# ORB University

# Fundamentals to
# WATERPROOFING

**(Keeping Water OUT)**

Presented by:

Carlos Roman, Jennifer Payán.

# Waterproofing

Is the process of making an object or structure waterproof or water-resistant so that it remains relatively unaffected by water or resisting the ingress of water under specified conditions.

Designers need to pay careful consideration to the selection of materials and methods specified to achieve the waterproofing results during the design process, as well as observation in the field before and during construction.

*Water contact cannot be avoided, but it can be managed.*

# Dangers of poor Waterproofing

Building deterioration from water damage includes:

- Structural damage to concrete by either cracking to displacement of foundation
- Mineral leeching in concrete (efflorescence)
- Rusting of reinforcement steel
- Poor air quality and mold and mildew growth.

Repairs are much more costly than the measures put in place the first time around.

# Where to look

**Parts of the Building**

- Below grade and foundation
- Slab, podium or grade
- Walls, windows and doors
- Roof

**Areas of Concern**

- Penetrations
- Cold joints
- Expansion joints
- Foundation drains
- Structural connections
- Damaged membranes
- Transitions and change of condition

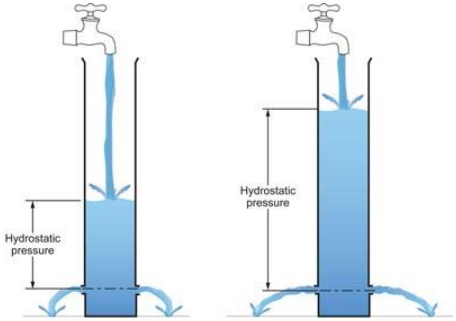
# Below-grade Waterproofing

The below-grade sealing of water intrusion at the building enclosure from the subsoils surrounding the structure should occur at an early stage in the construction project.

There are numerous resources available with the most current design practices and standards. There are building code considerations, material types, and different methods of achieving a dry building.

The system used must have the ability to prevent moisture from penetrating the foundation and alleviating the hydrostatic pressure imposed upon the system.

# What is *hydrostatic* pressure?




The pressure exerted by a fluid at equilibrium at a given point within the fluid, due to the force of gravity.

Basically, water pressure pushing up against foundation walls and floors.

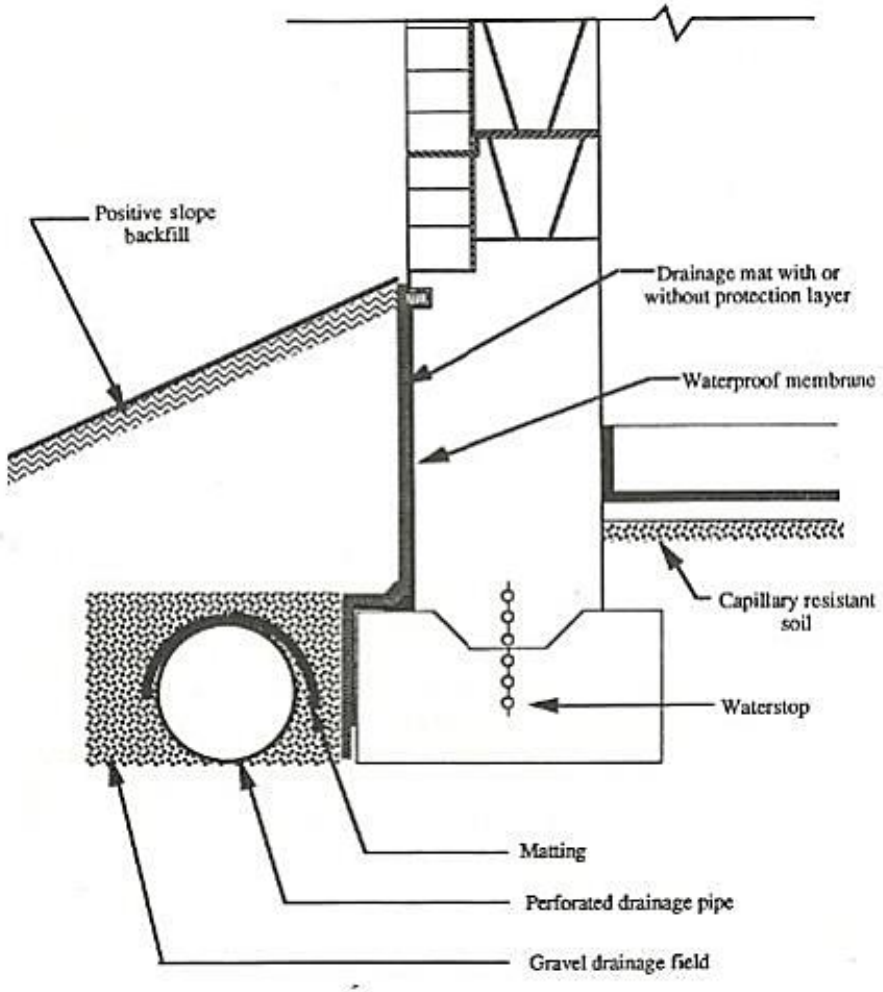
Weather can affect this force, with thaw or rain increasing the pressure against foundation and dry weather causing a contraction.

Water pressure cannot be avoided, but its effects can be mitigated.

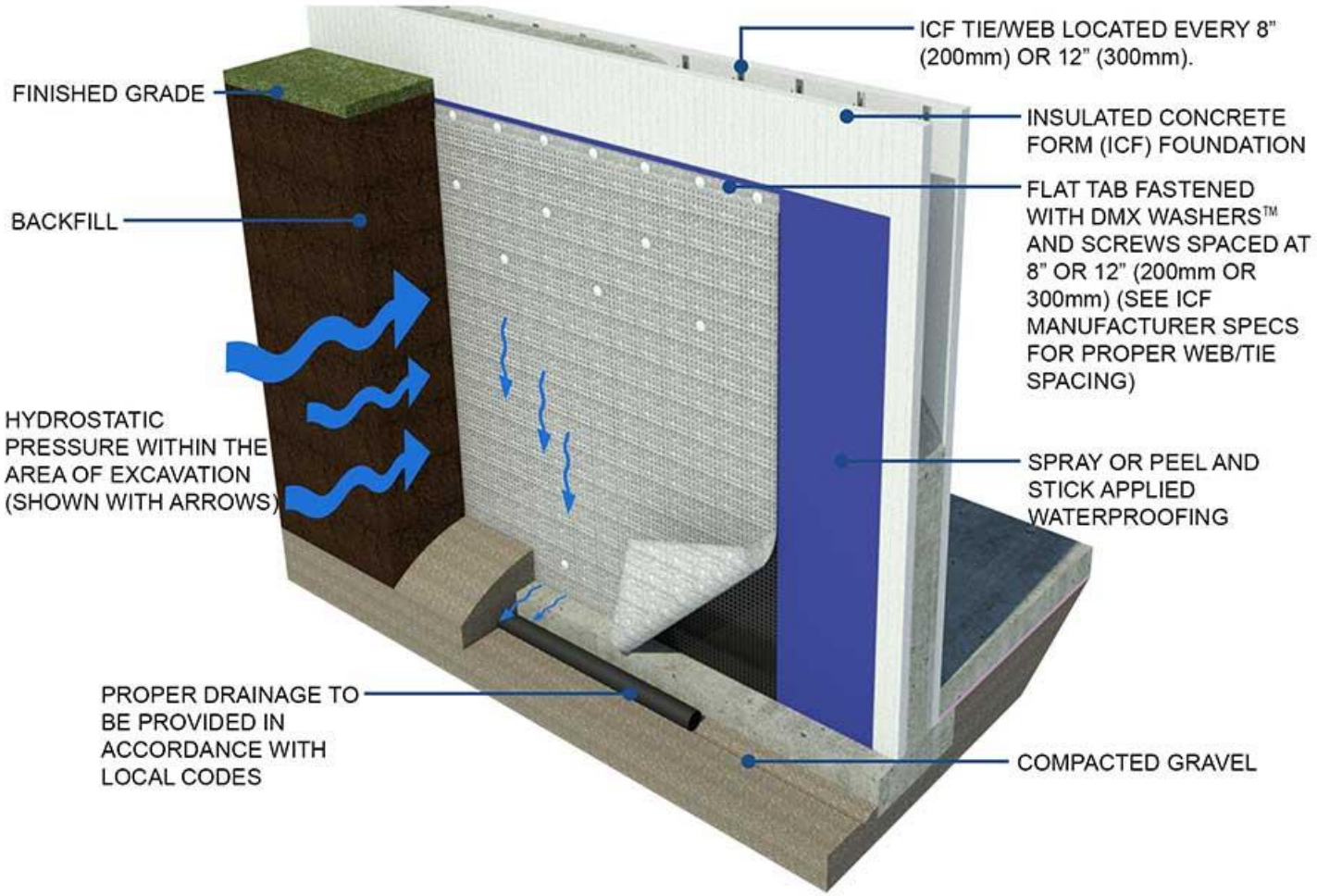
# Below-grade system

Typically, below grade waterproofing systems are made up of multiple elements*, which include:

- Below footing and below slab vapor barrier
- Insulation
- Drain board
- Foundation drain
- Waterstops
- Protection board
- Filter fabrics
- Clean wash stone




**Not all of these elements or pieces are required within every system.*

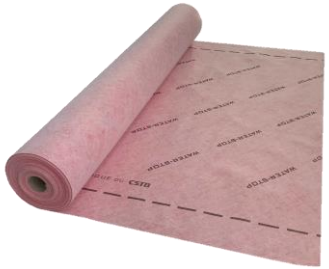



*Drainage board*

*Perforated drainage pipe*

*Protection Board (various types)*

*Waterstops*



*WRB Membrane*

*Wash stone*

# Drainage to keep water away

Proper drainage from basement walls, which significantly reduces the pressure the basement wall must resist.

This reduces the potential for cracking and the possibility of water penetration into the basement if there’s a failure in the waterproof system in place.

Water and soil exert pressure on the back face of walls in proportion to density and depth.

# Below-grade Waterproofing

*Face-applied* waterproofing is often considered the standard waterproofing, as it is the act of applying the waterproofing system to the foundation wall on the exterior side prior to the backfill of the excavated soils.

The waterproofing membrane should continue unbroken from the face of the footing to the top of the footing to above-grade level, and typically be lapped behind the WRB* of the above-grade wall control layer.

Remaining layers to be installer per manufacturer's recommendations to achieve a tested complete system.

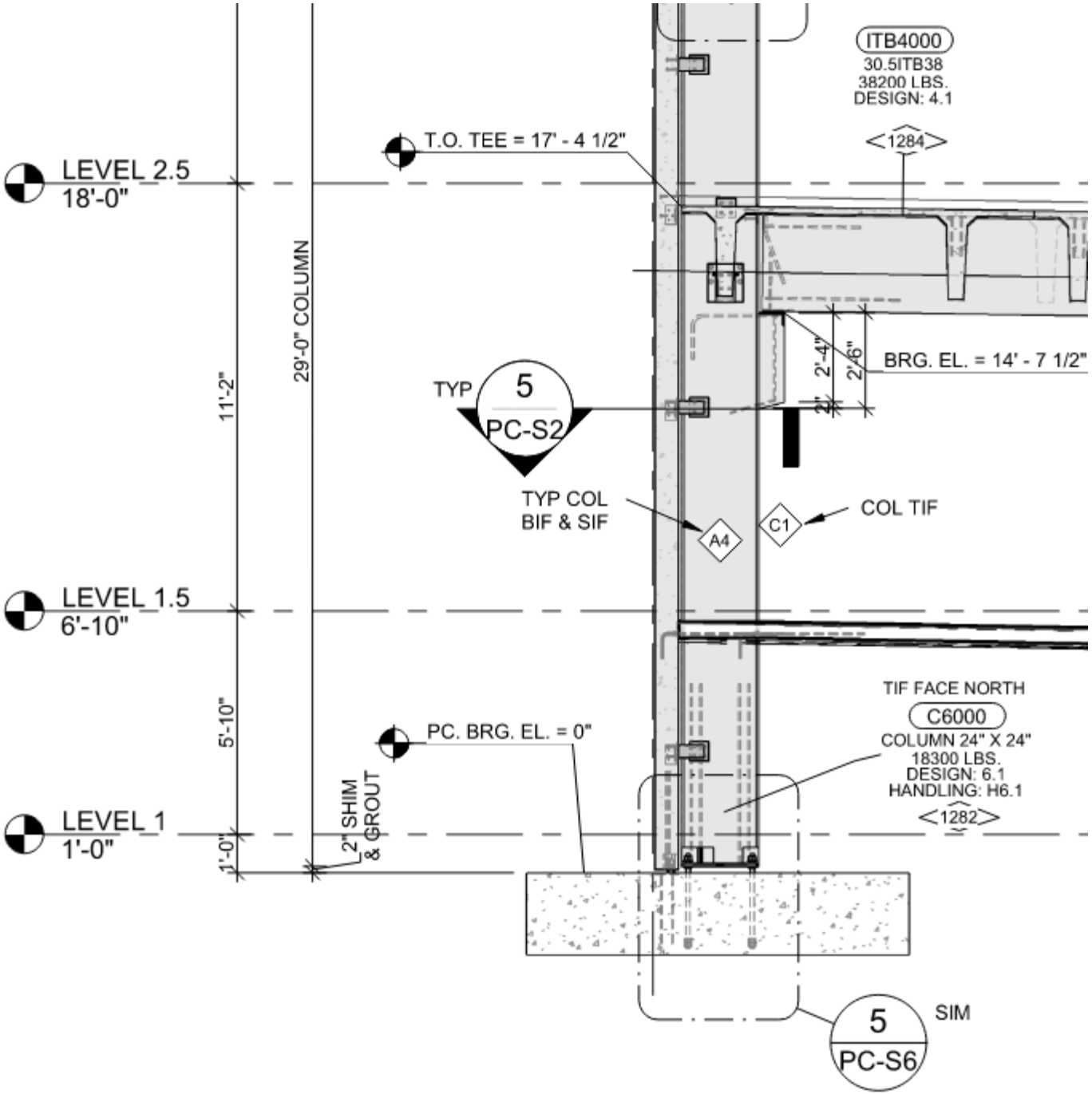
**WRB – Water Resistant Barrier*

# Below-grade Waterproofing vs. Damp-proofing

Not all below-grade elements to structures with conditioned space within them should be waterproofed.

**What is Dampproofing?**

It’s simply keeping soil moisture out of a structure, this depends on the level and location of the structure’s foundation, soil conditions, water table, rainfall/drainage and method of construction.




Q: What are we looking at?

A: Negative Waterproofing
B. Blindside Waterproofing

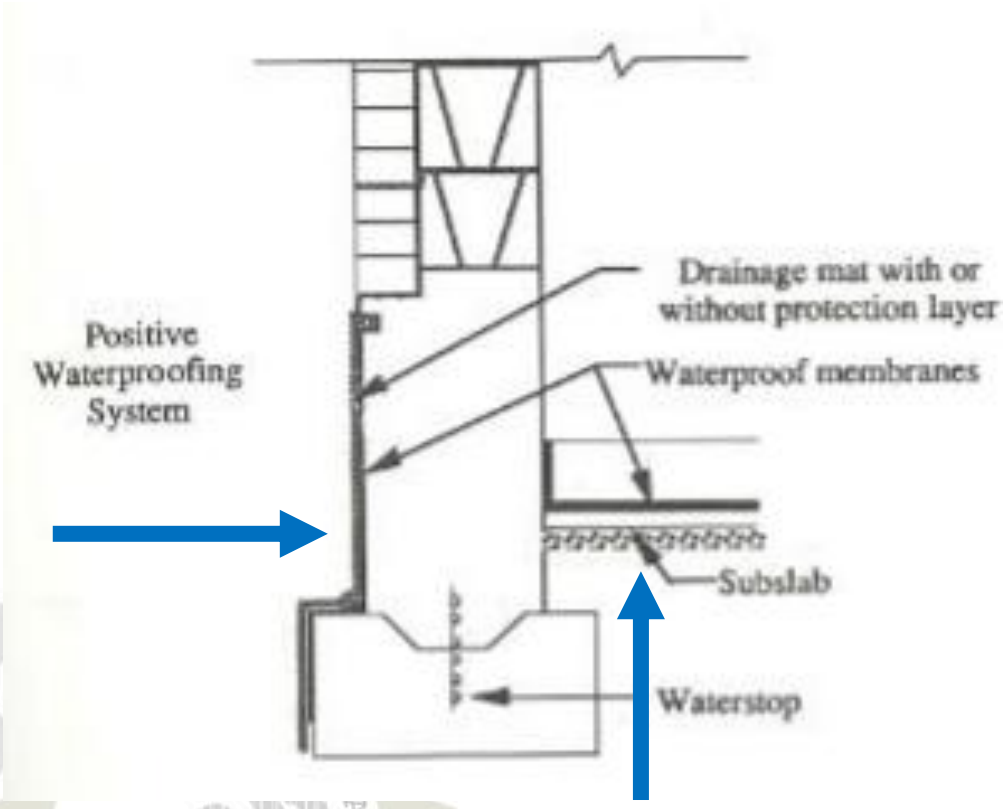
# Positive vs. Negative Waterproofing

For new and remedial projects there are “positive” and “negative” side below grade systems. Negative is also referred to as Blindside WP.

The positive side is the most widely used whereas the negative systems is an option in remedial work where access to the positive side is restricted.

Typical materials for negative side applications are chemical grouts, epoxy grouts and pressure grouts admixtures, these have similar features as for positive side applications but not as effective as the direct/surface applied systems.

# Positive vs. Negative Waterproofing



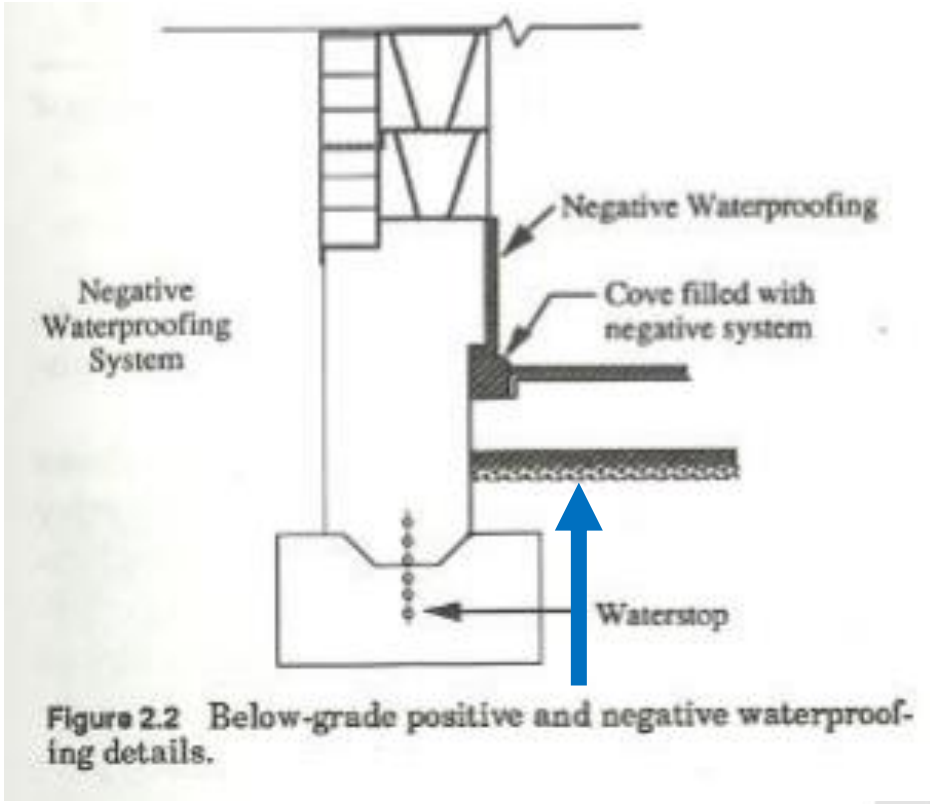




Figure 2.2 Below-grade positive and negative waterproofing details.

# Blindside Waterproofing

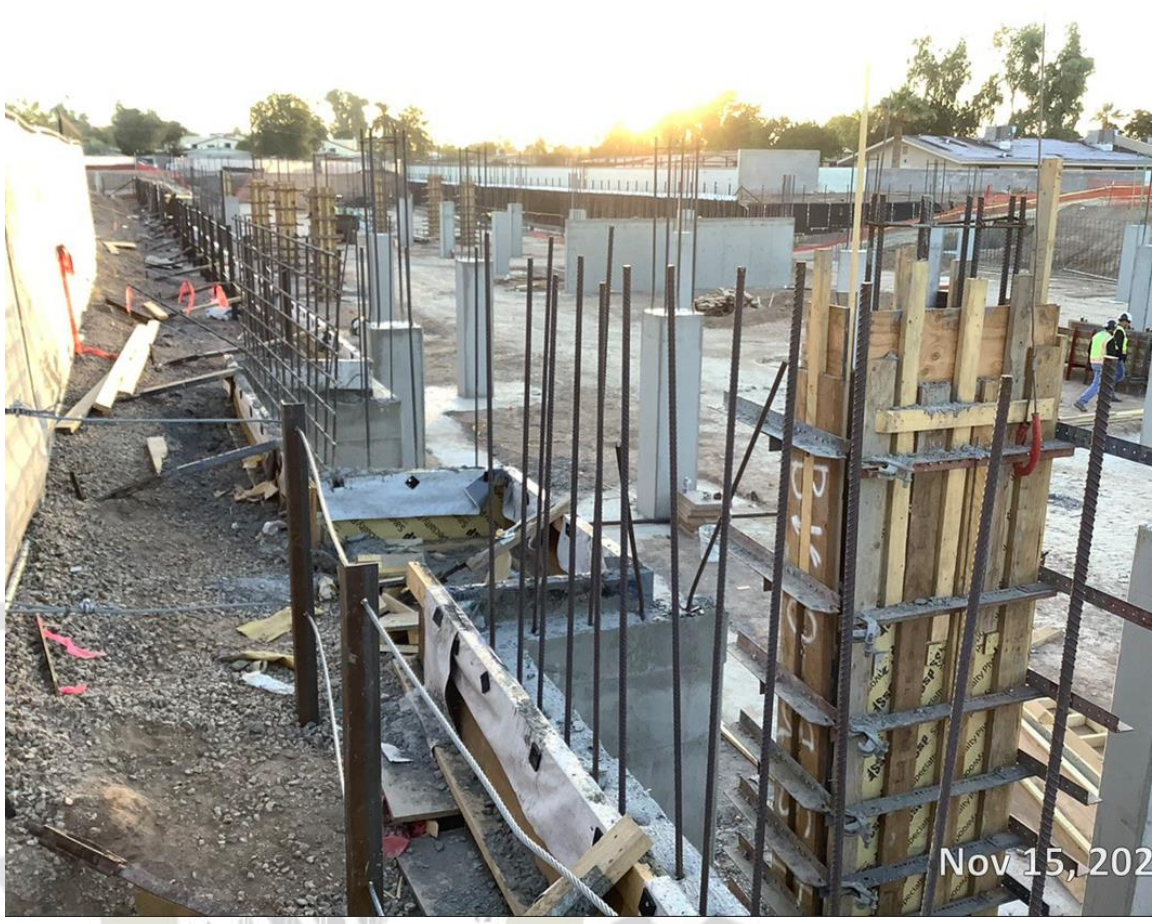
Blindside waterproofing is the foundation waterproofing method of choice whenever excavation past the foundation walls isn't possible – think zero lot line sites where the new foundation will border existing walls, or locations that are otherwise inaccessible to heavy equipment.

Also known as pre-applied waterproofing, blindside waterproofing is installed before the foundation is poured – the waterproofing membrane is applied to the adjacent wall or shoring, which can be soldier pile, metal sheet piling, soil-nailing, or shotcrete.

Once the waterproofing membrane is in place and fully detailed, then the structural walls are placed and the foundation is poured.

*Don't let odd terms shock you!*

# Blindside Waterproofing




18-201 BS on 7th– Garage and blind side WP. 11/15/2022


18-201 BS on 7th– Garage and blind side WP. 09/23/2022

# Blindside Waterproofing



18-201 BS on 7th– Garage and blind side WP. 01/10/2023

# Specifying below-grade waterproofing

There are many excellent systems in the marketplace that can be specified and installed. Key to success is understanding the specific benefits and limitations of each system and the conditions on our site.

Excavation and replacement of a failed system can be COSTLY, and warranties can run between 5-20 years. Proper design inspection is imperative for all systems no matter the guarantee or warranty* is provided.

**Look up the difference.*

# Types of below-grade WP Systems

- Cementitious
- Fluid Applied membranes (hot or cold)
- Sheet membrane
- Hydros Clay
- Vapor Barriers

- Sheet membranes: Thermoplastics, vulcanized rubbers, rubberized asphalts.
- Hydros Clay: Commonly referred to as bentonite. Typically, bentonite waterproofing applied in a dry state and when subjected to water it swells and becomes impermeable to water. Excellent waterproofing but must be hydrated properly.
- Vapor Barriers: Not suitable for waterproofing applications. They prevent transmission of water vapor through a substrate in contact the soil. Typically used on slab on grade conditions, they also are used in limited vertical applications.

- Cementitious: Portland cement base (sand or no sand) with an active waterproofing agent. There are four types; metallic, capillary systems, chemical additive systems and acrylic modified systems.
- Fluid Applied membranes (Hot or Cold): These materials are solvent based mixtures containing a base of urethanes, rubbers, plastics, vinyl, polymers, asphalt or a combination. Applied as liquid to form a seamless membrane, application can be cold or hot applied.

*Cementitious*

*Fluid applied membrane*

*Sheet membrane*

*Hydro Clay (applied as membrane and hydrated)*

*Hydro Clay sheet*


*Vapor Barrier*

# Project Conditions to Watch out for

- Soil conditions, rock or clay soils can harm waterproofing systems during backfill (if not protection board)
- Chemical contamination, especially acids and alkaline,
- Expected movement, including settlement and differential.
- Concrete cold joints, to see if they are treatable for the system selected.
- Freeze-thaw cycling (in cold zones) and envelope portions below frost line
- Positive or negative systems, which is better suitable for the project
- Large vertical applications, often more problematic

# Project Conditions to Watch out for

- Difficult termination and transition detailing
- Length of exposure of installed system
- Safety concerns
- Dewatering requirements
- Concrete curing time available before backfill or other construction  “must commence”
- Adjacent envelope systems (compatibility with other systems)
- Scheduling requirements
- Access for repair after construction is complete.

# ORB University

## Fundamentals to

# WATERPROOFING

# WINDOWS

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# Considerations

Windows are used in all types of claddings, how to detail the windowsill, jamb and head will vary based on a number of factors:

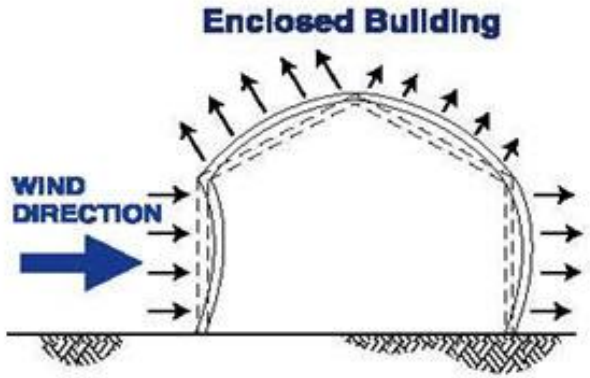
- Type of window, flanged or non-flanged.
- Structure and location of the building, a concrete highrise ≠ single story wood house.
- Window Performance Class through AAMA (American Architectural Manufacturer’s Association).

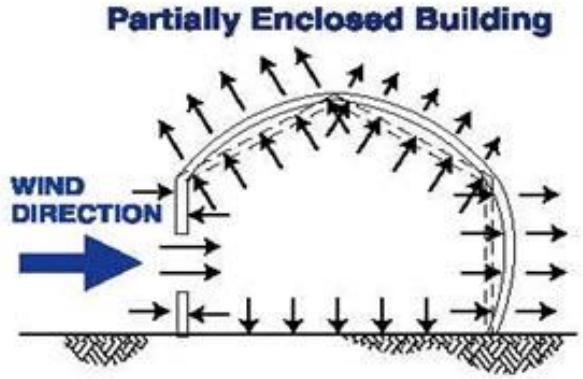
# Design Pressure

Three-coat stucco (Portland Cement Plaster) meets the AW Performance class if properly applied by SMA, ASTM, Code and Manufacturer’s requirements.

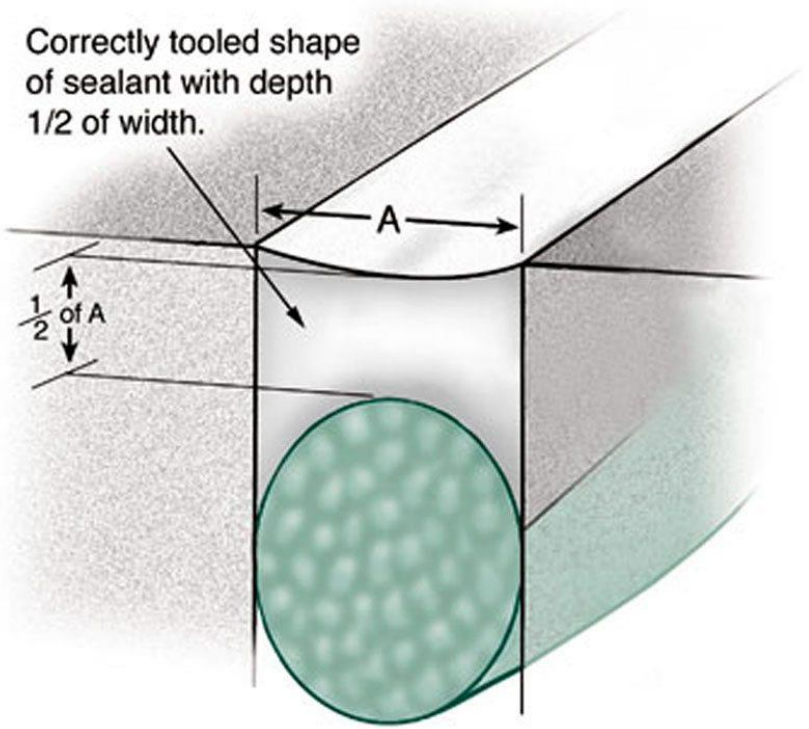
The criteria for this includes Design Pressure (DP) and Performance Grade (PG) rating for structural integrity and water resistance.

Design pressure is a numerical value rating which defines structural wind load requirements for a building, and it’s measured in PSF.



# Performance Grades / Class




Most windows require a casing bead with a functional sealant joint. The sealant joint should meet the characteristics of hourglass form and correct size to allow for flexibility and approved material.

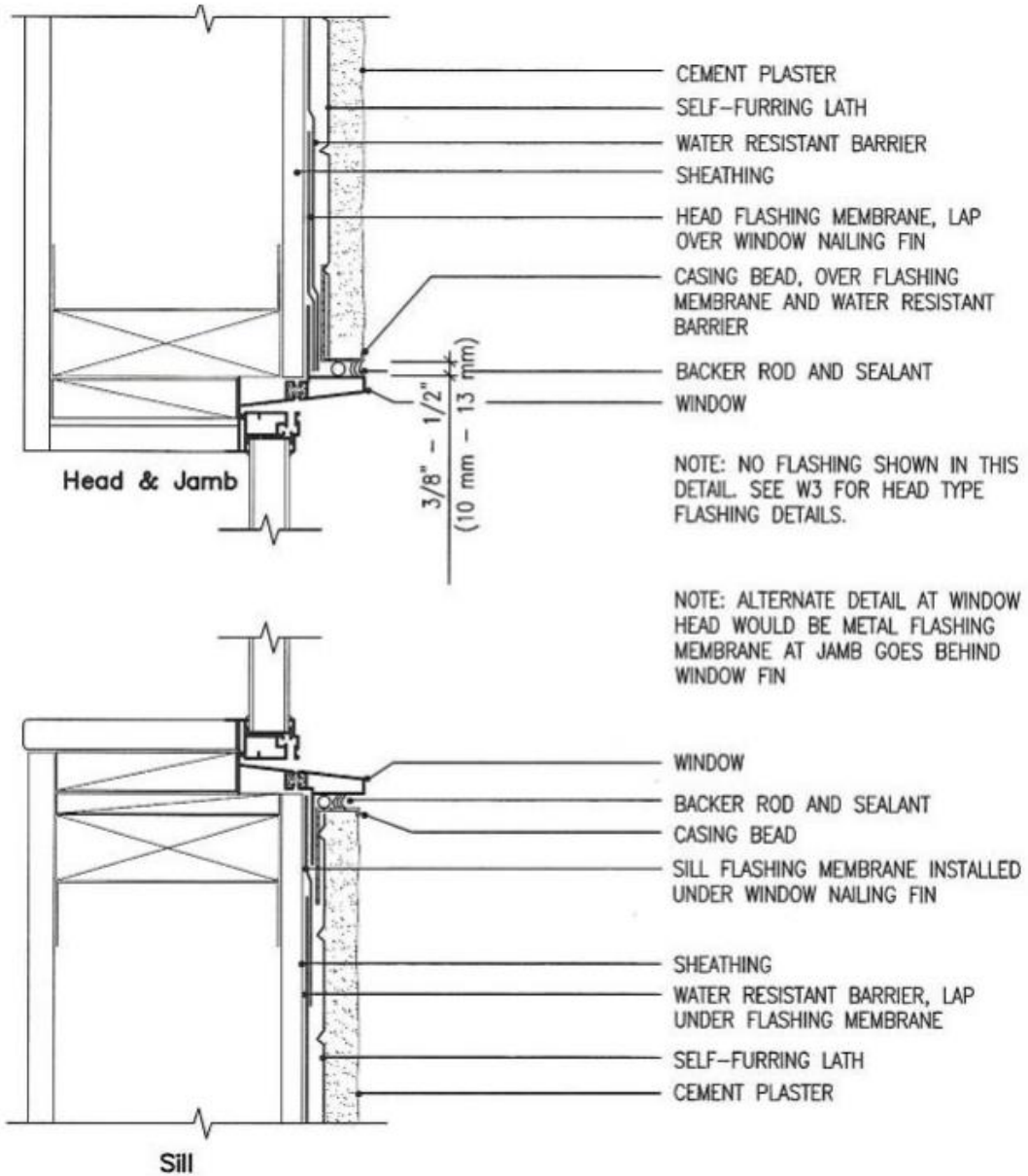
The grades are prescribed according to building type and depending on fenestration requirements.

15 psf – R class (single or two family dwellings)

25 psf – LC Class (multifamily dwellings)

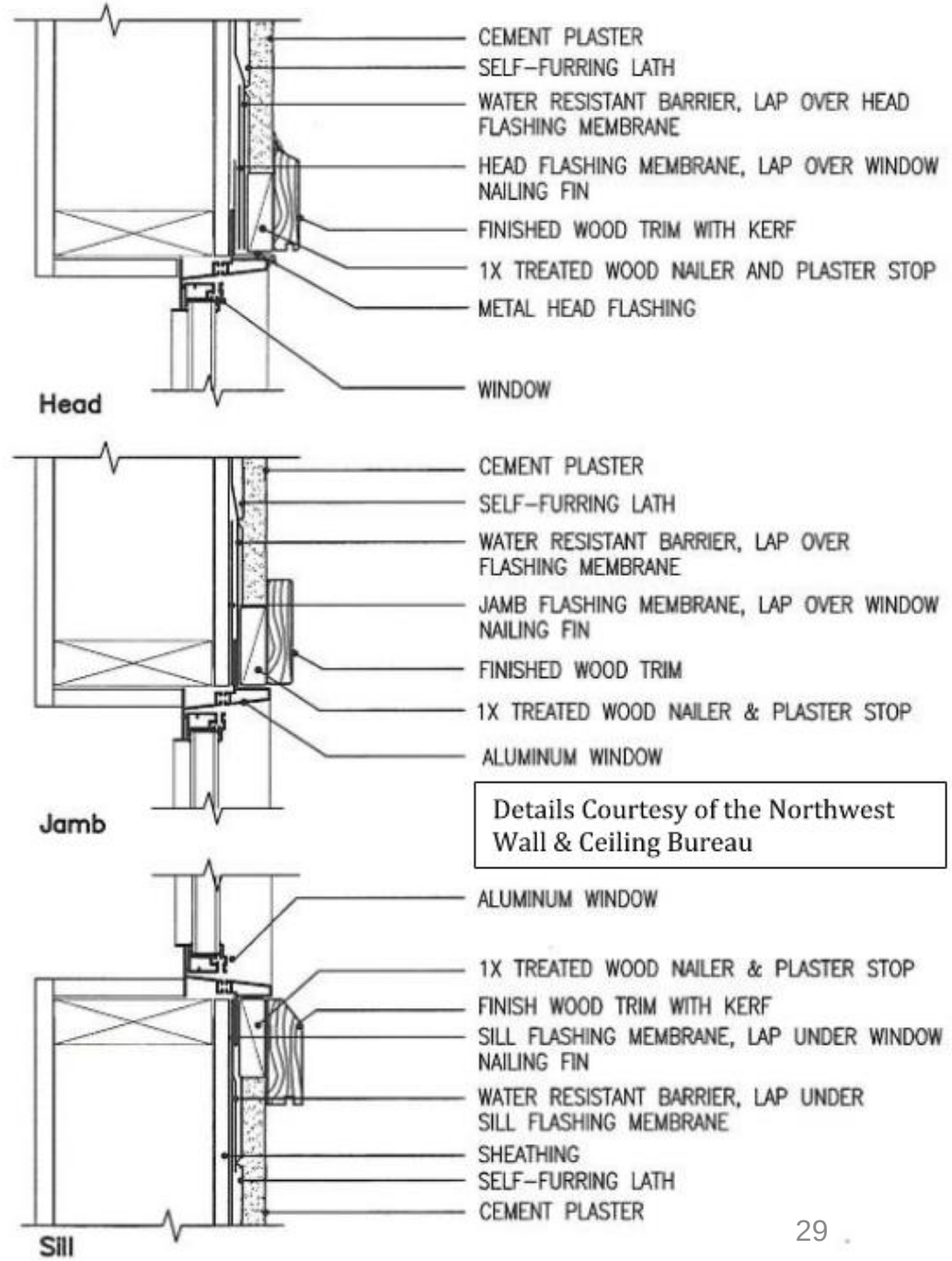
30 psf – CW class (low and midrise buildings)

40 psf – AW class (high rise & midrise)

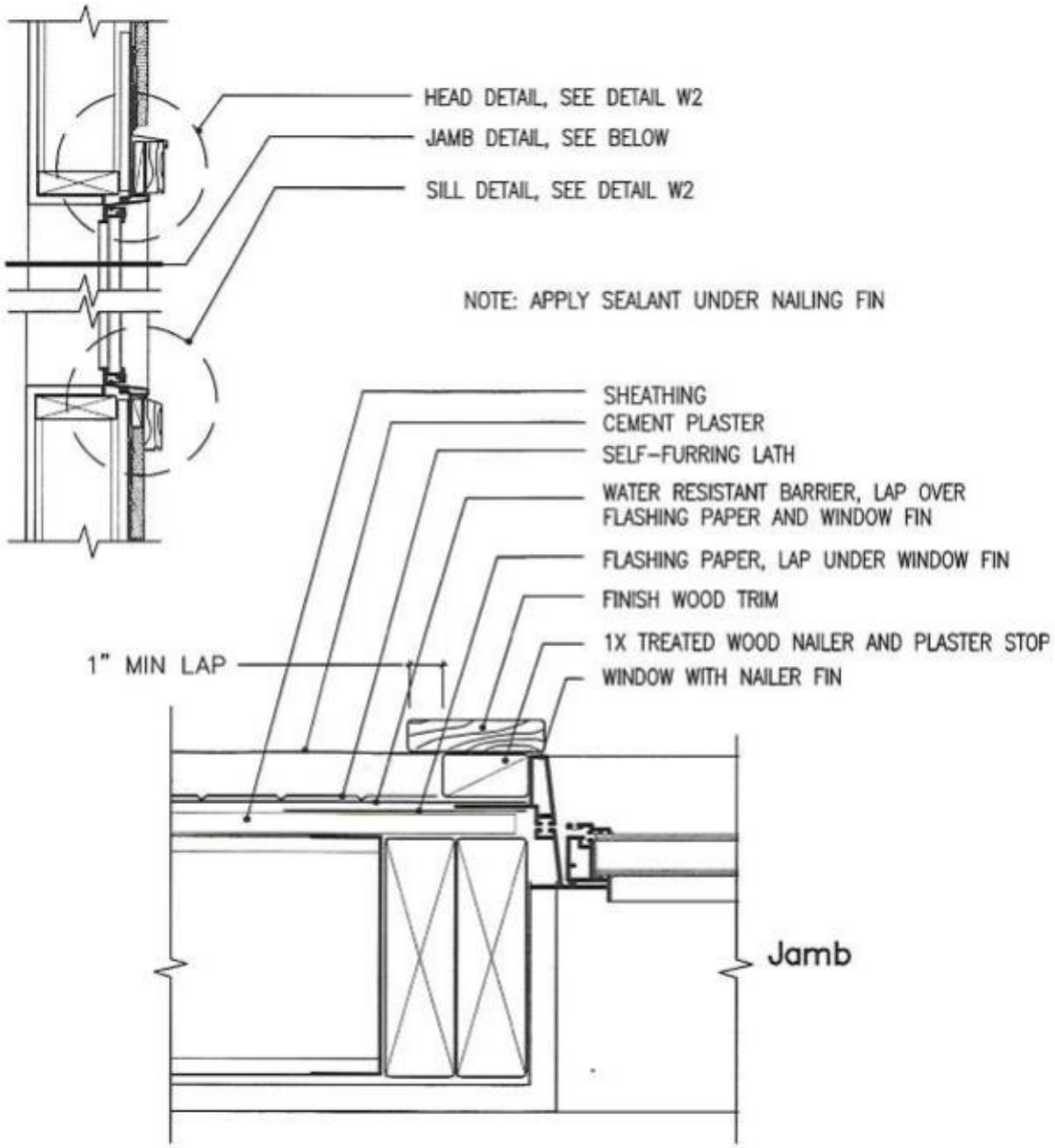



## W6 – Nail–on Window

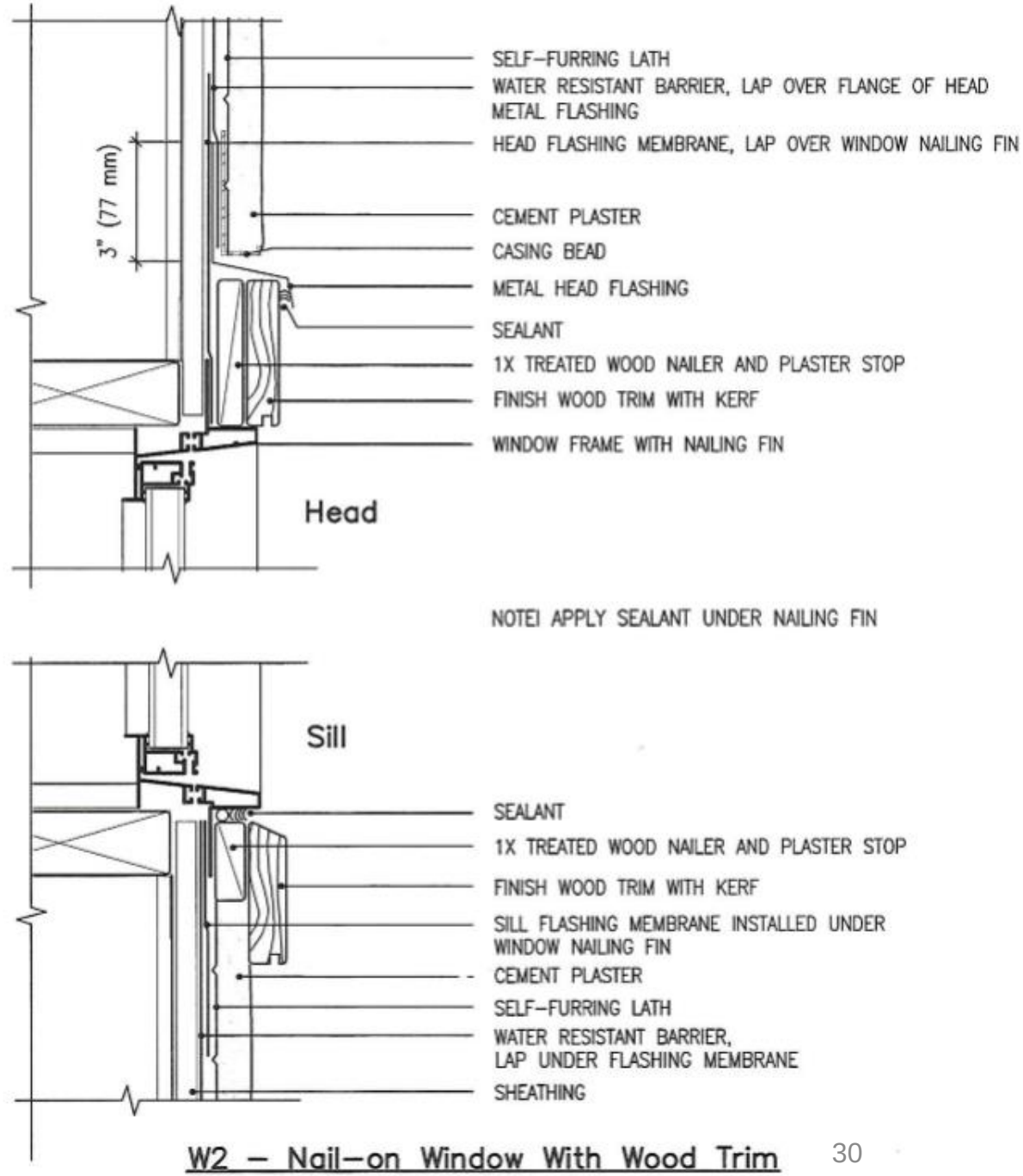
**SMA NOTE:** Stucco may directly abut the window frame if the conditions of SMA Technical Bulletin ***"Flashing a Nail Flange Style Window For Stucco"*** have been met.



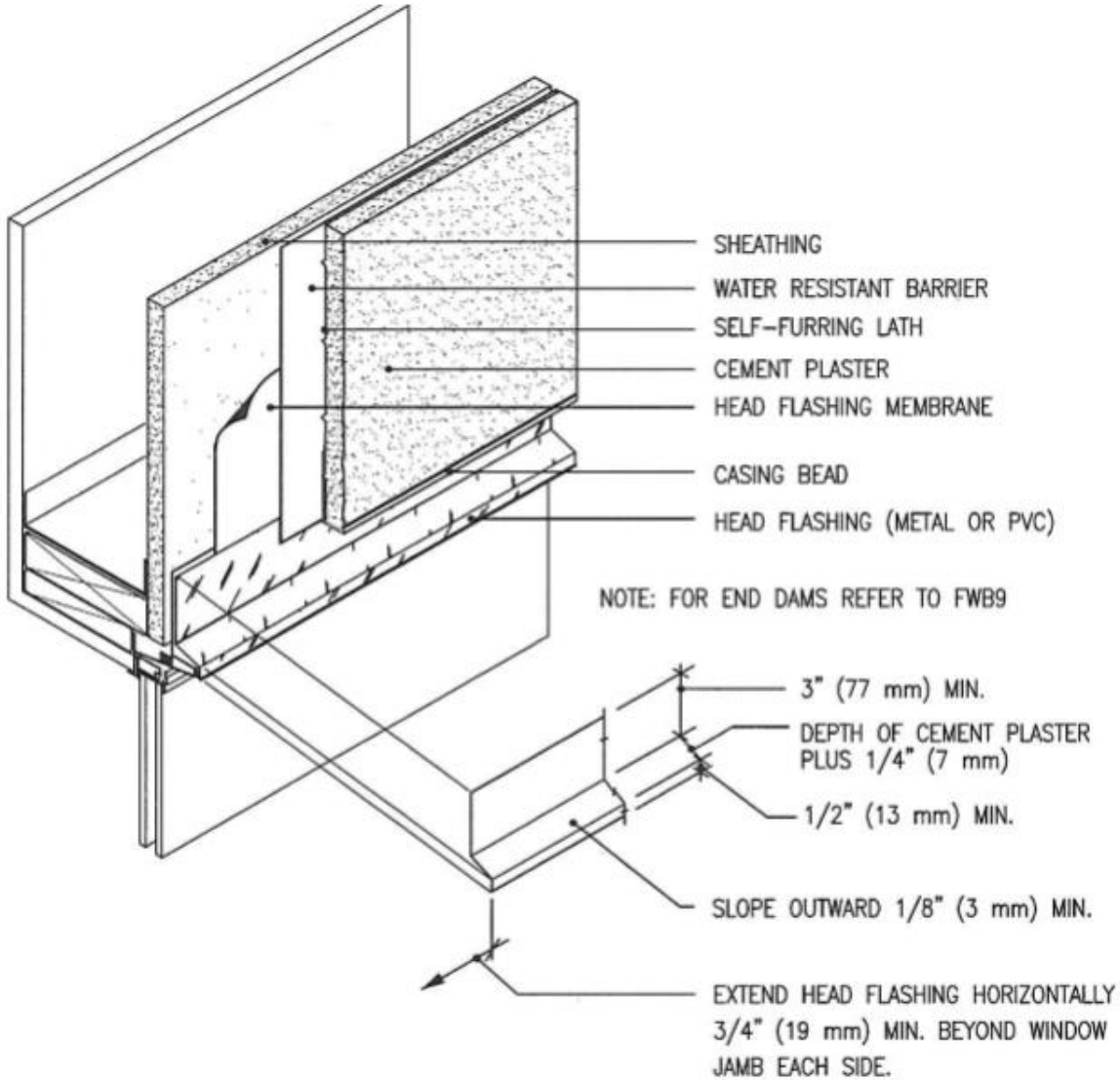

Details Courtesy of the Northwest Wall & Ceiling Bureau




W1 – Nail-on Window with Wood Trim

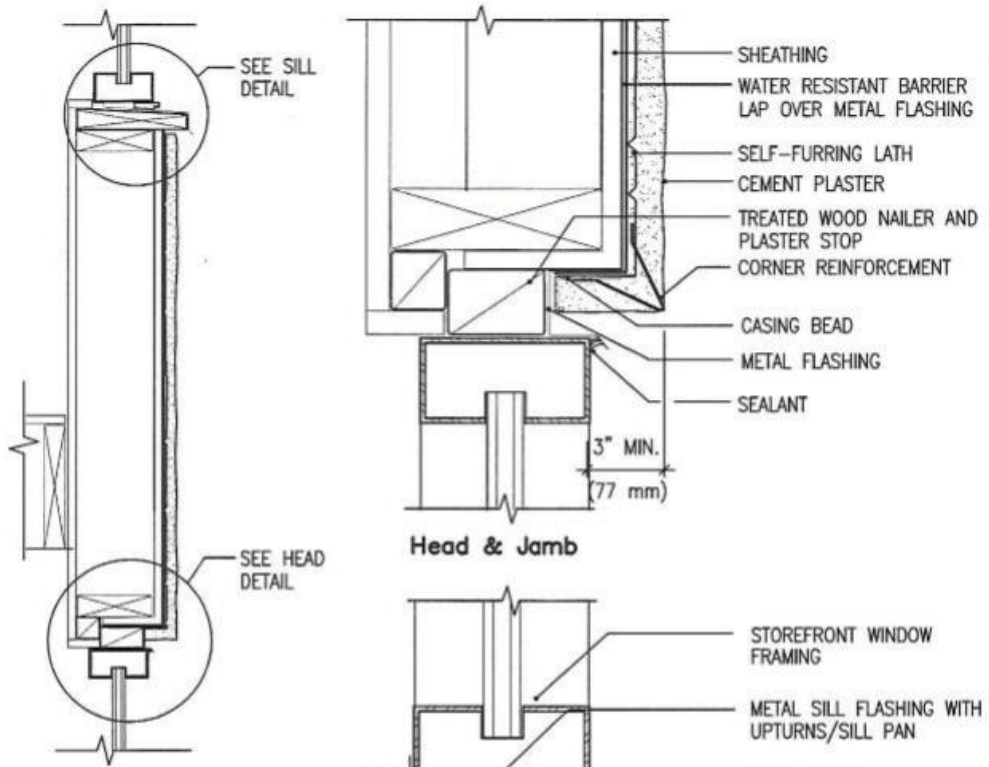



W2 – Nail-on Window With Wood Trim



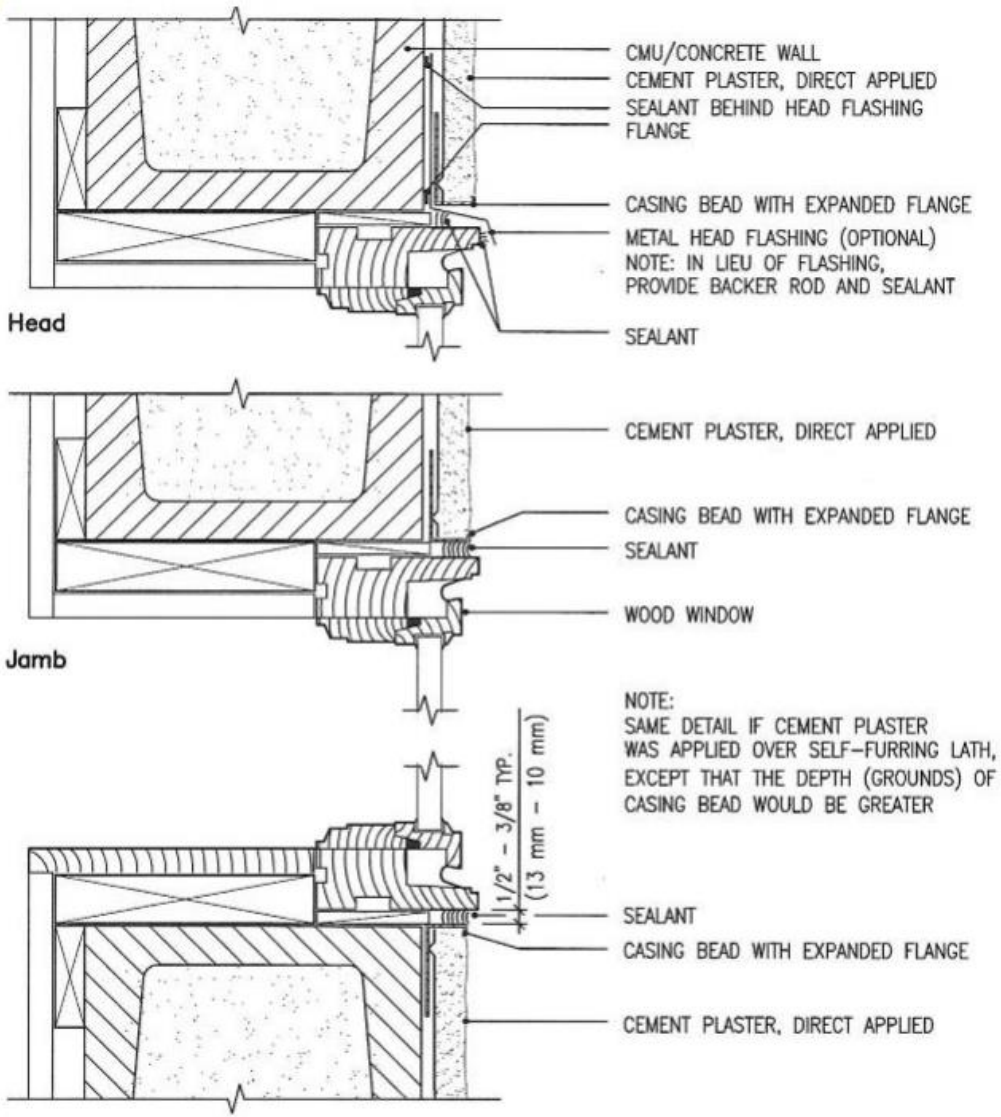

## W3 – Window Head Flashing (Fabricated From Metal or PVC)

**SMA NOTE:** Head Flashing Membrane may be placed <u>over</u> the Head Flashing (Metal or PVC)



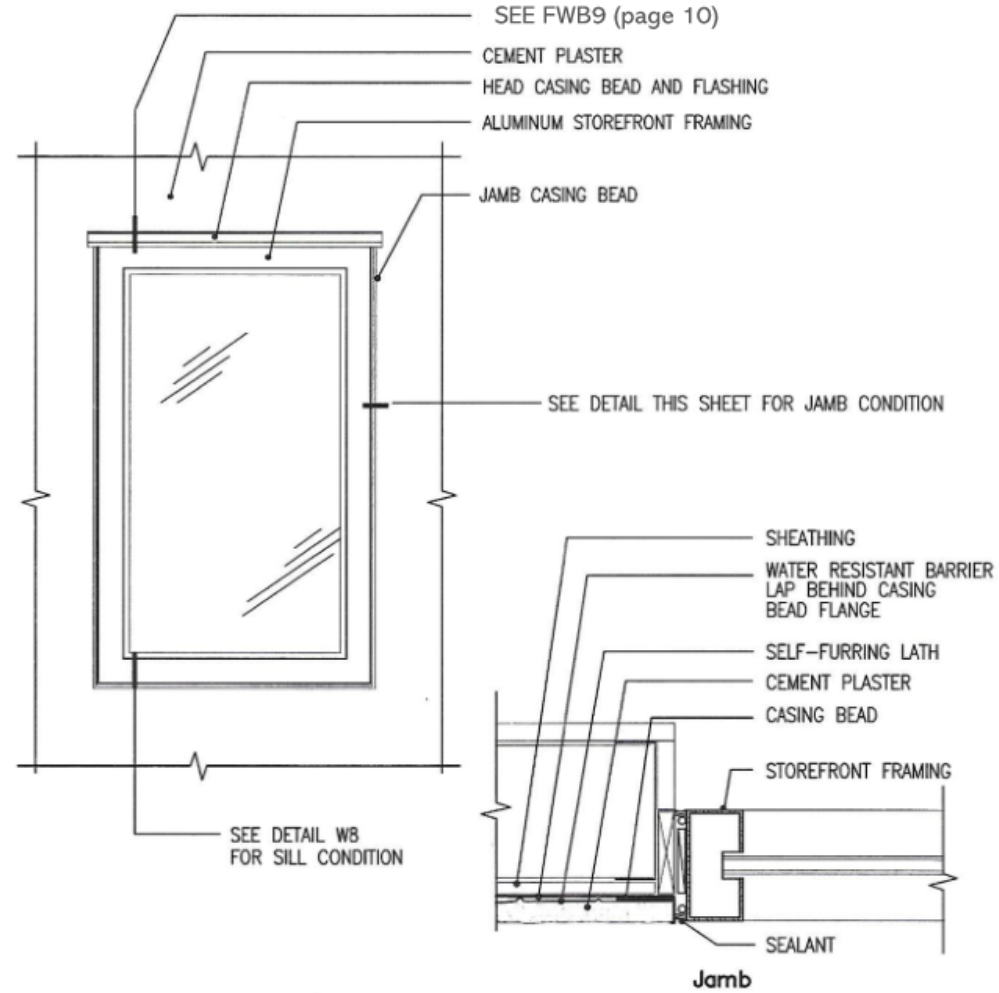

## W9 – Storefront Window Set–back

***SMA NOTE:*** A sheet metal sill pan is recommended for all Storefront style windows, particularly when the window is set-back. Stucco may terminate under the lip of the sill pan when set in a bed of sealant. For a sloped stucco sill in to window refer to page 13.



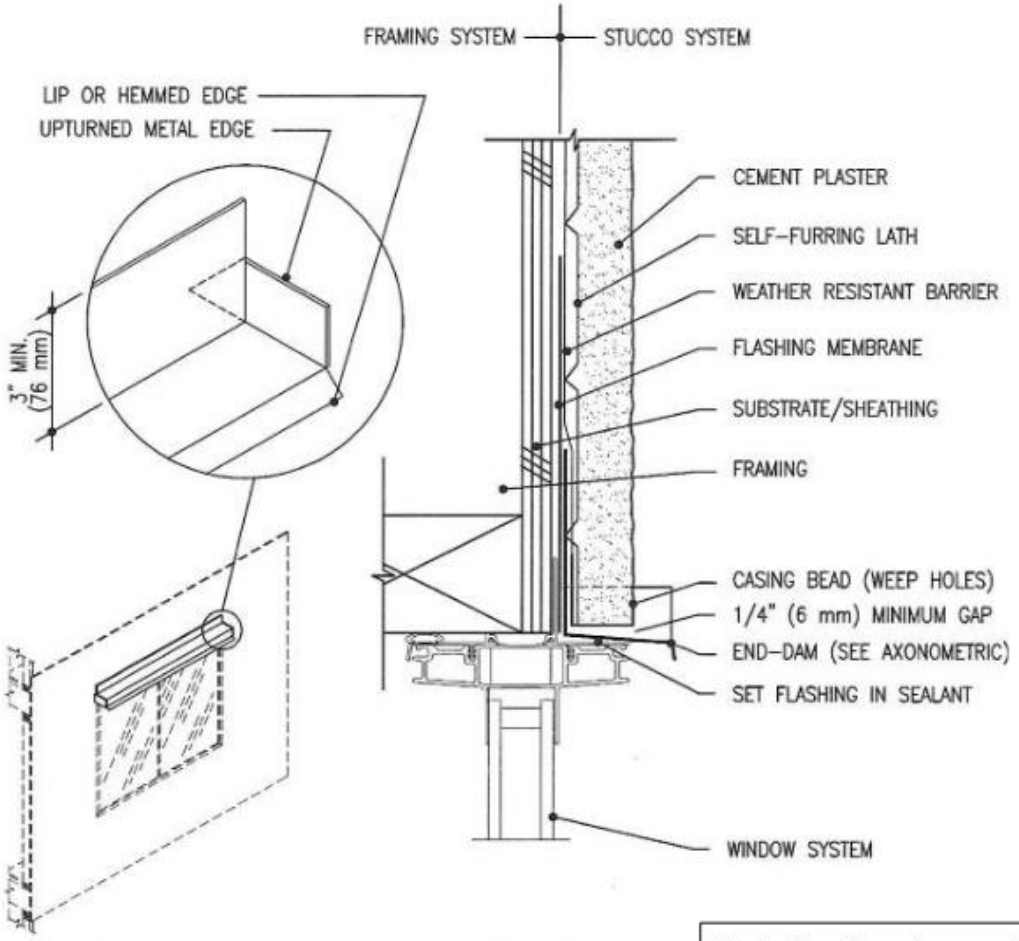

## W10 – Wood Window/Concrete Masonry

**NOTE:** This detail is acceptable for metal and PVC style windows on CMU or concrete. Lath is not required for cement plaster on CMU.




## W7 – Storefront Window

**SMA NOTE:** This is a basic stucco detailing method for all non-flanged style windows. Head flashing is not always required and a sealant joint is acceptable in low and mid rise structures in Dry zones (B) per the 2015 IECC climate zone map C 301.1. Moist (A) and Marine (C) should have head flashings if not protected by overhangs or above a single story in height. Flangeless windows require a selant around sill and jambs in all zones unless protected from rain.




**End–Dam Axonometric**
**(Not to Scale)**

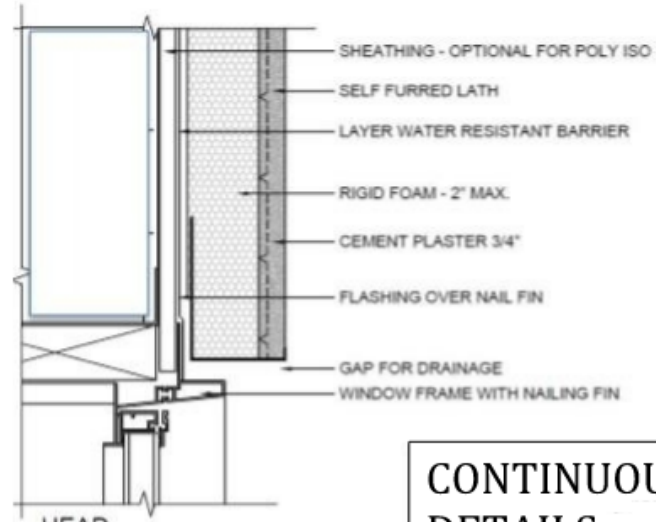
**Section at Head**
**(Not to Scale)**

Details Courtesy of the Northwest Wall & Ceiling Bureau

NOTE:
END–DAMS ARE RECOMMENDED ON HEAD FLASHINGS TO PREVENT MOISTURE FROM ENTERING THE STUCCO AT JAMB AREA. END–DAMS SHALL BE COMPATIBLE WITH THE HEAD FLASHING MATERIAL. THIS EXAMPLE IS AN END–DAM AS AN UPTURNED METAL EDGE.

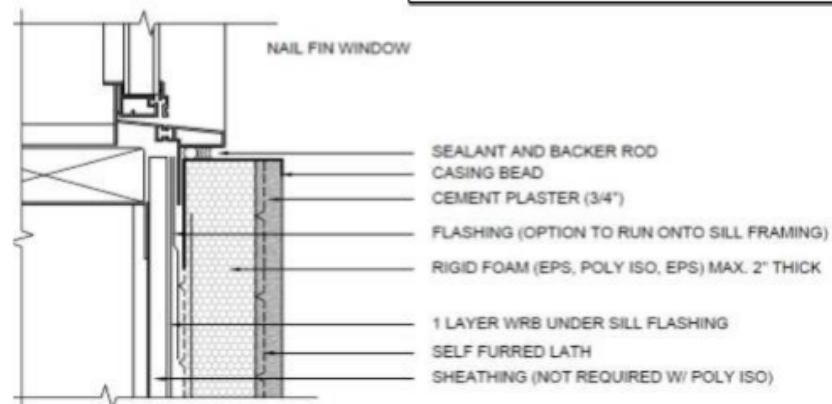
## FWB9 – Window Head Flashing Assembly

**NOTE:** End dams are recommended but not required, see note on W-7.




HEAD

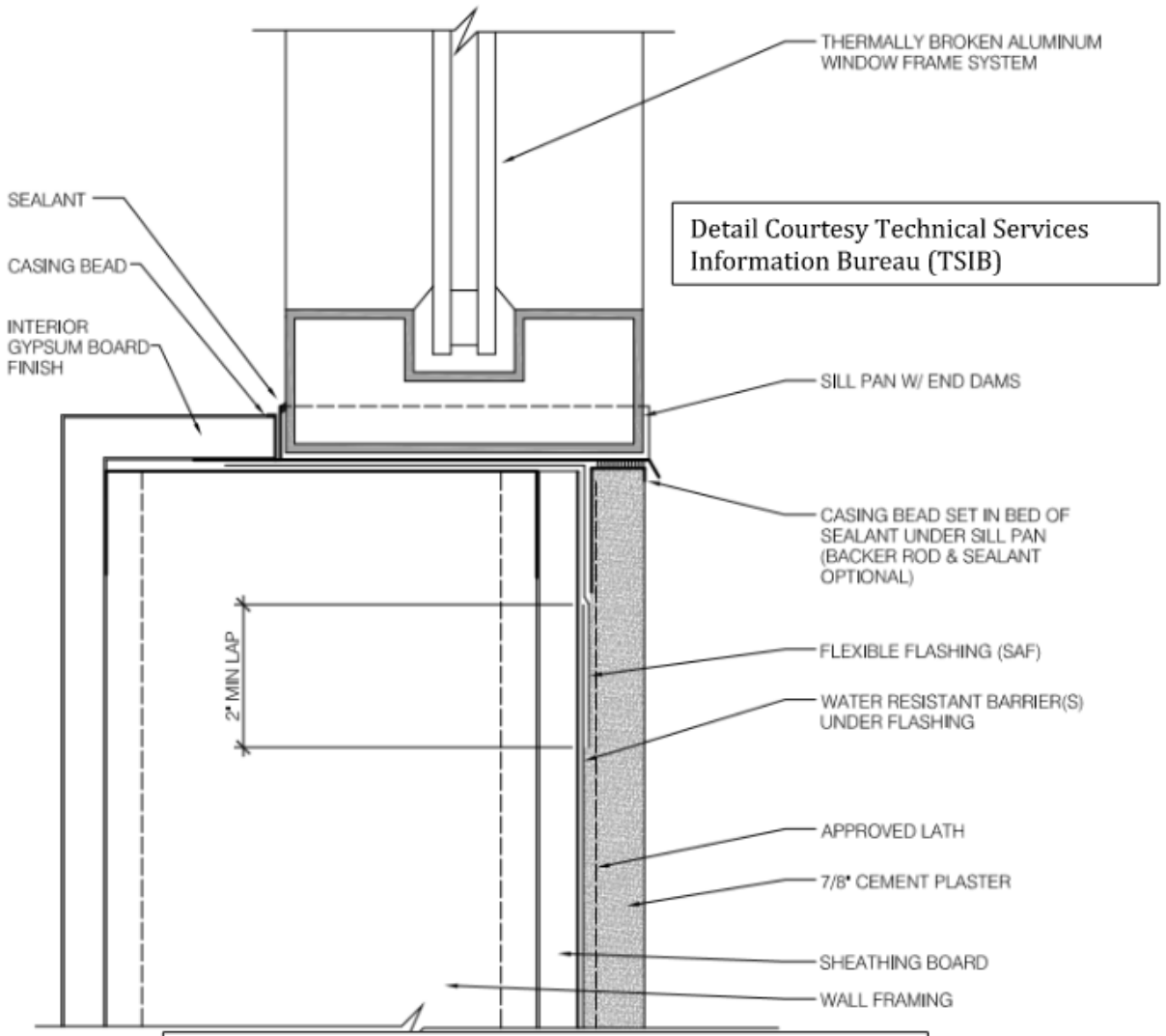
# CONTINUOUS INSULATION DETAILS




SILL & JAMB

***SMA NOTES:***

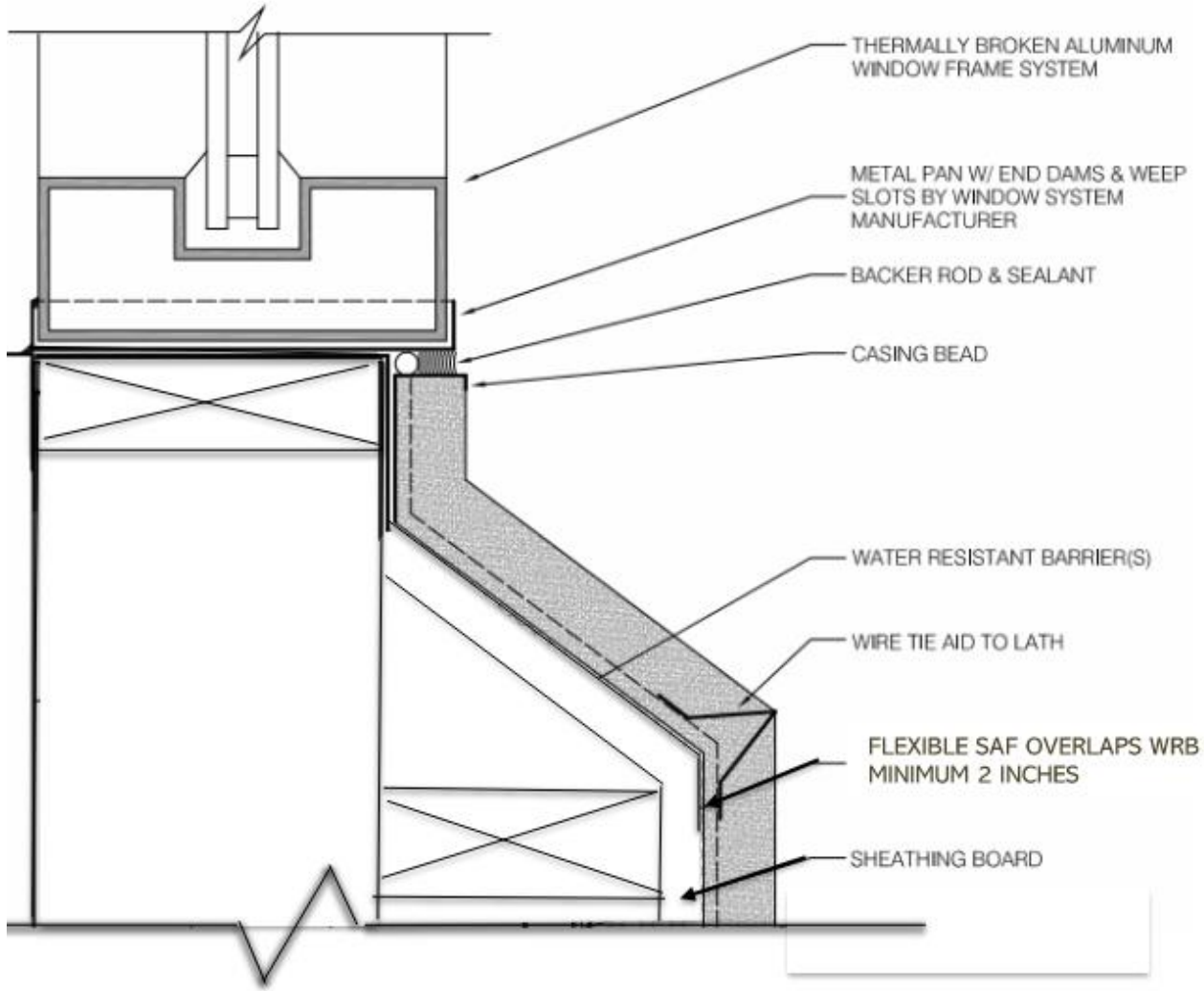
- Flashing for the Nail Flange (Fin) style window to be per the SMA technical bulletin ***" Flashing a Nail Flange Style Window for Stucco".***
- Single layer WRB may be used under rigid foam if the the foam has drainage channels or drain mat
- Metal Head Flashing (Optional) may be added to window head.
- Using a one-coat stucco system, with larger window frames and following SMA Flashing guidelines may eliminate need for a casing bead and sealant joints, if allowed by the one-coat stucco manufacturer




Detail Courtesy Technical Services Information Bureau (TSIB)

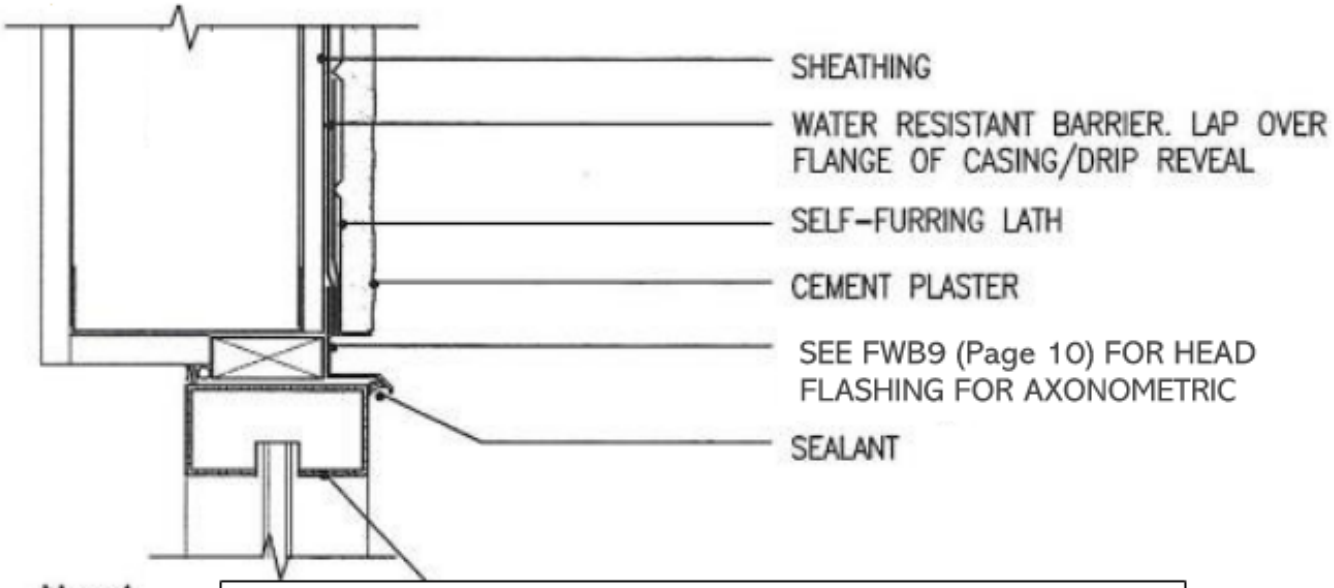
**Store Front Sill W/Hidden Sealant Joint**

- The Sill Pan (all corners sealed) end dams should be a minium ¾ inch in height
- Flexible SAF should be a minimum 40 mils and lap over framing full depth of window frame
- See page 9 for jamb details




**Store Front Style Window In-Set**

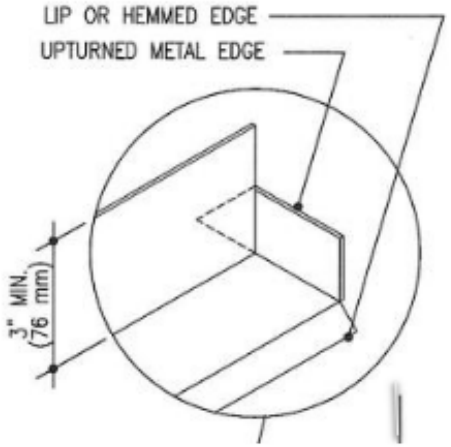
- **See page 7 for Head Detail**




Store Front Head Flashing

***SMA NOTES :***

- Casing bead should have weep (drip) holes. If no weep holes, WRB should be behind casing bead flange and over head flashing flange
- Head Flashing & Casing may be a one-piece trim accessory




**END DAMS FOR HEAD FLASHING**