



The Ultimate Guide to DOT Construction Technology

Why each Department of Transportation must look at future tech

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Introduction

The condition of America's infrastructure has become a high-stakes issue. Traffic congestion plagues our inadequate and crumbling roads and bridges. Neglect has made public transportation almost unusable in some of our most vital major cities. The effects ripple throughout the economy as workers spend more time on stalled subways than in the office, and as companies find the reduced efficiency impacts their bottom lines.

At all levels of government, politicians have been promising fixes for years, only to see their plans founder. Some leaders balk at the cost of these projects, as former New Jersey governor Chris Christie did back in 2010 when he canceled the ARC tunnel that would have carried commuter trains under the Hudson River¹. Donald Trump rode to victory in the 2016 presidential election partly by promising a trillion-dollar infrastructure plan, but his administration has pushed the idea aside as soaring debt has made both his advisors and Congress skittish about taking on so much spending². Globally, infrastructure projects tend to have lower cost inflation. Infrastructure projects in the US have cost up to 2-3x that of similarly sized projects in the European Union, with no consensus or a good explanation as to why. In the meantime, subway systems continue to degrade. Nations continue using roads and bridges long past their intended lifespan.

Growing cities see even more negative quality-of-life issues as residents struggle with their limited options. As public transportation breaks down, more and more turn to ride-sharing services that increase traffic on the streets, which means even more congestion on already-overwhelmed infrastructure, which makes fixes both more necessary and more expensive. It is a vicious cycle³. These problems present enormous challenges to departments of transportation (DOTs) across the country. A recent McKinsey report suggested future infrastructure solutions that ease congestion will look very different from those of the past⁴. We will need more charging stations for electric vehicles. We'll require more bike lanes as people abandon cars and public transportation both out of convenience and over environmental concerns. Accommodations for package-bearing drones that can replace delivery vehicles will also become necessary. The technology now used to plan heavy civil construction projects will change as well. How DOTs retool to meet these challenges will greatly impact the pace at which the nation will fix its dilapidated transportation infrastructure.

Growth Of The DOT

Conditions in every state are different, but the goals of DOTs in each one remain similar. DOTs look to build and maintain transportation infrastructure while looking for ways to increase safety, reduce congestion, make transportation systems more reliable and plan livable neighborhoods—all while balancing the demands of both citizens and businesses that may have conflicting development goals. And that's just for starters.

DOTs have to orient themselves for a future in which transportation needs and systems will look very different. The ability of cities and states to adapt to climate change that will greatly impact their livability and the types of infrastructure needed will largely define the future.

And DOTs will do this while competing with other governmental departments and demands for ever fewer resources.

Because DOTs are increasingly constrained by tight budgets even as demand for transportation services grows and becomes more diverse, departments across the country are looking for ideas from each other. State DOTs, supported by the federal Department of Transportation, have been forming initiatives to share data and information on "smart growth" policies in their own cities⁵.

The challenges these departments face include improving highway and transit safety, better oversight (at the federal level) of the nation's air-traffic control and railway systems and modernizing and securing the IT infrastructure that powers and protects these systems—all while being transparent in their spending so as to please the politicians and a public that views government expenditure with suspicion⁶.

In thinking about how to address these challenges, DOTs have adopted the term "smart growth." This can mean many things, from building more affordable housing near public transportation to installing more sidewalks to accommodate foot traffic.



For custodians of traffic infrastructure, “smart growth” means managing self-driving vehicles, implementing better real-time traffic management and considering zoning and planning for transit-oriented development such as affordable housing near public transportation hubs⁷.

Because every city’s needs are different, the challenges will vary. Those responsible for overseeing infrastructure will need to consider a range of technological options for planning the heavy construction projects of the future in a wide variety of environments.



Identifying Future Opportunities

In 2016, the U.S. Department of Transportation announced four research priorities to guide an overall strategic plan to address the nation's future transportation needs⁸. Each area would look at trends in transportation systems across the country and consider ways the department could support the initiatives being undertaken to drive those trends.

The four research areas were:

- Promoting Safety
- Improving Mobility
- Improving Infrastructure
- Preserving the Environment

All four priorities are driven by the evolving needs of American commuters, the overcrowding of our cities that puts ever-greater stress on aging infrastructure (currently, roughly 86% of the population lives in urban and suburban areas), and the effects of climate change that will shrink the amount of buildable and livable land.

The USDOT has already identified possible innovations in transportation that will address these priorities⁹. We have already mentioned the need for more charging stations as electric vehicles become more common, and more bike lanes as bike-sharing programs become more popular. Ground-level pedestrian lights—that is, lights implanted in the sidewalk to tell people when it is safe to cross a street—are an immediate need due to the rising number of accidents involving pedestrians in the smartphone era.

Other possible innovations, such as maglev trains and hyperloops, are already under development or even in limited operation in other countries. Other innovations, such as flying hotel pods and smart roads that will be “virtually alive,” sound like something out of a science fiction story. Their adoption is likely many years off.

Still, imagine the technology that will be required to plan, build and maintain heavy civil projects such as smart roads with embedded technology.



These roads are expected to capture solar energy and convert it into electricity that can be used to power the cars driving on them. They may contain a photo-luminescent powder that charges during the day and lights up at night, improving visibility for drivers, or even use electricity to melt snow, which will allow for safer driving.

These roads, along with the other projects identified by the government, will require a type and level of planning previously unseen in capital projects managed by DOTs everywhere.

A "Green New Deal"

Many of these more environmentally-friendly projects may be funded as part of a long-ranging "Green New Deal"¹⁰. That is the current term for an ambitious public-works project being touted by the incoming Democratic majority in Congress.

The goal of the Green New Deal is to cut carbon emissions by 2.7% by the year 2100, as mandated by the Paris Climate Agreement signed by the Obama administration. As currently envisioned, this initiative will greatly impact areas overseen and regulated by DOTs, including building electric vehicles, retrofitting infrastructure such as bridges and roads to withstand rising sea levels and installing alternative energy sources.

These new technologies—and the massive, society-wide effort to transform civil infrastructure envisioned by proponents of a Green New Deal—mean that DOTs should be reorienting themselves to a future in which they will guide these projects from development to building to long-term maintenance.

The DOT Toolkit

Projects undertaken by DOTs have a vast number of requirements that must be tracked in granular detail. Managers must track permits, regulatory compliance, environmental standards and corporate activities. There are layers of government bureaucracy to navigate while striving for transparency.

The civil projects undertaken by a DOT will generate a comprehensive list of requirements, from taking a system through its initial development and planning stage to implementation and deployment¹¹. After the project's completion and initial deployment, maintenance requirements need to be prioritized and made functional. The maintenance phase requires processes for monitoring and evaluation of maintenance needs.

Software companies have designed suites of tools that attempt to manage this incredible flow of information. These tools are generally best described as project management software that tracks capital requirements and procurement, costs, schedules, product delivery and a host of other necessities.

The best tools for DOTs will ideally track a project all the way through development and building into the operations and maintenance phases. But the functionality of these programs is hampered in part by the ever-evolving needs of various projects and the changes in requirements that are a normal function of transportation structures and systems over their lifecycle.

Throw in the coming changes in technology that will be an integral part of transportation planning and it becomes clear that construction software will have to be just as forward-thinking as the DOTs it will serve, if not more so.



Conclusions

The nation's transportation systems face a difficult future. Years of declining budgets have led municipalities to neglect important infrastructure. That neglect is now catching up with them. Subways in New York City barely run. Congestion in and around Washington, D.C. has made it almost impossible to navigate the region by car. These problems are replicated everywhere across the country.

Then there are the questions about what the city of the future must look like. Coastal cities will need to find ways to mitigate the damage caused by rising seas. Larger populations will affect the development of neighborhoods, pushing many cities to build more high-density housing near public transportation. There is a rush to find solutions that are more environmentally-friendly like electric vehicles or making cities more conducive to biking and walking.

In this environment, it is imperative that Departments of Transportation at both the state and federal levels retool themselves to meet these challenges. At the moment, repairing or building new infrastructure to replace the old has been hampered by a lack of political will and tight budgets. It is up to the DOTs to make the case for the importance of planning for radical changes in the physical structure of American cities and also to prove they are ready to meet these challenges.

DOTs can achieve this transformation by accurately assessing the needs of future construction projects from conception and design all the way through to building and completion. Adopting software that is nimble enough to adapt to as-yet-unforeseen challenges is one of the most important steps they can take.

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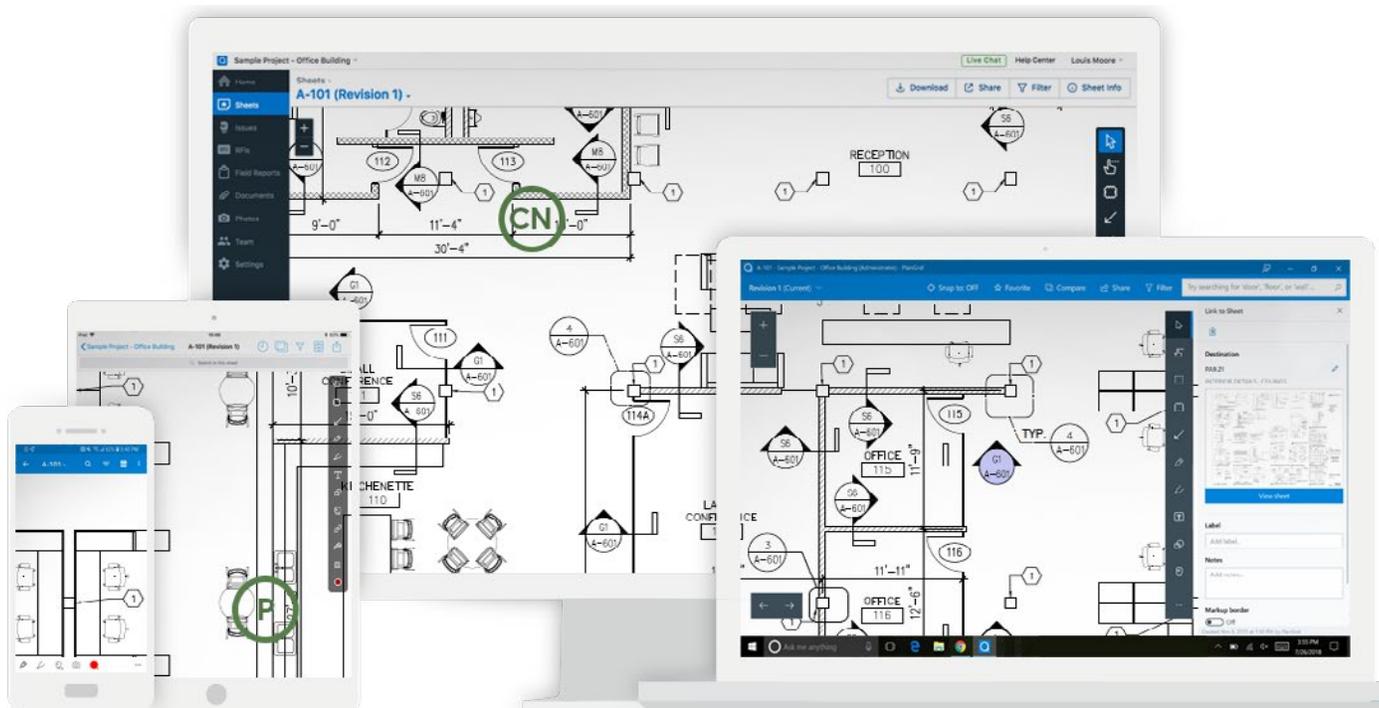
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