STAINLESS CLAD HIGH PERFORMANCE REINFORCEMENT

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ABSTRACT

Answering the call for enhanced corrosion protection of reinforcing steel that is also economically viable, SMI has developed SMI 316 SC stainless steel clad bars. This product combines the cost effective attributes of commonly specified ASTM A615 grade 60 carbon steel as the core with a metallurgically bonded outside layer of AISI 316 stainless steel, widely recognized for its superior corrosion protection.

The presentation will review the issues of deteriorating infrastructure due to corrosion, structure design life concepts and the composite nature of reinforced concrete. The options available in reducing corrosion damage are discussed. The rationale for using stainless clad and the technologies currently available are covered. Material characteristics of stainless clad and the process used to manufacture SMI 316 SC are illustrated.

Keywords: Beyond the Realm of the Traditional, Repair and Rehabilitation, Value Engineering, Designing and Constructing for Durability, Other

INTRODUCTION

Because of the enormous cost of repairing existing bridges, roads and concrete structures and the associated disruption of traffic, highway engineers are searching for ways to extend the useable life of concrete reinforced structures and roads. Corrosion of rebar from salts is the main cause for detoriaration.

A solid stainless steel bar is the best approach to minimize the deleterious impact of corrosion but is deemed too expensive based on economic life cycle costing. Epoxy coated rebar is losing favor because it is not providing the anticipated extension in the useable life of concrete reinforced structures and roads.

Stainless steel clad products are gaining acceptance as a solution to the needs of design engineers for a corrosion resistant product that is:
more durable than epoxy coated bars
less expensive than pure stainless steel
capable of offering five to ten times the life of carbon steel products.

To date, Departments of Transportation in 20 states have approved stainless coated rebar and dowels for trial projects.

PROBLEM STATEMENT

Deteriorating infrastructure
Structure design of 75+ years
Composite nature of reinforced concrete
- Concrete cover
- High performance concrete

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WHY STAINLESS CLAD?

Excellent corrosion protection
Complimentary to current design, fabrication and construction practices
Enhanced concrete bond
Toughness during fabrication, transportation and installation
Cost effective at around $0.75/lb

REDUCING CORROSION DAMAGE

Eliminating chloride from the environment
Avoiding or reducing exposure to water
Reducing the permeability of concrete by reducing w/c ratio and/or adding a pozzolan or blended cement
Avoiding stray or impressed electrical currents
Protecting the reinforcing steel with coatings
Using a corrosion inhibitor

STAINLESS CLADDING TECHNOLOGIES

Heat shrinking of stainless steel tubes around a billet or round
Compacting carbon steel scrap into a stainless steel tube
Spray forming stainless steel onto carbon billets or rounds
Roll cladding of stainless steel sheets on semi finished carbon bars
Pouring molten carbon steel into stainless steel tubes

MATERIAL CHARACTERISTICS OF STAINLESS CLAD

Core is ASTM A-615 Grade 60
Conventionally melted in electric arc furnace
Capability to produce ASTM A-706 core material
Capability to produce Grade 40, 60, 75 or other

Cladding is AISI Grade 316
Best for proven corrosion resistance
Potential to utilize other grades but not currently under consideration

STAINLESS CLAD PROCESS

Billets are induction heated prior to entering the spray chamber
Billets are rotated in a nitrogen-rich environment and extracted from the opposite side
Stainless steel bonds metallurgically to carbon steel billets and provides a surface that will not peel or separate from the base metal during rolling or fabrication

Cladding facility will ship finished billets to mills for rolling #4-18 rebar and smooth rounds
Process provides a consistent coating designed to meet 7 mils on finished products (proposed standard)
ASTM and AASHTO specifications currently being developed
Coating plant is sited at Cayce, SC and product is now being manufactured