TRANSPORTATION

A guide to California's transformation to BIM

Workflows that support CALTRANS projects

AUTODESK

Get started >

Introduction

Bring innovation into your Caltrans projects

The infrastructure industry desperately needs to close the gap between funding and demand: it's currently estimated to be the delta between the $3.7T annual demand and current spending levels of $2.5T, leaving that $1.2T gap you hear about on the evening news. In the recent past, the best way to address this was to find ways to be more efficient on projects. But, the question can no longer just be: "Are we building infrastructure right, or in the most cost-effective way". Instead, we must also consider if we are making the right infrastructure decisions – ones that have the greatest impact on social and economic factors, as well as ones that will meet the future infrastructure need. Innovation on civil projects is the next frontier, and Federal and State partnerships have formed through Every Day Counts and other programs such as the "Smart Cities" initiative. Programs like these seek innovation to support improvement in infrastructure.

If you think the how you design and deliver highway projects is 'good enough', you can stop reading now. But if you believe technological innovation is one path to improved productivity – as studies indicate – then this letter is for you.

The construction industry has begun implementation of new workflows to capitalize on these improved efficiencies which is helping to minimize risk, improve schedules, and maximize profits. This is great if you are in the construction industry, not so great if your focus is in the design phase. Maintaining the status quo–focusing on traditional methods of project delivery and maintaining focus on a 2D deliverable–is no longer enough to position you for success in this digital evolution. Your industry relevance in the design phase could be at risk if you continue to let other phases of the project move ahead with BIM-centric workflows while recognizing the benefits BIM brings. If you want to assure your place in the evolution, it's time to bring innovation into your projects.

Here are a few ways that BIM plays a role in this innovation: anytime, anywhere collaboration; seamless data flow across the lifecycle; and insights from connected physical & digital assets. To reap the full benefits of a truly connected BIM process, you need to implement these procedures across the entire lifecycle – relegating a process change to any one phase of the job will not reach the savings the industry must recognize. This is where you can be a leader on your project, within your department or company, or with your client and ultimately the industry. Who will be seen as innovators? Those who invest first and take advantage of the productivity gains that come from BIM workflows.

Why should you change now?

You have already taken the first step: AutoCAD Civil 3D enables a BIM process for the detailed design and documentation of your projects. Now you need to expand your BIM experience to begin enabling a cloud connection to your processes. Here you will leverage the power of the cloud to enable reality capture tools to build project context, connect simulation and analytics to your design models, and improve collaboration by sharing design intent and models across the lifecycle. So, why not take this opportunity to explore solutions that help you move beyond traditional CAD to more integrated and cloud connected workflows.

Get started on the right foot and take advantage of all of the content Caltrans provides for working with AutoCAD Civil 3D. State kits are available here.

Take the next steps: *Get familiar with the value of BIM in this ebook. Learn about the potential benefits throughout the project workflow - from planning and preliminary engineering to detailed design and virtual construction.*

A guide to California's transformation to BIM

- Business Owners & Executives
- Project Managers
- Civil Engineers & Designers

Business Owners & Executives

Managing profitability

Challenge

Running your business efficiently has direct impact on your profitability. Do increasing project complexities and financial pressures have you wondering how you can improve your firm's cost-effectiveness? Have you considered that some inefficiency occurs because your projects are still being managed on paper or with 2D processes? How can your firm continue to deliver high quality projects and improve your chances of being profitable?

Solution

Enhance your ability to manage profitability by implementing a Building Information Modeling (BIM) approach on your infrastructure projects.

- Help reduce the risk of costly conflicts using workflows that allow exploration of design concepts in a real-world contextual environment.
- Use intelligent models and information from start to finish, so project teams can better predict costs throughout the project lifecycle.
- Optimize delivery and increase the quality of complex transportation infrastructure projects.

Autodesk combines leading industry expertise with a track record of streamlining workflows through the interoperability and intelligence of BIM. BIM helps transportation project teams anticipate problems, assess options and ultimately act more confidently from start to finish.

There are distinct advantages to a BIM approach over traditional practice. The level of advantage is the ability to streamline workflows by having all players adopting a model-centric workflow. Better business results plays a role in the decision to move to BIM.

Learn more on managing profitability >

Business Owners & Executives

Minimizing business risk

Challenge

Minimizing safety, environmental and other performance risks associated with projects is essential if you want to grow your business. Poor performance on projects your firm delivers could cause delays, budget overages and client dissatisfaction, putting your reputation, and ultimately the health of your business, on the line.

Solution

Give your project teams the ability to explore design concepts in a real-world, contextual environment, allowing stakeholders to envision and understand implications and impacts of different alternatives. Teams can more quickly iterate through different options in order to determine the optimal solution, helping to increase quality. Intelligent models help foster stakeholder collaboration and improved communication, helping to minimize business risk.

- Support the reduction in cost of borrowing and insurance with the ability to view projects in context from start to finish. Project teams can better identify risks and challenges.
- More effectively collaborate with internal teams, 3rd party contractors, and the client across the lifecycle to identify safety, environmental, operability and constructability issues much sooner.

Sharing consolidated design models with contractors and subcontractors early helps you share the responsibility and rewards of more-streamlined design processes. Design transparency allows for close review and discovery of issues before work happens and shared models provide a new level of communication and collaboration that is very different from prior practices.

WSP helps collaborate with all stakeholders to mitigate business risk.
Watch video >

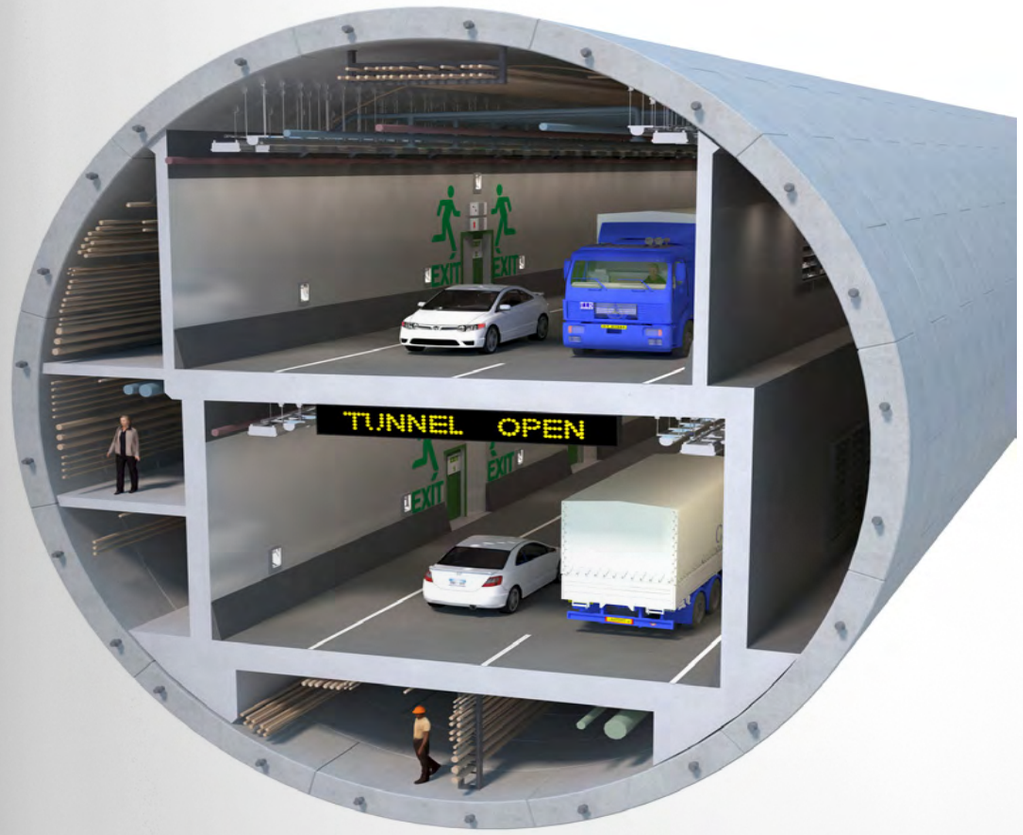

Image courtesy of WSP

Business Owners & Executives

Business expansion

Challenge

Expanding your service offerings is a great way to grow your business. Maybe you envision your company expanding its services beyond design or by adding specialized analysis services. Maybe you want to offer visualization services to your clients, or perhaps offer services to complete projects all the way from planning to construction. To win work with new and expanded services, you need to demonstrate you're capable of tackling the most complex jobs, coordinating with other contractors and engineering firms and differentiating your value to the client.

Image courtesy of Dawn Digital

Solution

Autodesk combines leading industry expertise with a track record of streamlining workflows through the interoperability and intelligence of BIM. The Autodesk solution can help you expand your services by:

- Providing the technology and services needed to implement BIM processes for any-sized project and to any infrastructure project phase.
- Offering unique conceptual and preliminary design tools that enable you to provide more value to design projects you've already won, demonstrating your ability to do more than traditional detailed design tasks.
- Delivering powerful visualization capabilities which are integrated with the design process and don't require specialized training.
- Extending the value of the project model with powerful, specialized analytics capabilities that are connected to the bigger design workflow.
- Work in a more collaborative environment to ensure you are providing the right information to the right person at the right time - clients, contractors and other engineering firms.

Consider BIM as an opportunity to navigate shifts in the industry and competitive landscape, to outperform rivals through more adept project coordination and schedule flexibility, and to spawn business opportunities such as new service offerings. Learn more about advancing technology and the role it can play in road and highway design.

Read these articles:

Designing transportation systems of the future >

Cure for aging roads and bridges >

Business Owners & Executives

Maintaining competitive advantage

Challenge

Are you missing out on business you want? Maybe the effort to win a project is so large that you cannot take resources off billable projects on the chance that you might win. What can you do to make your company more attractive both to existing customers and to new prospects? How do you win over competing engineering firms? How do you brand your company as an industry leader and innovator?

Image courtesy of Heijmans, Breijn, Volker Infradesign, and Geonius- The Netherlands

Solution

Provide valuable differentiation through better business processes and more streamlined project delivery. Using Autodesk Transportation solutions that enable BIM, you can show clients that you can relate to them in ways that most engineering firms cannot. BIM is much more than a productivity tool. It is a critical business strategy for gaining a competitive advantage that will allow you to differentiate your services from competitors. BIM can help your firm to take on larger, more complex infrastructure projects.

- Define a business strategy that incorporates BIM and the value that your project workflows will provide to your clients.
- Model proposed approaches to projects during the marketing phase to demonstrate your BIM prowess at the same time you impress your clients with your understanding of the unique aspects of projects.
- Build better client relationships because you improve how you communicate the most complex details in ways that are easier to consume.
- Adopting BIM workflow methodologies has been proven to improve visualization, enable faster design reviews, enhance coordination, ensure better constructability and increase collaboration, all which can improve your company's reputation and profile.

Beyond project delivery, see how making BIM a strategy can change a company's mindset, relationships, and competitive advantage.

Read ebook: Think beyond today >

Business Owners & Executives

Attracting talent

Challenge

Delivery of quality work requires a skilled workforce. Are the best and brightest engineering graduates choosing to work for your firm? After hiring, what are you doing to retain your most qualified engineering professionals? Are you losing talented people to companies that are innovating with intelligent modeling and 3D technologies?

Solution

Autodesk developed BIM and established its role as the cornerstone and future of optimized project delivery. Adopting BIM for Infrastructure as your standard business process will help create a forward-thinking workplace that can keep your employees motivated and challenged—as well as provide processes for continued knowledge management and training.

- Inspire innovation using the latest technologies and methodologies.
- Offer interesting opportunities where employees can grow and develop in their jobs.
- Take advantage of the number of Autodesk-trained graduates entering the workforce to help your firm transition or continue to enhance BIM workflows.

In organizations that implement BIM processes, new roles are defined that are attractive to tech-savvy generations. How will you will attract and retain the talent you need to compete? See how one firm addresses BIM as a discipline to shift the mindset in the organization.

Read the Redshift article >

Project Managers

Winning projects

Challenge

The competitive landscape in the transportation industry is rapidly evolving. While projects are becoming more complex customers tend to expect more even in proposal selection. To stay ahead, firms must demonstrate that they are able to tackle even the most complex jobs with capabilities that separate them from the competition.

Image courtesy of American Structurepoint

Image courtesy of American Structurepoint

Solution

Autodesk Transportation Solutions enable a BIM process to deliver innovative, higher quality proposals on any size project and gain a competitive advantage. Respond to Requests for Proposal and presentation requests with results that showcase your vision of a project, but with less investment in time and resources.

- Share project proposals using near real-world visualization.
- More easily present clients with design options in context of existing conditions.
- Create interactive simulations and visualizations, and make changes on-the-fly during client meetings.

More companies are finding success by making BIM a part of the strategy to win projects.

Watch video: Cole Engineering uses BIM as winning strategy >

Read these articles:

KFW Engineers & Surveying communicates to win >

Clearing hurdles of BIM implementation at a 30-office civil consulting firm >

Project Managers

Meeting project schedule & budget

Challenge

As the complexity of projects increase, you may find that you spend a lot of time worrying about schedule and budget and less on exploring the optimal designs. And more traditional workflows have disconnections across planning, analysis, and preliminary and detailed design. Teams work in silos – especially those in different discipline areas. In addition, when working with 2D design files and printed documents it is sometimes difficult to communicate with non-technical stakeholders. Any of these challenges can lead to changes at a point in the project where it is most costly and time consuming. You need your teams working smarter and faster, collaborating across disciplines and delivering content that is easier for clients to understand and approve.

Solution

Civil engineering project managers credit Autodesk Transportation solutions as critical for keeping projects on time and on budget. Our solutions give you new ways of working that provide the results you need in the time you need them. With the ability to better predict project outcomes – making informed changes to designs much earlier in the process – you can protect schedules and budgets.

Help make managing projects less challenging for your firm.

- Manage scope changes more efficiently, and improve design decisions throughout the project lifecycle.
- Improve team and client collaboration.
- Manage project documentation and models more effectively.

Image courtesy of COWI

Civil engineering firms save time and money using BIM workflows to anticipate, assess and act more confidently from start to finish.

Want to better understand how to keep projects on track? **Watch the video >**

Project Managers

Minimizing project risk

Challenge

Do you feel confident that you have minimized project risk as you sign off on each design project? Design errors and omissions, environmental commitments, public safety and operational performance – all can lead to considerable project delays, budget overages, unsatisfied clients and a dissatisfied public.

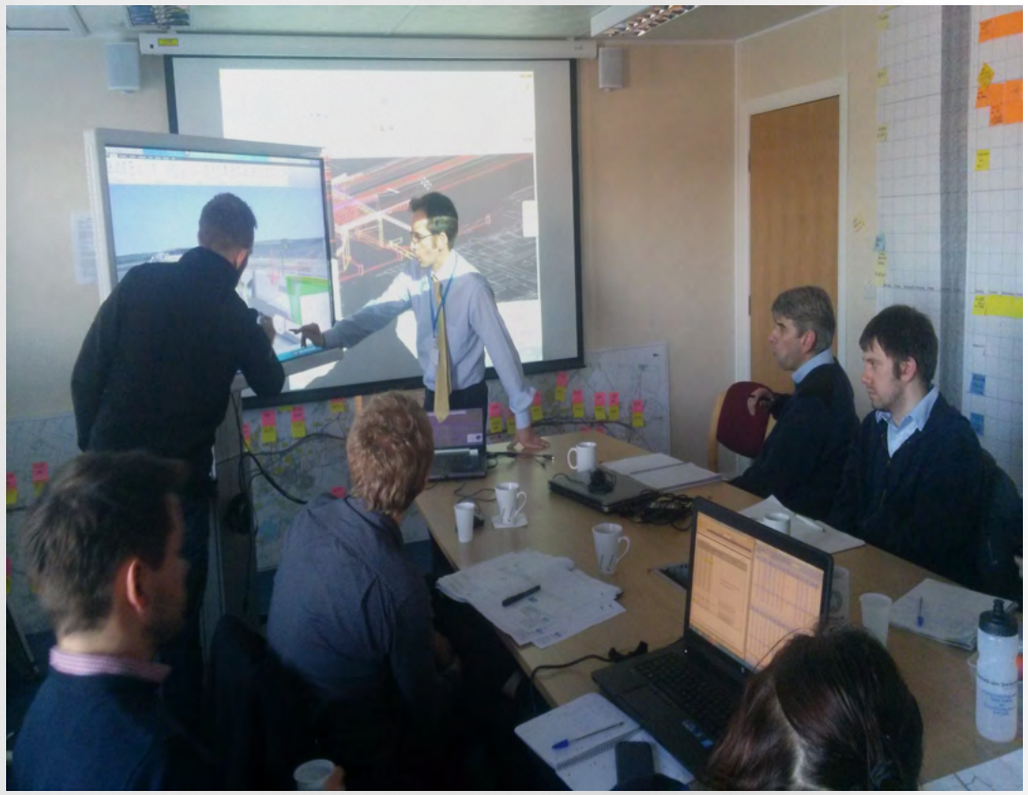

Image courtesy of Grontmj

Solution

Autodesk Transportation Solutions can help minimize risk of projects failing by giving you the tools that help you improve predictability, allowing you to virtually build the job during the design process to help you minimize this risk.

- Better predict how facilities will perform (size of vehicles, traffic analysis, drainage).
- Help your teams improve design quality (proper geometrics, site lines, minimize road side obstructions) to support operational performance and public safety.
- Combine interdisciplinary components of the design (roads, bridges, tunnels, earthworks) for review to find clashes virtually.
- Use intelligent models as real-world business plans to foster project confidence and to make certain you are meeting your environmental commitments.

In organizations that implement BIM processes, new ways to collaborate emerge allowing teams to address project scope issues more quickly by using tools that help communicate and collaborate complex design information in the simplest ways.

Read the Redshift article >

Project Managers

Client satisfaction

Challenge

Client satisfaction is directly related to project performance. You need to consider that you are evaluating the most optimal designs, responsive to client needs, and collaborating effectively with all stakeholders throughout the project lifecycle – all while maintaining transparency to the appropriate stakeholders. And you must do this while you are maintaining an agreed upon budget and schedule. It is a constant communication and management of expectations. Any issue can hurt your reputation and your ability to win the next job—not only with that client but potentially others.

Image courtesy of WSP

Image courtesy of David Evans and Associates

Solution

Autodesk Transportation solutions help you establish and maintain a track record of proven performance through outstanding execution and high-quality project outcomes.

- Use modeling and visualization much earlier in the preliminary design phases to present options or design progress to both technical and non-technical stakeholders to help make better decisions about designs much earlier.
- Improve communication and transparency to help accelerate stakeholder approvals using visualization to demonstrate progress through project completion.
- Deliver to client's expectations for documentation and models (2D, 3D and 4D).

David Evans and Associates uses new ways to visualize and communicate much earlier in the design process to improve communications and help minimize potentially costly changes later in projects.

Read more >

Civil Engineers & Designers

Establishing required existing conditions

Challenge

Complex field conditions can present challenges as you try to accurately representing existing conditions during civil infrastructure project development. To help plan and design transportation projects, a broad collection of data must be accessible and usable. Are you challenged with aggregating this information and ensuring it is fit for the intended purpose? Without the tools to accelerate data processing and a planning and design workflows that can run parallel to collection activities, time and money can be lost waiting until there is a complete view of existing conditions.

Solution

More easily access and aggregate data from a wide range of sources and use it to create more accurate and intelligent existing conditions models for projects. Import and process data from a wider variety of sources, faster than before, with less time spent reworking and reprocessing. With the ability to aggregate existing conditions data from various readily available sources, field crews can be better equipped before leaving the office.

- Support planning, design, and management workflows using aggregated data throughout the project.
- Aggregate CAD, GIS, terrain, raster, LIDAR, and more, into a highly accurate 3D in context model using real-world coordinate systems.
- Improve data quality using automated tools, such as drawing cleanup and data classification.
- Spend fewer man hours reworking data with more intelligent data capture and the ability to collect and process data simultaneously.

Image courtesy of COWI

See how you can create, refine and communicate existing conditions to support stakeholder review and approval.

Watch existing conditions videos and read article >

Civil Engineers & Designers

Optimizing designs

Design changes happen every day. Whether it is new survey data, design alternatives, or changes in project scope, every adjustment leads to a trickle down of additional changes. Project engineers spend extra time updating all the affected project components, including time-consuming documentation updates and manual validation of designs. More often than not projects are completed by virtual teams and outsourced third parties. This means that communication of changes is critical.

Add to this the onslaught of advancing technology disrupting project work. From drones to LiDAR to cloud based services - technology advancement is rapid and it is going to get increasingly more difficult to ignore this if you want to compete for roads and highways work. But can advancing technology – although disruptive in some ways –help improve the productivity, efficiency and accuracy of your projects? The short answer is 'yes'.

Image courtesy of Kelprojektas

- Design in a real-world context. Traditionally, some design decisions were difficult to make until in detailed design process. Now, there is an even greater level of decision-making, alternative review and analysis that you can perform in much earlier stages of the design – helping to make detailed design a more efficient process. See chapter on existing conditions.
- Improve decisions with analysis & simulation. From drainage and watershed analysis to optimizing intersections and roundabouts to traffic simulation, each decision made early improves design with minimal rework since data can move from preliminary design into detailed design phases.
- Dynamic design helps improve productivity and accuracy. Go through design iterations faster and more efficiently with intelligent modeling. The model dynamically updates to incorporate design changes, leading to fewer mistakes while helping you to more easily explore multiple options and arrive at the optimal solution in less time.

See how you can improve design optimization with this series of videos on dynamic design, roadway design, drainage design, bridge design and more.

Watch the design optimization videos >

It's time to move away from old ways of working. You still need CAD, but traditional workflows need a make-over. There is no better time than now to consider how BIM can help make more money for your company, giving you the ability to anticipate, access and act more confidently from start to finish. Here are five things you can do to move your teams into the 21st century.

Learn more >

Civil Engineers & Designers

Designing for constructability

Challenge

The complexities of infrastructure projects combined with a lack of real world context can lead to constructability issues that result in a greater risk of RFIs during construction. Traditional workflows do not give you a complete picture of your working situation. One cause of project overruns and overspends is encountering unforeseen ground conditions at the construction stage. When any design issue is found during construction, the result can be rework for you, construction delays, material waste and the potential for liquidated damages, overtime, or even contract penalties.

Image courtesy of Sundt Construction

Solution

Your ability to anticipate problems, access options and act on information is enhanced because workflows are powered by intelligent 3D models. Intelligent model-based design processes using tools that support cross-disciplinary collaboration give you the ability to see problems before heading out to the field and adjust the design in real-time. Help to improve the quality of the design by considering constructability issues before hand-off.

- Design in context to uncover and resolve issues virtually before breaking ground.
- Using quality geotechnical data management and modeling techniques together with a thorough site investigation will greatly aid your understanding of the site and should help reduce those costly unforeseen ground conditions.
- Improve predictability by collaborating across multi-disciplinary teams and consider all project components in a consolidated view. This will allow you to find potential clashes at any stage of the design process.
- Identify potential environmental, safety concerns or operational issues with the ability to bring together all types of information and perform analysis.
- Take into account critical dependencies to make better decisions about activity timelines before you hand off a design to construction.
- Go from plan to production in only a few simple steps. Whether it is plan only, profile only or plan and profile, the plan production tools help you to quickly create construction documents from drawings.

Improving the way you prepare for construction hand-off includes virtual construction, geotechnical considerations and improved documentation.

Watch these designing for constructability videos to explore project feasibility and prepare for project hand-off. **View now >**

Civil Engineers & Designers

Effective internal collaboration

Challenge

Collaborating with other members of your project team can be hampered by inefficient means of managing, storing and sharing project information. Multi-disciplinary teams who may also be located in multiple offices must effectively communicate project decisions and directions in order to be successful. Challenges arise when the various groups use different information, different data formats and different software to work on their specific component of the larger project. Communicating on design requirements or discussing design issues is more difficult because you aren't working from the same baseline.

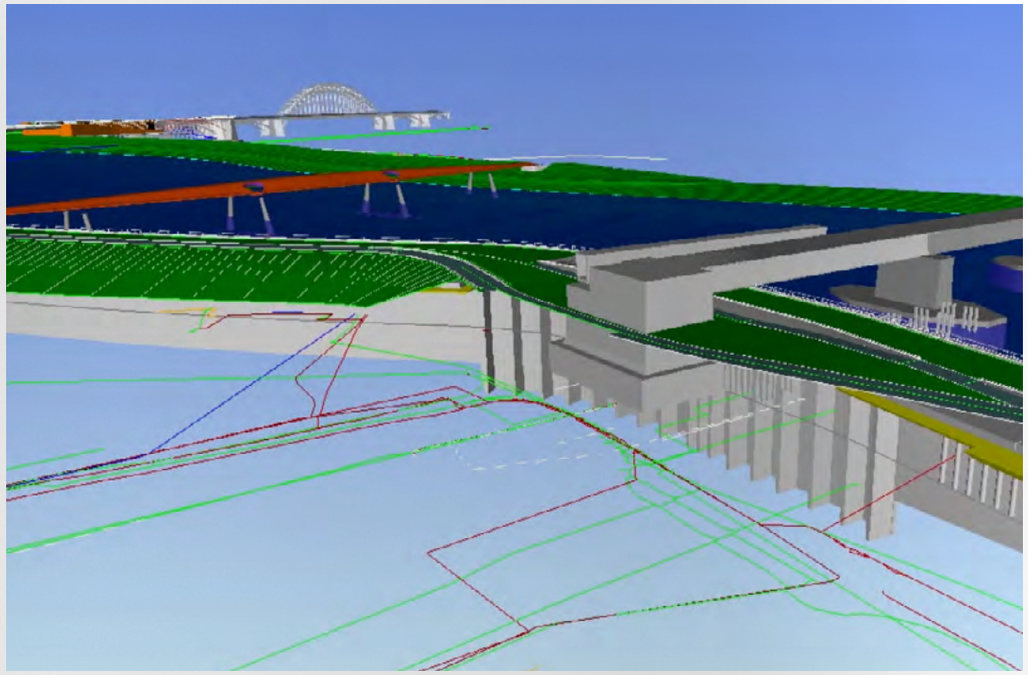

Image courtesy of iNFRANEA

Solution

Integrate project processes across the lifecycle to better manage civil infrastructure project information. Design teams can interact with and consume the same model information helping you improve how you collaborate and communicate across multiple disciplines and offices. Autodesk provides a solution with connected workflows which brings together different data types and formats in a more seamless way, allowing you to work from common information no matter where you are or what part of the project you are working on.

Automate, standardize, and track project processes to improve accessibility of all project information.

- Reuse preliminary design models of roads, bridges and drainage networks in the detailed design phase.
- Share data between various discipline specific design tools; or share design files with contractors in the file types they need.
- Consolidate project information for design reviews and collaboration.
- Consolidate designs to communicate with external and non-technical stakeholders.
- Improve workflows with active managed versioning.

Digital tools are driving volumes of data. Businesses and project teams are getting more distributed and complex. And firms are under pressure to be more productive and efficient. iNFRANEA brings together multiple disciplines and organizations on large projects in The Netherlands. **Read more >**

Watch the video and read the ebook for five things you need to know about project data management. **View now >**

Civil Engineers & Designers

Stakeholder communication

Challenge

Communicating technical information to non-technical stakeholders is required in order to quickly capture the necessary project approvals. Do you find that communicating project proposals and design intent to stakeholders is time-consuming and often disconnected from the design process itself? Do you struggle to convey project information to the reviewers using 2D design files, maps and other technical documentation?

Image courtesy of HNTB

Solution

Create compelling visuals directly from the project data at any stage in its development.

- More quickly and accurately layout, model and visualize civil engineering project proposals in the context of existing conditions.
- Better communicate project information to stakeholders and clients with near photorealistic renderings and animations of the design.
- Create compelling presentations with storytelling tools.
- Make necessary changes on the fly during the reviews that can be quickly incorporated back into design.

You can get the right information to the right person at the right time with tools that help you more easily communicate with all stakeholders in all stages of a project.

Watch the video on using 3D models to communicate and tell the story of a project. **View now >**

HNTB helps connect design to environmental and social requirements and creates visualizations to communicate the replacement of iconic bridge in LA.

Read more >