Tomorrow's Steel Bridges

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TOMORROW'S STEEL BRIDGES will be built with improved steels, new advanced designs, and better fabrication. Clean low-carbon (<0.08) alloy bridge steel (copper-nickel) will yield strengths of 350 to 700 megapascals (MPa). These high-strength materials will improve weldability, formability, fracture resistance, and ductility as compared with present bridge steels.

The new ease of making welded connections will not only decrease cost because preheating will not be needed, but also increase quality and reliability as a result of better working conditions. Weldment systems incorporating improved high-strength weld metals and high-purity consumables will produce joints free of cracking and other process-related defects.

To utilize these materials effectively, particularly above 500 MPa, new innovative structural forms are needed, such as composite or corrugated webs that make it unnecessary to weld transverse stiffeners and diaphragm connection plates to the girder to provide web stability for spans that exceed 35 meters. Bottom flanges will make greater use of post-tensioned tubes in both plate and box girders, providing fracture- and fatigue-resistant cross sections that will eliminate redundancy concerns. High-performance cast steel nodes will allow optimal fatigue-resistant splice details for truss, girder, and box girder bridges, including bracing and truss members. Innovations will occur as well in cable-suspended bridges with new cable systems, end fittings, and corrosion protection. There will also be an increased focus on modular and composite systems that are easily installed and repaired or replaced.

High-performance concrete decks will provide greater resistance to deterioration and optimal composite cross sections. They will utilize precasting, post-tensioning, and modular components to minimize shrinkage and tensile cracking, and to provide rapid replacement and more durable wearing surfaces. There will be greater use of orthotropic deck systems with modular components fabricated from steel, aluminum, or fiber composite materials in a factory environment. It will be possible to apply high-performance wearing surfaces to these modular components under controlled conditions for enhanced durability. More durable and crack-free decks will also allow greater use of high-performance weathering steel as more effective ways are found to keep roadway salts and dirt and debris off the structure.

Finally, designs will incorporate means of monitoring tomorrow's bridges. Strain transducers, corrosion monitors, and crack-detection sensors are among the devices that will allow continuous monitoring for damage detection, while providing a means to assess service life and permit more rational repair intervals so the public is provided safe and convenient systems.

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Tomorrow's bridges will incorporate innovations in materials, design, fabrication, and erection. These innovations will also lead to enhancements in maintenance and retrofits for existing bridges.