

# BCBEC - AGM

## Detailing Construction and Control Joints

The Below-Grade Building Envelope  
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# Foundation Waterproofing Strategies

## ■ Three Basic Types

- Concrete wall or slab only.
- Conventional waterproofing (formed both sides).
- Blind side waterproofing (formed one side).

# Waterproofing Strategy

- Choose type based on:
  - The site conditions.
  - The strength and durability of the membrane system.
  - The Owner's expectation of performance.
    - Parking only or finished space?
  - Cost.

# Foundation Waterproofing

## ■ Building Envelope

### ➤ Concrete

- Water passes through durable concrete so slowly that it is effectively impervious.

$$\text{Permeability} := 1 \cdot 10^{-10} \frac{\text{cm}}{\text{sec}}$$

■ Wall Thickness = 200 mm

■ Time to Leak = 6342 years

# Foundation Waterproofing

## ■ Building Envelope

### ➤ Concrete

- Water passes through concrete structures only at cracks (at or between control joints) or joints between concrete pours (construction joints).
- Can repair cracks as required, or...

### ➤ Membrane

- Effective barrier, when continuous.

# Concrete Technology

## ■ Cracks

- Cracks will form.
- Cracks are the main locations of moisture entry.
- Reduce severity by adding reinforcing steel above what is normally used.
  - Steel does not prevent cracking - it limits crack width after the cracks have formed.
- Cracks can be effectively treated.

# Concrete Technology

## ■ Construction Joints

- Locate carefully and use to control cracking.
- Keep clean to promote bond with the next pour.
- Use a high quality water stop.

# Construction Joint Leakage





# Construction Joint



Provide  
concrete  
coverage

# Construction Joint



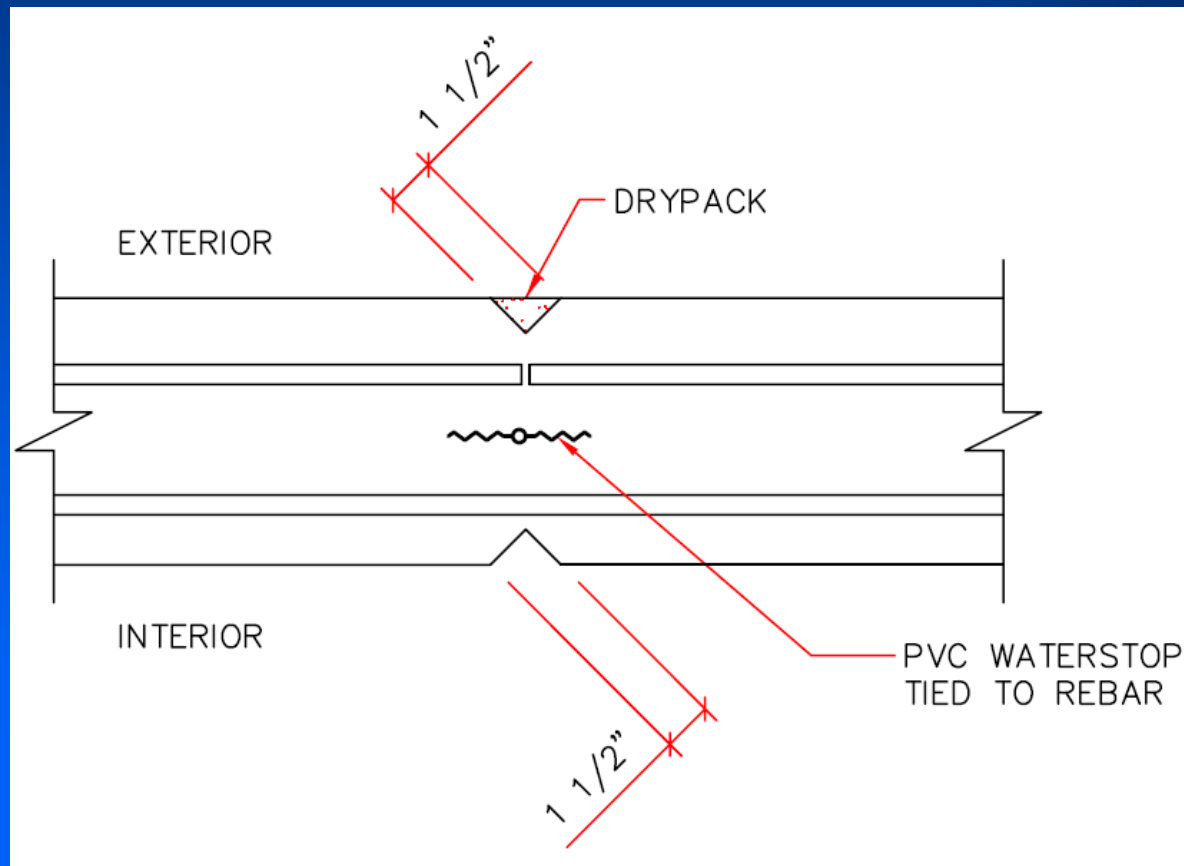
# Concrete Technology

## ■ Control Joints

- Locate between construction joints.
- Create notches to concentrate stress and promote a crack at the joint.
  - Align notches vertically.
- Decrease rebar area at the joints.
- Fill exterior, if accessible, with a non-shrink grout.
- Detail additional membrane at the joints.
- Consider a PVC water stop.

# Control Joint

## ■ An example...



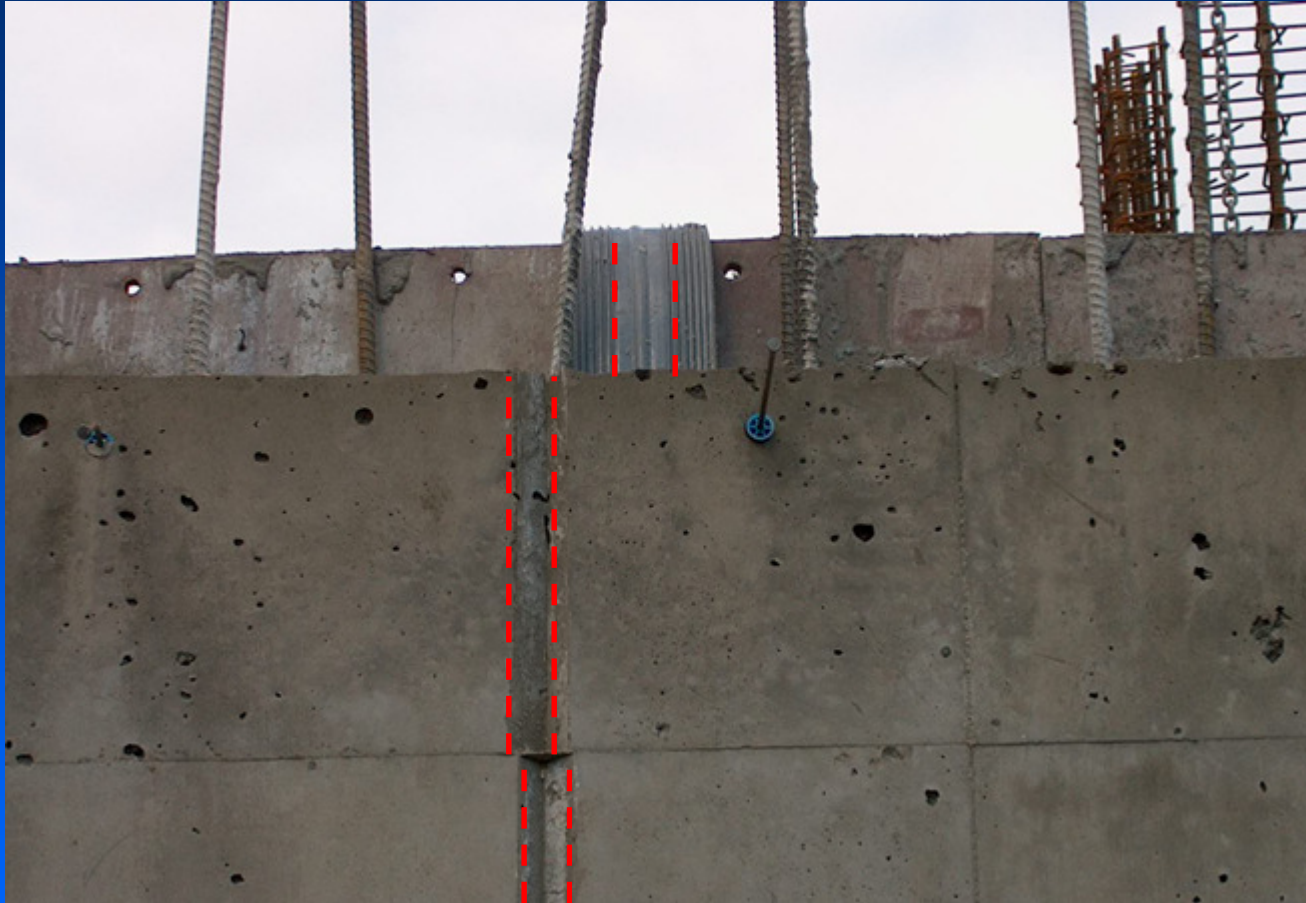
# Control Joint



# Control Joint



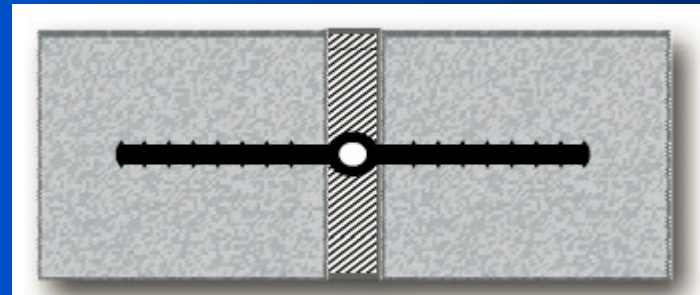
# Control Joint Water Stop



# Waterstops

## ■ Vinyl

- Must be continuous in vertical and horizontal directions.
- Must be tied to rebar to remain normal to joint.
- Must be heat welded at joints (requires T and cruciform sections).





# Waterstops

## ■ Bentonite

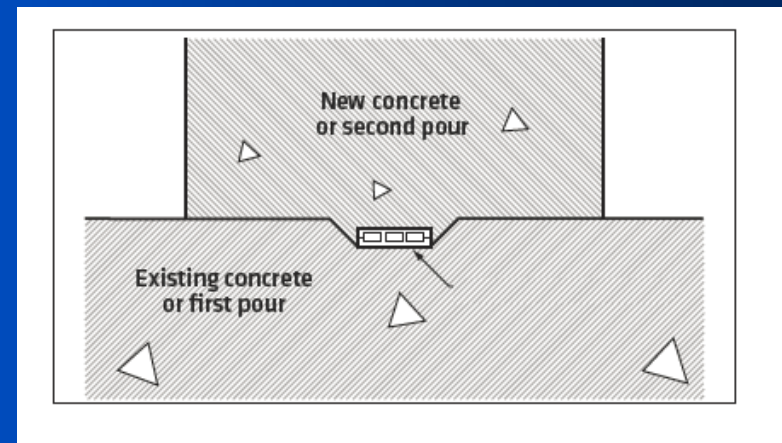
- Must be continuous.
- Water absorbed by fine clay particles.
- Must be removed and replaced if moistened prior to pour.



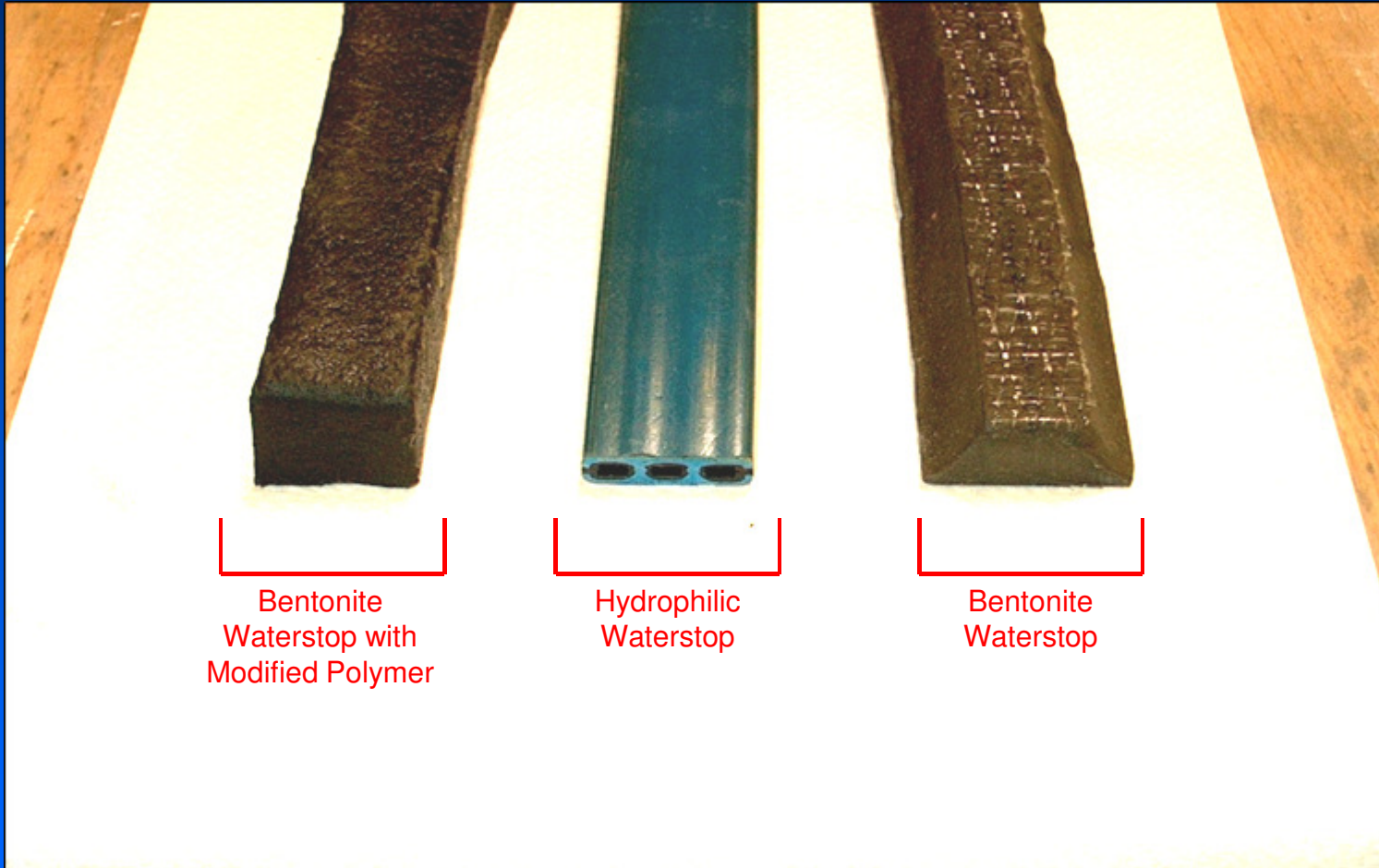
# Waterstops

## ■ Hydrophilic

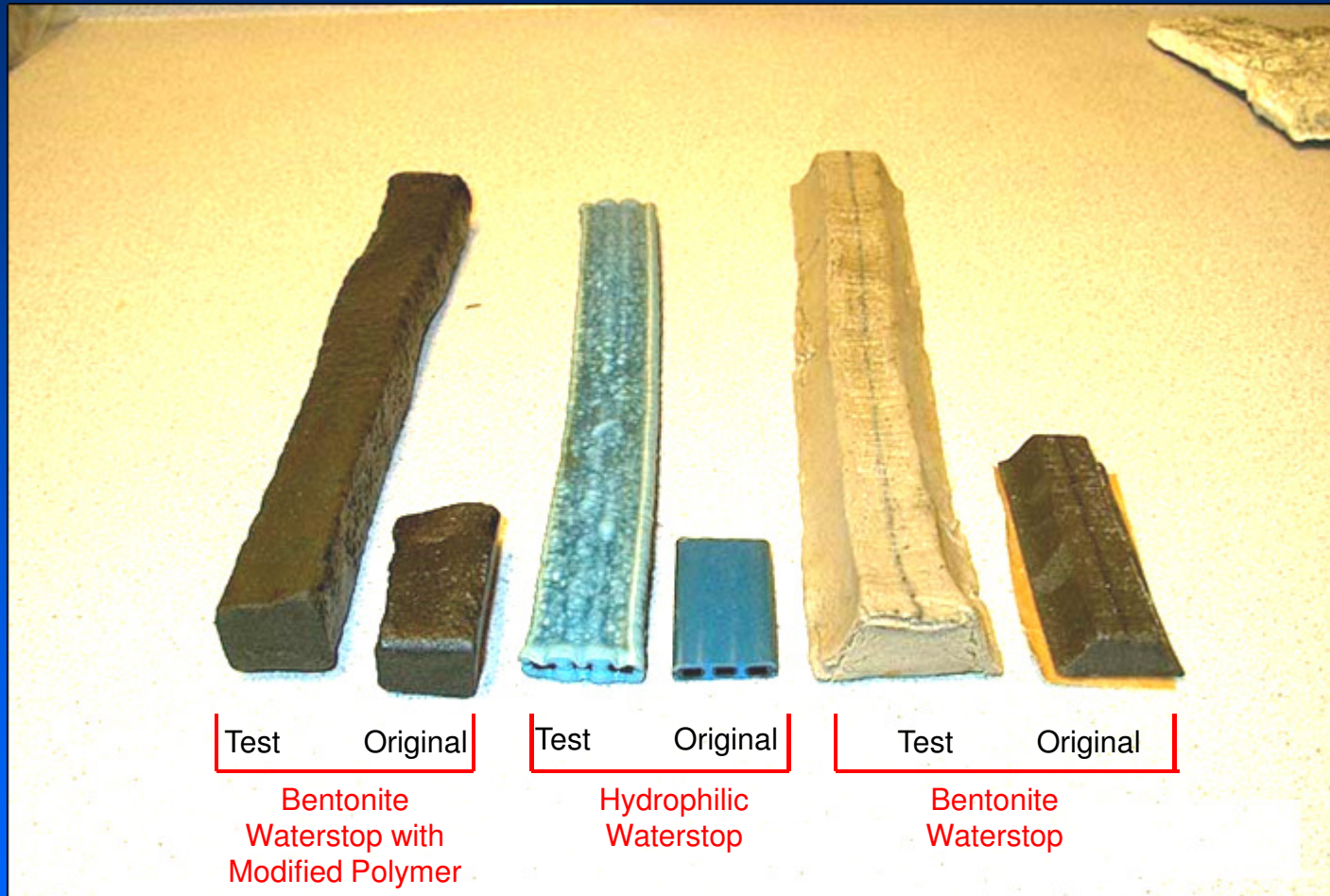
- Must be continuous.
- Water adsorbed by polymer.
- Coated to prevent early response to moisture - OK if moistened prior to pour.
- Costly.
- Excellent performance.



# Waterstops



# Waterstops



After 48 hours of water immersion...

\* Testing performed in an open environment (No concrete coverage)

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# Waterstops

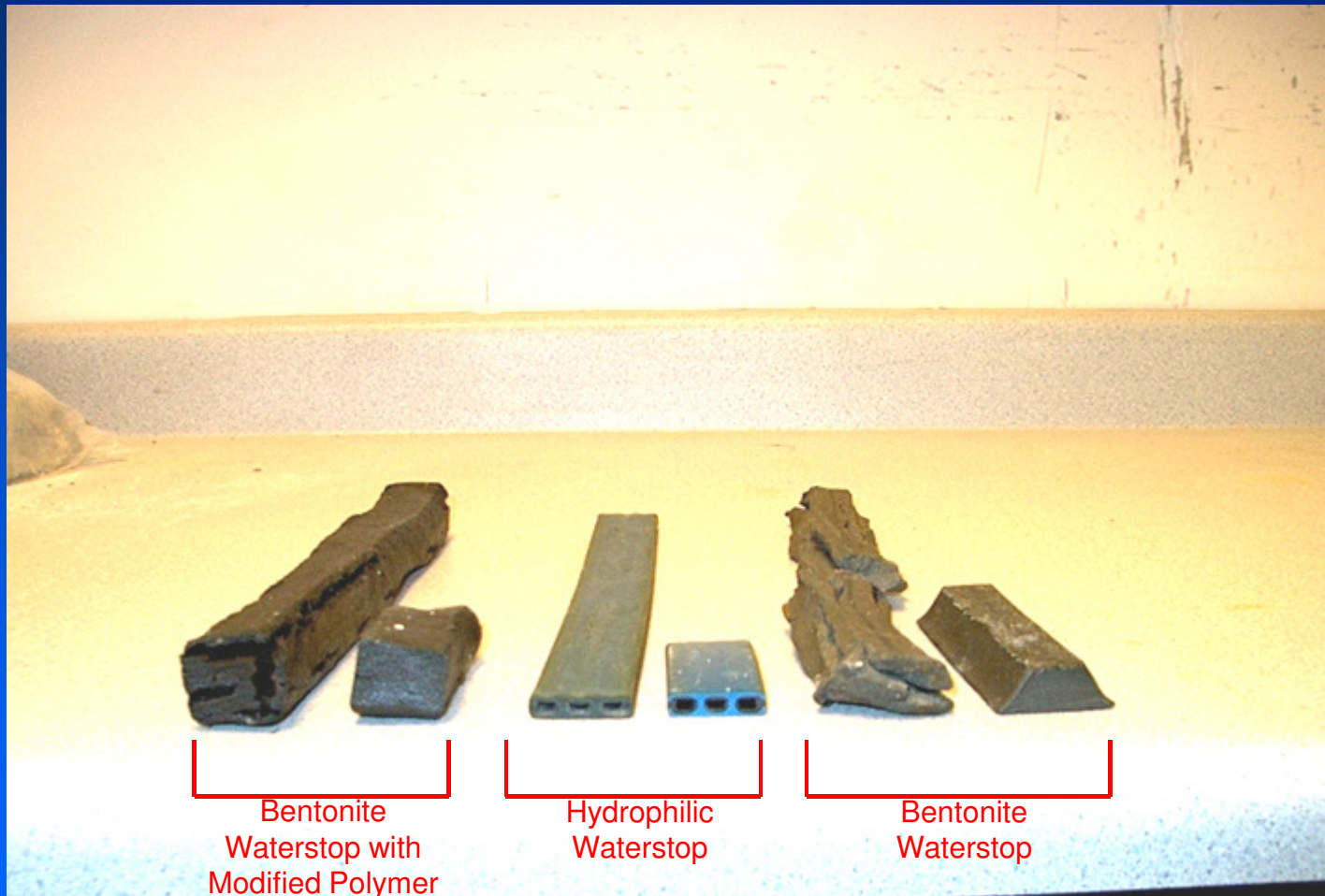


After 17 days of water immersion...

\* Testing performed in an open environment (No concrete coverage)

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# Waterstops



Bentonite  
Waterstop with  
Modified Polymer

Hydrophilic  
Waterstop

Bentonite  
Waterstop

After 9 days of drying...

\* Testing performed in an open environment (No concrete coverage)

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# Waterproofing

## ■ Concrete Wall Only



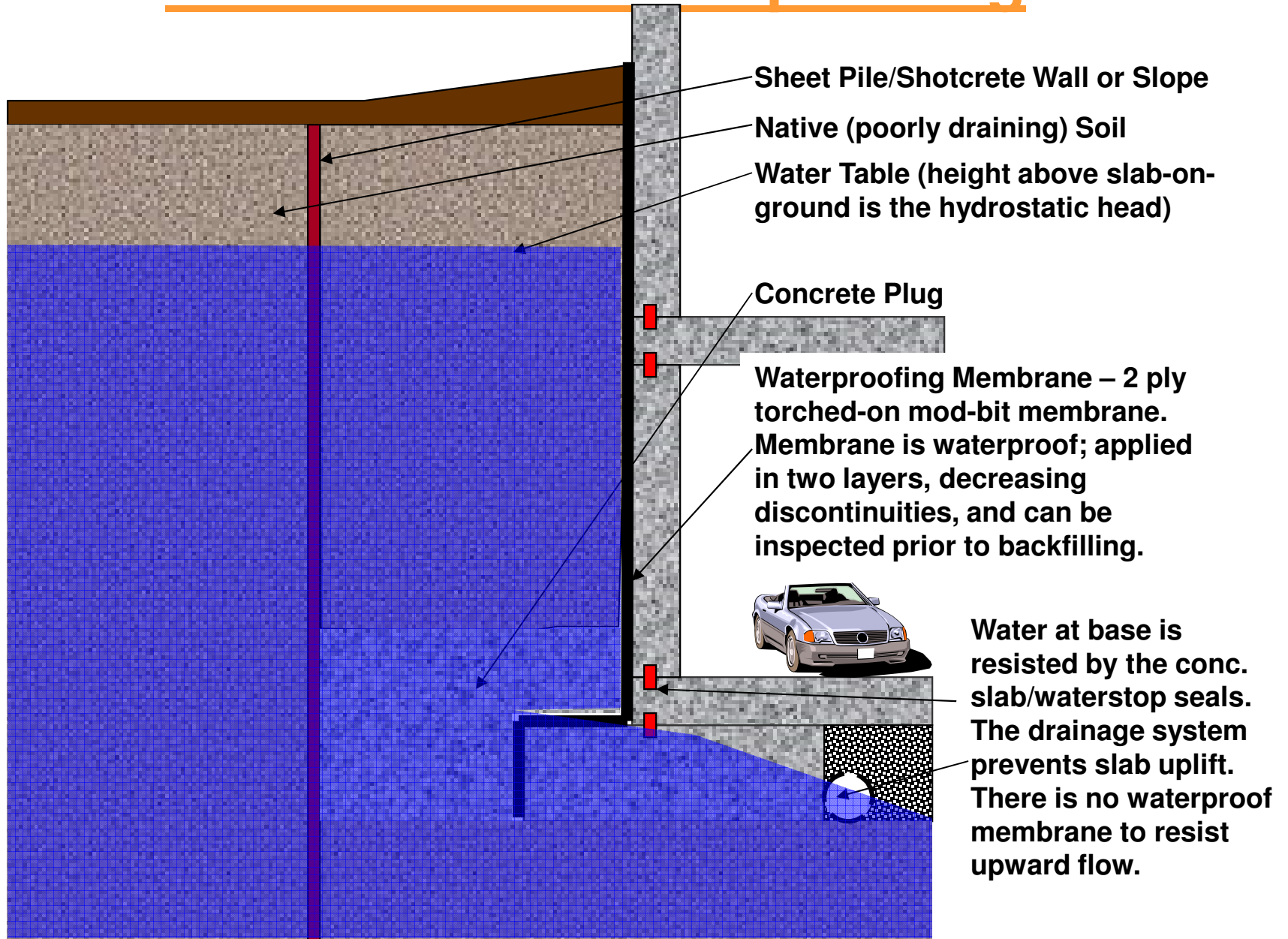
# Conventional Waterproofing

## ■ Membranes

- Effective moisture and vapour barrier.
- Use when moisture ingress cannot be tolerated.
- Will essentially prevent moisture ingress only at cracks and joints in the concrete wall.
- Are not 100% effective.



# Conventional Waterproofing



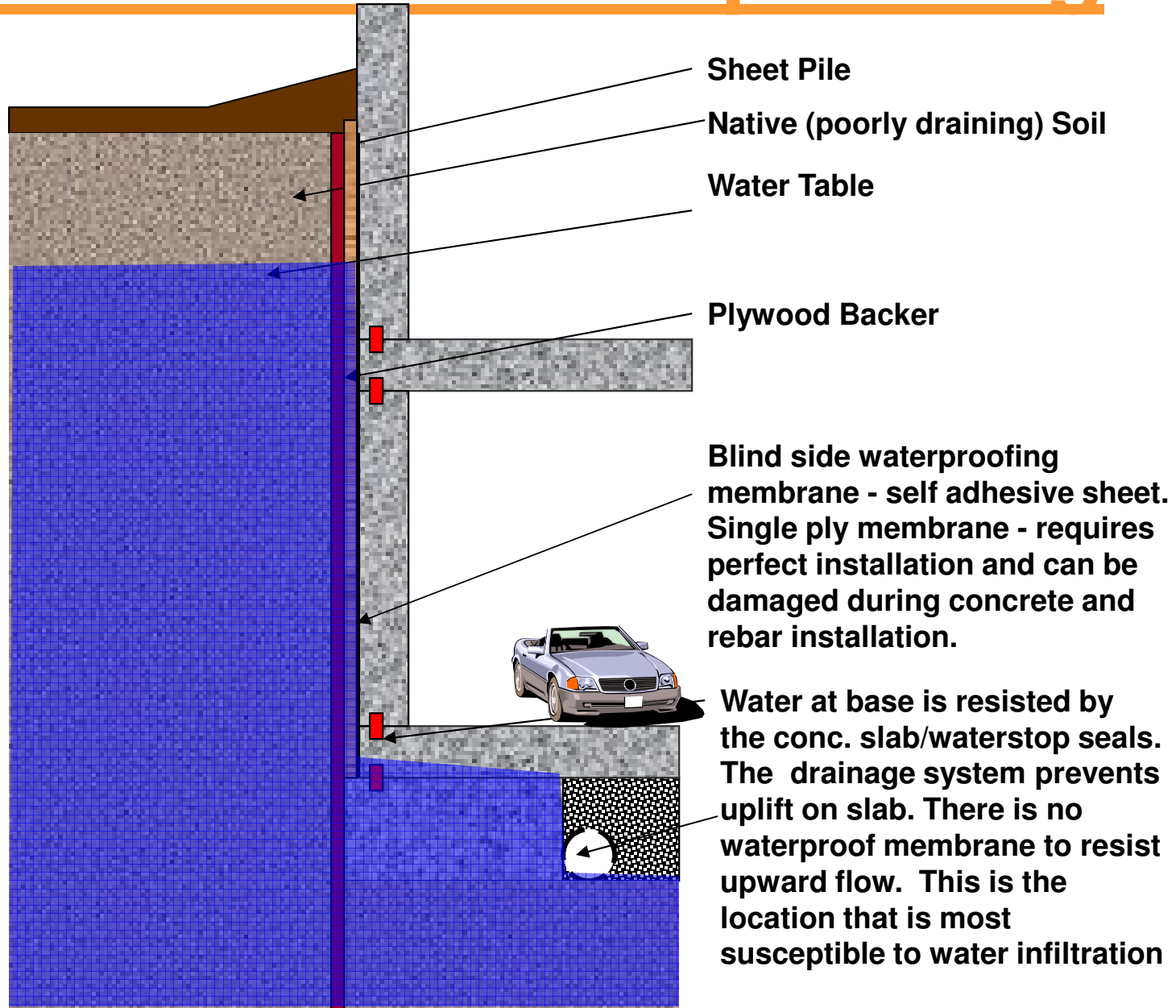
# Conventional Waterproofing



# Blind Side Waterproofing

- Positive features compared to conventional
  - No tie-holes through walls.
- Negative features compared to conventional
  - Can't inspect after walls are cast.
  - Susceptible to damage during rebar or concrete placement.
  - Joints between sheets require attention to detail when placing.
  - Lesser ability to elongate at cracks or joints than a thicker, torched-on membrane.

# Blind Side Waterproofing



# Blind Side Waterproofing



# Blind Side Waterproofing

Details and interfaces impossible to perform 100% perfectly in all locations.



Fish mouth discontinuity

Seal to footing



# Blind Side Waterproofing



# Penetrations



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# Water Ingress

## ■ Types of Leaks

- Cracks at or between control joints.
- Construction joint between slab band and wall (blind side membrane).
- Wood spreaders left in form at base of wall.
- Seepage between slab and base of wall.

# Recommendations

## ■ Joints

- Select proper construction joint locations.
- Clean joints.
- Place a waterstop in all joints.
  - Glue and nail.
  - Continuous.
- Low Control joint spacing (8 m).
- Pre-strip membrane.

# Recommendations

## ■ Membrane

- Proper substrate.
- Instruct workers.
- Careful installation.
- Care when placing rebar and concrete.
- Diligent field reviews.

# Closing

- Don't be surprised when leaks occur.
  - Address in a timely manner.
  - They can be effectively sealed.
  - They can reappear.
    - May require more than one treatment.