TRANSFORMING THE INTERSTATE HIGHWAY SYSTEM

America's right of way to the future

An expanded version of this article is available on David Thomason's webpage on Medium.com.

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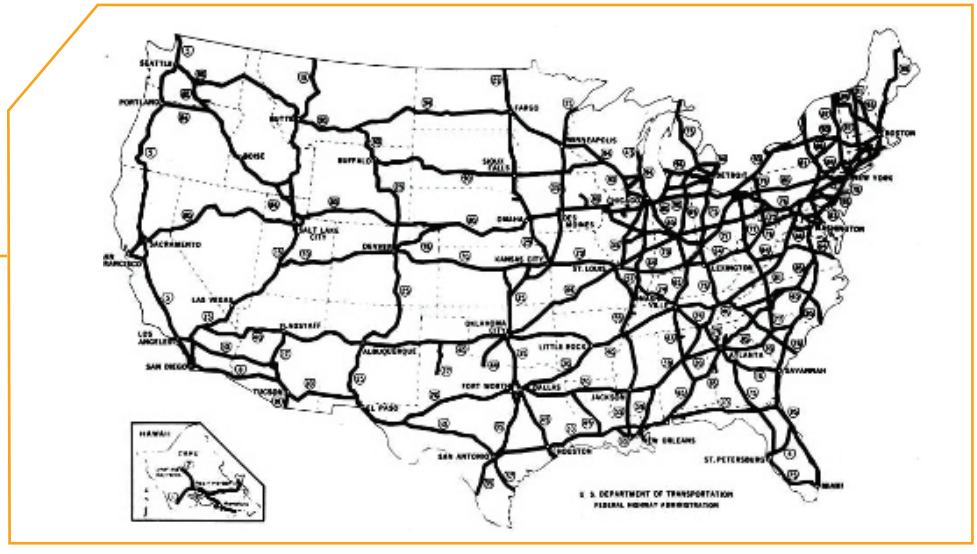
The Eisenhower Interstate Highway System (IHS) has the most expansive right of way (ROW) in the United States. A seamless collection of individual state ROWs, it comprises over 48,400 miles of limited-access divided highways. The IHS traverses every state and intersects with hundreds of thousands of other ROWs. For now, it's still the world's most advanced highway system, but challengers such as China's National Trunk Highway System may soon surpass it. For the U.S. to remain competitive on the world stage, it's time for a modern transformation of the IHS. ROW professionals have a key role to play in this effort.

A NATIONAL CIRCULATORY SYSTEM

When visionaries proposed the IHS back in 1956, many worried about the cost and practicality of such a massive transportation project. Today, we can't imagine American commerce or travel without it. The IHS has become the nation's circulatory system. According to the Federal Highway Administration (FHWA), 25% of all highway miles driven in the U.S. are on the IHS.



The Interstate Highway System — FHWA

ROOM FOR IMPROVEMENT

Although the IHS is a modern marvel, there are some obvious problems. The "limited-access" feature of the roadway means drivers cannot easily exit when problems like accidents, bad weather or construction projects cause crippling traffic jams and frustrated travelers as well as slowing the flow of commerce. Idling vehicles also waste precious fuel and can lead to pollution. According to the U.S. Environmental Protection Agency (EPA), transportation in the U.S., including IHS traffic, is estimated to cause 29% of the nation's annual CO2 emissions.

Safety is also an issue. The National Highway Traffic Safety Administration estimates that more than 90% of the accidents on all U.S. roadways are at least partially due to human error. These accidents result in about 40,000 deaths and thousands more injuries each year.

TRANSFORMING THE IHS

Despite its problems, the IHS is essential for U.S. commerce. Now, modern technology has the potential to transform this marvel of the 20th century into a model of 21st-century transportation. This transformation could begin right away, using *existing* technology, by taking five practical and synergistic steps:

1. Adopting advanced self-driving vehicle (SDV) technology.

Thanks to advancements in self-driving technology, SDVs are ready for highway driving even if they aren't ready for other roads. More than 25 new car models now have *highway-only* features like adaptive cruise control, allowing hands-free driving. Adding vehicle-to-vehicle (V2V) communication creates cooperative adaptive cruise control (CACC) and enables SDVs to platoon. When platooning, closely following SDVs operate in unison to quickly and safely navigate hazards. This reduces slowdowns, extends vehicle ranges and allows for much greater traffic volume with fewer lanes. We already know this can work because the FHWA successfully demonstrated platooning using CACC in 2017. Research shows that platooning is even more effective with managed lanes (such as HOV lanes in cities) to keep platooning vehicles separated from other vehicles.

2. Automate the IHS.

Futurists have dreamed of an automated highway for decades, but we now have the technology to make this dream a reality. A computerized network of sensors such as optical and infrared cameras, radar, GPS and weather instruments could monitor the ROW and warn motorists of hazards like extreme weather, debris, animals or construction. The network could send localized alerts to motorists' cell phones and inform cloud mapping applications, like Google and Apple Maps. The system could also communicate with individual SDVs or platooning groups of SDVs for enhanced control, like automatic slowing to avoid hazards, creating an integrated vehicle-to-everything (V2X) network. This system would result in a quantum leap in highway safety and bolster public confidence in SDVs, further accelerating their adoption.

3. Renewable energy installations on the IHS.

Americans are more interested in switching to an electric vehicle (EV) than ever before, and there are multiple options available. But many are concerned about making the switch due to a lack of electric charging stations, especially for long-distance highway travel. Some also question whether EVs are "green" technology when not powered by renewable energy. Adding thousands of electric charging stations along the IHS powered by renewables will convince more Americans to adopt this technology and greatly reduce our national carbon footprint. The FHWA already reports over 30 solar and wind facilities on IHS ROW, and much more potential exists.

Current federal safety regulations severely restrict the amount of IHS lands available for renewables. Even so, a 2020 University of Texas study found 127,500 available acres in IHS interchanges capable of generating 36 TWh of solar energy annually. Assuming an average electric vehicle charge of 50 kWh, this would be enough energy for about 720 million electric vehicle charges per year, and the charging stations would be located in interchanges exactly where they are most needed.

Although that is a lot of power, it will be insufficient as more EVs hit the roads. Beyond IHS interchanges, the total area of the ROW is estimated to be over 2.3 million acres, most of it open space. Safety improvements that will come from automated highways and SDVs could allow the federal government to relax the IHS land-use rules, opening up much more land for renewable energy installations. If 1 million acres of this land ultimately could be used for renewables, it could potentially generate an estimated 282 TWh of energy — enough for about 5.6 *billion* EV charges per year.

4. Underground high-voltage electrical transmission lines.

Another pressing infrastructure issue is improving and updating the nation's power grid. Creating new high-voltage electrical transmission lines is necessary to bolster nationwide connections and facilitate energy transfer to the places that need it when they need it. A 2021 National Academy of Sciences report indicated that by 2030, up to 40% more transmission capability is necessary "to better distribute high quality and low-cost wind and solar power from where it is generated to where it can be used across the country." However, due to their large size and unappealing appearance, officials often encounter local resistance and legal hurdles when trying to construct new lines. Instead, these lines could be installed underground in the IHS ROW.

Using modern, directional-drilling equipment would make these much-needed lines cheaper, safer and less disruptive to construct. The added lines could connect new renewable energy installations along the IHS and link to other transmission lines crisscrossing the ROW. This would bolster our entire national electric grid, reduce blackouts and bring the promise of renewable energy to the entire nation.

5. High-speed mass transit.

As a longer-term goal, an electric high-speed mass-transit system (MTS) could be installed in the improved ROW of the IHS. This could be a modern rail system or even a system incorporating hyperloops. City transportation systems already sometimes use the IHS ROW for local mass transit options, like the MARTA system in Atlanta. With the safety improvements that will come with SDVs and highway automation, it will be easier to use medians and other ROW space for the MTS.

Some may argue that an MTS is impractical because of cost. However, leveraging the many billions of dollars that have already been spent on the IHS for earthmoving, overpasses, underpasses and other improvements would make it cost-effective. The MTS would serve long-distance travelers and reduce interstate air travel, further reducing CO2 emissions. Plus, it too could be powered by renewable energy generated along the IHS.

MAKING IT HAPPEN

There's no reason many of these ideas wouldn't also work on other U.S. highways. But it makes sense to start with the IHS because the clear federal authority to regulate interstate commerce would make it much easier to enact the necessary legislation and regulations to accomplish these changes nationwide.

These improvements need not be a partisan issue. Improving transportation, commerce and safety are common goals people of all political persuasions can agree upon. Regardless of a person's position on climate change, there's no question that these improvements would advance renewable energy, reduce pollution, enhance energy distribution, save lives and help keep the U.S. competitive on the world stage.

ROW professionals can assist in this effort by sharing the contents of this article with State DOT officials and state and federal lawmakers. Shockingly, according to the referenced 2020 UT study, only one state (Iowa) has sufficient spatial data sets to determine their total ROW area and configuration. This is a huge opportunity for right of way professionals to assist in determining the total area and configuration of the IHS ROW to assess its potential for renewables.

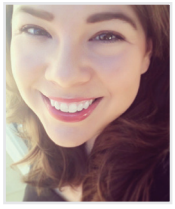
Past investments in the IHS have returned an estimated $6 to our economy for every dollar invested, and there's no reason to think that these improvements won't do the same or more. The visionaries who originally launched the Eisenhower Interstate Highway system 65 years ago left the American people an immense national treasure. With similar foresight, it is time to open the treasure chest and give our country the modern transportation system it deserves. ✪

DOLLARS AND SENSE

The idea of going from our current system to the one described here almost sounds too good to be true. Skeptics may fret about potential costs, but since each of the envisioned improvements can be constructed and launched one highway section at a time, costs would be manageable. Over time, these transformations would generate enormous cost *savings* by accommodating more traffic without expanding highways and huge economic gains from a safer, more efficient, more environmentally friendly IHS.

At the outset, much of the costs could be borne by large corporations through public/private partnerships, as has been done with the burgeoning private space industry. As one example, Tesla's Energy Subsidiary might install their solar panels, car chargers and mega-batteries in IHS interchanges for a share of the profits from energy sales. Likewise, the MTS could be financed and built by private partners with the government reaping part of the benefits from rider fares.

David Thomason, now retired after 40 years with a global engineering company, is a patent-holding inventor and futurist.



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