



DAVID GOLDMAN, AP

STREET SMARTS

Intelligent, interconnected infrastructure will help cities of the not-too-distant future tackle the biggest transportation challenges

Matt Alderton | Special for USA TODAY

Before Karl Benz built the first automobile in 1885, most human beings were confined to one place in daily life. They had to live within walking distance of food, education and employment. Horses, buggies and trains provided the ability to travel longer distances, but even relatively short trips by today's standards could take days or weeks. Cars made miles measurable in minutes. With an automobile in the garage, people could live, work and play wherever they wanted.

But not everything automobiles created was good. Along with increased mobility, convenience and speed, motor vehicles worsened air pollution, which kills 5.5 million people annually, according to the Institute for Health Metrics and Evaluation. And they gave us traffic

jams, which cost U.S. drivers an average of 42 hours and \$1,400 per year, says traffic-information company INRIX. And car accidents, which the World Health Organization blames for 1.25 million deaths globally per year.

It was those kinds of problems that Florida land developer Metro Del-

A passenger steps off a driverless shuttle bus during a demonstration in the Atlanta area last January sponsored by the Alliance for Transportation Innovation. The 12-person bus successfully navigated a course laid out in a parking lot and picked up and dropped off riders.



METRO DEVELOPMENT GROUP

opment Group was looking to solve when it hatched “Connected City,” the nation’s first “gigabit community.”

The 7,800-acre, 10-year master-planned community is being constructed from the ground up in Pasco County, Fla., outside Tampa. The nerve center of Connected City is an ultra-fast broadband network that eventually will run a vast array of municipal services. Those services will include an intelligent traffic management system that supports autonomous vehicles and self-driving electric shuttles that give residents on-demand transportation.

“It will get people from point A to point B when they want, at a much lower cost, and in a way that’s safer for them and better for the environment,”

“Our guiding principle is to give people time back in their lives, because you can’t get back the time that you spend in long commutes.”

Kartik Goyani,
vice president of operations
for Metro Development Group,
developer of Connected City

Kartik Goyani, Metro’s vice president of operations, says of Connected City’s transportation system. “Our guiding principle is to give people time back in their lives, because you can’t get back the time that you spend in long commutes.”

Although Connected City is still in its infancy, its vision is maturing rapidly in communities around the world. The promise: “smart cities” that use technology to diagnose and treat society’s most vexing transportation challenges.

CEREBRAL CITIES

In human beings, intelligence is a product of the nervous system. The human brain is a vast network of neurons constantly communicating with

one another. Urban intelligence operates on the same principle. But it’s up to cities to build the nervous system themselves. Which is exactly what so-called smart cities are doing.

“Smart cities are basically putting in a fabric that senses what happens around a city,” says Raj Rajkumar, a professor in the Department of Electrical and Computer Engineering at Carnegie Mellon University in Pittsburgh, where he also is director of Metro21, a multidisciplinary initiative exploring 21st-century solutions to modern metropolitan problems. “You can use that fabric to collect data and perform analytics on top of it, which is like taking the pulse of the city. Know-

The Connected City planned community currently under construction near Tampa has “smart city” principles in its DNA.

► **STORY CONTINUES ON 22**

Future built upon data

► CONTINUED FROM 21

ing what the city's vital signs are, you can react to things and make better decisions.”

Instead of nerves and neurons, cities are constructing municipal nervous systems out of computers, sensors and fiber—building blocks for the Internet of Things (IoT). Like a brain, they ingest information about the world, process it and then react to it. In areas ranging from transportation to health care to sustainability, the result of those decisions is government spending on applications and infrastructure that will solve real problems for citizens.

“A smart city is a city that has a holistic strategy for leveraging IoT technology and solutions to drive value for citizens and for the city around cost reduction, efficiency, sustainability, public safety and, in general, creating a more equitable and livable society,” says Mike Zeto, general manager and executive director of the Smart Cities business unit at AT&T, whose broadband networks are enabling smart-city development. “The thread that's weaved through all that is data.”

NO MORE TRAFFIC JAMS?

Anyone skeptical of data's potential to improve quality of life would do well to look at communities that are already on the path to intelligent transportation.

One such community is Oakland County, Mich., just northwest of Detroit. Since 1991, it has been installing adaptive traffic signals that detect the number of cars at intersections and adjust signal timing to reduce congestion. About 700 of the county's 1,200 signals are adaptive. The benefits include faster commutes and fewer accidents: Adaptive traffic signals can improve travel time by 10% to 50% and reduce crashes by up to 15%, according to the U.S. Department of Transportation. Less congestion also means lower vehicle emissions, which



An Oakland County, Mich., public works employee installs a traffic light in South Lyon last summer. The county near Detroit is installing adaptive traffic lights that can detect congestion and adjust their timing to reduce it. About 700 of the county's 1,200 signals have been converted to adaptive technology.

► STORY CONTINUES ON 24

JOHN HEIDER, (LIVONIA, MICH.) OBSERVER & ECCENTRIC

Quality of life is key

► CONTINUED FROM 22

translates into improved air quality. “The traffic signals in Oakland County, where I happen to live, are very smart,” says Kirk Steudle, director of the Michigan Department of Transportation. “The trouble is, they have no voice. They know how many cars are waiting at the corner when the light turns yellow, but now we have to enable that information to be shared.”

That’s the next step. Since 2012, nearby Ann Arbor, Mich., has been testing connected-vehicle technologies that allow cars with special receivers to communicate with one another and with infrastructure — including adaptive traffic signals like those in Oakland County. The technology could eventually do such things as let drivers know when the light they’re at is going to turn green, notify emergency responders if there’s an accident, report congestion and lane closures to drivers so they can take alternative routes, and even apply cars’ brakes to prevent collisions.

Those capabilities already are percolating in Las Vegas, where the Regional Transportation Commission of Southern Nevada has partnered with automaker Audi to deploy its new “Time-to-Green” technology.

“If you’re driving Audi’s new Q7 vehicle in Las Vegas, you’ll get information from our traffic signals about how many more seconds there are until a red light turns green,” says the commission’s general manager, Tina Quigley. “Maybe you’re hoping the light will turn green right away. But if you learn you have another 60 seconds, you can relax and pick up the baby’s bottle or take a bite of your sandwich or any other activity you can get done while you’re waiting for a light. And then, four seconds before the light turns green, you get alerted so you know it’s time to get your head back in the game.”

Reducing driver stress like that doesn’t just benefit drivers; it helps ev-



AUDI USA



JOHN TERHUNE, (LAFAYETTE) JOURNAL & COURIER

Making connections: A public Wi-Fi access point is mounted atop a pedestrian crosswalk signal in downtown Lafayette, Ind.

eryone around them.

“It reduces human error and lag time,” Quigley says. Drivers who know a green light is imminent will be ready to move. “As soon as the light turns green, the car is fleeing in a kind of peloton behind the vehicles in front of it. So, you’ve pushed more cars through that intersection than you would have otherwise.”

Intelligent traffic signals can ease cities’ traffic problems, but they won’t

eliminate them. After all, streets are only so wide and can accommodate only so many cars. Another important aspect of smart cities, therefore, is shared mobility.

“If you only focus on pavement and green time, eventually you’re going to exhaust your capacity,” Quigley says. “We also need to talk about how we can increase the number of people in vehicles and decrease the number of vehicles on roadways.”

Like Connected City in Florida, many smart cities are looking to autonomous shuttles. Las Vegas, for instance, recently conducted a pilot with shuttle-maker Navya, whose self-driving electric ARMA vehicle provided free rides in downtown Las Vegas for 10 days in January.

Meanwhile, automaker Ford last year acquired Chariot, an on-demand shuttle service that occupies a gap between mass transit and ridesharing. Currently available in San Francisco and Austin, Texas, with plans to expand to eight more U.S. cities this year, Chariot vehicles operate along crowdsourced routes where mass transit is lacking, giving underserved communities better access to jobs, education and other opportunities. Riders use their phone to reserve and pay for a ride, as with Uber or Lyft, then show up at a designated pickup time and location, as they would for a bus. Although Chariot currently has human drivers, Ford plans to launch autonomous shuttles by 2021.

“It’s not enough to build more roads

Audi has partnered with a transportation agency in the Las Vegas area to pioneer a technology that lets drivers know when a red light will turn green. The system aims to reduce driver stress before the light turns, increase awareness once it does, and then get traffic moving more quickly afterward.

and put in more trains,” says John Kwant, Ford’s vice president of City Solutions. “The only way cities will be able to cope with growing urbanization is to get greater carrying capacity in the same footprint that a single-occupancy vehicle currently has.”

SMART CITIES, HAPPY CITIZENS

What ultimately makes cities smart isn’t adaptive traffic signals or autonomous shuttles. It’s the networks that underlie them, connecting technologies in a way that breaks down civic silos and enhances city services.

Case in point: Pittsburgh, which is upgrading 40,000 streetlights. The new streetlights will have Internet-connected LED bulbs with sensors capable of detecting pedestrian and vehicle traffic, monitoring air quality, and communicating with other networked objects.

For example, based on pedestrian volume, streetlights near a concert venue could detect when a show lets out and notify law enforcement, which could be dispatched for crowd control and public safety; waste management, which could be deployed to empty trash receptacles; and adaptive traffic signals at nearby intersections, which could change to optimize traffic flow around the concert venue. Subsequently, various city departments could aggregate data from the same streetlights to identify geographic, environmental and demographic trends relevant to planning in areas as diverse as revenue, zoning, housing, energy, personnel and infrastructure.

“As you improve the environment of a city, the aspiration for many is to reduce spending on crime, health care and other related services so you have more dollars to invest in driving the city forward and making it a strong and healthy contributor to GDP,” says Andrew Till, vice president for technology, partnerships and new solutions at Harman Connected Services, which designs software for connected vehicles.

In other words, technology is the means, but the end is more efficient and responsive local government.

“The reason we’re making these investments comes down to quality of life,” says Alex Pazuchanics, a policy adviser to Pittsburgh Mayor William Peduto. “That means that all residents have efficient and safe trips to work or leisure activities, that we’ve got better air and water quality, and that there’s a linkage between our transportation system and quality housing. It all comes back to residents and the kind of Pittsburgh we want to support for them.”

CITIES RISE TO CHALLENGE

Governments and private industry share their data-driven ambitions for more efficient transportation. The winner: Columbus, Ohio.

Matt Alderton | Special for USA TODAY

Consumers can't get their hands on new technology fast enough. When there's a new iPhone or Xbox, they stand in line for hours to get it. The same can't be said for governments. As citizens race to be early adopters, their leaders typically lag behind.

There are good reasons for that, says Andrew Till, vice president for technology, partnerships and new solutions at Harman Connected Services, which designs software for connected cars. One is speed: Although technology moves fast, governments move slow by design, since impulsive decisions rarely make for good policy. Another is scale: Their size and composition make government implementations especially complex. Finally, there's cost: Because they depend on taxpayer dollars, governments have limited resources and little risk tolerance.

"They're interested in (technology), but the reality for most cities is they can't do it on their own," Till said.

The U.S. Department of Transportation agrees. Although it recognizes the contribution that technology can make to cities' social and economic development, it also recognizes the challenges cities face in adopting it. So in December 2015 it launched the USDOT Smart City Challenge, the goal of which was creating a "city of the future." It invited midsize cities to present their vision for moving people and goods with the assistance of data and technology.

"Innovative, smart-city-style transportation solutions offer communities a tremendous opportunity to increase mobility and strengthen their local economies," says Ken Leonard, director of the DOT's Intelligent Transportation Systems Joint Program Office. "Advanced technology will play an integral role in rebuilding our nation's infrastructure now and into the future."



JAY LAPRETE, AP, FOR VULCAN, INC.

Columbus residents celebrate their city's first-place finish in the USDOT Smart City Challenge.

To help cities implement their vision, it promised up to \$50 million in public and private funds — \$40 million from the DOT and \$10 million from Microsoft co-founder Paul Allen's Vulcan Inc. — and assistance from private-sector partners such as AT&T, Autodesk and Google parent Alphabet, among others.

The challenge drew 78 applications. Seven finalists were chosen: Austin, Texas; Columbus, Ohio; Denver; Kansas City, Mo.; Pittsburgh; Portland, Ore.; and San Francisco. The winner, chosen in October 2016: Columbus.

Columbus' plan—dubbed "Smart Columbus" — is ambitious. Among its many goals:

DEVELOP a universal payment card that allows cash-reliant citizens and those without access to credit to ride all transit options in the city, including buses, taxis and bike and ride-sharing;

INSTALL a connected transportation network that includes adaptive traffic signals that respond to traffic volume, alerts pedestrians to transit vehicle arrivals and gives drivers tips for environmentally-friendly motoring

USE a connected parking management system to alert drivers about open

spaces on streets and in garages.

INSTALL motion-activated streetlights that also serve as access points for free Wi-Fi to reduce electricity consumption and bring Internet access to underserved communities.

DEPLOY autonomous electric shuttles as last-mile transit for workers employed at a local shopping center.

SUPPORT electric vehicle adoption with electric buses, an electrified city fleet, and solar panels and electric vehicle charging stations.

INTRODUCE an electronic medical appointments and scheduling platform that integrates with a transit planning and tracking application to help patients in underserved communities make and keep doctor appointments.

Although its vision was inspired, what made Columbus stand out was its broad coalition of partners, including Battelle, American Electric Power, Ohio State University, Nationwide, Honda, L Brands and Cardinal Health, among others. Collectively, the partners committed \$90 million to Smart Columbus. That, along with money from the DOT and Vulcan, gave Columbus \$140 million with which

to execute its vision. Since then, contributions from additional public and private sources have grown the pot to \$417 million.

"Getting engagement from the largest employers in the city, and the various economic interests in the city, was for us a great signal that Columbus could actually pull off what they said they were going to do," says Spencer Reeder, Vulcan's lead on the Smart City Challenge. "It wasn't just the mayor's office or the county government; it was all of them plus the private sector that had come to the table in a really magnificent way."

It wasn't just Columbus, either; collectively, the seven finalists identified \$500 million in initial partnership funding for their projects—proof that smart cities are as much about teamwork as technology.

"For the last 100 years the city has been making significant capital investments in our infrastructure, and we'll continue to do that," says Mike Stevens, chief innovation officer for the city of Columbus. "But resources are always a challenge, and what we're doing needs to be sustainable. So it's critical that our private sector is behind this effort and part of it."