MARQUETTE UNIVERSITY

Departmental Colloquium
Electrical and Computer Engineering

Automated Detection of Dowel and Tie Bars in Concrete

Tuesday, April 28, 2026
2:00 pm – 3:00 pm
E-Hall 236

Reception to follow
3:00 pm – 3:30 pm
E-Hall 236

Dr. Ken Maser
Senior Principal, Infrasense, Inc.

ABSTRACT: Dowel and tie bars in concrete pavement transfer loads and limit differential movement between adjacent pavement sections. Dowel bars transfer loads across transverse joints while allowing expansion and contraction, whereas tie bars transfer loads across longitudinal joints, typically between adjacent lanes. Because concrete pavement placement is generally automated, these bars can be misplaced due to equipment malfunctions, support movement, and other causes. Common defects include vertical tilt, horizontal skew, and errors in depth or lateral position. Such misplacement can lead to joint locking, spalling, cracking, and eventual pavement failure. This work aims to identify missing, misplaced, or misaligned dowel and tie bars in concrete pavement using 3D ground penetrating radar (3DGPR) data. Unlike conventional single-channel GPR, 3DGPR provides multiple channels across the road width, making it possible to detect tie bars, dowel bars, and other spatial features more reliably. An automated analysis procedure was developed that: (a) analyzes 2D horizontal image slices to create a binary mask showing bar locations, (b) identifies high-amplitude reflection peaks in individual channels within those areas, and (c) generates a 3D scatter plot representation of all detected bars. The detected points are then clustered so that each group represents one bar, allowing further evaluation of position, alignment, depth, and spacing. The presentation will describe the method, show sample data used in algorithm development, outline the analysis steps, and present final detection results along with a graphical user interface for use by highway agency personnel.

BIOGRAPHY: Dr. Maser is a professional engineer with over 40 years of experience in the application of non-destructive testing (NDT) technologies for evaluating pavements, bridge decks, tunnels, and other transportation infrastructure. He received his Ph.D. in Civil Engineering from MIT and has authored over 150 publications in his field. He was the winner of the 2019 ASCE Wilbur S. Smith Award for his leadership and innovation in developing and providing highway agencies with non-destructive methods for subsurface condition evaluation of pavements and bridge decks.