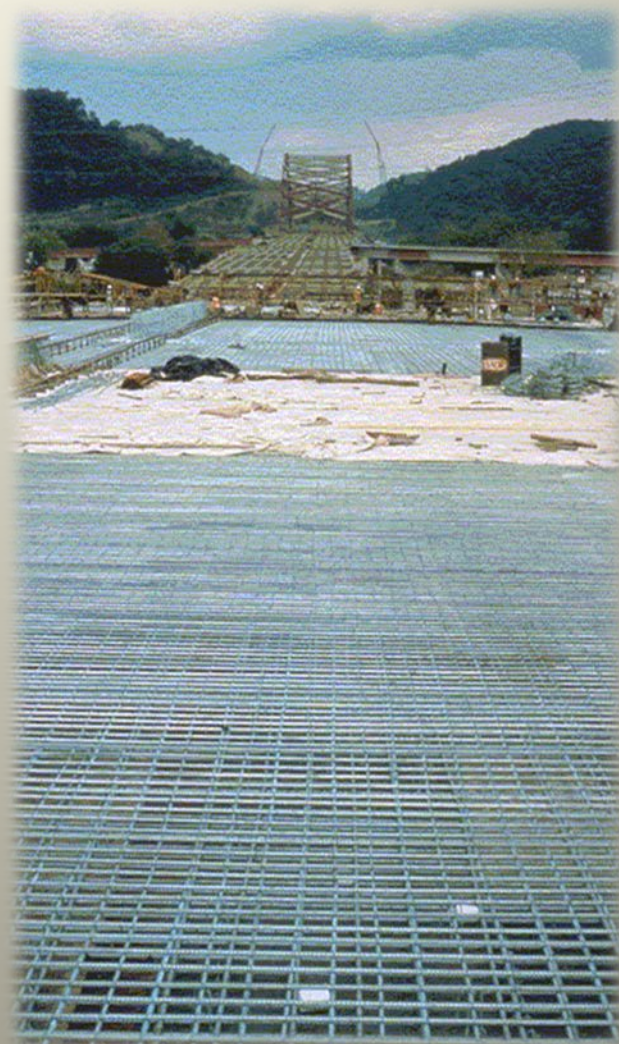
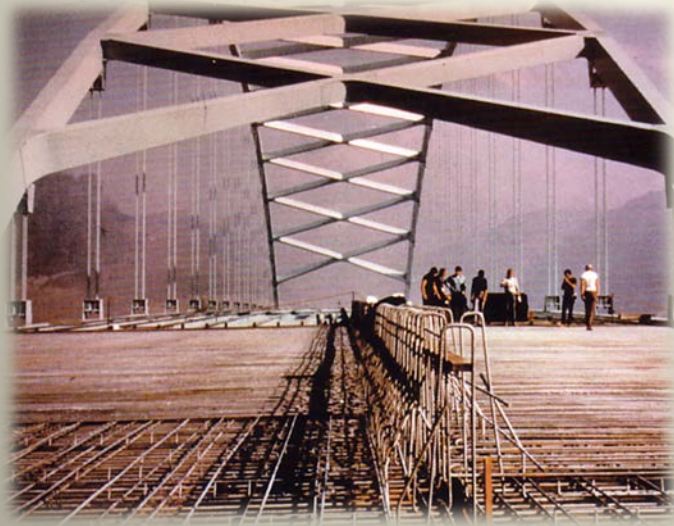


**Examples of use of
Galvanized Reinforcement
in Highways and Bridges**

Bridges and Highways: North America



June 2007 In situ galvanized reinforced concrete road and bridge deck construction

Bridges and Highways: North America



Bridges and Highways: North America



Highway crash barriers



USA



Autoroute 40
France



Montreal, Canada

US Bridge survey data: 1975-2002

Location	Build	Inspect	Chlorides (kg/m ³)	Zinc coating (microns)
Boca Chica Bridge , FL	1972	1975	1.17	130
		1991	1.21	102
		1999	1.93	170
Tioga Bridge, PA	1974	1981	0.35	150
		1991	0.64	224
		2001	1.34	198
Curtis Road Bridge, MI	1976	2002	4.13	155
Spring Street Bridge, VT	1971	2002	2.50	191
Evanston Interchange, WY	1975	2002	1.53	236

Results of periodic inspections undertaken by commercial laboratories on galvanized reinforced concrete bridges.

Notes on US bridge survey data

- Multiple inspections were undertaken on the Boca Chica and Tioga bridges, but not at the same general location. The data set is thus not unique at a single location.
- The ACI Chloride threshold (0.2% by mass of cement) is equivalent to 0.6 kg/m^3 of chlorides for a cement content in the concrete of about 300 kg/m^3 . This was used as a basis for comparison.
- The minimum specified coating thickness for hot-dip galvanized reinforcement (as per ASTM A 767) is 85 microns, equivalent to a coating mass of $600\text{-}610 \text{ g/m}^2$.
- Since the thickness of the hot dip galvanized coating varies along the bar and in different batches of steel, thicker coatings may be measured at different inspection times.

Boca Chica Bridge, Florida (1972)



Inspection Details:

1975

Zinc – 130 microns

Chlorides - 1.17 kg/m³

1991

Zinc – 102 microns

Chlorides – 1.21 kg/m³

1999

Zinc – 170 microns

Chlorides – 1.93 kg/m³

Chloride levels at all inspections were well above the ACI threshold level (to 3.2x) and the residual coating thicknesses indicate an estimate of an additional 40+ years of maintenance-free corrosion protection.

Tioga Bridge, Pennsylvania (1974)



Inspection Details:

1981

Zinc – 150 microns

Chlorides – 0.35 kg/m³

1991

- Zinc – 224 microns

- Chlorides – 0.64 kg/m³

2001

- Zinc – 198 microns

- Chlorides – 1.34 kg/m³

Chloride levels at 1991 and 2001 were well above the ACI threshold level (to 2.2x). The residual zinc coating thicknesses indicates a further 40+ years of maintenance-free corrosion protection.

Curtis Road Bridge, Michigan (1976)



Inspection Details:

2002

Zinc – 155 microns

Chlorides – 4.13 kg/m³

Chloride level at 2002 were 6.9x above threshold level for black steel. Current coating thicknesses indicate an estimated 40+ years of maintenance-free corrosion protection for the galvanized rebar deck.

Spring Street Bridge, Vermont (1971)



Inspection Details:

2002

Zinc – 7.5 mils

Chlorides – 2.50 kg/m³

Chloride levels were 4.2x above the ACI threshold for black steel. Galvanized bars were used in the upper mat of the bridge deck which was covered by 3.5 in of asphalt. The residual zinc coating thicknesses indicates an estimated 40+ years of maintenance-free corrosion protection.

Evanston Interchange, Wyoming (1975)



Inspection Details:

2002

Zinc – 236 microns

Chlorides – 1.53 kg/m³

Chloride levels were 2.6x above the ACI threshold for black steel. Galvanized bars were used in the upper mat of the bridge deck and the concrete cover was in the range 2 – 4 inches. Based on the current coating thickness, an estimated 40+ years of maintenance-free corrosion protection was predicted.

Route 66 bridge deck – a 30 year case study



During maintenance in which a concrete Jersey crash barrier was to be installed, original galvanized deck reinforcement was uncovered. It was in excellent condition after 30 years and was cast into the new crash barrier. The tenacious bond of the bar to the surrounding concrete was noted confirming the excellent bond obtained with galvanized coatings

The chloride content at the existing bar in the deck was 3.0 kg/m^3 , 5x the ACI threshold for black steel. The thickness of the zinc coating remaining was 247-270 microns, well above the specified minimum for ASTM A767 Class II coatings. There was no need for any refurbishment.

