Traffic congestion is one of the banes of this modern age. Traffic jams and roads clogged with cars — even when they are flowing relatively well — create added delays and stress on drivers all around the world. For private citizens, the delays caused by traffic congestion can be immensely frustrating — tired workers who are delayed in getting to or from work, road rage and added fatigue from having to be extra watchful in heavy traffic.

Commercial vehicle drivers must deal with all those issues as well. In addition, they have to handle the havoc congestion plays with optimized routing, scheduled pickup and delivery times, hours-of-service demands as well as general safety and productivity concerns.

Congestion is a particularly thorny issue with multiple causes. For starters, even the most optimistic highway planner in the 1950s could never have imagined the sheer volume of vehicles on our roads today. Funding new highways in recent times has generally followed demand increases, not proactively proceeded them. More problematic, U.S. roadways have largely languished over the past 20 or 30 years. Many major roads, highways and bridges have not been maintained properly. When funding allows for work to be carried out, many existing roadways simply are returned to usable 1950s standards.

When actual expansion work is carried out, the improvements may help ease traffic congestion somewhat, but often do not provide a long-term fix, and whatever enhanced efficiency they do provide often becomes moot in a short period of time as more vehicles begin using them.

In short, the U.S. today is not doing an adequate job in maintaining its highway and road networks at the standards created in the 1950s when Interstate Highways were first planned and built. In contrast, many other parts of the world, including China, Japan, and most of Europe, are busy building modern, smart highway systems designed to carry motor vehicles into the 21st Century with new standards of safety and efficiency. Autonomous vehicles will be an important component in making these new roads deliver those promised enhancements.

To be precise, autonomous vehicles will be one of three new, complementary and integrated technologies that will be deployed in the effort to ease or end congested roadways in the near future, along with Vehicle-to-Vehicle (V2V) and Vehicle-to-Infrastructure (V2I) systems.

V2V technology is a way to allow vehicles to exchange basic telemetry data with other vehicles and electronically “talk” to one another as they move down the roadway. There are obvious privacy issues, of course, to ensure one vehicle won’t be able to hack another and find out where the driver lives, what their destination is, or anything like that.

But V2V-equipped cars and trucks will broadcast a steady stream of information out to other, similarly equipped cars and trucks. This information will include vehicle speed, steering and braking alerts, as well as some limited navigational information. For example, if the car needs to begin moving over to the right in order to take an upcoming exit ramp. Parked emergency vehicles may digitally notify oncoming traffic to automatically slow and move over.

In contrast, V2I technology means building “smart” infrastructure such as bridges, overpasses, traffic lights, crosswalks and merge lanes. As with V2V cars and trucks, these new types of roadway structures will be capable of both receiving and transmitting information, too. A newly constructed bridge embankment, for example, will send out an invisible electronic signal, like a new age lighthouse telling approaching vehicles equipped with V2V, “I am a bridge embankment. Do not crash into me” over and over again.

The other new technology that will enable fully integrated autonomous vehicles will be V2I, which means building smart highway systems designed to carry motor vehicles into the 21st Century with new standards of safety and efficiency. Autonomous vehicles will be an important component in making these new roads deliver those promised enhancements.

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About the Author: Jack Roberts is a transportation journalist who has been covering North American commercial vehicles for 25 years and has developed a reputation as a leading authority/futurist concentrating on new trucking technology, including autonomous vehicles, battery-electric trucks and emerging blockchain technology.

The North American Council for Freight Efficiency (NACFE) works to drive the development and adoption of efficiency enhancing, environmentally beneficial, and cost-effective technologies, services, and operational practices in the movement of goods across North America. NACFE provides independent, unbiased research, including Confidence Reports on available technologies and Guidance Reports on emerging ones, which highlight the benefits and consequences of each, and deliver decision-making tools for fleets, manufacturers, and others. NACFE partners with Rocky Mountain Institute (RMI) on a variety of projects including the Run on Less fuel efficiency demonstration series, electric trucks, emissions reductions, and low-carbon supply chains. www.nacfe.org

we will have to reach a tipping point where the majority of vehicles on a V2I-capable stretch of road also are equipped with autonomous control systems and V2V. But once that threshold is met, it is easy to see how these three technologies will be able to begin to ease traffic congestion and even possibly end it one day.

Working together, autonomous vehicles, V2V and V2I will begin bringing some sense of logic, predictability and even choreography to the chaotic driving conditions we experience today. Cars will be able to understand each other’s needs and work to accommodate them, all while maintaining a reasonable traveling speed.

Safety in traffic always has been a team effort. V2V and V2I can help to normalize traffic safety, minimizing dangerous events and collisions, providing adequate vehicle spacing for braking and maneuvering events, improving traffic conditions by reducing stop and go behaviors, and more.

Moreover, V2I will enhance this already impressive capability by holding traffic lights on “green” longer during peak travel times, and better managing the flow of merging vehicles on and off of major travel arteries. If a lane is closed for construction work, approaching vehicles will be apprised of that situation a mile or two before they actually encounter the work crews and begin to merge in efficient ways that will keep traffic flowing.

Viewed from above, the overall affect may look similar to a college football marching band, or a highly choreographed musical or Broadway play, with cars and trucks seamlessly moving in and out of different lanes in complementary and efficient ways, while the overall traffic flow continues unabated.

Early efforts to develop autonomous truck control systems have been stymied by the fact that while computers do many tasks well, they have a hard time dealing with the chaotic and dynamic driving conditions. Ironically, it seems that — currently, anyway — human drivers are far better at reading a diverse set of signals and information such as the intentions of other human drivers and anticipating, or predicting and reacting to those inputs.

But as more and more vehicles become equipped with autonomous control systems, V2V and V2I, there will be less chaos and fewer unpredictable, random events that onboard computers will have to detect, analyze and react to. Computer predications will become more reliable. It may take a while, but it seems likely that once that technology threshold is crossed, roadways around the world will begin to slowly, but steadily, become more efficient and easier to travel — even if the current volume of vehicles is the same, or even increases.

There is conventional wisdom today that when autonomous trucks are deployed in the United States outside controlled spaces like depots, they will be limited — initially, at least — to long-haul routes on Interstate highways. But, as the promise of V2V and V2I combined with autonomous control systems shows, there may very well be useful applications for these technologies on some of the most congested urban roads in the nation far sooner than many experts currently predict.