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## Topics of Innovation

- MDOT's Research Administration
- Evaluation of New Materials and Products
- Every Day Counts
- Innovative Contracting
- Other Innovations

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# Research Projects 2021 – 2023

Steps in the research process	When
<b>1) Submit a Research Idea</b> Anyone may submit a research idea. Use the form to briefly explain what issues or challenges need to be addressed through research. MDOT selects research ideas that will be further considered at the Research Development Meetings.	October and November 2019
<b>2) Research Idea Selection</b> The MDOT Research Executive Committee and Research Advisory Committees review all submitted research ideas and select which ideas will be further developed at the Research Development Meetings.	December 2019 to February 2020
<b>3) Attend the Research Program Development Meetings</b> Stakeholders discuss research ideas with colleagues and other technical experts from in and outside MDOT.	May 2020
<b>4) Develop a Problem Statement</b> The MDOT staff person assigned to the project (project manager) creates a problem statement for the research idea using input from the Program Development Meetings. The problem statement tells potential researchers what MDOT needs to learn from the research and how the results will be used.	May to Mid-June 2020
<b>5) Research Problem Statement Approval and Research Program Approval</b> The MDOT Research Executive Committee and Research Advisory Committees approve all problem statements and approve the research program as a whole.	Mid-June 2020 to August 2020
<b>6) Solicit Proposals From Researchers</b> MDOT invites researchers to submit proposals for carrying out the research described in the problem statement.	October 2020 (2021 projects) Spring 2021 (2022 projects) Spring 2022 (2023 projects)

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# Recent Research Spotlights

**RESEARCH SPOTLIGHT**

**Pilot signal performance software improves driver travel times and traffic engineering efficiency**

**MDOT Project Manager:** [Name]

**RESEARCH Administration**

**RESEARCH SPOTLIGHT**

**Improved asset management of reinforced concrete bridge decks with high-resolution imaging methods**

**MDOT Project Manager:** [Name]

**RESEARCH SPOTLIGHT**

**MDOT research develops generic ultra-high performance concrete for mixing in field**

**MDOT Project Manager:** [Name]

**RESEARCH SPOTLIGHT**


**Improved asset management of reinforced concrete bridge decks with high-resolution imaging methods**

**MDOT Project Manager:** [Name]

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## Current Research Project Sonar Boat



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## New Materials and Products

- New Materials Steering Committee and Guidance Document
- Tools Used for Evaluation
  - New Materials Evaluation Procedures
  - Pavement Demonstration Program
  - Research Findings & Results
  - National & International Studies



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# Every Day Counts (EDC)

- FHWA Program with a State-based model to identify and rapidly deploy proven but underutilized innovations to:
  - shorten the project delivery process
  - enhance roadway safety
  - reduce congestion
  - improve environmental sustainability

IC-3 Final Report Highlights		
Date	Innovation	Priority
2015	3D Engineered Models	The Michigan DOT increased its use of 3D models nearly 50 percent in 2014. The agency collaborated with peer agencies, the construction industry and others to develop 3D design model requirements and submit them on the MDOT Developmental Quarterly page. The 3D model information, derived through the agency's approval process of the project advertisement stage as part of the reference information documents, has been used on 11 projects to perform quality assurance.
2015	Alternative Technical Concepts	The Michigan DOT has used the ATC process on 17 of the design build projects it has awarded. MDOT developed a design build guide that includes information on using ATCs.
2015	Alternative Technical Concepts	The Michigan DOT used the ATC process on two design-build projects that focused on maintaining traffic and staging. When the agency used alternative payment bidding on a U.S. 10 reconstruction project, it reduced project time from less construction seasons to one, a significant benefit to the public. Using alternative payment bidding on I-75 project resulted in an 8.78 percent savings over the engineer's construction estimate.
2015	Construction Manager General Contracts	The Michigan DOT successfully used CM@C 10 times during E13C-2. MDOT applied the process to encourage innovation and increase the constructability of projects such as a state employment, bridge data, inventory and predictive light rail, and passenger ship terminal and wharf. Using CM@C improved project schedules, public outreach efforts and construction methods and generated time and cost savings. CM@C enabled the agency to save an estimated \$4 million on replacement of the bearings of the Zeebwaer Bridge using contractor innovations.
2015	Design Build	In 2014, Michigan DOT developed a section on D.B. for its Innovative Construction Contracting Guide that includes recommendations for use and implementation steps.
2015	Intelligent Construction	The Michigan DOT has completed a lessons-learned document from an IC pilot project in 2013 in Iron River and will apply it to another pilot project planned for 2015.
2015	Intersection and Interchange Geometrics	The Michigan DOT has built 25 roundabouts with one more planned for completion in 2015. According to MDOT roundabouts have reduced severe crashes more than 50 percent and eliminate local agencies in Michigan have built about 130 roundabouts.
2015	Locally Administered Federal-Aid Projects	The Michigan DOT has four consultants on contract for statewide use to conduct local program development, oversight, grade inspections and close-out. MDOT is also developing a program for oversight of constructed engineering.

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# EDC - Current Efforts

## Unmanned Aerial Systems (UAS)

### Unmanned Aerial Systems (UAS)

**UAS offer several transformative aspects for highway transportation, enhancing safety and productivity and reducing cost.**

Unmanned aerial systems (UAS), sometimes referred to as drones, are small aircraft piloted from a ground operator on the ground. The benefits of UAS are wide ranging and impact nearly all aspects of highway transportation—ranging from on the ground, increasing efficiency, speeding up data collection and providing access to hard-to-reach locations.

UAS provide high-quality survey and data mapping that can be collected automatically or remotely. Large areas can be measured without the need for human surveying and mapping practices. Other uses include survey and imagery as part of emergency response events, where traditional surveying and mapping practices may be inoperable or slow responses to sites. UAS can supplement conventional methods, such as bridge safety inspection and routine construction inspection, to increase safety and protect data from potential weather-related perspectives.

**USES IN THE FUTURE**

UAS improve operations, construction, inspection and safety by collecting data needed to design, build and operate the highway system. Bridge inspection conducted by UAS improves safety for the inspection team and the traveling public by reducing the need for temporary work zones and

spot-related road way closures, which can also be very cost-effective. Construction inspection with UAS allows for a bird's eye view of a project's progress and for the development of three-dimensional (3D) design models that document the existing condition and cost of equipment or equipment quantity requirements.

UAS has multiple uses. State departments of transportation (DOTs) use it during the design process for roadway alternatives such as toll roads, overpasses, and flyovers, and for design elements following construction, this use helps to identify issues to adjust quality data to make further informed decisions, all collecting data in a simple, cost-effective manner.

**BENEFITS**

- **SAFETY:** Looking over the top of a bridge instead of using ladders. Traditional bridge inspection requires setting up temporary work zones, disrupting traffic, and using specialized and expensive equipment. UAS technology is providing data collection while reducing risk to workers and the driving public.
- **EFFICIENCY AND COST:** UAS technology can also provide the same data collection capabilities, such as survey or aerial photography, and therefore exact quantity calculation and efficient

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## EDC - Current Efforts

### Virtual Public Involvement

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Center for Accelerating Innovation

U.S. Department of Transportation  
Federal Highway Administration

**On-Ramp to Innovation**  
every day counts

### Virtual Public Involvement

**Virtual Public Involvement**

**Virtual public involvement supports agencies' efforts to engage the public more effectively by supplementing face-to-face information sharing with technology.**

Interactive virtual public involvement techniques provide state departments of transportation (DOTs), local agencies, transportation planning organizations (TPOs), and other transportation planning organizations (TPPOs) with a platform to engage the public and receive feedback. These strategies ensure efficiencies in time, information dissemination, and data input collection and generation, which can facilitate access to planning and project development processes.

**ENCOURAGING PUBLIC ENGAGEMENT**

Public involvement is a critical component in the transportation decision-making process, allowing for meaningful consultation and input from interested individuals. As daily users of the transportation system, the public has valuable concerns, insights, and observations to share with local DOTs, TPOs, and other agencies on the performance and needs of the transportation system or on specific projects, timely and meaningful public engagement has the potential to accelerate project delivery by helping identify and address public concerns early in the planning process, thereby reducing delays from potentially unknown interests late in the project delivery process.

**BENEFITS**

- **Efficiency and Low Cost:** Virtual tools and platforms can effectively be made accessible to communities, many of a lower cost than traditional public engagement methods.
- **Accelerated Project Delivery:** Virtual public engagement helps identify issues early in the project planning process, which reduces the need to rework decisions.

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## EDC - Current Efforts

### Advanced Geotechnical Methods in Exploration (A-GaME)

Tools for Enhanced, Effective Site Characterization

### Advanced Geotechnical Methods in Exploration (A-GaME)

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U.S. Department of Transportation  
Federal Highway Administration

**On-Ramp to Innovation**  
every day counts

### Advanced Geotechnical Methods in Exploration (A-GaME)

Tools for Enhanced, Effective Site Characterization

**Advanced Geotechnical Methods in Exploration (A-GaME)**

**Mitigate risks and improve reliability by optimizing geotechnical site characterization with proven, effective exploration methods and practices.**

Up to 80 percent of major infrastructure projects suffer impacts to schedule or cost due to geotechnical issues. Many of these issues result from insufficient data or methods to the scope and quality of the characterization with effective site characterization is critical for managing geotechnical risks that may affect design and construction and for ensuring safe and performing, and cost-effective projects.

**IMPROVED GEOTECHNICAL SITE CHARACTERIZATION**

Current practices for characterizing a project site will typically include a minimum number of borings with samples obtained every few feet. Design and copying of alternate solutions requires engineers to construct profiles of the subsurface using interpolation, which may result in inaccuracies in design and application.

Defining site conditions, due to inherent variability in soil test variations, groundwater levels, and geotechnical erosion and materials, require a significant number of cost-investments and delays on highways and bridge construction projects. These programs allow when the geotechnical uncertainties after have been characterized in geotechnical reports and contract documents, generated from innovative and proven geotechnical exploration programs, making decisions with confidence or limited information can result in costly construction issues and delays.

Several proven, effective, and innovative technologies are available that when combined with practices that provide an accurate, site-specific, site-specific characterization program for improved site characterization and maximum return on investment. These technologies include cone penetration testing, seismic and electrical geophysics, measurement while drilling, and optical and acoustic measurement.

**BENEFITS**

- **Reduced Risk:** Reducing uncertainties in subsurface conditions mitigates design and construction risk.
- **Improved Quality:** Improving confidence in the geotechnical characterization reduces unnecessary conservatism in design and eliminates a more reliable basis for design and construction of foundations and other geotechnical features supporting the highway system.
- **Accelerated Project Delivery:** Since a significant number of construction delays can be attributed to subsurface uncertainty, well-advanced investigation programs improve decision-making and predictability, providing time and cost savings for transportation agencies.

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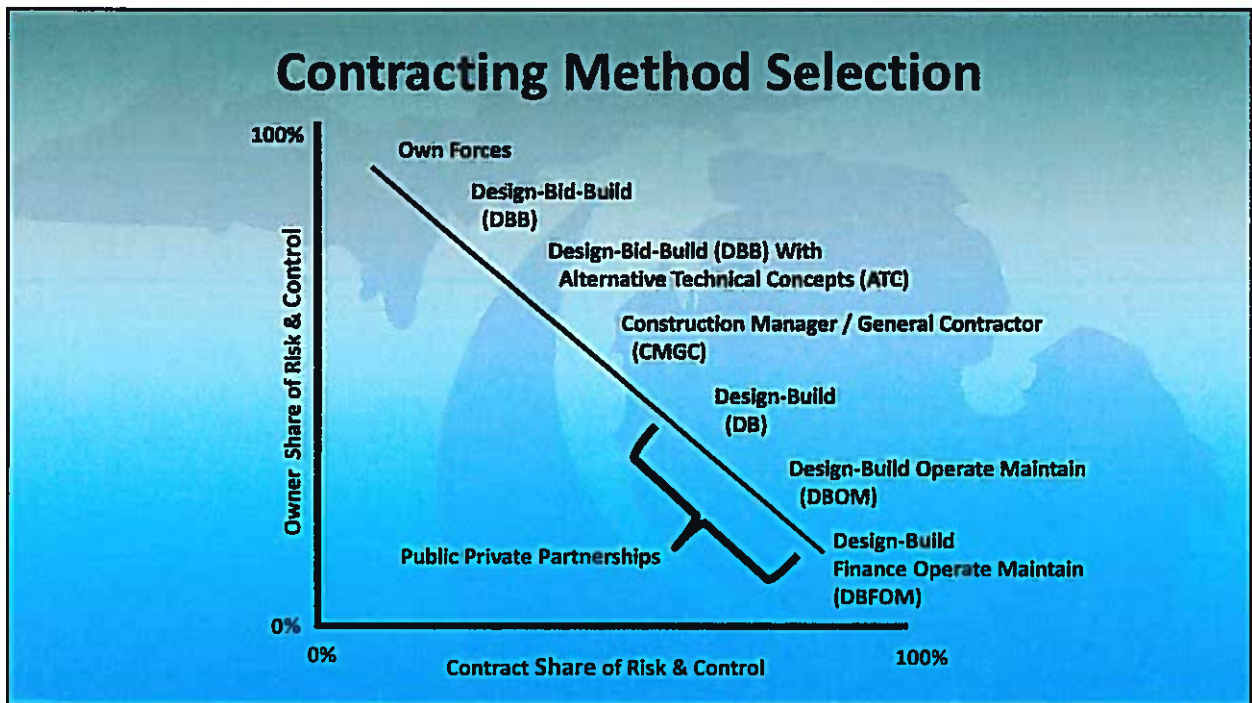
## Innovative Contracting

- Design-Build (DB)
- Design-Build-Finance
- Construction Manager/General Contractor (CMGC)
- Job Order Contracting
- Fixed Price/Variable Scope (FPVS)
- Alternate Pavement Bidding
- Alternate Technical Concepts
- Public Private Partnerships





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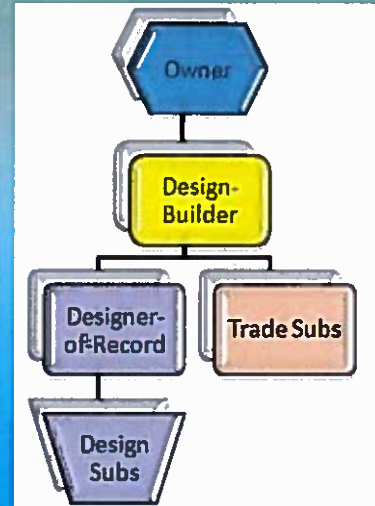


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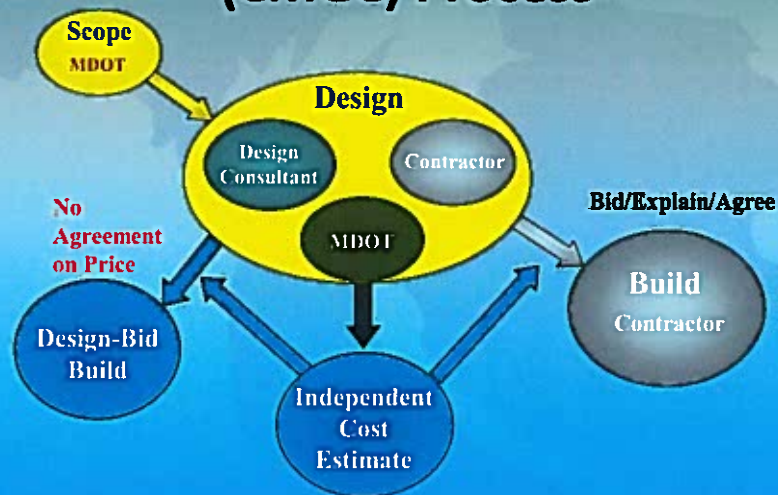
## Design-Build (DB)

- Types of Projects
  - Road & Bridge Reconstruction
  - Bridge Rehabilitation
  - ITS Systems
  - Bike Path Construction
- Procurement Process
  - 2 Step: RFQ / RFP
- Post Award Activities
  - Final Design
  - Construction Oversight



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## Construction Manager/General Contractor (CMGC) Process



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## Fixed Price/Variable Scope (FPVS)

- More Infrastructure Needs than Available Funding
- Maximizing the Amount of Work That Can be Completed within the Available Funding



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## Alternate Technical Concepts (ATC)

A means to incorporate a Bidder's concepts and innovations that provide equal or greater value into the bidding process.

### Process:

- During advertisement, contractors meet with MDOT in a confidential one-on-one setting to propose their concepts.
- MDOT evaluates and approves or rejects the concepts.
- If approved, the contractors may base their bid on the alternate concept.



*To date, MDOT has only used ATC on Design-Bid-Build Projects for maintenance of traffic items.*

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**Other Innovations**

- I-75 Modernization
- US-131 Movable Barrier
- US-23 Flex Route

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## Carbon Fiber Reinforced Polymer (CFRP) Prestressed Beams

- Pembroke Ave over M-39 (2011)
- M-50 over NS Railroad (2012)
- M-102 EB and WB over Plum Creek (2013 – 2014)
- I-94 EB & WB over Lapeer Road (2014)
- M-100 over Sharp Drain (2015)
- M-66 over West Branch River (2015)
- M-86 over Prairie Creek (2016)
- I-75 SB over Sexton-Kilfoil Drain (2017)
- M-3 over I-94 (2018)
- Brush Street over I-94 (2018)

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## CFRP Fabrication Facility Opened in Michigan

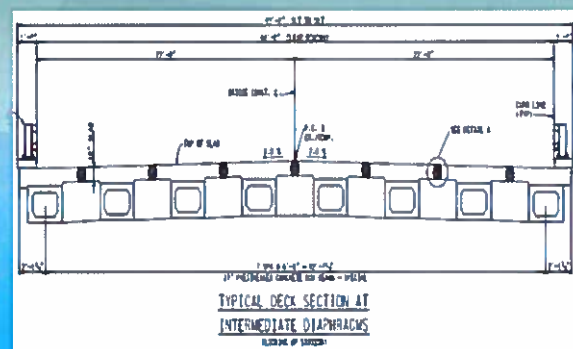
- Bringing jobs into Michigan
- Provides ability to deploy products locally



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## Overview: Design & Fabrication

- Superstructure Segments w/closure pours:
  - Beams & Deck – conventional design
  - Precast in 2 stages:
    - Stage 1 - Beams fabricated by precast fabricator
    - Stage 2 - Deck cast by prequalified contractor



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## Overview: Superstructure segments

- Loop bars used and placed staggered to avoid conflict during placement
- Longitudinal bars added in the loop



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## BridgeSlide on M-100, Pottersville

Constructed in 2015

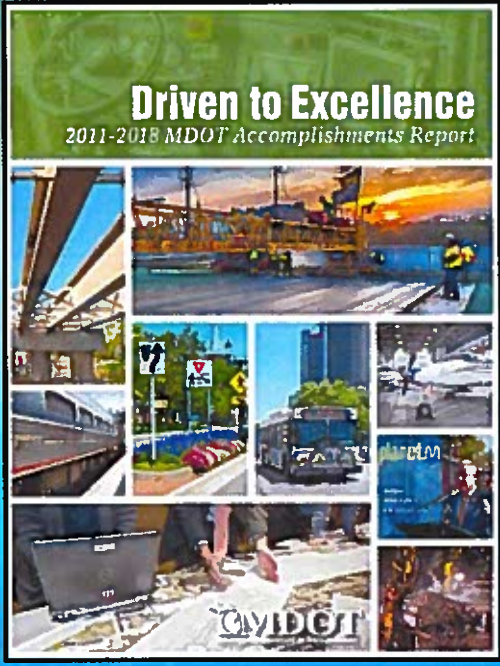



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Questions?



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