

Industry Perspective on Bridge Expansion Joints

- Proper preparation / installation practices of bridge expansion joints
 - Watson Bowman Acme – John Manning



- Proper sizing of bridge expansion joints
 - EMSEAL - Philip Benevides



- Preservation Methods of bridge expansion joints
 - RJ Watson - Matthew Keilson



The Expansion Joint didn't fail you, you failed the Expansion Joint.



Maintenance and design requirements of expansion joints can not always be met

- Poor choices during design (standards)
- Lack of clarity in plans
- More responsibility on contractor and manufacturer to address field conditions
- Engineers working with as built vs actual field conditions
- Poor substrate and concrete condition
- Temperature / time of installation
- Compromising quality for time constraints
- Repair vs reconstruction/replacement
- Lack of understanding
- Lack of preparation knowledge
- Lack of seal knowledge
- Absence of proper supervision
- Inattentiveness to detail/s
- What dynamics are taking place



Preparation – Understanding Required Procedures

- Industry standard guidelines
- Educating oneself on these important standards
- Applying the procedures and standards
- Supervising less qualified workers as the work is being done

**MAKE QUALITY A
HABIT**



Did You Know?

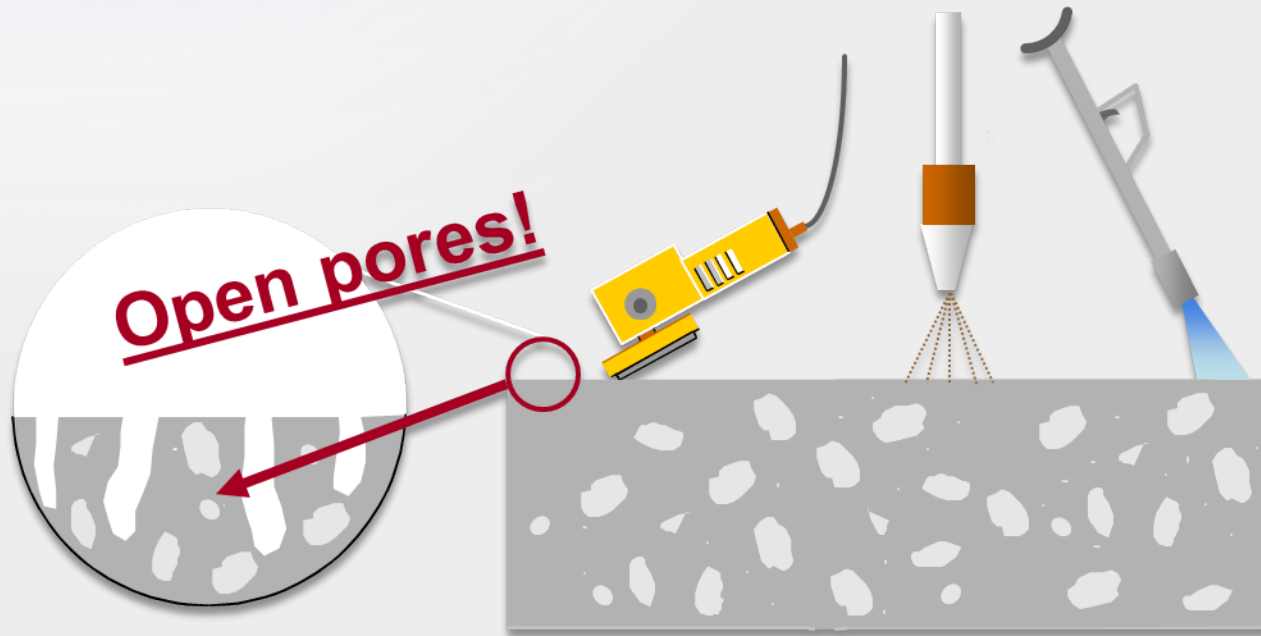
International Concrete Repair Institute (ICRI):

The *only association* in the concrete industry devoted solely to repair and restoration

- Concrete repair guidelines ACI (American Repair Institute)
- Cement and Concrete Terminology (reported By ACI committee 116)
- ICRI CSP (concrete surface profile) Chips 1 – 9 profile
- Epoxy injection 210.1-2016
- American Concrete Repair Institute – ACI 54614 Guide to concrete repair
- ACI -50605 – Guide to Shotcrete
- ACI-222 Protection of Metals in Concrete Against Corrosion (ACI)
- ACI-364107 – Guide for Evaluation of Concrete Structures before Rehab
- ICRI – 210-3R-13 Using in-Situ Tensile Pulloff Test to Evaluate Bond of Concrete Surface Materials
- ICRI – 210.4-2009 Nondestructive Evaluation Methods for Concrete Structures
- ICRI – 3102R13 Selecting and Specifying Concrete Surface Preparation
- SSPC SP1-SP15 Surface Preparation for Steel and Concrete Substrates

Preparation – Executing Required Procedures

Proper preparation is everything in extending the life expectancy of an expansion joint !



Find out what is Going on or Needed!

Prep/Repair Matrix:

- Determine the problem/existing conditions
- Evaluate the cause/ issues
- Engineer the appropriate solution
- Complete the preparation (No Shortcuts)
- Complete long term repair or placement



The Profile is All-important for Mechanical Adhesion

- A properly prepared, roughened surface provides a far greater surface area to which a repair material can be adhered
- A good, clean, profile allows the material to flow into the pore structure of the concrete and ensure a positive bond once it cures

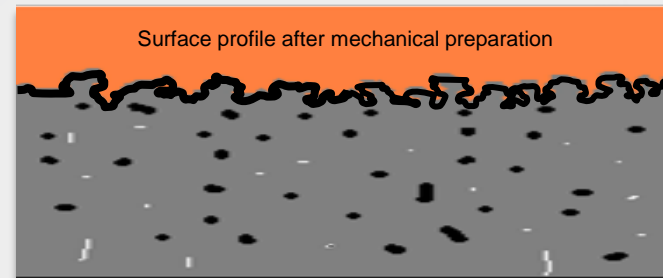
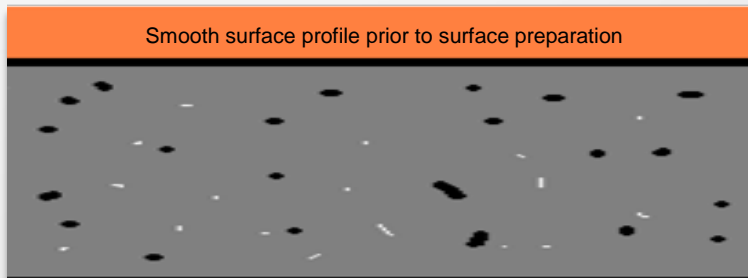


Illustration showing increase in surface area available for bonding after surface preparation:

Unprepared surface profile: 

Prepared surface profile: 

Prepared surface profile stretched flat to show comparative actual surface available for bonding:



Expansion Joint Seal Installation 101

Pre-Job Survey or Check list – every proper seal installation begins with a plan

- Is it new construction or retrofit?
- What type of substrate? ie: steel, epoxy, elastomeric, concrete etc.
- What condition are they in?
- Is it staged construction, day work or night work?
- Is weather going to be an issue?
- What size is the joint opening width?
- How many joints are there, do I have the material on hand?

Wabo®SPS Preformed Silicone Joint Sealing System
Designed for the preservation and maintenance of bridge expansion joints

Watson
Bowman
Acme

rev. 9.2014

PRE-JOB SURVEY

Company: _____ Name/Title: _____
phone/fax: _____ email: _____
Project Name: _____ Project Number: _____
Project City/State: _____ Project Agency/Owner: _____

Check appropriate boxes and fill in necessary information.

Expansion Joint Work to be Performed:
 New Construction
 Resealing
 Rehabilitation

Existing Joint Conditions:
 Concrete Substrate
 Steel Substrate
 Other: _____

Anticipated Joint Movement:
Thermal +/- _____
Vertical Deflection +/- _____
Racking (skew) +/- _____

Enter joint opening dimensions
A: _____ (in) B: _____ (in)

Enter blockout dimensions and deck thickness
E: _____ (in) F: _____ (in)

Joint Information and Configuration:
Joint Location # _____
Field Measurement gap "A" in inches: _____
Field Measurement right blockout "F" in inches: _____ and by "E" in inches: _____
Field Measurement left blockout "F" in inches: _____ and by "E" in inches: _____
Deck Surface temperature: _____ Ambient temperature: _____
Gap widths varies "A" from _____ to _____ over _____ length of joint
Groove depth restrictions "B" in inches: _____
Straight joint: [Y or N]
Skewed joint (note skew angle): _____
Field Measurement joint length: _____

BASF
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Questions? One rule: Contact WBA.
800-677-4922
716-891-7566
wabo-ca@basf.com

Expansion Joint Seal Installation 101

Pre-Job Survey or Check list – every proper seal installation begins with a plan

- What tools and equipment do I need?
- Are there any time restrictions?
- Manpower requirements?
- Are there any special transitions or details?
- Do you have a copy of the manufactures installation procedure with you?

**Two is One,
One is None**



Expansion Joint Seal Installation 101

- Training and certifications programs
- Having a Technical Representative on site



Basic Installation Procedures

- Inspection joint locations where work is to be performed
- Investigate surrounding substrates and deck for:
 - Cracks, spalling, concrete condition, adjoining header, steel integrity, anchorage
- Apply correct fix and/or prep procedure prior to installing joint
- Clean joint opening and surrounding substrate
- Workmanship to protect surrounding areas and public organize and stage site to ensure easier installation
- Install expansion joint system and set to proper depth
- work off the lower side of the deck when setting a joint
- Inspect installation, solvent wipe system if needed and remove any protected measures



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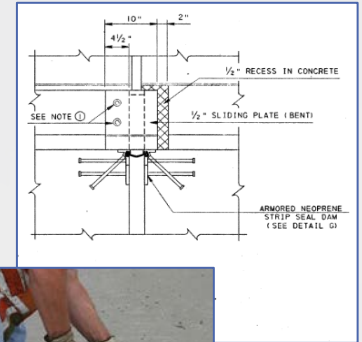


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Sizing Considerations

- Sizing decisions take place in many ecosystems...
 - Design
 - Repair
 - Rehabilitation



Bridge Design Considerations

- Theoretical Movement
- Material Limitations

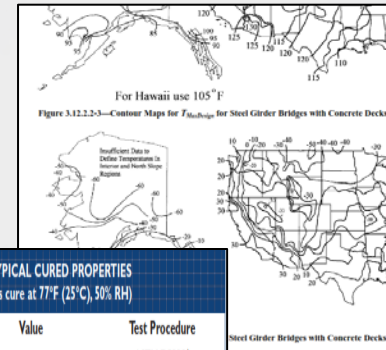


TABLE 2: TYPICAL CURED PROPERTIES (After 7 days cure at 77°F (25°C), 50% RH)		
Test Property	Value	Test Procedure
Adhesion, minimum elongation		ASTM D5329 ⁸
Asphalt	500	
Concrete	500	
Metal	500	
Elongation (%)	>1400	ASTM D412 ASTM D5329 ASTM D412 ASTM C661 Pecora Corporation ASTM C719



Theoretical vs. Actual Movement

- Calculated Thermal Movement
- Field Verification
 - Additional Measurements
 - Additional Tools
- Avoiding Extremes

3.12.2.3—Design Thermal Movements

The design thermal movement range, Δ_T , shall depend upon the extreme bridge design temperatures defined in Article 3.12.2.1 or 3.12.2.2, and be determined as:

$$\Delta_T = \alpha \cdot L (T_{MaxDesign} - T_{MinDesign}) \quad (3.12.2.3-1)$$

where:

L = expansion length (in.)

α = coefficient of thermal expansion (in./in./°F)

AASHTO LRFD 2012



"SCRATCH PLATE"

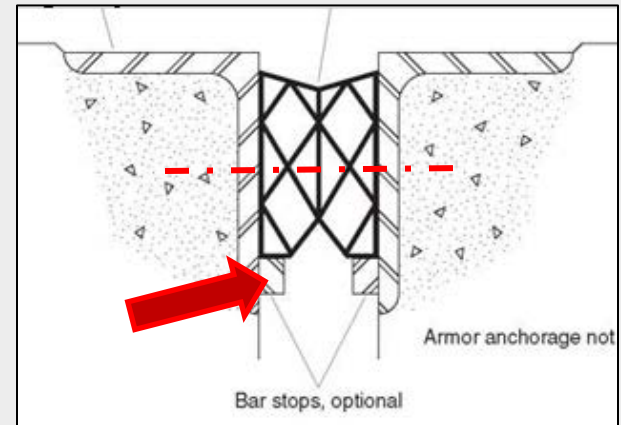


Material Limitations

- Overall Movement
- Depth Requirements



APJ DEBONDING



"BAR STOPS" LIMIT DEPTH

Repair Considerations

- Existing conditions
- Scope of repairs



Existing Conditions

- Condition of Substrate
- Unique Joint Conditions
- Joint “Re-Sealing”



SKEW & TRANSITIONS



CHANGE IN PLANE

**YOU GET A CHANGE
ORDER!**



EVERYONE GETS A CHANGE ORDER!!!

Scope of Repair

- Substrate quality
- Excessive Variation
- “No Go” Criteria



Rehabilitation Considerations

- Joint width
- Transitions



Resize, Rebuild, Reseal

- Rebuild & Resize
- Seal to Joint
- Joint to Seal



Rehab Remains

- Curbs
- Parapets
- Changes in Width



Sizing Considerations

- Design
- Repair
- Rehabilitation



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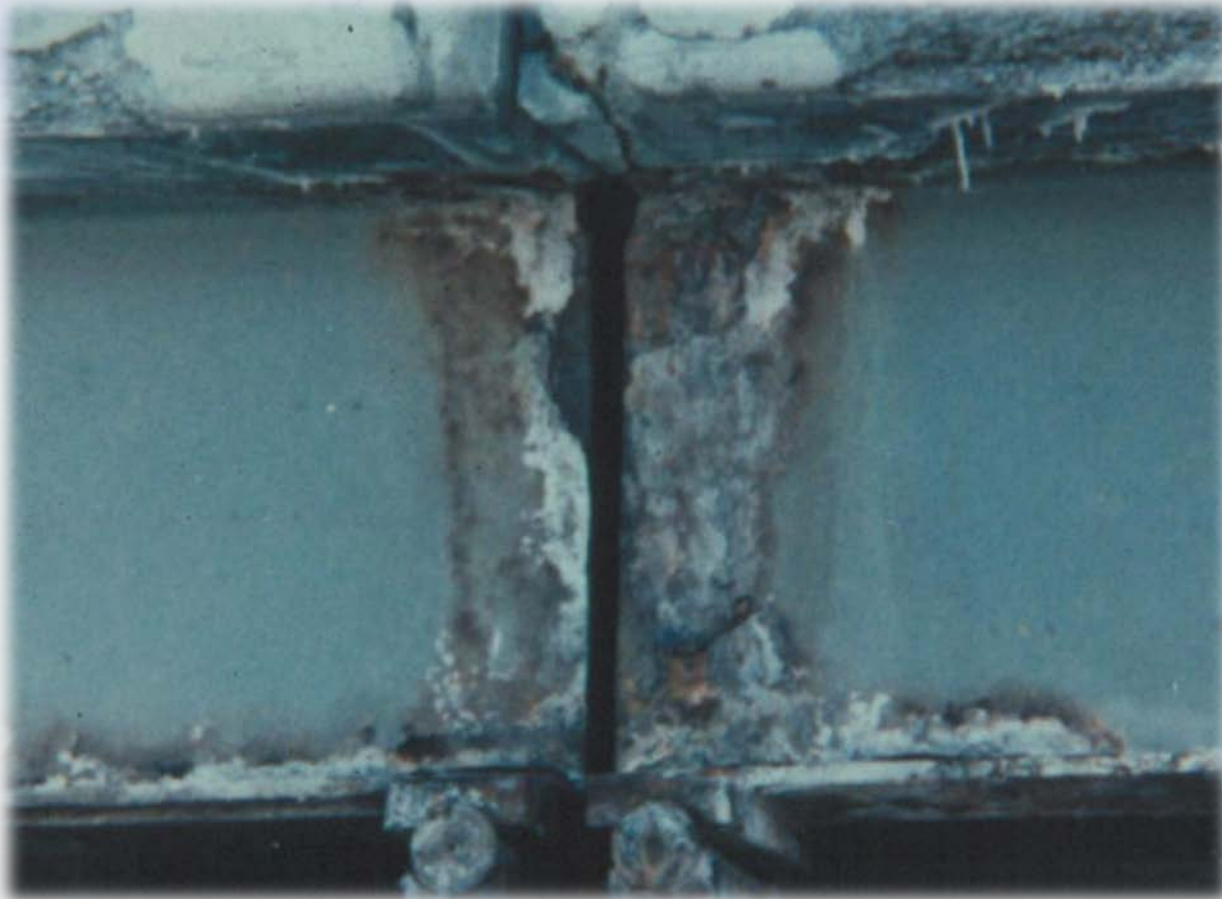
Preservation Methods of Bridge Joints

Repair vs Replace



wbpp

Western Bridge Preservation Partnership
Conference 2016





Western Bridge Preservation Partnership
Conference 2016

Repair







Replace









Recommendations

- Training of Field engineers on various expansion joints and technologies
- Utilize industry standards for proper preparation of substrates
- Flexibility in actual field conditions vs “standards”
- Avoid Compromising quality for time constraints
- Follow Deck/Surface Preparation and Repair Matrix
- Be Proactive with Material Suppliers in the Design Stages
- Get preparation, installation, and sizing recommendations from suppliers



WE ARE ONLY A PHONE CALL AWAY

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