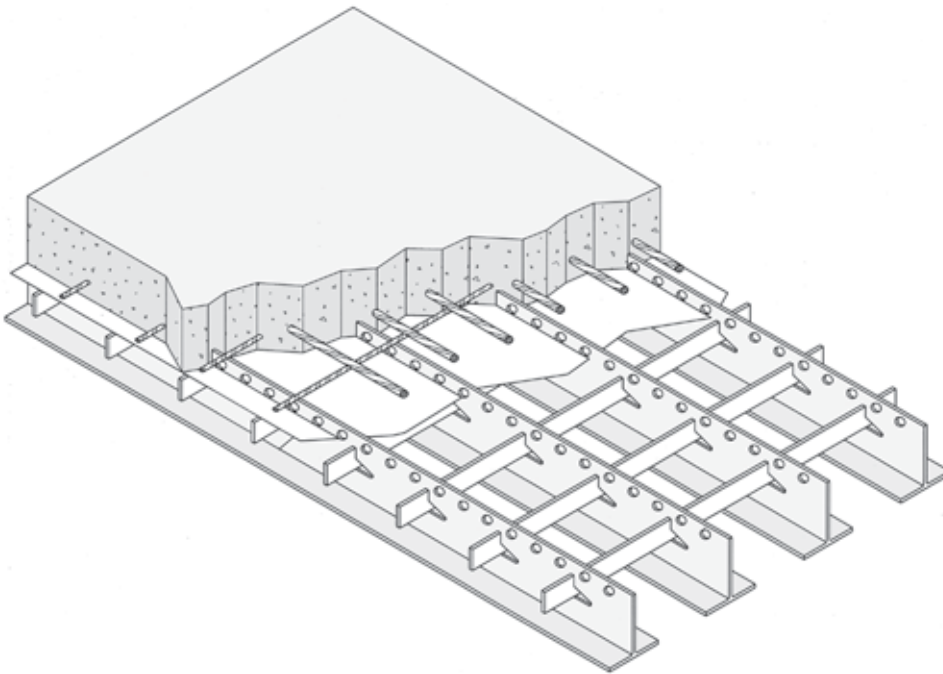


## An Introduction to Exodermic Bridge Decks



### OVERVIEW

An Exodermic (or “composite, unfilled steel grid”) deck is comprised of a reinforced concrete slab on top of, and composite with, an unfilled steel grid. This maximizes the use of the compressive strength of concrete and the tensile strength of steel. Horizontal shear transfer is developed through the partial embedment in the concrete of the top portion of the main bars which are punched with 3/4” holes.

Overall thickness of the system using standard components ranges from 6” to 9 1/2”; Total deck weights range from 39 to 74 pounds per square foot. Exodermic decks using standard components can span over 18’; larger main bearing bars and /or thicker concrete slabs can be chosen to span considerably further.

The concrete component of an Exodermic deck can be precast before the panels are placed on the bridge, or cast-in-place. Where the concrete is cast-in-place, the steel grid component acts as a form, the strength of which permits elimination of the bottom half of a standard reinforced concrete slab.

Exodermic decks are made composite with the steel superstructure by welding headed studs to stringers, floor beams, and main girders as appropriate, and embedding these headed studs in full depth concrete. This area is poured at the same time as the reinforced concrete deck when the deck is cast-in-place, or separately when the deck is precast. Exodermic decks require no field welding other than that required for the placement (with an automatic tool) of the headed shear studs.

## Why Use An Exodermic Bridge Deck?

### LIGHT WEIGHT

An Exodermic deck typically weighs 35% to 50% less than a reinforced concrete deck that would be specified for the same span. Reducing the deadload on a structure can often mean increasing the live load rating. The efficient use of materials in an Exodermic deck means the deck can be much lighter without sacrificing strength, stiffness, ride quality, or expected life.

### RAPID CONSTRUCTION

Precast Exodermic decks can be erected during a short, nighttime work window, allowing a bridge to be kept fully open to traffic during the busy daytime hours.

Cast-in-place Exodermic decks also permit considerable savings in construction time – the steel grid panels come to the site essentially ready for concrete. The steel grid component of an Exodermic deck acts as a pre-cut, pre-formed, stay-in-place form. Panels are quickly placed, and layout of the single mat of rebar is simple and straightforward, without the need for chairs or other aids in most cases. Cantilevered decks can be formed without temporary supports.

### EASE OF MAINTENANCE

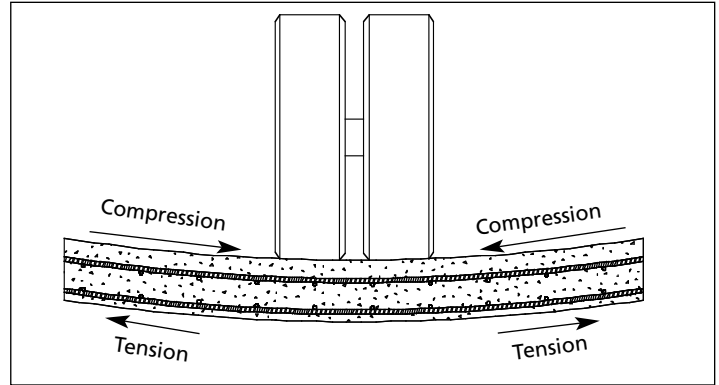
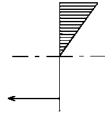
An Exodermic deck is easily maintained with standard materials and techniques, since the top portion of an Exodermic deck is essentially the same as the top half of a standard reinforced concrete deck. If desired, any overlay compatible with concrete can be used, including latex modified concrete, polymer concrete, microsilica concrete, or a membrane with asphaltic concrete overlay.

# Exodermic Design - How It Works

## IN POSITIVE BENDING

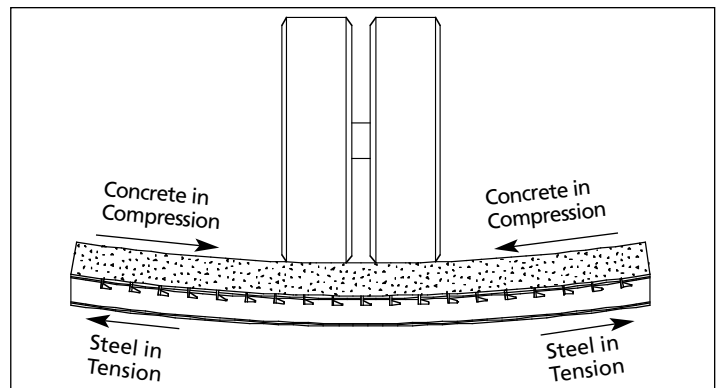
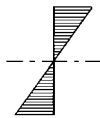
### Standard Reinforced Concrete Deck

In a standard reinforced concrete deck, in positive bending, the concrete at the bottom of the deck is considered 'cracked' and provides no practical benefit. Thus, the effective depth and (stiffness) of the slab is reduced, and the entire bridge – superstructure and substructure – has to carry the dead load of this 'cracked' concrete.



### Exodermic Deck

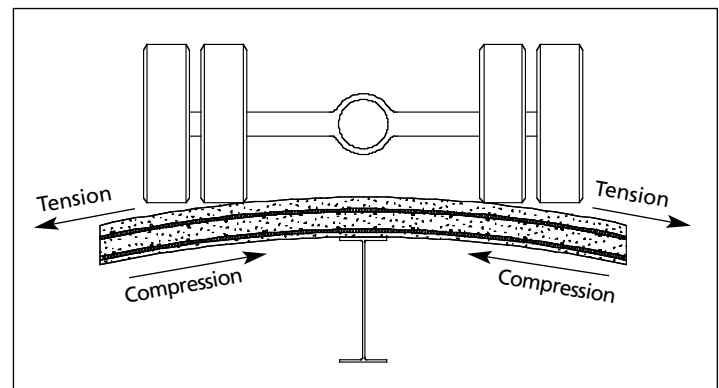
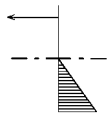
In an Exodermic deck in positive bending, essentially all of the concrete is in compression and contributes fully to the section. The main bearing bars of the grid handle the tensile forces at the bottom of deck. Because the materials (steel and concrete) in an Exodermic deck are used more efficiently than in a reinforced concrete slab, an Exodermic design can be substantially lighter without sacrificing stiffness or strength.



## IN NEGATIVE BENDING

### Standard Reinforced Concrete Deck

In negative bending, a standard reinforced concrete deck handles tensile forces with the top rebar; concrete handles the compressive force at the bottom of the deck.



### Exodermic Design

Similarly, in an Exodermic design, the rebar in the top portion of the deck handles the tensile forces, while the compressive force is borne by the grid main bearing bars and the full depth concrete placed over all stringers and floorbeams. Rebar can be selected to provide significant negative moment capacity for longer continuous spans and sizable overhangs.

