.

Inspiration: Design Flexibility:
Pictured here is a project with LED lighting incorporated into the louvers. The manufacturer worked with the architect from the very beginning to customize the colors on the louver blades and provide the LED lights integrated into the louver blades so they can illuminate at night.
The louver wall is right across from the main bus terminal, and it acts as an aesthetically pleasing visual feature for commuters while also providing lighting for enhanced safety in the area at night. This artistic louver wall has since become a feature of the surrounding landscape while also servicing the mechanical requirements of the equipment behind it.

This was a highly customized project.
In addition to the LED lighting, all blades were painted in a three-coat finish, with a mix of different finish types ranging from solid to metallic, as well as eight different colors of blades and frames.



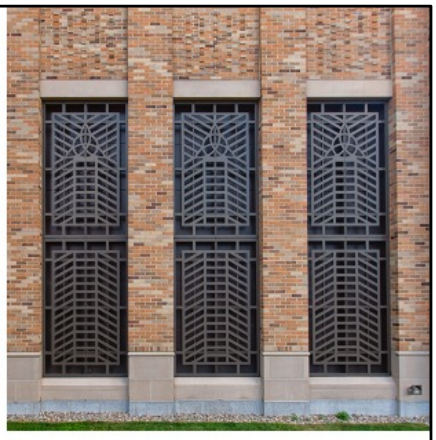


Inspiration: Unique Design Vision

The Wave at Stadium Place Seattle, WA

- Challenge: Architect desired a zipper look
- Louver specified: Single, horizontal, drainable blade louver; closely spaced horizontal blades with built-in reveals
- Results: Very unique aesthetic

On this next project the architect wanted to use the louvers to mimic long continuous "zippers" up each of the four building elevations.
In addition to making all of these louvers in special puzzle-like shapes to accommodate the staggered vertical band, the manufacturer of the louver had to incorporate custom glazing frames that would have an expressed border on the left and right sides, plus a custom reveal to match the curtain wall and the head and sill of each unit.
Although only a small portion of these louvers are active, this project is a shining example of using the texture of architectural louvers to enhance your unique building's visual statement, while also integrating into surrounding materials in a nontraditional manner.



Inspiration: Concealed Performance

University of Notre Dame Stadium
Notre Dame, IN

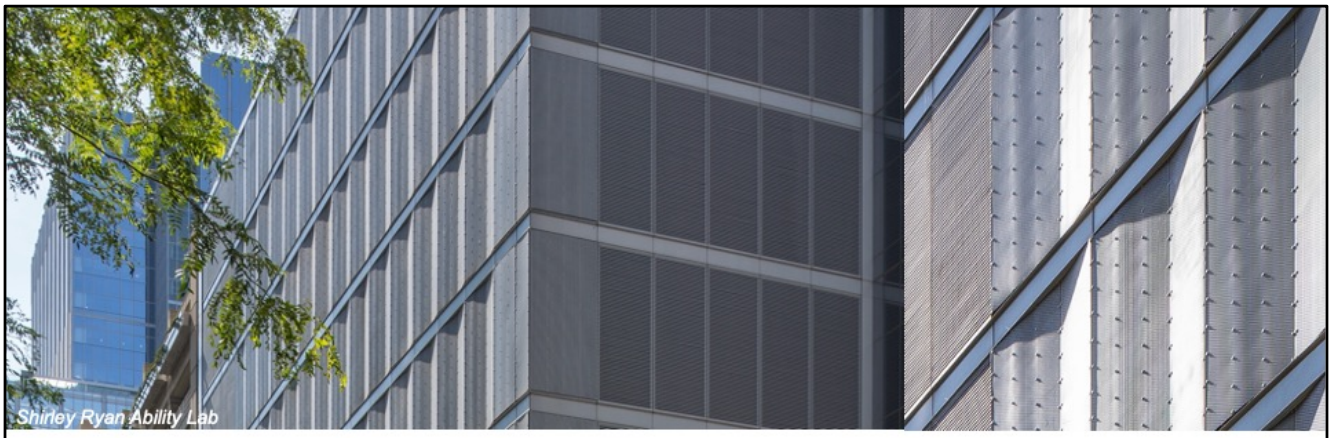
- Challenge: Create a front design to cover the louver, and test to ensure that the system met all mechanical requirements
- Louver specified: Vertical Storm-resistant louver with Trinity architectural metal cover
- Results: A beautiful, high performance louver system tested in accordance with AMCA standards

Concealed Performance:
One of the most renowned stadiums in college sports combines the student experience of community, tradition, and football. The manufacturer was asked to create storm-resistant louvers that would perform in variable weather conditions in a design that would accentuate the stadium's existing architecture.
The successful louver integration protects Notre Dame Stadium from the elements with an additional custom grille cover to align with the design intent of the project.

For this project highly efficient storm-resistant louvers were paired with a face-applied custom grille as a combined unit.
The dual component assembly was mocked up and tested to AMCA standards by the manufacturer during the design stage.
A performance specification was then written to establish the required mechanical performance of the assembly.

The rear louver frame incorporated vertical storm-resistant louvers at the active mechanical locations, and insulated blank-off panels in lieu of rear blades in the inactive/decorative panel locations.
Everything was painted black to disappear into the shadows, l**eaving the visual focus on the face grille pattern.**
This active/inactive approach also yielded economies by incorporating active louvers only where needed for mechanical airflow with less costly insulated blank-off panels used elsewhere.
The panels were shipped as assembled units, with the decorative "Trinity Grille" element factory installed to the rear louver frame.

Architect: SLAM (Connecticut)
Contractor: Crown Corr Inc.



Inspiration: Concealed Performance

Shirley Ryan Ability Lab Chicago, IL

- Challenge: Provide a unique facade aesthetic with high performance louvers
- Louver specified: Vertical storm-resistant louvers with unique metal screen; horizontal storm-resistant louvers
- Results: Exciting exterior that hides high performance

Concealed Performance:
This is an example of how a desire to conceal functioning mechanical louvers behind an architectural screen element was accomplished.
Although areas of traditional horizontal blade louvers on this project were visible and installed in the curtainwall (in the center of the image.)
The challenge here was to provide a unique facade aesthetic, while including functioning storm louvers.
The solution: To attain this added architectural effect, the vertical storm-resistant louvers were concealed behind decorative perforated aluminum panels as can be seen in the area on the right.
Project-condition-specific louver testing of the tandem perforated screen/rear storm louver was conducted to confirm that the combined performance of the louver and the perforated panels met the mechanical requirements.

The perforated sheet was installed over the rear storm louvers. Being in a winter climate region, ice breaker dots were also added to the panel design to help prevent snow and ice buildup on the facade.

Inspiration: Interior Louvers

Stanford Hospital
Stanford, CA

- Challenge: Client wanted paneling look but it hindered airflow to the building interior
- Louver specified: Large banks of louvers with faux woodgrain finish
- Results: Stunning lobby with uninhibited airflow

Here is an intersting interior louver application:

Wood can be an appealing aesthetic choice that adds warmth to an interior space and provides homage to nature.
In this project, the architect specified wood grain paneling to achieve their design vision for the hospital's lobby areas.
Although the wood panels provided the intended aesthetic appeal, they inhibited air intake and exhaust.
Woodgrain finished louvers – consisting of a faux wood pattern on powder coated extruded aluminum blades - were used to meet both the design and performance requirements.
In this unique application, about 95% of the louvers were inactive and used for visual interest and texturing only, while the other 5% provided the airflow required to service the building's mechanical needs.

Mechanical plenum behind the louvers up top.

Over $2.5M Louvers (RS-7305 & custom blade louvers) + Sunshades

Conclusion

- Louvers manage the movement of air, wind, and wind-driven rain.
- Help bring fresh air in and leave unwanted water out
- Promote cleaner, healthier, quieter environments which contribute to the safety and welfare of building occupants
- Building codes differ by region. Ensure you are aware of all relevant local codes.
- Select/specify louvers based on these three things:
  - The mechanical and water rejection parameters
  - The design intent
  - The local building codes
- Can be beautifully incorporated into design of the building
- Can function as part of the expressed design or can blend into the building facade
- Collaborate with your manufacturer early to ensure design elements and codes are met.

Louvers are engineered to manage the movement of air, wind, and wind-driven rain.
Louvers help to promote the circulation and bringing of outside fresh air in while leaving unwanted water out
The use of louvers can lead to cleaner, healthier environments which contribute to the safety and welfare of building occupants.
Before specifying louvers, research all local/regional building codes as they may differ by region.
Select/specify louvers based on these three things:
-The mechanical and water protection parameters
-The design intent
-The local building codes
Remember, louvers can be beautifully incorporated into the design of the building.
Louvers can function and be seen as part of the design or they can function and blend in to the building facade; designing with louvers in mind offers a range of aesthetic diversity.
Incorporate all movement design elements at the onset of planning, collaborating with your manufacturer to achieve the desired visual aesthetics while meeting, or exceeding, local building standards and project requirements.

Construction Specialties

Acrovyn® Wall Protection + Doors I Acrovyn® Wall Covering + Panels
Architectural Louvers I Architectural Grilles + Vision Barriers I Cubicle Curtains + Tracks I Entrance Mats + Grids
Expansion Joint Covers I Explosion + Pressure Relief Vents I Fire + Smoke Vents I Sun Controls

This concludes the presentation.
We trust you have enjoyed learning more about louvers in the built environment, and now have an enhanced knowledge of how to select the proper louvers on your next project.

Thank you for participating------good day.