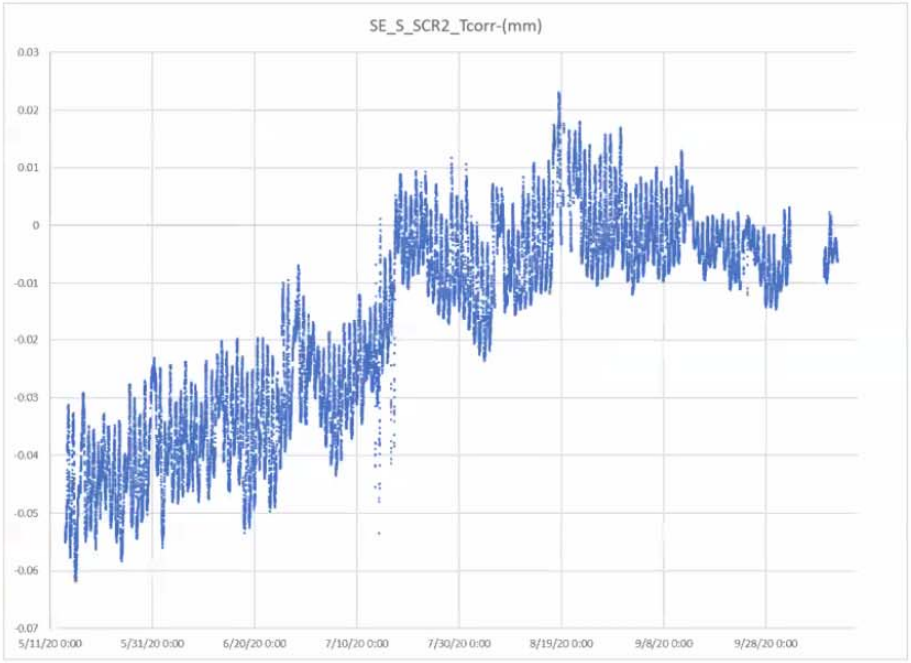
Monitoring

Crack growth has slowed since the spring

- Manual Measurements of crack length
- Temperature-corrected measure of crack slip



Concrete Cracking

The following table is reproduced from the Bridge Inspector's Reference Manual (BIRM), Volume 1, Table 2.2.3; and should be used to distinguish between different sizes of concrete cracks.

Concrete Crack With Guidelines				
	Reinforced Concrete		Prestressed Concrete	
	English	Metric	English	Metric
Hairline (HL)	< 1/16"	< 1.6 mm	< 0.004"	< 0.1 mm
	(0.0625)			
Narrow (N)	1/16" to 1/8"	1.6 to 3.2 mm	0.004" to 0.009"	0.1 to 0.23 mm
	0.0625" - 0.125"			
Medium (M)	1/8" to 3/16"	3.2 to 4.8 mm	0.010" to 0.030"	0.25 to 0.76 mm
	0.125" - 0.1875"			
Wide (W)	> 3/16"	> 4.8 mm	> 0.030"	> 0.76 mm
	> 0.1875"			

Concrete Structural cracking: For the purpose of BMS coding, concrete structural cracks are narrow (or wider) in regions of high shear or moment (see BIRM). Crack width is significant to the extent that it indicates exposure of rebar to water and/or a structural problem in a concrete element. Generally, most concrete elements have hairline cracking and not considered significant structurally.

4.03 BMS Computer Programs

WSDOT currently uses the Bridgit computer program for bridge network analysis only. One of the many functions of this software is to provide guidance on how best to allocate funds in an agency bridge network. Bridgit software will allow quick answers to various "What If?" funding scenarios, providing immediate feedback needed in the budgeting and programming process. A BMS element for the environment state is controlled by the BMS Engineer and used for modeling the "What If". This element is not coded by the bridge inspectors for the Washington bridges.

4.1 Bridge Decks

The intent of the bridge deck elements is to record the top surface deterioration. The Concrete Deck Soffit, slab, or deck-girder elements record the structural deterioration. Deck elements 12, 13, 14, 20, and 26 record deck patches in CS2, deck spalls in CS3, and delaminations in CS4. Other deck top surface distress such as cracking, scaling, and rutting are not tracked in the deck BMS condition states. These items should be described in the notes at the inspector's discretion. Do not count filling in of the rut as a patch. These locations have filled in a rut with ACP or Ure-Fast and are not considered a deck structural repair.

All bridges will have at least one deck element, even though some bridges do not have a traditional deck and use elements 13 or 14. (The one exception is a Luten Arch structure that is earth filled with an asphalt pavement only.)

Traditional concrete bridge decks use elements 12, 20, or 26 to record the top surface deterioration; and have the Structural Concrete Deck Element (35) to record the structural deterioration.

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CRACK WIDTHS AND COVER THICKNESS

Sufficient concrete cover over the steel reinforcement and prestressing tendons is important for durability, particularly in the marine environment. To find an optimum value for the cover thickness it should be remembered that too much cover increases the width of cracks in the cover concrete, whereas too little will lead to easier penetration of the corrosive salt water. It is assumed that owing to normal volume changes, reinforced concrete will crack in service; however, the designers tend to limit the crack widths in the belief that there is a relationship between the crack width and corrosion. Although it is known now that a direct relationship does *not* exist between structural cracks and corrosion, wide cracks tend to enhance the rate of corrosion in permeable concrete. As cited by Burdall and Sharp,[10] Lenshow found increasing probability for serious corrosion when crack widths approached 0·5 mm and little corrosion in the range of 0·1 to 0·3 mm, which is recommended by most industry codes. ACI 224 R-80 recommends 0·15 mm maximum crack width at the tensile face of reinforced concrete structures subjected to a wetting and drying environment or seawater spray. FIP recommends that crack widths at points nearest to the main reinforcement should not exceed 0·2 mm for 50 mm cover, or 0·3 mm for 75 mm cover. Also, it is generally observed that from the standpoint of corrosion of steel the cracks longitudinal to the reinforcement are more critical than transverse cracks.

For offshore and coastal structures, with 0·5 m or more thickness, the nominal cover thickness for protection of reinforcing steel and prestressing tendons is related to the exposure zone of the structure. For the submerged zone both FIP and ACI 357 R recommend a 50 mm cover thickness over principal reinforcement, and 75 mm over prestressing tendons. In the splashing and the atmospheric zones, which are subject to seawater spray, the recommended cover thickness is 65 mm for reinforcing steel and 90 mm for prestressing tendons. Stirrups may have 13 mm less cover than the preceding recommended values.

As stated earlier, when concrete cracks, the crack width is found to be directly proportional to the cover thickness. Since large