Crash course in passenger safety

Research into crash energy management shows promise in making rail travel safer than ever

In January, representatives from the Volpe Center gave a presentation on crash management at the Transportation Research Board’s annual meeting in Washington, D.C. Their report demonstrated that passenger rail car using crash management technology and meeting alternate FRA standards could be at least as safe as one designed to meet current Tier I regulations: 400,000 pounds applied in one direction along a car-to-coupler without permanent damage. Alternate standards enable researchers to apply the force at different angles on the passenger rail car, as might occur in a derailment or if the car is struck from the side, what researchers call “full load path” versus “collison load path.”

The alternate standards (800,000, 1 million, or 1.2 million pounds in a single collision load path) would allow a car manufacturer to design a car with a structural integrity that is stronger than any one element. “All the others hinge on it,” Tyrell says. His published research covers just one movement, but a necessary one. “All the others hinge on it.”

Other standards include how and when a car’s roof comes apart in a collision and if passengers sit in place well enough to be safe during and after a crash. Tyrell and fellow engineers, evidence that alternate crash-test methods and standards are OK enables better research into shock absorbers, interior design, and use of innovative materials.

For FRA, Lauby, the research is another barrier crossed in seeking U.S. high-speed rail. The administrator said alternate Tier I passenger rail car standards that define safety construction load path would set the state stage for Tier III or high-speed rail passenger cars traveling up to 225 mph. “We’re working really hard to get ahead of the curve,” Lauby says, mentioning future projects in California. “All these super piers need answers … someone is going to have to bid on what we need, and what this country needs is to allow Tyrell and fellow engineers to create what they know best: a train wreck.”

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>> TECHNOLOGY BRIEF

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The 18th Annual Wheel Rail Interaction Conference will be held near O’Hare airport May 7-10. For more information and speakers, visit http://wheel-rail-seminars.com

Despite having alternate rail car safety rules, the U.S. doesn’t have equipment meeting the alternate rules for revenue service. He says just one manufacturer, based in Europe, expressed interest in building to the alternate Tier I standards on a U.S. light-rail network. And even if that passenger car manufacturer follows through on its plans, the standard will apply only to sets of like passenger cars strung together. The talk of mixing cars of different standards is far down the road.

Computer simulations could prove most useful in the short run. Technology, along with alternate approaches, enable him and his co-workers to do “fewer tests — less expensive tests and a broader range of design,” Tyrell says. “What we’re doing is a lot more computer simulation and much less destructive testing. It’s similar to what the U.S. automobile industry started in the 1990s.

The biggest difference, of course, is that trains are heavier and have so much more mass than an automobile that the crash forces created are enormous. And, Tyrell says, cars and trucks tend to stop quickly when they collide. Trains often have enough momentum to continue for hundreds of feet to fractions of a mile before stopping. That’s not the only challenge.

“The hardest thing for us to cope with is material failure. If you’ve got a crashed car, a crack can form and a crack can start to propagate,” Tyrell says. “It requires that you understand how material behaves.”

To deal with the uncertainty, he uses computer simulations to study variations of design and placement on couplers, wheels, shock absorbers, nuts and bolts, even seats and metal alloys, to get a handle on how all of it will behave when wrecked. Then again, even the best computer simulations can only educate guessers as to what any material or piece of equipment will do in a given situation. So when they finally talk of mixing cars of different standards, the hope is that they can, and engineers have put forward their best design, perhaps the only way to know for sure that what equipment is safe, and what this country needs is to allow Tyrell and fellow engineers to create what they know best: a train wreck.