EVERY DAY COUNTS

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Many of you already know all about EDC and its history, but as a quick overview:

Every Day Counts is not about inventing the next "big thing". It's about taking effective, proven and market-ready technologies and getting them into widespread use. By advancing 21st century solutions, we can improve safety, reduce congestion and keep America moving and competitive.

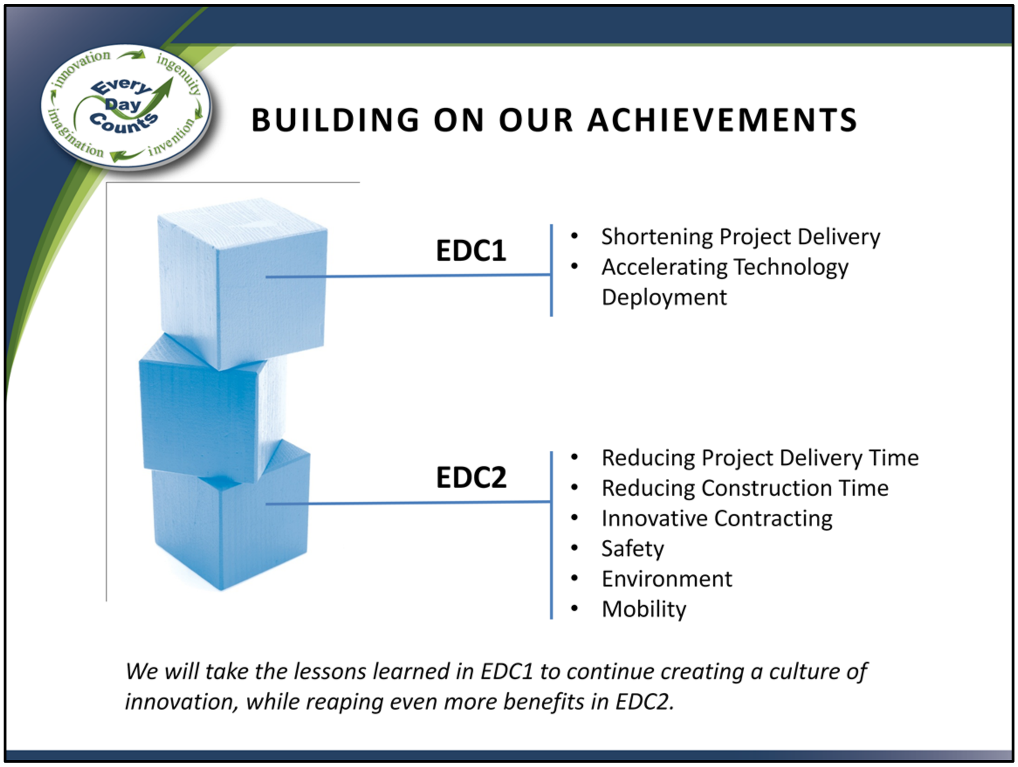
- Launched in October 2010
- Initiative is designed to:
    - identify and deploy innovation aimed at shortening project delivery
    - Enhance the safety of our roadways
    - Improve environmental sustainability
- Officially transitioning from the first phase of the program (EDC1) to EDC2 on December 31.
- 16 initiatives which we will discuss in the following slides

- Under EDC1, we had 16 initiatives. Some are technologies and some are methods for shortening project delivery.

EDC1 INITIATIVES

Accelerating Technology Deployment

- Safety Edge
- Warm Mix Asphalt
- Geosynthetic Reinforced Soil Integrated Bridge System
- Adaptive Signal Control
- Prefabricated Bridge Elements and Systems



As we transition from EDC1 to EDC2 on December 31st, the agency is expanding EDC1 to include more key areas such as safety, environment, mobility, which are key areas of interest for State, regional, and more local transportation agencies.

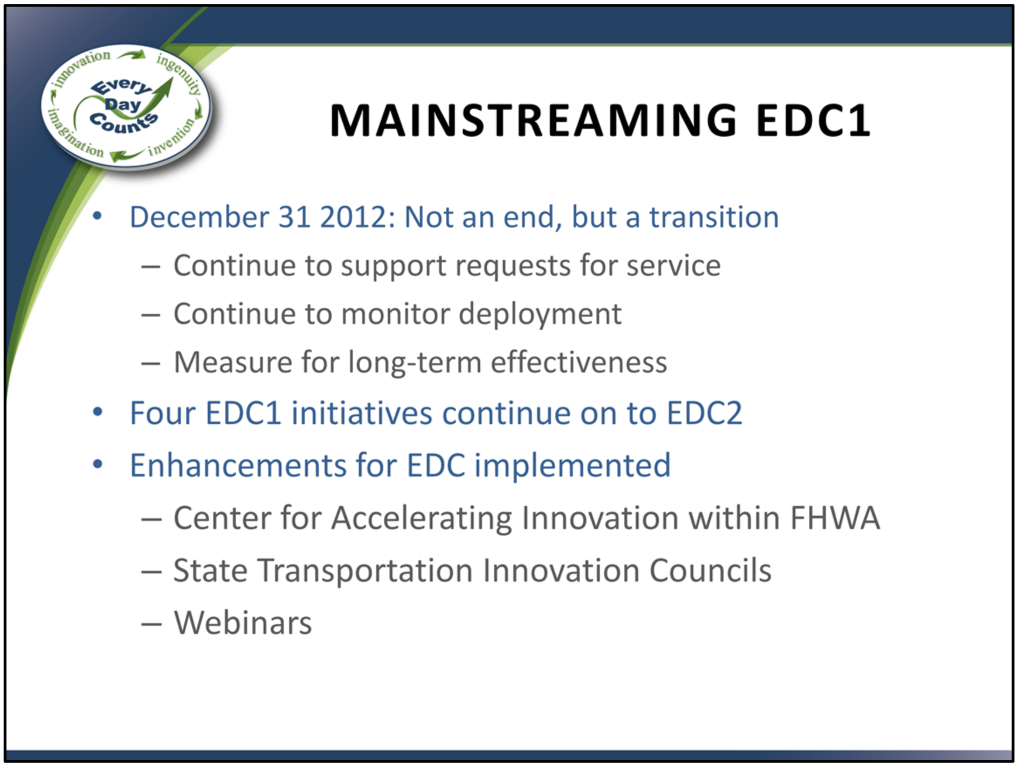
Lessons learned from EDC1:

Better communication strategies

- Distribute finding results and articulate the benefits of proposed technologies to a wider audience, including transportation, technology, engineering, and policy experts, as well as the general public.
- Conduct faster and more concise follow-through to share findings (both benefits and issues) with experts, as well as a wider audience.
- Follow-through includes senior transportation management at the USDOT, State and more local transportation agencies, private and public associations, and the general public.
- Means for communications could include e-mail, newsletters, websites, focus groups, and workshops and public speaking events.

Process

- Engage state and local transportation agencies, public and private associations, others in discussions to determine transportation/technology issues/needs – this could lead to creating a Public-Private Partnership of some sort…
- More clearly link selected EDC technologies to broader and longer term departmental policies, visions, and goals.
- Assist state and local transportation agencies in integrating new technologies into their programs by providing guidance and training support
- Seek input from early agencies/private sector that have deployed technologies and reassess EDC program based on input
- Assist deployment agencies by recommending funding/financing opportunities for integrating technologies into their decision-making processes



Transitioning the EDC One Initiatives

- Although at the end of this year – on December 31st, to be exact -- we will officially stop providing specific EDC support for several of the initial sixteen EDC initiatives, they will not shut down. Rather, they, too will transition:
    - We will continue to support requests for service regarding them through our Resource Center and headquarters offices, as appropriate.
    - We will continue to monitor their deployment
    - The individual Offices within FHWA that deal with the initiatives (the Office of Infrastructure, for example, with warm mix asphalt, and the Office of Safety with the Safety Edge) will be doing this monitoring
    - We'll also measure their long-term effectiveness… did they make a difference in terms of lives saved, congestion decreased, project delivery time shortened, money saved?
- Also, four of those original 16 initiatives will themselves transition to EDC2. There's more work to be done on them, and we're not yet ready to let them go.

Also, we've made some enhancements to the Every Day Counts effort:

- Established the Center for Accelerating Innovation within FHWA, including a staff to coordinate communication, develop training and education tools, to provide technical support and assistance and work with the various partners throughout the highway industry.
- Created the State Transportation Innovation Councils, as well as developed a webinar that will be offered this fall on steps to take to get innovations implemented successfully.

STATE TRANSPORTATION INNOVATION COUNCIL

T2CTT
Florida Transportation Technology Transfer Center

fice

Florida Transportation Builders' Assn. Inc. 1933

State of Florida Department of Transportation

MPOAC

Florida Association of County Engineers and Road Superintendents
FACERS

U.S. Department of Transportation
Federal Highway Administration

Florida Chapter APWA
American Public Works Association

EDC2: So if transitions are a way of going from the past to the future, let's take a look at those initiatives for EDC2:

There are 13 initiatives aligned to project objectives: Reducing Project Delivery Time, Reducing Construction Time, Innovative Contracting, Safety, Environment and Mobility

First: how did those 13 initiatives get selected?

- We sent the word out that we wanted to find those areas that really needed work and the solutions that were already working somewhere and could be applied nationally.
- Word was sent out to AASHTO member states, associations, the construction industry, and, of course, among our own staff at FHWA.
- We received more than 200 ideas, eventually whittled down to 13.

The total 13 are aligned to project objectives: Reducing Project Delivery Time, Reducing Construction Time, Innovative Contracting, Safety, Environment and Mobility

- Programmatic Agreements II
- Design Build and CM/GC
- Accelerated Bridge Construction, which includes GRS-IBS, as well as Slide-in Bridge Construction and some other techniques
- Prefabricated Bridge Elements and Systems
- Locally-Administered Federal Aid Projects
- Three-Dimensional Modeling
- Intelligent Compaction
- Alternative Technical Concepts
- High Friction Surfaces
- Intersection and Interchange Geometrics
- Geospatial Data Collaboration
- Implementing Quality Environmental Documentation
- National Traffic Incident Management Training (a SHRP2 initiative)

The Local Agency Program Community of Practice (LAP CoP) group is facilitated by the LAP Project Review Section. This group of 28 individuals statewide reviews technical issues applicable to the LAP processes and procedures.

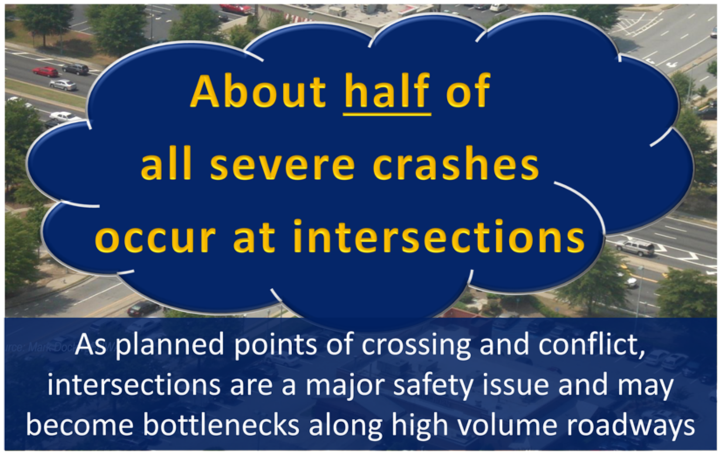

Every Day Counts
innovation ingenuity invention imagination
IMPROVING PERFORMANCE
SAFETY
ENVIRONMENT
MOBILITY
• High Friction Surfaces
• Intersection and Interchange Geometrics
• Level of NEPA Documentation and Quality
• First Responders Training (SHRPII)

The aggregate topping shall be a bauxite consisting of a 1-3mm gradation.
two part cold applied modified exothermic epoxy resin binder

Hand mixed- 20-30 sf/gal aggregate 13 lbs/sy
Use only lightweight roller
Approximately 2 hour cure

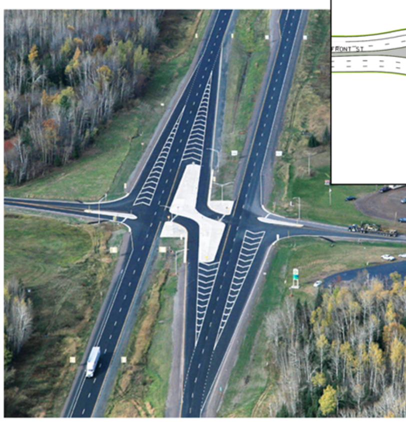
The Tyregrip system was installed on a 300-foot section of the ramp, just upstream of the gore
area on I-75
Slight decrease 2-4 mph

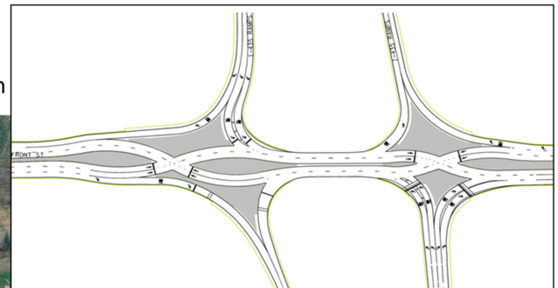
INTERSECTION/INTERCHANGES



INTERSECTION/INTERCHANGES

Restricted Crossing U-Turn



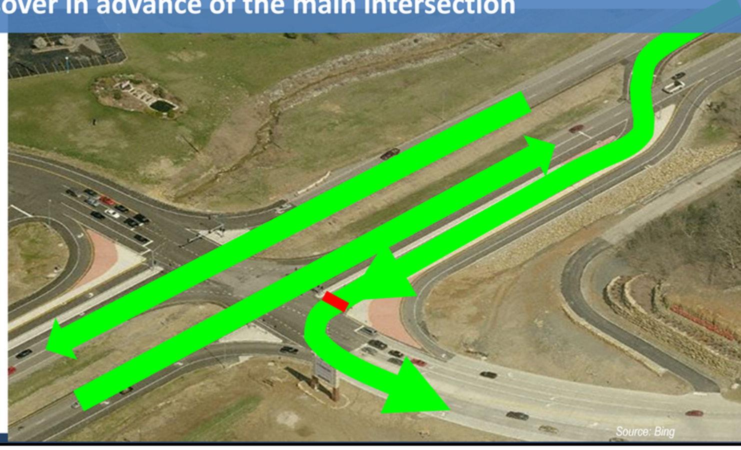


Diverging Diamond Interchange

Displaced Left Turn (DLT) Intersection

Distinguishing Feature:

Left-turn movement (on one or more approaches) strategically relocated to the far-side of the opposing roadway via interconnected signalized crossover in advance of the main intersection



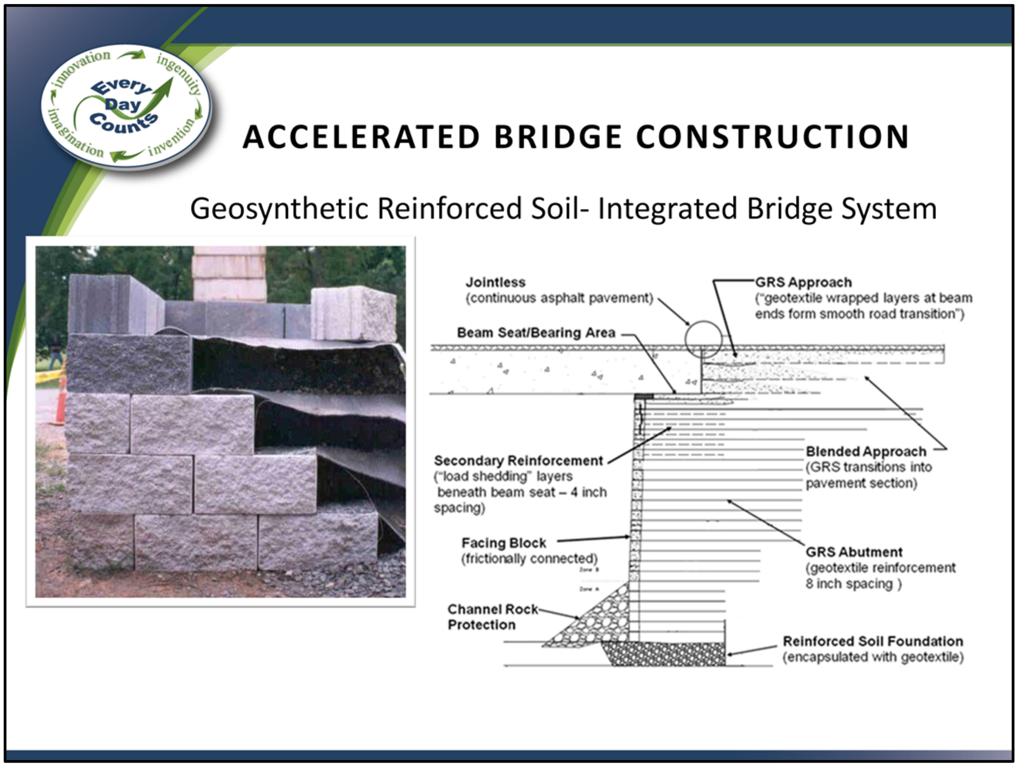
REDUCING CONSTRUCTION TIME

3D Modeling for Construction Means and Methods

Accelerated Bridge Construction

- Geosynthetic Reinforced Soil (GRS) Integrated Bridge Systems (IBS)
- Prefabricated Bridge Elements and Systems
- Slide-in Bridge Construction

Intelligent Compaction



Single span bridges which are not at risk of movement due to sliding, uplift, etc., and 2. Sites where excessive scour or settlements are not anticipated.

Utilize a Reinforced Soil Foundation (RSF) in lieu of the concrete leveling course utilized for MSE walls

Single span bridges which are not at risk of movement due to sliding, uplift, etc., and 2. Sites where excessive scour or settlements are not anticipated.

Utilize a Reinforced Soil Foundation (RSF) in lieu of the concrete leveling course utilized for MSE walls

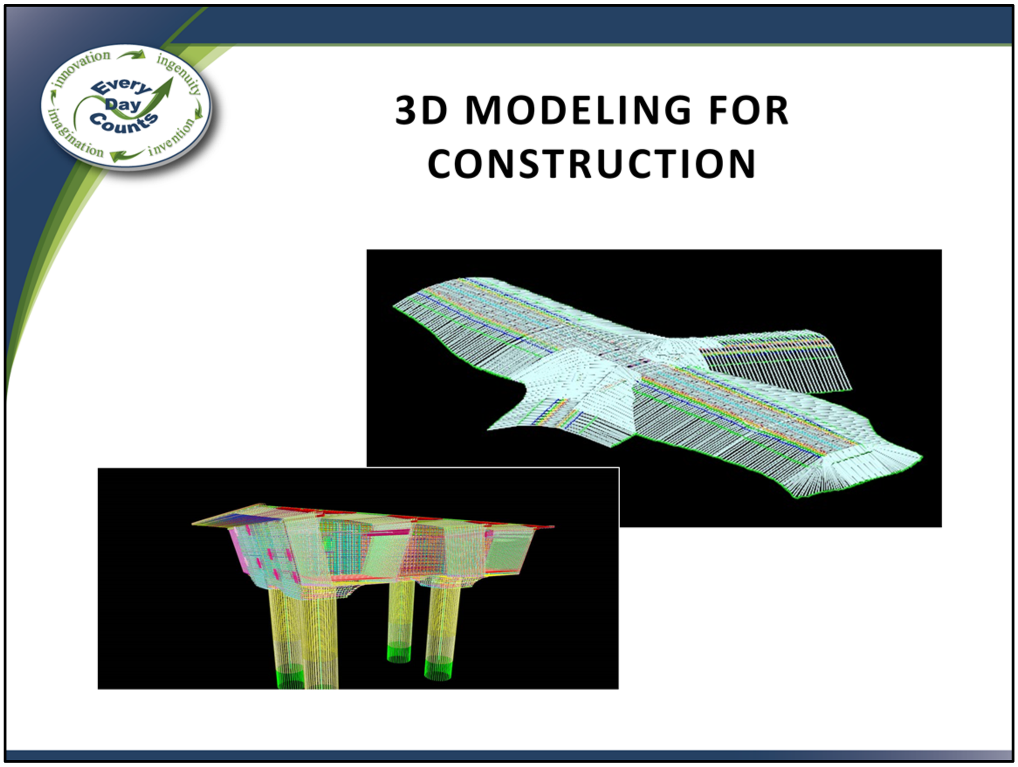
Benefits: non-specialized labor, simple machinery, speed of construction, bump elimination

Why the red block?

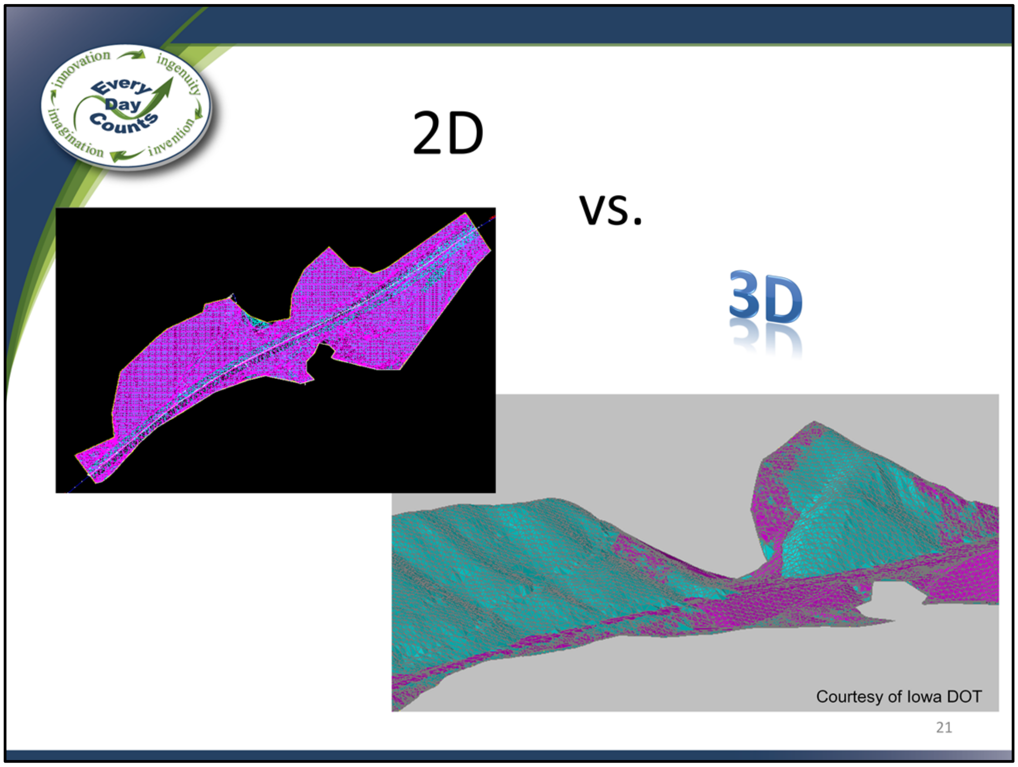
ACCELERATED BRIDGE CONSTRUCTION

Geosynthetic Reinforced Soil- Escambia County

1) Good compaction (95% of maximum dry unit weight) of high quality granular fill
2) Closely spaced layers of reinforcement



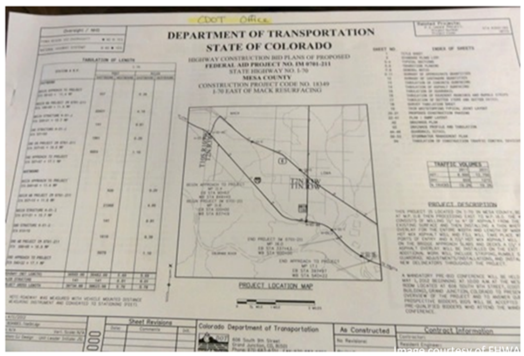
Bridge box girder with steel reinforcing



This is another 3D model. The top picture is a plan view while the bottom picture is a perspective view. If you look carefully at the perspective view, you may notice the figure is composed of small triangles. Each of these triangles represents a small plane. Together the triangles create a surface called a 'triangular, irregular network" (TIN) which conforms closely, but not perfectly, to the actual proposed surface. In making a model, a person develops a mathematical or physical entity that approximates a real situation sufficiently close

BENEFITS

- Better understand the design and locate possible conflicts and/or errors in the design
- Improves communication between the owner, consultant, contractor, prefabricators, and materials suppliers



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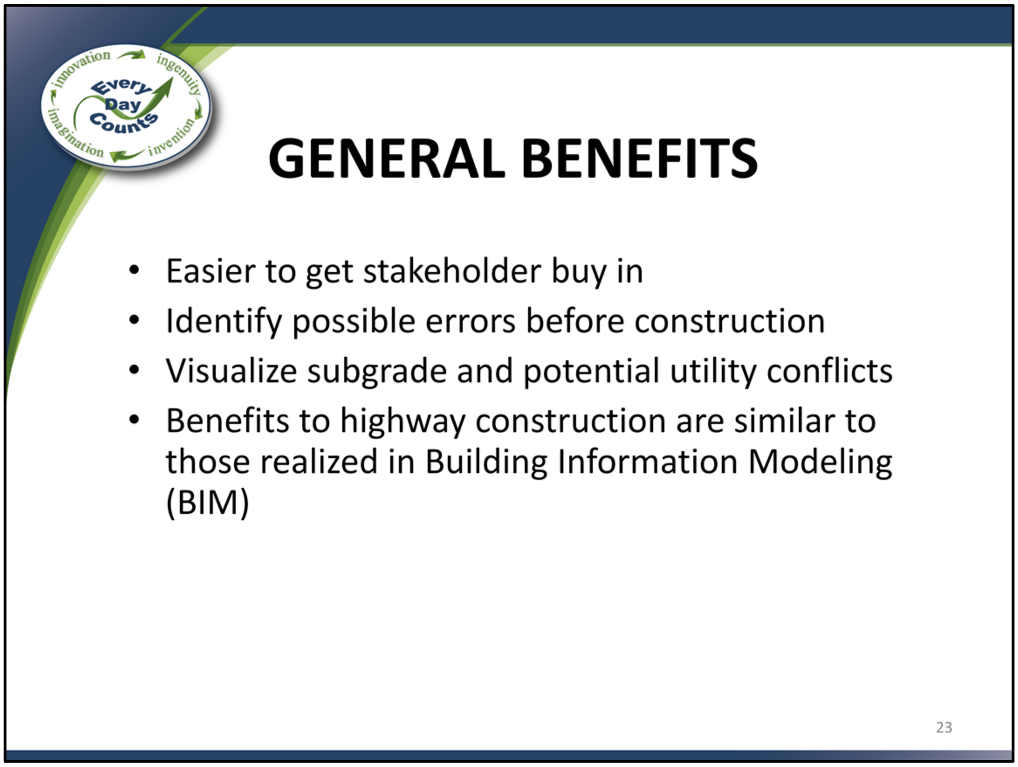
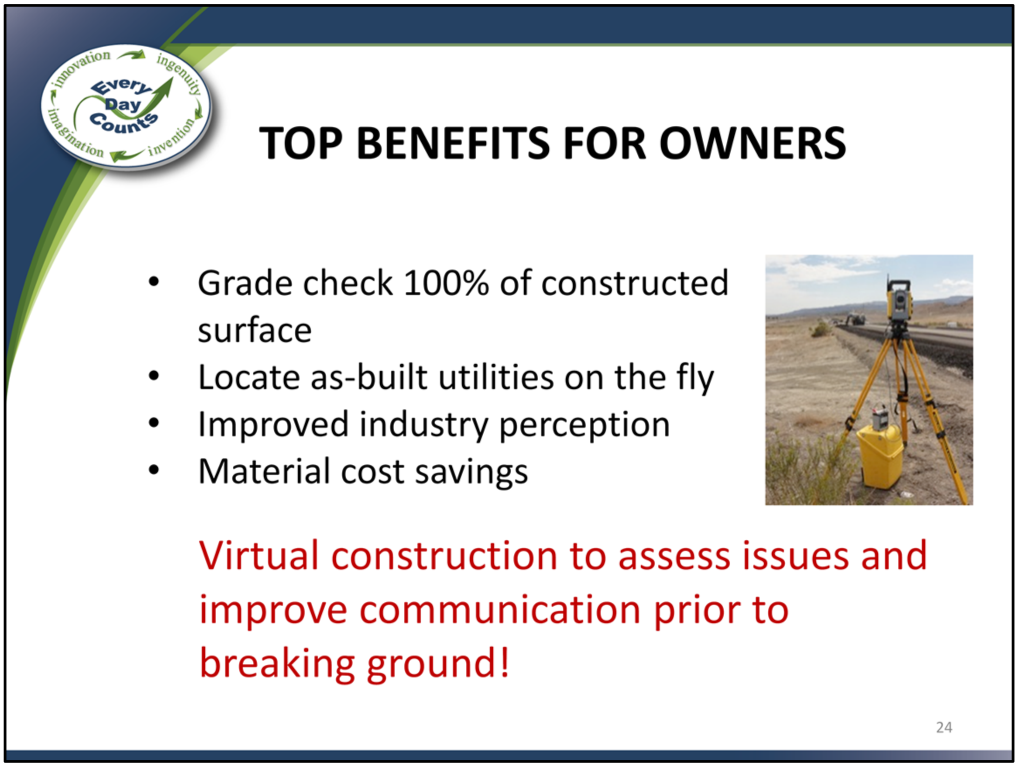
Working in 3D, models are more intuitive and can be used for various functions. One benefit of the 3D model is better communication across a variety of stakeholders, including designers, construction engineers, contractors, and the public.



Some general benefits of 3D engineered models include:

-Stakeholder buy in on the project and key elements.
-Streamlining of information flow, paperless, stakeless construction.
-Contractors are in the process of adopting the technology. The highway industry sees benefits of use, including early problem identification such as utility conflicts.
-Benefits are similar to those previously realized in Building Information Modeling (BIM) such as clash detection.



There are several benefits to project owners such as a State DOT. For example, instead of having cross sections every 50 feet, there are surfaces you can grade check against continuously and fairly close to built utilities. 3D models also improve industry perception by having a more detailed representation of the constructed facility. Additionally, the more accurate contractors are, the less potential for overruns on the project. For example, base materials under the pavement may be six inches thick. Contractors may put in an extra inch because of concerns with penalties for making it too thin. This represents almost 20% extra material over a large area that may result in many additional square yards. There are savings associated with reducing the amount of material a half an inch will still meeting the specification. 3D models allow for communication on such challenges before breaking ground.

TOP BENEFITS FOR CONTRACTORS

- Save labor of setting string line (paving) or stakes (grading)
- Stringless paving may limit need for traffic closures
- Increased productivity
- Increased efficiency
- Reduced labor costs

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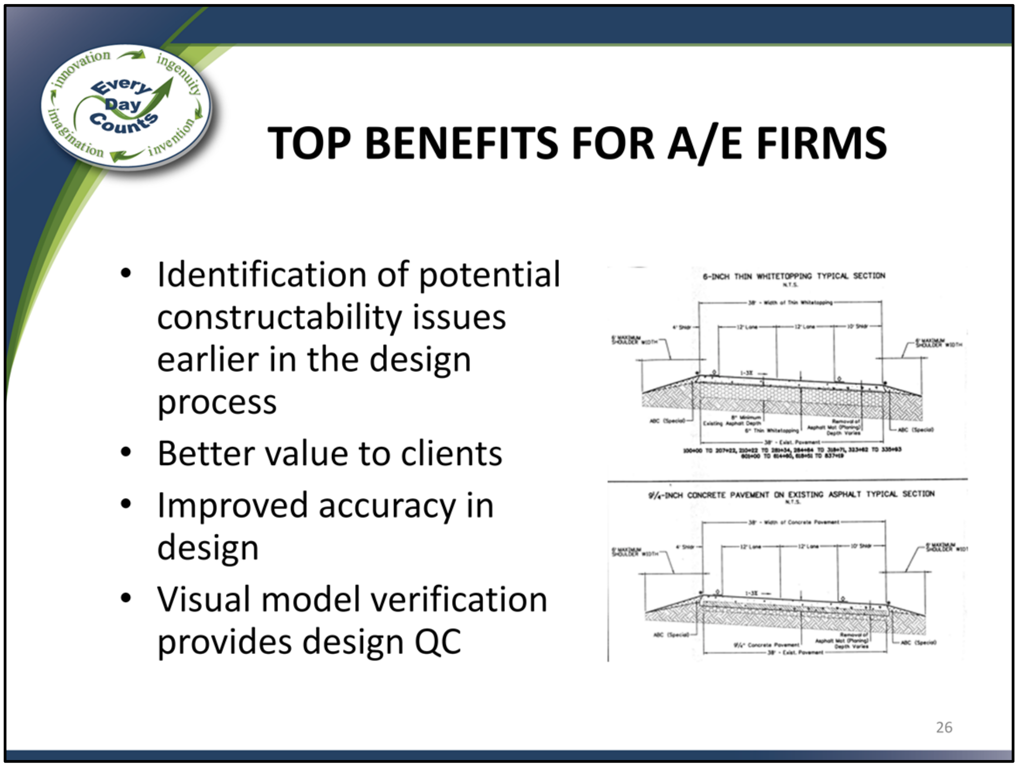
Contractors have benefits as well. Using a 3D model, they can grade and pave without stakes and string lines. These field applications increase productivity and efficiency and save on labor costs. Contracting labor cost is a large cost and provides some risk in the project for cost overruns. Efficiencies in the project can help reduce risk ultimately providing a benefit for the contractor.



Architectural and Engineering (AE) firms also have benefits from using 3D models. Constructability issues can be seen in 3D before the contractor mobilizes the equipment. If design changes are needed, they can be accomplished earlier in the process and prior to construction, minimizing change orders and lower risk for all involved. Quality control also occurs earlier in that the 3D models represents the facility in an enhanced form over traditional 2D models.

CHALLENGES TO IMPLEMENTATION

- Time investment from 2D to 3D
- Project selection – what characteristics to look for
- Coordination across key stakeholders (contractor, owner, designers, suppliers, etc.)

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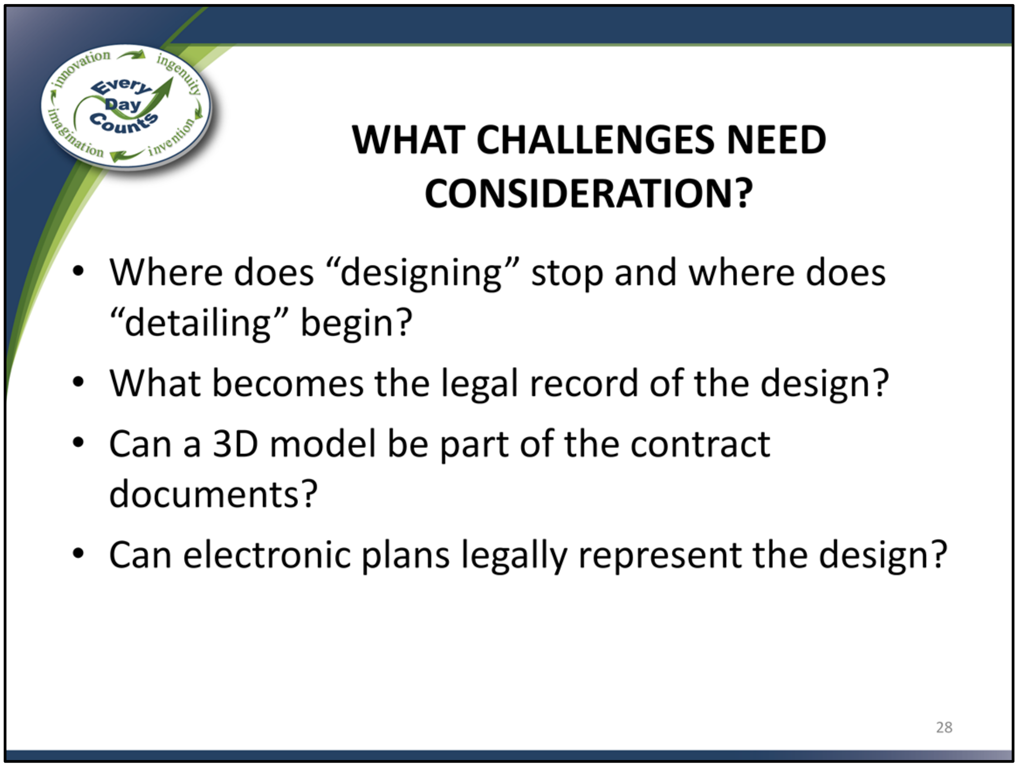
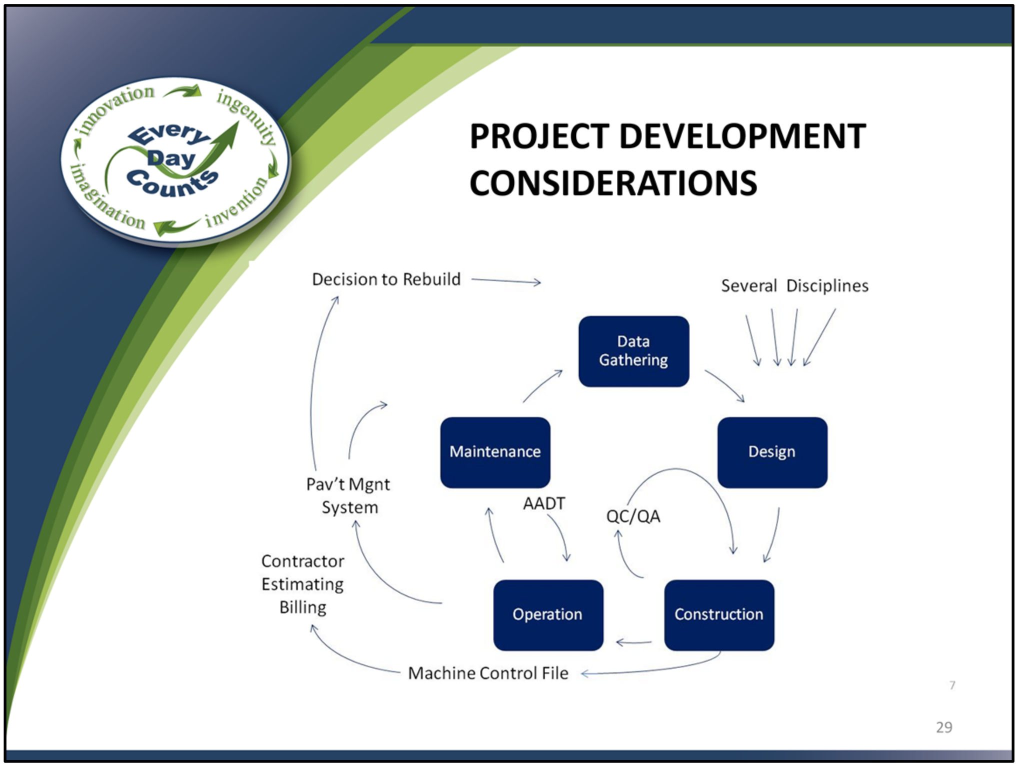
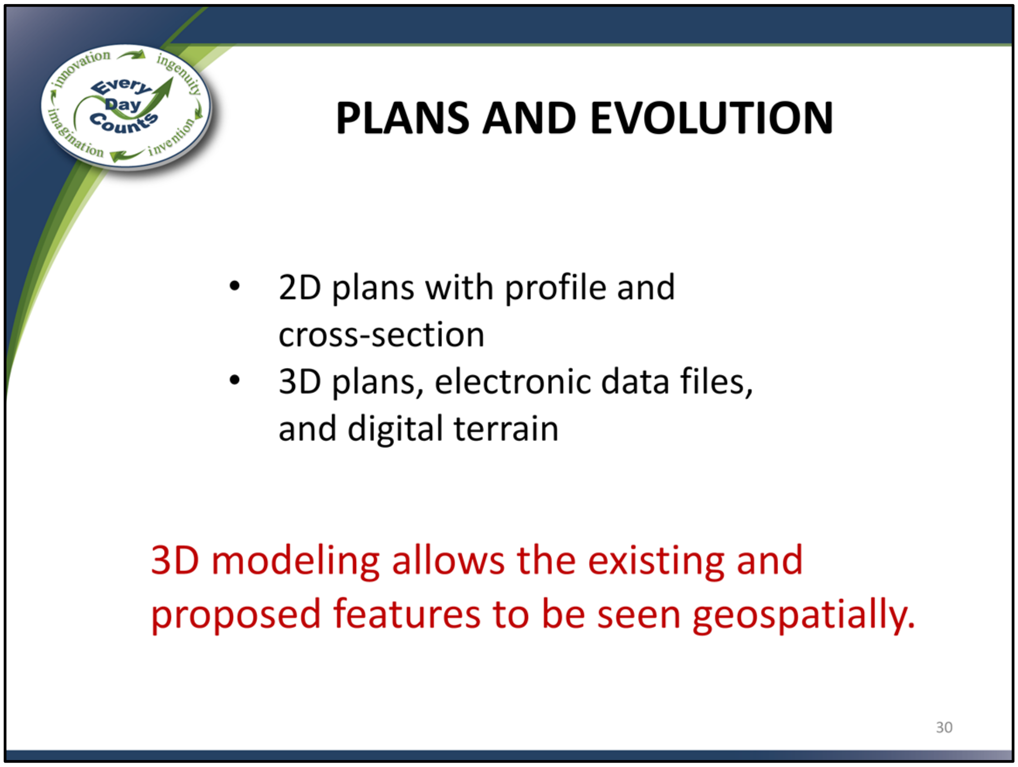
There is a time investment going from a 2D design shop to a 3D design shop. Some of the costs include training, time, and software. There is a considerable amount of training that is needed, and taking personnel away from other work will impact output. A researcher from Wisconsin estimated that it would take two years to make the transition. This transition will not occur in a short time and all at once. There may be pilot projects during this time that allow for lessons learned and additional data to benefit processes and provide for updates. Begin with a pilot project that has a good opportunity for success. There are coordination issues in getting 3D modeling to work well, as there is a need to send an electronic file from the surveyor to the designer and from the designer to the contractor and from the contractor back to the owner. Agreement is needed on what those files involve, how they are formatted, and how updates are documented.



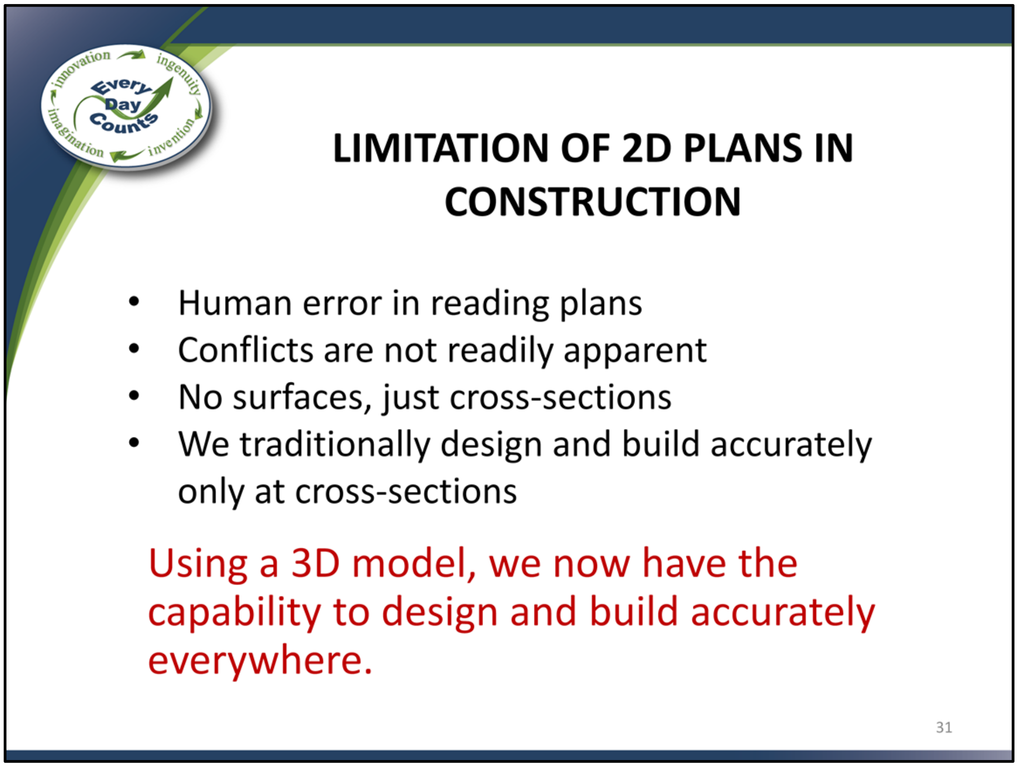
Designers and professional engineers who sign and seal drawings will turn over their design to a contractor. There are questions as to who is responsible for certain portions of the design, such as the contractor making changes to the model that might impact design and create a need for a professional engineer seal. Another question lies in who is detailing and preparing the model for "plug and play" into a machine. Another question lies in whether or not an electronic model can be stamped by a licensed engineer. There are a some states where this practice is not permitted and others that allow it.



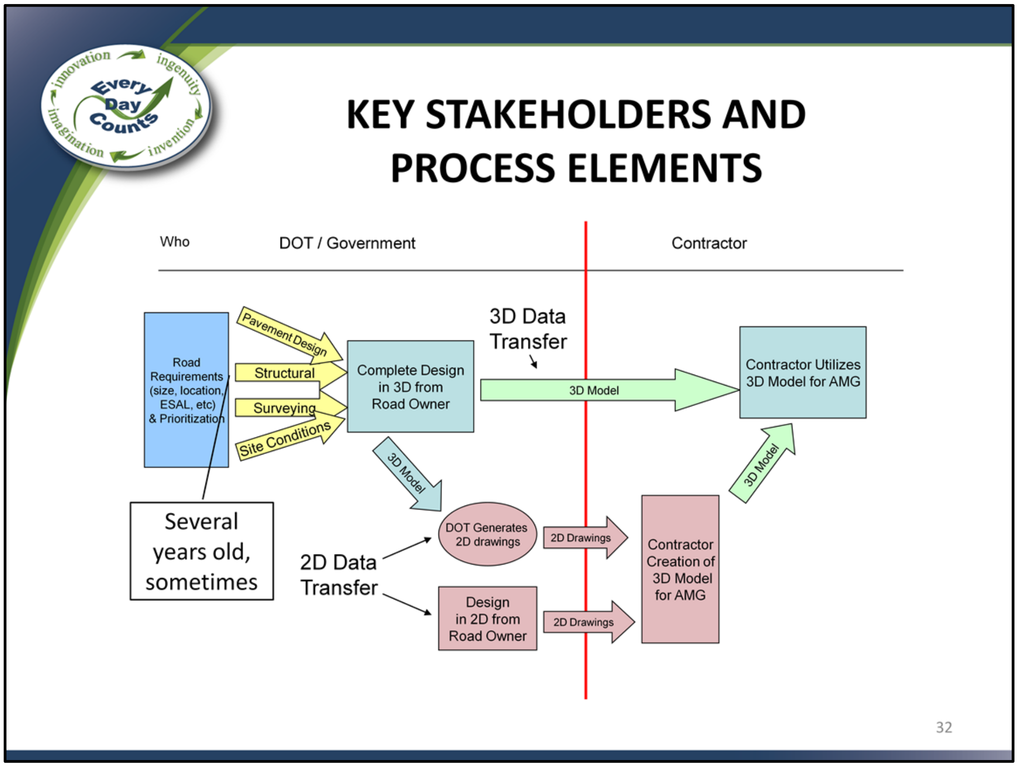
When 3D modeling becomes more fully implemented, it will be possible to start early in the design phase to build the 3D model. After a decision has been made to upgrade, replace, or build a facility, models can make data gathering more efficient. GIS databases can be used to plan initial surveys and to develop a list of important features to be located in the field. After the surveying and data gathering are complete, designers build the 3D model. When the model is complete, it can be passed on to the constructor who can use the model for planning, quantity checking, visualizing the work, and automatic machine guidance. QC and QA activities can be recorded on the model at their proper location. Upon completion of the project, the contractor can modify the model to reflect the as-built condition and the model can be retained by operations and maintenance personnel who can use the model to record maintenance and road condition information at the proper location. When the decision is made to rebuild, existing 3D models can be used for planning and design. At this point, the model can be cycled through another construction project.



Traditionally, construction projects use 2D plans with profiles and cross sections. These cross sections provide design detail at specified locations throughout the horizontal construction project (i.e. every 50 feet). With 3D models, cross sections are not needed, as the digital terrain model will allow for evaluation of a portion of the project at any location along the horizontal alignment.



There are limitations with 2D plans in construction. Some of these limitations are alleviated by 3D models. In 2D, there can be human error in reading plans. Clash detection is a key benefit of 3D models, but in 2D conflicts are not as readily noticeable until they are discovered during construction. Surfaces provide for a more detailed representation in 3D of the facility. In 2D, cross sections and profiles must be referred to consistently and thus introduce greater potential for error. Using a 3D model, we now have the capability to design and build accurately everywhere in the horizontal alignment.



In order for contractors to take advantage of automatic machine guidance, a 3D model of the constructed surfaces must be available. If a 2D design process is used as shown in the lower part of the diagram shown on this slide, the contractor must develop a 3D model, almost from scratch. If 3D modeling were used in the design, it might be desirable to transfer the model directly to the contractor as shown on top. Sometimes legal or other concerns may prevent this transfer. Also, in many jurisdictions, the legally binding design must be represented on paper. Under such circumstances, if 3D modeling is used, the designer develops the traditional plan, profile and cross section views by extracting them from the model and then setting them up in plan sheets that can be printed on paper. If this is the case, it is possible that the 3D model can be transferred over to the contractor with the understanding (usually enforced by a signed waiver) that the model is for information only and that any model that the contractor uses which is derived from designer's 3D model must conform to the hard copy plans. Otherwise the contractor will have to use the 2D plans to develop the contractor's model, as described earlier.

WHAT IS AUTOMATED MACHINE GUIDANCE?

- A process where design software and construction equipment are linked to direct the operation of machinery with a high level of precision, improving the speed and accuracy of the construction process.

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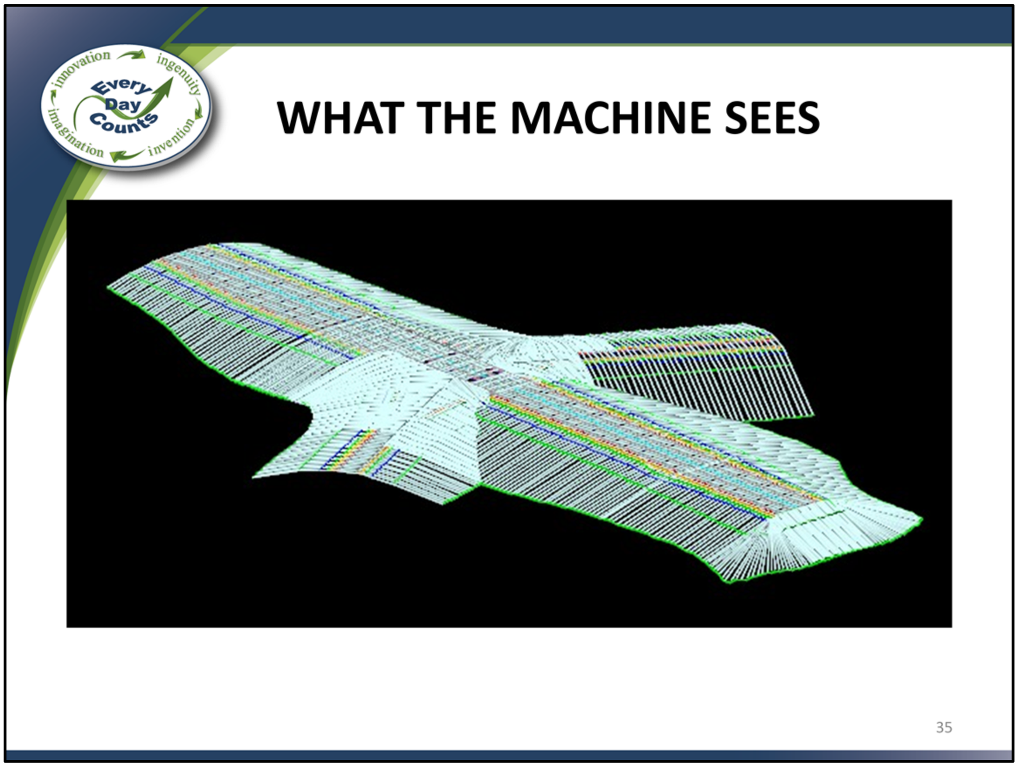
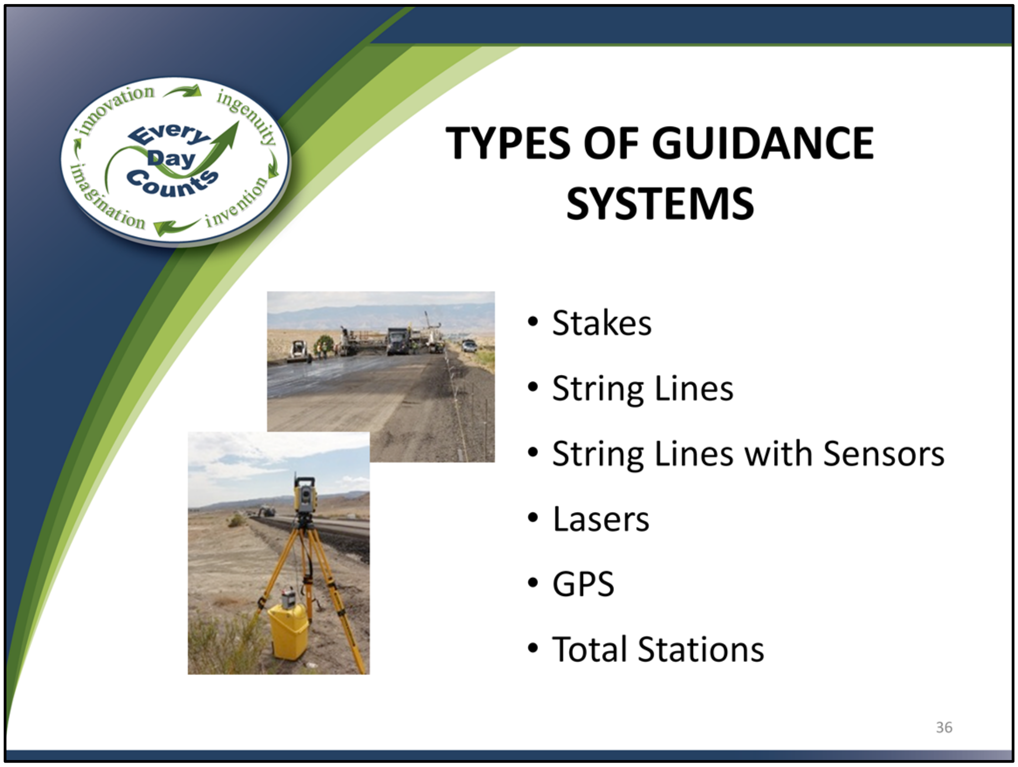
Automated Machine Guidance is one field technique that can be used based on data in the 3D model. A machine file is prepared and loaded into the main computer on an equipped bulldozer or paver. This file references locations that might have traditionally been documented and located using stakes and string lines.

The bulldozer in this picture is set up for automatic machine guidance. It carries the electronic model in its on-board computers. The location of the GPS antennas are known and the cutting edge elevation and position can be computed by calibrating the cutting edge to the antenna. The on-board computers calculate the difference between the current cutting edge location and that of the proposed surface. The difference is displayed graphically on the computer screen in the machine if the distance is large. If the distance is small, AMG can be used to position the blade automatically without human assistance.



This is a reminder of what the model might look like in the computer of the machine.



Paving requires tighter Z tolerances, so a positioning system that is more accurate than GPS is used. In this picture, robotic total stations that are located on the right of way at known locations shoot the prisms mounted on the paver. Radio signals send position data from the robotic total stations to the machine guidance system which steers the machine and positions the paving mold.

USING STAKES-TRADITIONAL

- Provides visual guide/grade information
- Stakes set by surveyor
- Field personnel read stakes and guide machine operator

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Under the traditional method, surveyors locate points in the field and set stakes to help machine operators identify positions and ultimately final grades.

USING STRING LINES- TRADITIONAL METHOD

- Allows for machine control along a non-level surface
- Line represents a design surface at a particular elevation

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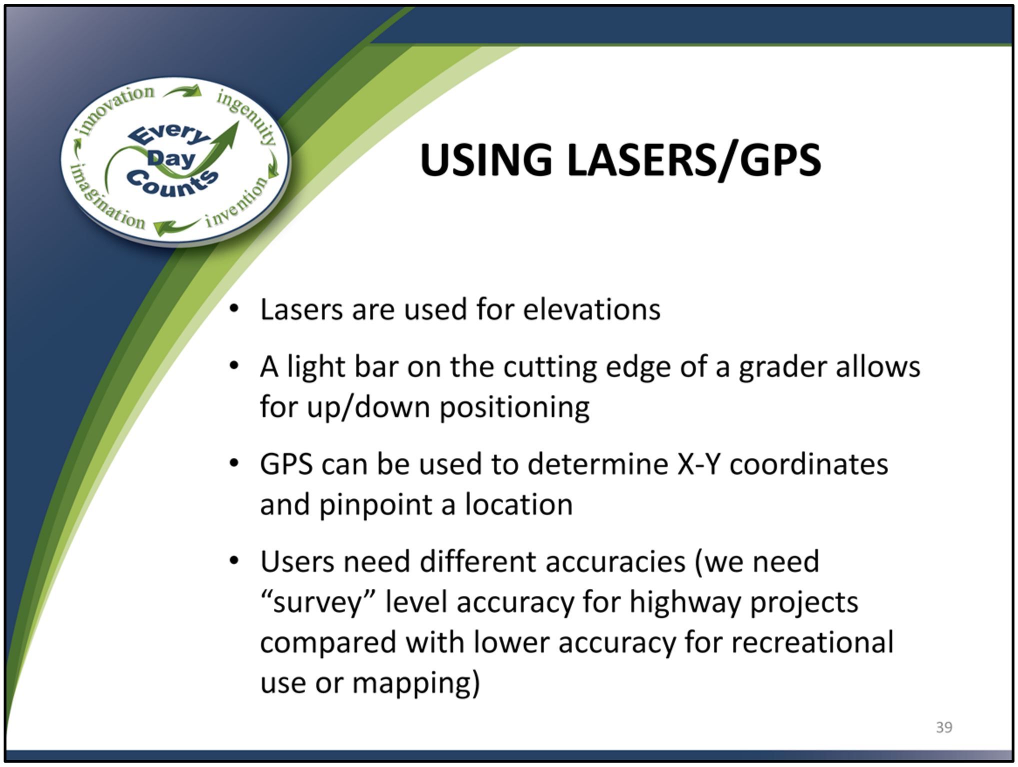
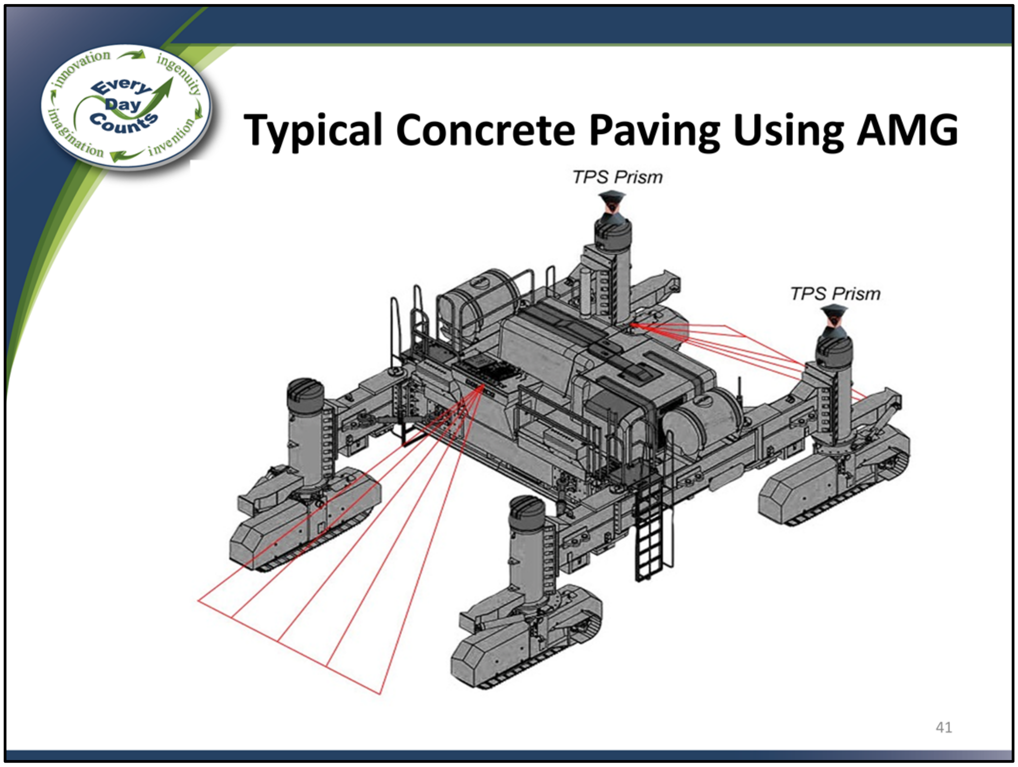
In paving operations, string lines are placed along the edge of pavement to help guide a paving machine along the correct location.



Global positioning systems, or GPS, reference locations in x-y coordinates. That is, they lack elevation, but can pinpoint a location such as on a map for travel distances. Other systems, such as lasers, supplement GPS coordinates and help provide for elevations at points located using x-y coordinates. This ultimately helps us locate exact positions and elevations for grades, as an example.

This bulldozer has two GPS antenna on masts above each corner of the bulldozer blade. This configuration has been patented by Trimble Navigation Ltd. A calibration process determines the offset from the antenna to the cutting edge and the on-board computer calculates the actual position of the corner of the cutting edge of the blade based on this offset. With RTK (real time kinematic) GPS, the X and Y measurements are more accurate than the Z measurement. However, the Z measurements with RTK GPS are sufficiently accurate for earthmoving.



This is an example of a concrete paver with AMG capability. The two pictures at the top and bottom show 3D paving surfaces and provide data to guide the paver using a stringless system.

Like concrete paving, 3D modeling and automatic machine guidance can be used for asphalt paving.

Photo courtesy of David White, Iowa State University.

GRADING

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This picture shows a road grader with GPS antenna mounted on the moldboard. In some cases, lasers are used for vertical positioning rather than GPS in order to achieve greater accuracy. Since the x and y measurements of GPS are relatively accurate, GPS measurements can be used for horizontal positioning while the lasers are used for vertical positioning. Note that the roller has only one GPS antenna. In the case of a roller, the GPS positioning data is likely only to be used to confirm the number of passes that the roller makes.

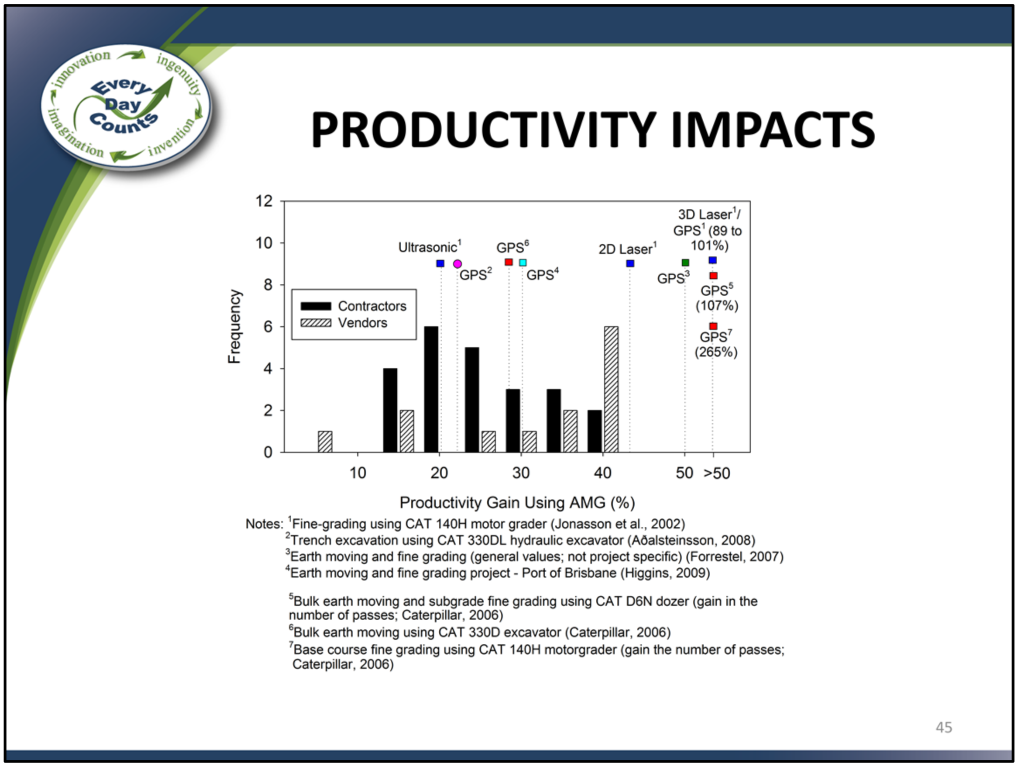
PERCEIVED AMG BENEFITS-PHASE 1 SURVEY

Perceived AMG Benefits*	Contractor	Agency P/C	Equipment Vendors
Labor savings (direct cost on projects)	96%	76%	80%
Environmental-Fuel savings	N/A	36%	60%
Project schedule compression	86%	57%	93%
Avoidance of re-work (re-grading)	93%	60%	87%
As-built documentation	58%	57%	80%
Ease of constructability review	44%	49%	73%
Jobsite safety	68%	44%	60%
Safety of the traveling public	N/A	31%	40%

** Percentage of respondents choosing the benefit at the two highest risk levels*

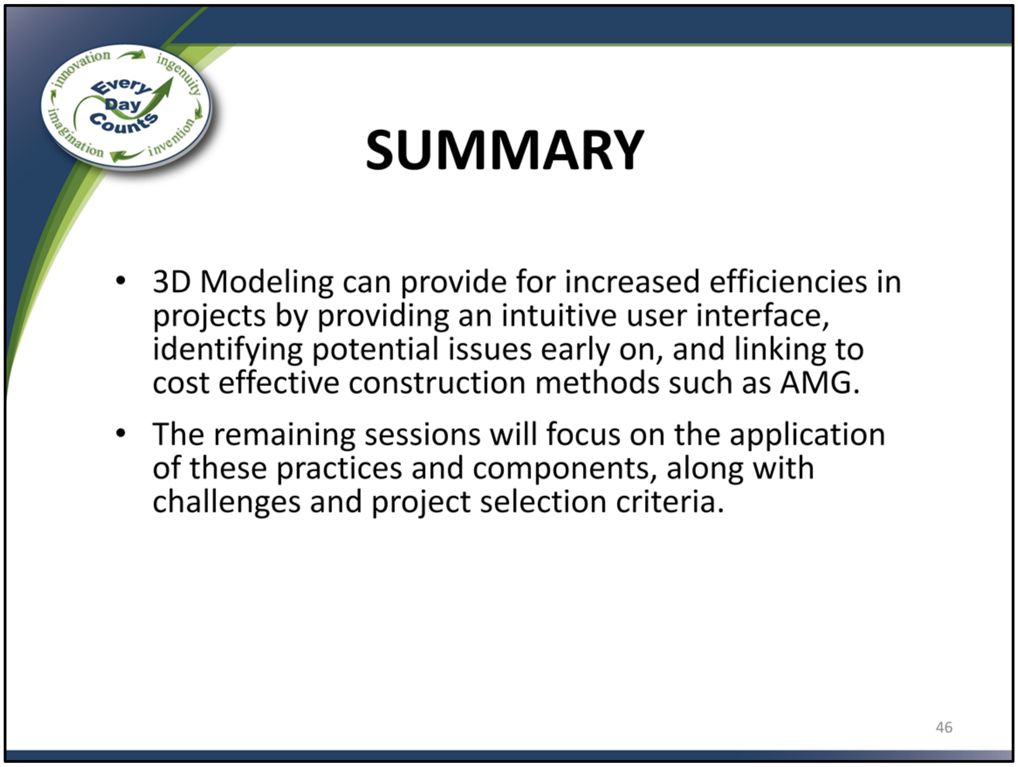
An important benefit of 3D modeling is that having a 3D model available encourages contractors to use automatic machine guidance (AMG) during construction. According to a survey that was conducted for NCHRP project 10-77, labor savings and schedule compression are important benefits of using AMG. This survey included over 400 respondents who participate in AMG in various ways. In this slide, we examine the responses of contractors, agency construction and procurement personnel, and construction equipment vendors (dealers and manufacturers).

Source: NCHRP 10-77



This slide compares the frequency of response for contractors and equipment vendors for the question of how much productivity is improved by the use of AMG. Although the vendors were more optimistic than the contractors, even the lower percentages of productivity increase acknowledged by contractors (about 25% on average) is important when one considers that a profit margin for most contractors is less than 10%. The slide also shows measured productivity increases in published case studies. The greatest increase was reported for fine grading tasks.

Source: NCHRP 10-77.



In summary, 3D modeling can provide many benefits to owners, designers, contractors, and the public. Increased application of field technologies can provide for efficiencies in constructing highway facilities including cost and time. The second part of this presentation focuses on application of 3D models and such field technologies.