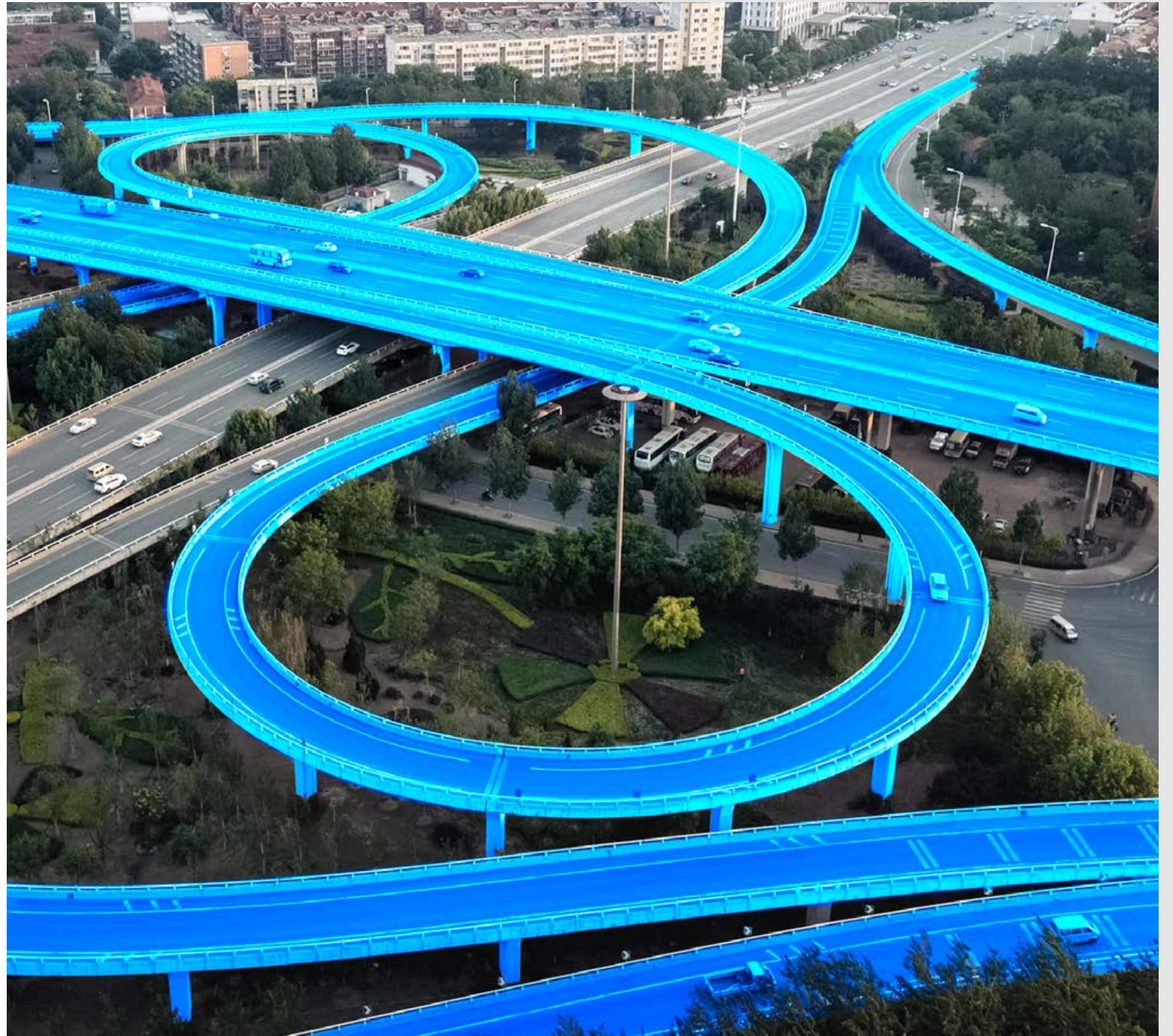


# MORE WITH LESS

Better Transportation  
Project Management





## INTRODUCTION

When working with transportation agencies, you are facing twin challenges: the demand to achieve greater insight, heightened accountability, and better project delivery as well as the mandate to increase and improve services. You need to achieve this with constrained budgets!

As we continue to address the challenges of tomorrow today, you have an opportunity to rethink how to mitigate risk, contain costs, and maintain stakeholder confidence while maintaining infrastructure, avoiding failures, and planning budgets more strategically. These challenges are forcing you to interact with the transportation agencies in smarter, more innovative ways and be ready with a future proof platform across the project lifecycle.

The solution is clear. Teams of engineers and designers can look to technology partners to help them collect, prepare, integrate, and use data more effectively to upgrade infrastructure and eliminate project overruns by reducing the errors and omissions that cause them. This will allow you to establish collaborative digital practices across disciplines, and coordinate linear and vertical infrastructure design.

Working together, we can transform traditional project management in a way that refocuses the AEC industry on driving positive outcomes for transportation projects. This data-focused approach is called infrastructure project delivery.

Modern tools are required to account for the Future of Work. Having grown up in the digital age, emerging young leaders will be more comfortable with technology. They'll also be aware that the public and other partners will want to interact with them digitally, enabling this new digital world will be a priority at the top of their agenda.

# HOW DO WE GET THERE?

*This eBook will explore project delivery around the following key themes.*

*Let's explore.*



Transportation trends in 2020 and beyond.



Driving the digital transformation of infrastructure project delivery throughout the lifecycle, including:

**PHASE 1:**

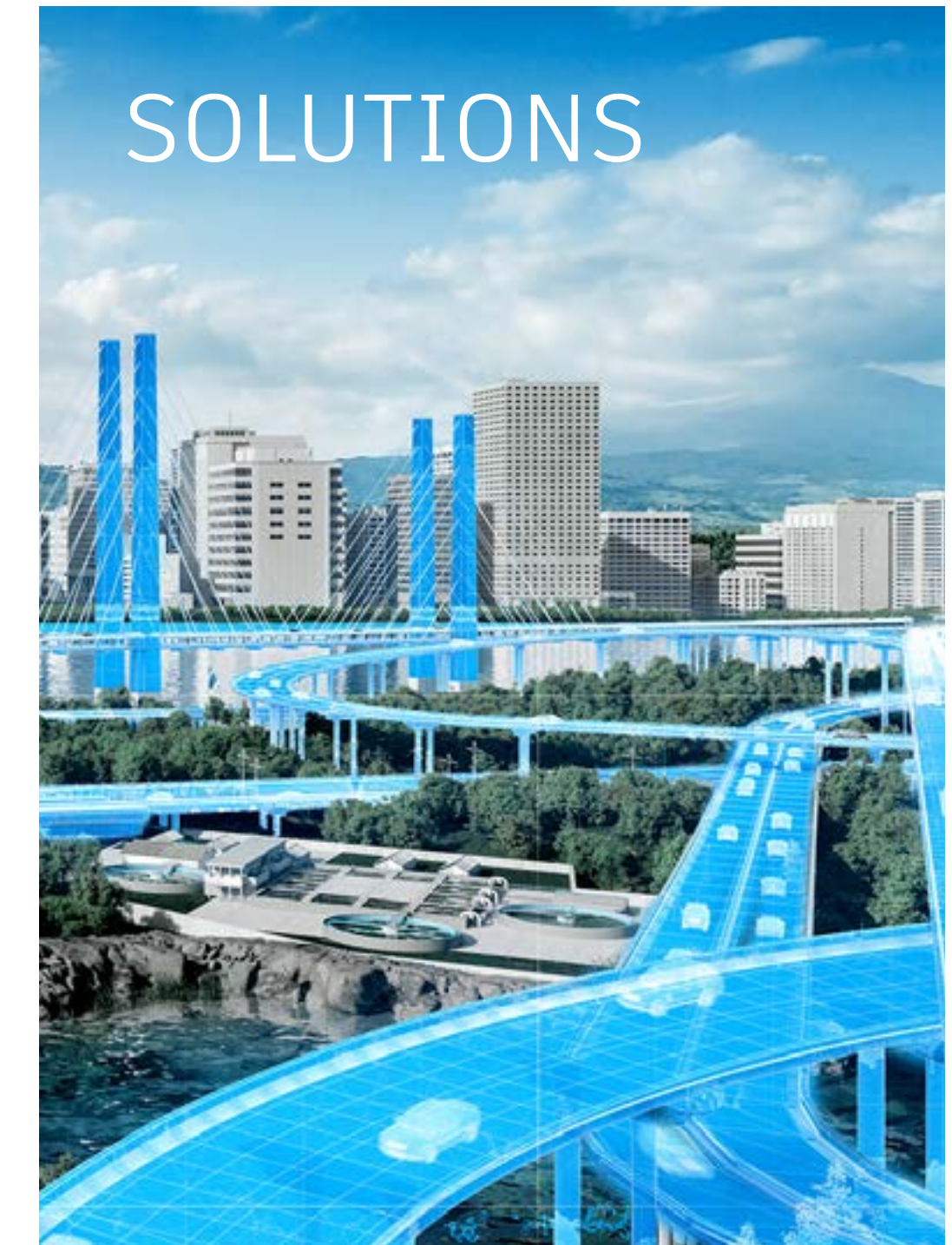
PLAN

**PHASE 2:**


DESIGN

**PHASE 3:**

BUILD AND MAINTAIN



Autodesk presents the modern stack.



# TRANSPORTATION TRENDS 2020 AND BEYOND

Key trends transforming the  
infrastructure landscape

## 01. CRUMBLING INFRASTRUCTURE

It's no secret that global infrastructure is woefully underfunded. According to ASCE's 2017 Infrastructure Report Card, one in five miles of road has been rated in poor condition.<sup>1</sup> It estimates that \$4.5 trillion is needed by 2025 to fix roads, bridges, dams, and other infrastructure in the United States alone – a budget that is not currently available. Globally, infrastructure needs are greatest in China and emerging markets in Africa and other parts of Asia.<sup>2</sup>

## 02. AGING WORKFORCE

Twenty percent of the construction industry workforce is nearing retirement age, and 35 percent of engineers are currently over the age of 55. This will make it difficult for Architecture, Engineering, and Construction (AEC) firms to find the skilled workers needed to deliver projects.

## 03. REMOTE WORKFORCE

The Covid-19 global pandemic has dramatically changed the way people work, pushing them out from a central office to home offices and dining room tables across the globe. The result has been an increased reliance on remote collaboration using shared, cloud-based resources. Yet, business must continue despite growing latency, bandwidth, performance, and security challenges.

## 04. BUDGET CONSTRAINTS

Global infrastructure investment is expected to fall short by \$20 trillion over the next two decades. This infrastructure funding gap increases pressure to do more with less. As a result, we need to optimize our current processes through improved collaboration to build more and better with less resources and less negative impact to the world.

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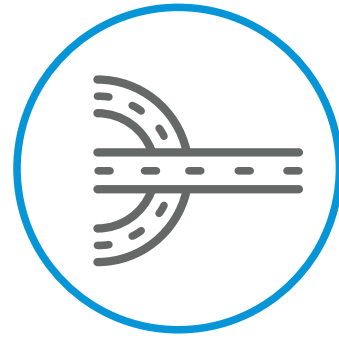
## THE BOTTOM LINE

Our infrastructure is crumbling, the AEC workforce is aging, transportation agencies and engineering service providers are having challenges finding skilled workers, and the Future of Work has turned traditional ways of collaboration upside down. The combined weight of these factors is putting enormous strain on already stretched transportation infrastructure. The need to adapt has never been stronger.

1. ASCE (2018). 2017 Infrastructure Report Card. [www.infrastructurereportcard.org](http://www.infrastructurereportcard.org)

2. Infrastructure spending forecast 2017. [www.statista.com/statistics/271779/infrastructure-spending-forecast-by-region](http://www.statista.com/statistics/271779/infrastructure-spending-forecast-by-region)

TRENDS



ROADS + HIGHWAYS

**1 IN 5**  
**MILES OF ROAD**  
**IS IN POOR**  
**CONDITION**

In major cities around the world, people spend **150+ hours** in traffic a year.

Traffic delays cost **\$160 billion** in wasted time and fuel in 2014

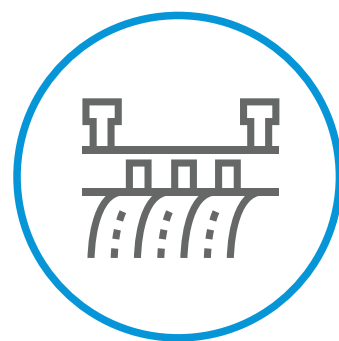


BRIDGES

**4 IN 10**  
**BRIDGES ARE 50**  
**YEARS OR OLDER**

**56,000 bridges** are structurally deficient

The backlog of bridge rehabilitation needs equals **\$123 billion**



DAMS

**7 IN 10**  
**DAMS ARE 50 YEARS**  
**OR OLDER**

Nearly **15,000 dams** have been identified as **high-hazard** potential

**\$45 billion** in investment is needed to repair these aging, **high-hazard** dams

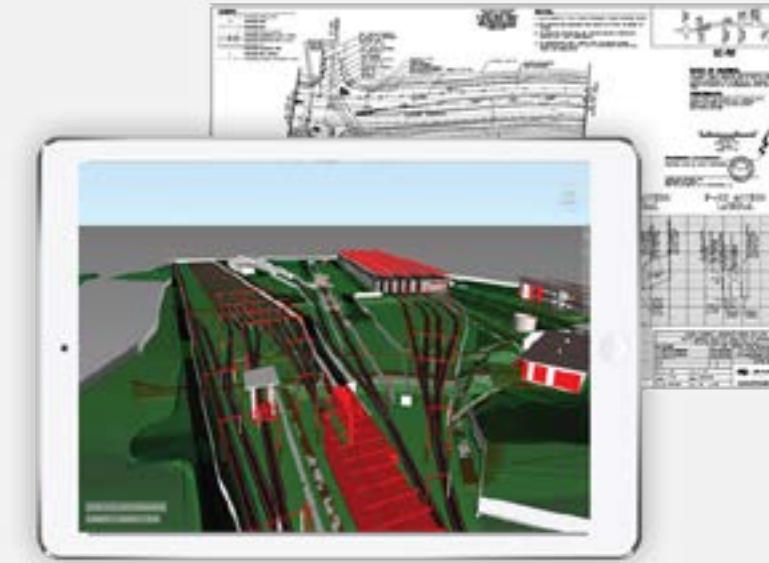


RAIL

**1/3**  
**OF EXPORTS IS**  
**CARRIED BY RAIL**

Rail delivers **5 million** tons of freight and approximately **85,000 passengers** each day

Forecasts show a **40% increase** in freight shipments over the next 30 years



**GOING BEYOND CAD TO BIM**

CAD based design has been the industry standard for decades, enabling designers and engineers in the transportation industry to operate in a drawing centric design world. BIM has emerged as the greatest technological innovation centered around the utilization of intelligent models to improve coordination across design and construction. These rich information models provide designers and engineers the ability to make better decisions earlier in the project delivery process hence saving time and money. Having the ability to design and virtually build before construction begins greatly reduces risks that impact predictability, reliability, quality and most importantly cost.



# DRIVING THE TRANSFORMATION OF PROJECT DELIVERY

BIM Powers Design Throughout  
the Project Lifecycle

## DATA AT THE CENTER

Building Information Modeling (BIM) powers every aspect of the design and build process, allowing designers and engineers to create intelligent rich 3D models of the project before a shovel ever hits the ground. Having the ability to design and build virtually prior to construction beginning can greatly reduce risks that impact predictability, reliability, quality and most importantly cost. A centralized location for collecting, managing, and disseminating information through a managed process delivers accuracy and less rework across the project lifecycle.

***Let's see how data at the center of a digital project works across the project lifecycle:***

- Dynamically modify the roadway configuration directly in the model instead of reprocessing templates and corridors.
- Interrogate the design with profiles and cross sections and dynamic reporting.
- Calculate and define super elevation with dynamic interrogation to understand effects on design in real time.

BIM models of the project allow you to exercise 4D/5D analyses and simulations to review and communicate project intent, schedules, and logistics—enabling more effective collaboration and coordination among project team members from design through to construction handover.

## BIM IN ACTION

Prepare better technical and financial project proposals with a common BIM environment and shared design model that facilitates better coordination across multiple locations and disciplines.

In the case of bridge projects, engineers and designers can lead the process and work directly with the model to define the bridge components. Using this same model data, structural engineers can analyze the girders of the superstructure and other bridge structural design elements in detail.

Once the detailed design has been completed, the bridge model can then be seamlessly integrated with the corridor design files to create the final roadway design model.

Finally, the completed model can be used to create detailed documentation for review, bidding, and construction of the bridge and related roadways.

## PLAN > DESIGN > BUILD AND MAINTAIN

**Every infrastructure project competes for scarce resources.** With Autodesk project delivery solutions, you can provide greater visibility to project stakeholders from earlier on in the conceptual design process. What's more, you're now able to shift your emphasis from being cost-centric to considering multiple outcomes and project value—signaling out critical design approaches while prioritizing new projects based on social, economic and environmental factors.

AEC professionals also need to plan for the future –using data to enrich models that predict how assets will perform in handling future demand. Designing infrastructure with these concerns in mind will save money and time down the road, improve asset performance, and reduce disruptions due to maintenance and repair. This will satisfy transportation stakeholders increasing demands to do more with less. You can also leverage BIM models to support training programs, ensuring knowledge and skill transfer.

### 01. CAPTURE EXISTING CONDITIONS

Start your project by rapidly creating a large-scale, intelligent digital 3D model of your project's real-world environment. Autodesk solutions allow you to aggregate large amounts of existing conditions data, including traditional survey, reality capture, 2D CAD, and raster data. You can then incorporate GIS data to enhance accuracy and fine-tune your model ready for detailed design and engineering work downstream.

### 02. PROVIDE DIGITIZED PROJECT DATA

Many times, as-built drawings of existing infrastructure already exist in the form of paper, microfilm or 2D digital documents. In the past, this has resulted in duplicated efforts, costly errors and loss of valuable insights. By providing transportation agencies with digitized models that can be handed over to construction, you are providing valuable data that can be leveraged for the life of the infrastructure asset. Autodesk allows you to capture and digitize infrastructure-related information and feed them into your BIM models where they can enrich your dataset.

## THE AUTODESK SOLUTIONS THAT MAKE IT HAPPEN

### PLANNING



#### ReCap™ Pro

Scanning software to create 3D models from imported photographs and laser scans.

*Use Case:*

*Existing conditions capture and site evaluations.*



#### BIM 360™

Connect project teams and data to help reduce risk, improve quality and deliver projects on time and budget.

*Use Case:*

*Collaboration for the design.*



#### 3ds Max™

3D modeling, animation and rendering software for design visualization.

*Use Case:*

*Final modeling and public viewing.*



#### InfraWorks®

Geospatial and engineering BIM platform for planning, design and analysis.

*Use Case:*

*Laying out future work, mobility simulation and concept level planning.*



PLAN > DESIGN > BUILD AND MAINTAIN

**03. GET STAKEHOLDERS ON BOARD**

Infrastructure projects impact the general public, and they typically have one overriding concern: how the proposed project will impact them on a day-to-day basis. They have questions like: “What will the project look like?”, “How long will it take?”, and “How will the construction phase impact me?” Transportation agencies want to easily provide this information. Now, there are tools that simplify how you convey the impact of infrastructure projects to users and help them better understand and visualize your design intent as well as where tax or bond dollars are being invested.





PLAN > DESIGN > BUILD AND MAINTAIN

**01. RAPIDLY CONCEPTUALIZE YOUR DESIGN**

Quickly conduct the preliminary conceptual layout in real-world context. For transportation projects, use conceptual modeling tools to quickly and efficiently develop roadways adding turn lanes, intersections, and overpasses. Incorporate conceptual bridges and tunnels and other structures such as retaining walls and drainage networks. Use specialized analysis tools to optimize your proposal to achieve the best project outcome.

**02. TRANSITION FROM CONCEPTUAL TO DETAILED DESIGN AND ANALYSIS**

You can reuse your intelligent 3D conceptual project model and take advantage of the work that was already performed. You can quickly transition to a detailed design process to optimize and fine tune your design to meet design standards. You can make better design decisions for sight distance, superelevation, drainage, mass-haul and more. You can curate your 3D digital model to produce the level of design detail to deliver documentation for construction. Ensure that you keep your documentation current and up-to-date through dynamic connections to model changes, eliminating costly errors during construction.

**03. REVIEW DESIGN ALTERNATIVES**

Designers and civil engineers need access to tools that facilitate the modeling of different design scenarios before final design and plan documentation. Evaluating project schedules and design alternatives can be easily exercised, helping to determine the most efficient and cost-effective design approach with the least community impact. Model different types of intersections and roadway configurations and simulate traffic at different times of day to find road design alternatives that perform best. Effectively determine if you need to widen roadways while increasing bridge clearances, providing for better storm water management and incorporating light-rail corridors and connections. Finally, perform clash detection of many discipline models, simulate construction sequencing and timelines, and produce high quality visualizations.

**THE AUTODESK SOLUTIONS THAT MAKE IT HAPPEN**

**DESIGN**



**Civil 3D®**

For designing and modeling roads the way an engineer would.

*Use Case:*

*Corridor alignments, profiles, cross sections, site grading, drainage, and plan production*



**Revit®**

Detailed design of civil structures (bridges and tunnels) and building management with powerful tools for BIM.

*Use Case:*

*Building facility, terminal expansion, terminal reconfiguration, and multi-modal transportation hubs*



**AutoCAD®**

Software for 2D and 3D CAD with a subscription that includes AutoCAD, specialized toolsets, and apps.

*Use Case:*

*Intelligence, mapping, sites, and lines*



PLAN > DESIGN > **BUILD AND MAINTAIN**

**Innovators paving the way in road and highway construction need best-in-class solutions to connect teams, workflows, and data.** A robust network of professionals and firms can use powerful predictive analytics in Autodesk Construction Cloud to help transportation construction thrive.

**01. BUILD WITH INTERDISCIPLINARY COORDINATION**

A shared model gives designers, owners, and contractors a central place to work through the tradeoffs that impact design constructability and costs. Owners stay engaged in the process through the shared model, and contractors can use the model to create an informed bid while minimizing cost surprises. Construction sequencing can help team members discuss and walk through various approaches to design construction. With more efficient coordination, compromises can be worked out prior to pouring any concrete.

**02. ENABLE CONNECTED CONSTRUCTION**

Cloud-enabled solutions help support data management and design collaboration across multiple stakeholders. This improves delivery on your project design objectives and outcomes and mitigates the risks of cost and schedule overruns during construction. Collaboration in the cloud also allows your team to better predict the performance of yet-to-be-finished infrastructure assets and finalize detailed design and documentation in a collaborative and multidisciplinary manner.

**03. FACILITATE SEAMLESS HAND-OFFS WITH REDUCED ERRORS AND OMISSIONS**

Errors and omissions can cause expensive delays and rework in any infrastructure project. BIM tools and processes help you more effectively identify, inspect, and report on interferences in a 3D project model. BIM helps you to better anticipate potential problems with your project before construction and reduces risks of project cost and schedule overruns during construction.

**THE AUTODESK SOLUTIONS THAT MAKE IT HAPPEN**

**BUILD AND MAINTAIN**



**Navisworks®**

Navisworks Manage, Navisworks Simulate, and the Navisworks Freedom 3D viewer for 5D analysis, clash detection, design simulation, and project review.

*Use Case:*

*Scheduling with construction, running clash detection, maintenance of existing traffic within the airport*



**BIM 360™**

Connect and manage project teams and data to help remote teams reduce risk, improve quality, and deliver projects on time and budget.

*Use Case:*

*Check on progress, operations handover, and existing topography when connected to Civil 3D*



**Autodesk Construction Cloud™**

Easily bring design models and files into the field, ensuring the information created during the planning and design phases is leveraged during construction.

*Use Case:*

*Tools to harness the power of connected construction and improve construction handover as it relates to infrastructure offerings*



PLAN > DESIGN > **BUILD AND MAINTAIN**

**04. ASSET MANAGEMENT**

BIM models can drive efficiencies and cost savings for maintenance and asset management. These models store functional data that allows operators to simulate actual and future asset performance. Operators can work on real as-built models that help them focus on their tasks without unnecessary interrupts. This ensures accurate and up-to-date progress reports that inform decision making.

**05. MONITORING AND ENFORCEMENT**

BIM modeling powered by real-time data can improve monitoring and enforcement by giving operators accurate information about demand and performance.



# THE AUTODESK SOLUTIONS THAT MAKE IT HAPPEN

Autodesk Presents the Modern Stack

*Autodesk invests heavily in the infrastructure and construction software industries with a range of acquisitions and partnerships with the goal of extending the value of BIM to construction.*

## AEC Collection

Use powerful BIM and CAD workflows to create in new ways and build with confidence.



REVIT



CIVIL 3D



AUTOCAD



INFRAWORKS



NAVISWORKS  
MANAGE



RECAP PRO

## Autodesk Tools that Drive Cloud-Based Construction

Expand digital project delivery across the project lifecycle from the cloud.



## Business Partnerships

Ensure you have the data that meets your needs today and into the future.



GIS



CAPITAL PLANNING



ANALYSIS &  
SIMULATION



SOLUTIONS

SUPPORT FOR OPEN STANDARDS

*An International series of standards creates a level playing field for organizations and suppliers from around the world to compete, innovate, and collaborate—regardless of where those companies are located.*

Autodesk BIM 360 helps companies meet ISO 19650, an international standard for managing information over the whole life cycle of a built asset using BIM. It contains all of the same principles and expectations of Level 2 BIM as set out within the UK PAS 1192 standards and enables teams from around the world to minimize wasteful activities and increase predictability around cost and time through a common approach to information and data management.

As a result of ISO 19650, we are increasingly seeing delivery teams made up of organizations from different countries with different cultures and different ways of working coming together. The ISO has helped these teams adopt a simplified and common approach to managing information.

AUTODESK SOFTWARE	buildingSMART	LANDxml.org	CityGML
INFRAWORKS	IFC 4.1	LandXML 1.2	CityGML 2
CIVIL 3D	IFC 4	LandXML 1.2	CityGML 2
REVIT	IFC 4.1 Alignment	LandXML 1.2 Surface	
MAP 3D			CityGML 2

VENDOR INTEROPERABILITY PARTNERSHIPS



## AUTODESK EMPOWERS A RESILIENT FUTURE

The world is changing, and the transportation industry has an opportunity to build a better future for everyone.

You can rise to the occasion by partnering with Autodesk to collect, prepare, integrate, and use data more effectively to design, build, maintain, and upgrade transportation infrastructure.

Only a modern toolset based on BIM principles allows engineers and designers to collaborate across a shared design model that facilitates coordination across multiple locations and disciplines for better project delivery.

Having the ability to design, build, and operate virtually from a central location before construction begins can greatly reduce risk, ensure accuracy, and lead to less rework across the project lifecycle.

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[\*Contact us today\*](#) to learn how Autodesk can help you build the infrastructure of the future.

