

## **BRIDGE DECKS: PRECEPTS TO CONCEPTS**

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### **Abridgment**

Environmental changes not anticipated in the design, coupled with design changes that had broader implications than intended in the design, are shown to be causative mechanisms to the concrete bridge deck durability problem. Adaptive design changes are shown to contribute further to problem disorder, demonstrating the need for organizing the problem solution against unwanted design effects.

To realize a problem solution that "fits" the environment, the precepts of the problem are listed as numbered "misfits," a term referring to all the things that can go wrong in developing a suitable fit between the bridge deck and the environment. By analysis of the precepts, as both design misfits and research misfits, the problem is decomposed and organized into hierarchical independent subsets that are displayed to show the order that the solution calls for.

The problem of the designer is shown to be conceptual and to be that of employing the precepts of research to produce an ensemble of concepts of independent problem solutions that intrude with the least misfit into the environment.

The complexity of the concrete bridge deck durability problem is demonstrated in the problem organization. Further, the cost experience and trends for only a few of the research-stimulated design changes from the complexity are shown, on the basis of risk, to open to design and research consideration for other bridge deck systems. The analysis of updated precepts reorganizes the problem to concepts for selecting a bridge deck system from a mix of possibilities, each having preselected service life characteristics for the environment intended. The problem reorganization emphasizes, for the immediate future, the design needs for more research knowledge about service life characteristics of bridge deck systems, for more research knowledge about the bridge deck surface as the interface with its environment, for more research knowledge on environment or usage changes, and for more research knowledge on methods to utilize the benefits of research more effectively in design.