

CORROSION PROTECTION OF STEEL BRIDGES WITH THERMAL SPRAY ZINC DUPLEX COATINGS – 50 YEARS EXPERIENCES

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SUMMARY

Since 1969 the specification for corrosion protection of steel bridges in coastal areas of Norway has been to apply a thermal spray zinc (TSZ) duplex coating, and from 1977 this practice also applies for inland bridges. The duplex coating consists of TSZ with a protective paint coating on top. The corrosion protection experiences with these coatings are very good in all environments from C2 to C5. The majority of the bridges with duplex coatings have never had any coating maintenance, although the oldest ones now have a 50 years lifetime. The duplex coating has degraded to varying extent on most of the bridges, though, as must be expected. A statistical analysis of duplex coating performance, as function of exposure environment and age is presented in this paper.

Keywords: *Corrosion Protection, Thermal Spray Zinc, Duplex Coating, Steel bridges.*

1. INTRODUCTION

In Norway there are about 17 000 road and rail bridges, of which about 4000 have a deck or superstructure partly or entirely made of steel. Design life of the bridges is typically set to be 100 years but decommissioning of bridges is usually due changes in traffic, and not the technical condition of the bridge. Hence, longer lifetimes must be expected. The bridges shall therefore be operated in such a manner that degradation does not limit lifetime.

Until the mid-1960s steel bridges in Norway were generally protected by red lead paint. However, with the massive development of infrastructure at that time, and experiences with costly coating maintenance of large coastal steel bridges, the Norwegian Public Roads Administration (NPRA) wanted more durable coating systems. The Forth Road Bridge in UK was opened in 1964, protected by a duplex coating system, i.e. a coating system consisting of thermally sprayed zinc (TSZ) and a paint system on top [1]. This inspired the NPRA to recommend duplex coatings on coastal bridges from 1965, and in 1969 duplex coatings were formally specified for all coastal bridges. Red lead was still allowed on inland bridges in dry areas, though. In 1977 heavy metal containing products were banned by the NPRA, and both lead based paint and pigments based on hexavalent chromium were removed from the specifications. Hence, duplex coatings were specified for all bridges, also the inland bridges.

Considering the life cycle cost (LCC) of a bridge, coating maintenance is the main cost driver in the operation phase (possibly with an exception for the mechanics of movable bridges). Coatings with long lifetime and little need for maintenance is therefore highly desirable. According to ISO 12944-1, coating lifetime is defined as time until first major coating maintenance operation. In addition to coating lifetime, the cost of the maintenance operations will of course also affect the LCC of the bridge. Hence, several parameters like selection of maintenance methods and products, corrective versus preventive maintenance, and timing of the maintenance should be optimized.