GEORGIA DOT RESEARCH PROJECT 16-21

FINAL REPORT

FLASH TRACKING FOR ACCELERATED PROJECT DELIVERY (APD)

OFFICE OF PERFORMANCE-BASED MANAGEMENT AND RESEARCH
15 KENNEDY DRIVE
FOREST PARK, GA 30297-2534

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The objectives of this study are to identify, assess, and validate best practices that are crucial for the successful completion of Flash Track projects. Five Georgia Department of Transportation (GDOT) projects and three Virginia Department of Transportation (VDOT) projects are used as case studies. These cases were carefully studied to validate existing Construction Industry Institute (CII) practices and to identify new practices essential for successful completion of Flash Track projects. The Flash Track tool developed by the CII was used to determine the readiness of a project team to complete a project of this nature. The research data were collected through numerous meetings, interviews, questionnaires, through various statistical analyses, and through discussions with project personnel from the studied projects. Some of the pertinent conclusions and products of this study are as follows:
• The xDOT toolkit best represents the best practices crucial to the successful completion of Flash Track projects.
• The seven categories of xDOT best practices: (1) Right of Way & Utilities [11.9%], (2) Pre-construction [9.6%], (3) Contractual [21.2%], (4) Planning [9.7%], (5) Information Management [9.7%], (6) Execution [21.9%], and (7) Traffic Management [15.9%].
• The top three xDOT best practices are: (1) Implementing construction driven designs, (2) Ensuring worker/public health and safety, and (3) Having a responsible in-charge engineer/design-build integrator.</td></tr>
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GDOT Research Project No. 16-21

Final Report

FLASH TRACKING FOR ACCELERATED PROJECT DELIVERY (APD)

By

Pardis Pishdad-Bozorgi, Ph.D., Principal Investigator, Georgia Institute of Technology
Jesus M. de la Garza, Ph.D., co-Principal Investigator, Virginia Polytechnic Institute and State University

School of Building Construction
Georgia Institute of Technology

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The contents of this report reflect the views of the authors who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policies of the Georgia Department of Transportation or the Federal Highway Administration. This report does not constitute a standard, specification, or regulation.

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EXECUTIVE SUMMARY

EXTENDED ABSTRACT

This report presents the final results of research identifying, assessing, and validating best practices crucial to the successful completion of accelerated, or Flash Track, construction projects. Five specific projects were used as case studies: SR 299 at I-24 Bridge Replacement; Jimmy Deloach Connector; SR 47 at Little River Bridge Replacement; Riverside Drive Roundabouts at I-285; and the Courtland Street Bridge Replacement. The first four of these cases were carefully studied to validate existing practices, as well as to identify new practices used in the industry to successfully complete Flash Track projects. All five projects were executed by the Georgia Department of Transportation (GDOT).

The Flash Track tools previously developed by the researchers were used to determine the readiness of the case study project teams to complete projects of this nature. These readiness assessment tools were based on two sets of Flash Track best practices: the first set (47 practices) was generated from a study chartered by the Construction Industry Institute (CII); and the second set (19 practices) from a study sponsored by the Virginia Department of Transportation (VDOT). By conducting structured interviews with subject matter experts (SMEs) on the four GDOT projects and by deploying the Delphi method and the Analytic Hierarchy Process (AHP), the researchers were able to isolate 17 emerging Flash Track practices. Moreover, the stakeholders on the GDOT Flash Track case studies collectively identified risks, barriers, and risk mitigation strategies for each of these 17 newly found Flash Track practices.

To construct one consolidated framework to best represent Flash Track best practices for transportation projects, the research team combined the GDOT and VDOT best practices, creating the xDOT framework. The xDOT best practices categories are as follows: (1) Right of Way (ROW) & Utilities; (2) Pre-construction; (3) Contractual; (4) Planning; (5) Information Management; (6) Execution; and (7) Traffic Management. The AHP method was used to determine the relative weights for each xDOT practice and category. Furthermore, the researchers updated the CII Flash Track Readiness Assessment Toolkit to include one module to include the original 47 CII Flash Track best practices and another module (xDOT) with the new set of 36 combined VDOT and GDOT Flash Track best practices. Finally, a case study project (i.e., the Courtland Street Bridge Replacement) was used as an implementation test case for this CII + xDOT Flash Track Toolkit. This research project also formalizes a re-engineered workflow process for successful Flash Tracking. Given the acronym cPEpC, this workflow process involves a high degree of collaboration through construction-driven design (c) among all project parties before they initiate strategic procurement (P), engineering (E), the balance of procurement (p), and construction (C).

INTRODUCTION

Highways are the backbone of the American transportation system. For decades, these highways have been used to transport economic goods and services across the country. Moreover, American travelers have been the biggest beneficiaries of the highway system, which provides a safe and inexpensive mode of transportation. Unfortunately, it has become a challenge for the growth of the American highway system to match the growth of the country's economy. To strengthen this fundamental element of the American transportation system, state highway agencies face challenges such as the need to extend the service life of existing highway infrastructure, as well as building, rehabilitating, and rebuilding the infrastructure without significant user impacts. Strategies must be developed to address the nation’s need for safe and uncongested roadways.

Because economic development has increased significantly in Georgia in recent decades, GDOT aims to strengthen the state highway system and improve its performance on accelerated construction projects. To do this, GDOT has worked to enhance research on and then deploy Flash Track best practices for successful completion of these schedule-compressed projects. In collaboration with the Georgia Institute of Technology (Georgia Tech) and the Virginia Polytechnic Institute and State University (Virginia Tech), GDOT has sought to advance the CII and VDOT research on Flash Track best practices, in an effort to identify Flash Track best practices suitable for GDOT.

RESEARCH FINDINGS

This research sought to identify and evaluate best practices for accelerated “Flash Track” project delivery through an extensive literature review and a detailed examination of five case study projects: SR 299 at I-24 Bridge Replacement; the Jimmy Deloach Connector; SR 47 at Little River Bridge Replacement; the Riverside Drive Roundabouts at I-285; and the Courtland Street Bridge Replacement. The first four cases were carefully studied to validate existing practices and to identify new practices for successful Flash Track projects. The fifth case (i.e., the Courtland Street Bridge Replacement) was used as an implementation case for the xDOT Flash Track Toolkit.

After thoroughly investigating these four projects, reviewing input from subject matter experts (SMEs), and comprehensively reviewing the literature review, the researchers identified 17 new Flash Track best practices. Added to the 66 Flash Track best practices previously incorporated into the CII and VDOT Flash Track Readiness Assessment modules of the CII Flash Track Best Practices Toolkit, these 17 new best practices facilitate successful Flash Track implementation. The identified 17 new practices were classified into four categories, and AHP was used to assess, validate, and rank them.

The best practices from VDOT and GDOT were then re-organized and grouped into a new set of xDOT categories: (1) ROW & Utilities, (2) Pre-construction, (3) Contractual, (4) Planning, (5) Information Management, (6) Execution, and (7) Traffic Management. To determine the relative weights for each xDOT practice in each category, the researchers used the AHP method to analyze data gathered from an automated online tool designed to develop pairwise comparisons. The final weights for xDOT categories and best practices are presented in Table 1. The top three xDOT best practices are as follows: (1) Implementing Construction-driven Design; (2) Ensuring Worker/Public Health and Safety; and (3) Having a Responsible In-charge Engineer/Design-Build Integrator.

Furthermore, the xDOT Flash Track tool was used to assess the team's readiness to execute the GDOT Courtland project on a Flash Track basis. As a result, the principal investigators provided GDOT with recommendations to incorporate a number of Flash Track best practices into the Courtland request for proposals and instructions to proposers (RFP-ITP). (See Appendix III and IV for the xDOT Flash Track Playbook and xDOT Flash Track Readiness Toolkit, both of which are based on the best practices identified through the previous research on VDOT and GDOT projects.)

Table 1: xDOT Best Practices Categories and their AHP Weights

Categories	Weight
ROW & Utilities	11.9%
Pre-Construction	9.6%
Contractual	21.2%
Planning	9.7%
Information Management	9.7%
Execution	21.9%
Traffic Management	15.9%
Consistency Ratio	**0.5%**

	ROW & Utilities	Weight
48	Having Early Engagement of Utility Owners	19.0%
49	Having Early Utility and ROW Coordination	20.6%
50	Having a Dedicated Utility Manager Consultants for xDOT and the Designer-Constructor Team	12.8%
51	Having Sub-surface Utility Engineering	14.7%
52	Overlapping Environmental and ROW Acquisition	17.1%
53	Starting ROW Acquisition during Conceptual Design (20% - 50% Design)	15.8%
	Consistency Ratio	**0.8%**

	Pre-Construction	Weight
54	Conducting Environmental Permitting and Scope Development in Parallel	32.9%
55	Gathering Accurate Geotechnical (Sub-surface) Data, to Reduce Risk	22.1%
56	Establishing Programmatic Agreements to Streamline the Process for Handling Routine Environmental Requirements	34.2%
57	Using Pre-construction Analysis Software to Evaluate and Select Alternative Project Scenarios	10.8%
	Consistency Ratio	**0.2%**

	Contractual	Weight
58	Having a Responsible In-charge Engineer/Design-Build Integrator	22.2%
59	Including ROW, Utility Relocation, and Environmental Mitigation in Design-Build Contract	18.0%
60	Using Incentives to Encourage Earlier Project Completion	21.6%
61	Employing Allowances for Certain Bid Items as Means of Risk Sharing	17.8%
62	Using Existing Open-ended Contracts to Procure Time-critical Elements	20.4%
	Consistency Ratio	**0.5%**

	Planning	Weight
63	Having A 30-day State-owned Float Activity As a Predecessor to the Scheduled Completion Date, to Absorb Critical Delays Occasioned by the State	10.0%
64	Considering 3D and 4D Modeling of the Execution Sequence during Detailed Design	10.0%
65	Phasing Environmental Permits to Match Phased Construction	28.3%
66	Using Software to Assist with Scheduling of Portland Cement Concrete (PCC) Pavement, Given the Design, Construction, and Environmental Factors	10.7%
67	Considering Both Inter-phase and Intra-phase Concurrency for Design and Construction Packages	26.3%
68	Establishing the Bridge Fabrication Facility near the Project Location	14.7%
	Consistency Ratio	**0.5%**

	Information Management	Weight
69	Collecting Lessons Learned from Similar Projects	17.6%
70	Developing a Planned Issue Resolution Process	41.9%
71	Utilizing an Integrated Document Management System for Tracking Requests for Information (RFIs), Quality Assurance/Quality Control (QA/QC), Submittals, and Other Time-sensitive Documents	40.5%
	Consistency Ratio	**0.2%**

	Execution	Weight
72	Pre-fabricating Project Elements that Are on the Critical Path	15.7%
73	Considering Innovative Construction Materials that Accelerate Construction	13.8%
74	Implementing Construction-driven Designs	31.6%
75	Making Timely Decisions through the Use of Workshops	19.0%
76	Establishing a Project Command Center	14.9%
77	Establishing a Shuttle Bus Service for Construction Workers, Taking Them from a Common Parking Lot to the Job Site	5.1%
	Consistency Ratio	**0.9%**

	Traffic Management	Weight
78	Ensuring Efficient Coordination of Construction with the Management of Traffic Issues	16.3%
79	Utilizing a Lane Closure Time Bank	7.5%
80	Deploying Continual Public Outreach, Media Campaigns, and Dedicated Communications Personnel	19.3%
81	Ensuring Worker/Public Health and Safety	36.2%
82	Performing Exhaustive Lane Closure Planning	10.0%
83	Implementing Smarter Work Zones to Dynamic Management of Traffic and Reduced Work Zone Impacts	10.7%
	Consistency Ratio	**0.5%**

REPORT LAYOUT

Section 1 introduces the project in general terms and briefly provides the project's background, the reason for conducting it, and its objectives and significance. Section 2 outlines the research methodology. Section 3 discusses the detailed study of the SR 299 at I-24 Bridge Replacement project, beginning with the project overview, project performance outcomes, its Flash Tracking readiness assessment score, a number of the project positives and challenges, and a listing of the practices derived from the project. Similarly, Section 4 presents a detailed study of the Jimmy Deloach Connector project. Section 5 describes the project at the Riverside Drive Roundabouts at I-285. Section 6 discusses the study of SR 47 at the Little River Bridge Replacement project in detail. Section 7 presents the results of the Literature Review and lists the practices identified from it. Sections 8 presents the 17 best practices categories developed by GDOT, giving a brief overview of the Delphi Process used to identify them. Section 9 discusses the final results including the final selection of categories for GDOT best practices, their relative weights determined through the Analytic Hierarchy Process (AHP), the risks, barriers, and risk mitigation strategies for each of the 17 GDOT Flash Track practices. This section also outlines the research methods and findings of the Flash Track best practices research sponsored by VDOT, and presents the consolidated xDOT framework of best practices for Flash-Track projects. Section 10 discusses the Courtland Street Bridge Replacement project as an implementation case for the xDOT practices. This section also formalizes a reengineered workflow process for successful Flash Tracking. Lastly, Section 11 presents recommendations for future research.

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SECTION I - INTRODUCTION

Time, cost, and quality constitute the trifecta of goals for any construction project. Getting all three right is a skill that many owners and project teams work hard to master. The increasing complexities and uncertainties of capital project delivery have made it difficult for projects to achieve high performance on all three. In the current project environment, it has become necessary to make time, cost, and quality trade-offs [1].

In the rapidly changing business environment of the 21st century, the construction industry has been seeking innovative ways to ensure faster and more economical project delivery [2]. Innovation and experimentation with newer project delivery methods have significantly helped project teams achieve all three goals. However, complexities still exist, and owners continue to suffer from problems such as schedule delays [3]. Consequently, many owner organizations harbor a negative impression of the construction industry [4].

Fast-tracking has recently emerged as a project delivery approach that has enabled the industry to take a leap forward in achieving schedule compression. With its practice of having construction begin before project design is complete, fast-tracking is now so common that major firms employ it on over 95 percent of their projects [5]. Even from a financial point of view, the numerous business benefits of early completion impel project managers to employ fast-tracking strategies [6].

Interestingly, the popularity of fast tracking has exposed its limits, since businesses competing for a market edge develop greater needs for even faster project delivery. A recent I-85 bridge collapse in Atlanta affected about 220,000 commuters who drive that section of the interstate highway every day [7]. Because fast tracking is just not fast enough in such emergencies, a dire need arises for innovative flash-track practices in this type of construction. This necessity has led to the advent of the new concept of Flash Tracking. A Flash Track project can be defined as being time-driven, and by necessity, involving a heightened degree of concurrency between engineering, procurement, and construction [3].

In addition to the prospect of gaining a competitive advantage, other compelling reasons owners increasingly demand faster project delivery include the growing number of emergency rebuilds and more stringent regulatory compliance considerations [3]. Hence, Flash Tracking in the form of faster fast-tracking is pursued [3].

To date, a number of Flash Tracking efforts have been successfully implemented; a few examples include an emergency rebuild of the Saint Anthony Falls I-35W Bridge in Minneapolis, a contractual Integrated Project Delivery (IPD) for a new 192-bed Maine General Medical Center in Augusta, and a new ThyssenKrupp state-of-the-art steel processing facility in southwestern Alabama [8]. Given the success of these initial Flash Tracking efforts, the need is clear for further research into identifying and documenting Flash Track best practices.

The primary objectives of this project are as follows:

1) To examine the 47 Flash Track practices identified by the Construction Industry Institute (CII) research for heavy industrial projects [3], and the 19 Flash Track practices identified through the Virginia Department of Transportation (VDOT); and to determine the applicability of these 66 Flash Track practices to projects performed by the Georgia Department of Transportation (GDOT).

2) To identify new Flash Track practices suitable for GDOT projects, validate them

by subject matter experts (SMEs) through a Delphi process; and rank by the SMEs through the Analytic Hierarchy Process (AHP).

3) To combine GDOT and VDOT best practices (i.e., called xDOT Flash Track best practices), rank them using the AHP method, and develop the Flash Track Playbook and Readiness Assessment Toolkit.

SECTION 2 - DETAILED RESEARCH STUDY

METHODOLOGY

The research methodology comprised four phases. The first phase involved an extensive literature review to identify additional Flash Track practices suitable for transportation projects. In addition, four Flash Track projects in the state of Georgia were studied to identify any new Flash Track practices particularly applicable to GDOT projects. Structured interviews were conducted with key engineering, procurement, and construction (EPC) team members involved in these projects. Each project interview involved a meeting with key stakeholders. In the second phase, the practices identified in the first phase were vetted by SMEs using the Delphi process, to determine whether they are essential to Flash Tracking. In the third phase, the SMEs used the AHP method to rank and weight the final GDOT Flash Track practices. Lastly, in the fourth phase, GDOT and VDOT best practices were consolidated into one framework, called xDOT, constituting a comprehensive compendium of best practices for flash-track projects. Moreover, the final set of xDOT Flash Track Best Practices were ranked and weighted through the AHP method. Figure 1 presents a flow chart of the entire research methodology.

<u>Phase I: Data Collection</u>

An extensive literature review was conducted to identify any fast-track practices that facilitate Flash Track efforts. Research journals published by the Transportation Research Board (TRB), the Federal Highway Administration (FHWA), and the American Society of Civil Engineers (ASCE) were a few of the numerous databases reviewed. Section 7 discusses this literature review in greater depth.

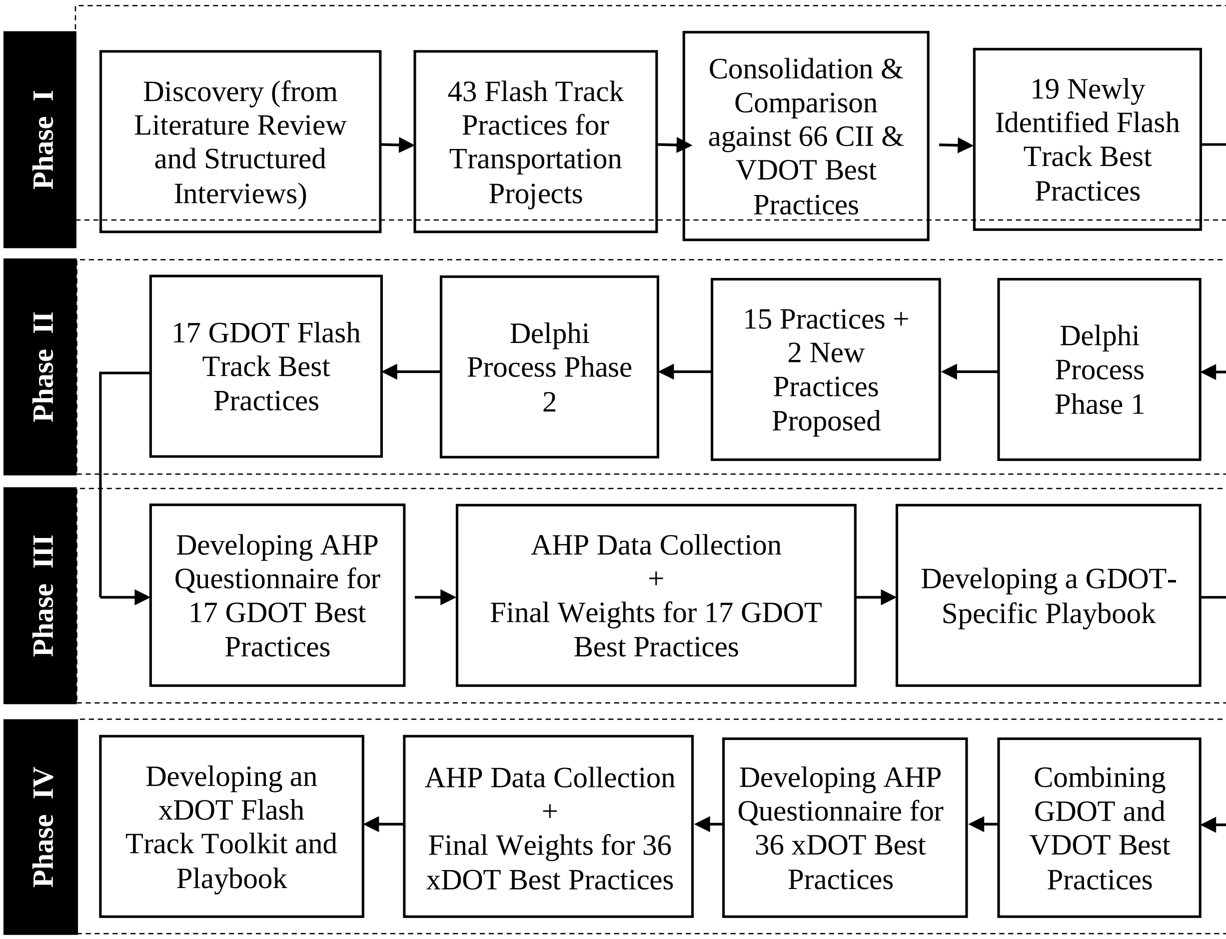

Figure 1: Research Methodology

Furthermore, the structured interviews of the EPC team members were conducted on four successful Flash Track projects in Georgia: the Bridge Replacement of SR 299 on I-24; the Jimmy Deloach Connector; the Bridge Replacement of SR 47 over the Little River; and the Riverside Drive Roundabouts on I-285. Seven meetings were held. The first meeting was a Kick-off meeting, where staff of the GDOT Office of Innovative Delivery (OID) gave a brief overview of their responsibilities, goals, achievements, and their current projects. The subsequent five meetings were divided across four projects. The seventh one involved validation of the identified practices, as well as briefing the SMEs about the AHP process. For these projects, Flash Track toolkits (e.g., the CII, VDOT, and xDOT toolkits) were used to retrospectively assess GDOT's readiness to deliver each one on a Flash Track basis.

In addition, readiness to undertake Flash Track projects was determined by giving the meeting attendees a Flash Track readiness assessment toolkit developed in previous research sponsored by CII and VDOT. The toolkit comprises a set of questions formulated to determine how project team members experience a project. These practitioners were advised to think retrospectively about how prepared they were to undertake a Flash Track project. This involved them assessing their readiness either to implement the 47 CII Flash Track Best Practices, or to implement the 19 VDOT practices on a scale of 1 to 10 [3]. (Table 2 presents the scoring rubric used.)

Table 2: Definition of Issues Scoring System

Score	Meaning
0,1	Unprepared
2,3	Somewhat Unprepared
4,5,6	Neutral
7,8,9	Somewhat Prepared
10	Very Prepared

At the end of every session, the teams were also asked to assess their overall success at Flash Tracking, using a scale of 1 to 10. On the basis of these scores, all four projects were deemed successful. Sections 3, 4, 5, 6 and 10 provide detailed descriptions of the case-studies, research method, and findings.

Phase II: Data Analysis - Delphi

To verify that the newly identified practices are essential to Flash Tracking, the data were analyzed through the Delphi process. Representatives from all four projects, along with a few GDOT officials, participated as SMEs in these Delphi studies. See Section 8 for a detailed description of this research method and the findings.

Phase III: Data Analysis - AHP

In addition to identifying the new Flash Track practices applicable to GDOT construction, it was important for the project teams to know the relative weights of each practice. The AHP method was used to determine the relative weights for each practice. This involved making pairwise comparisons based on the judgments and input of the SMEs. Section 9 provides detailed descriptions of this research method and the findings.

Phase IV: AHP for xDOT

The 17 GDOT and 19 VDOT best practices were combined into one framework and called the xDOT best practices. This combined set of best practices was re-organized and grouped into a new set of seven categories. Then, to determine the relative weights for each practice in each category, the researchers used the AHP method to analyze the pairwise comparisons generated by an automated online tool. Section 9 provides detailed descriptions of this research method and the findings.

SECTION 3 - SR 299 AT I-24 BRIDGE REPLACEMENT

GDOT awarded the contract for the reconstruction of the State Route (SR) 299 Bridge over Interstate (I) 24 in Dade County. This project was part of the agency's Accelerated Bridge Construction (ABC) initiative and delivered through its Design-Build program. Interestingly, it was the state's first bridge replacement project executed completely with ABC methods [11]. The $7.27 million project was designed to provide a safe and a reliable means of transportation for motorists in Dade County.

PROJECT OVERVIEW

Located approximately 0.6 miles south of the Georgia/Tennessee state line and crossing Interstate 24, this bridge is an overpass at the I-24 interchange at exit 169. The bridge's length is approximately 0.16 miles along SR 299. The replacement project's limits extended 0.39 miles north of the bridge and 2,000 feet south of it along I-24, for a total length of approximately 0.77 miles along I-24 [12].

Interstate 24 is a four-lane freeway (with two lanes going in each direction), with a speed limit of 65 mph within the area of study. The SR 299 interchange is a partial cloverleaf, with single-lane ramps to the south of SR 299.

Project Team

The SR 299 at I-24 Bridge Replacement project is the product of a public-private partnership between GDOT, FHWA, the HNTB Corporation, and the Design-Build team of Wright Brothers, and Parsons Brinckerhoff.

Challenges

The following are the numerous challenges of the project:

- Because the state route carries heavy traffic, closing the bridge for normal bridge replacement was not an option.
- The April 2017 deadline was critical because no closure was going to be possible in June or early July of that year; so, missing the deadline would have delayed the project by at least 1.5 months.
- Demolition of the existing bridge was difficult, since it was welded together and had to be broken down into two sections.

Project Map

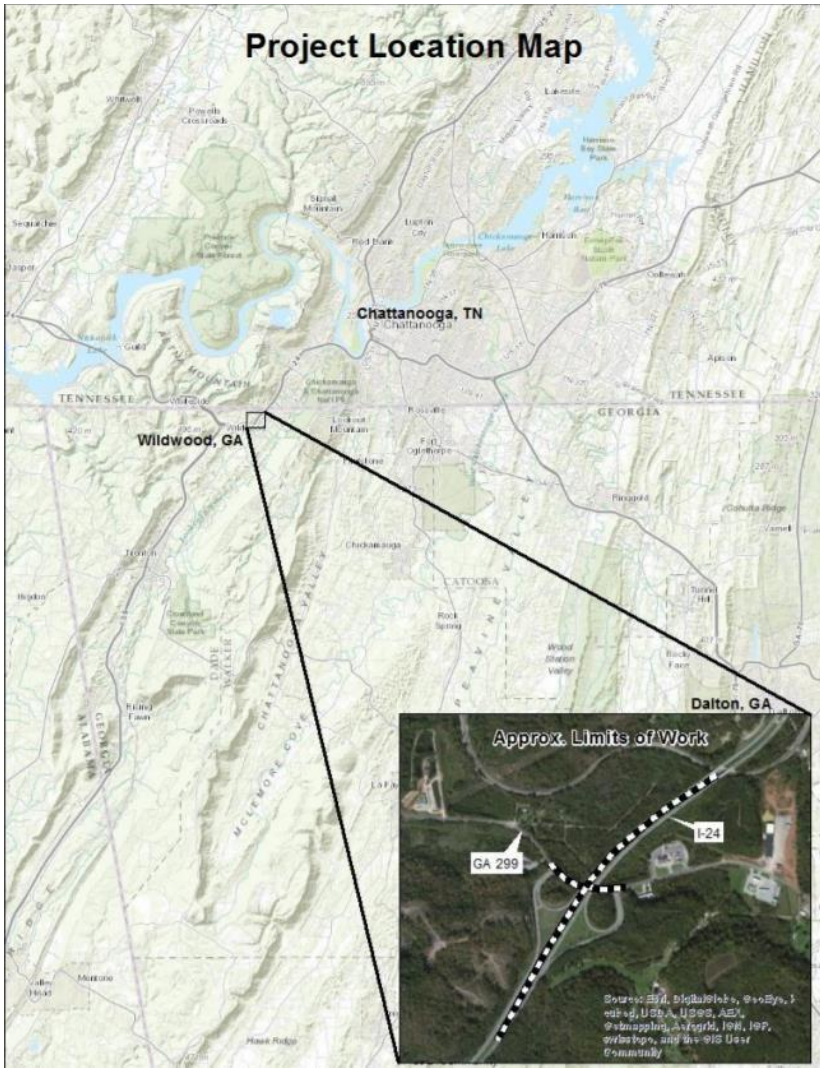

Figure 2: SR 299 at I-24 Bridge Replacement Project Map

OVERALL SUCCESS OF SR 299 AT I-24

After considering the positives, challenges, lessons learned, and Readiness Assessment scores, the researchers concluded that the SR 299 at I-24 bridge replacement was a successful Flash Track project. (See Figure 3 below for the project's Flash Track readiness scores.)

ASSESSMENT OF READINESS FOR FLASH TRACKING

The meeting for this project took place on August 18, 2016. During this meeting, the researchers interviewed the participating SMEs to determine the project team's readiness to carry out this project on a Flash Track basis. With the input of the SMEs, the research team identified new Flash Track best practices and documented lessons learned.

Meeting Attendees

Table 3 shows the attendees of the SR 299 at I-24 project interview.

Table 3: SR 299 at I-24 Meeting Attendees

Name	Company
Andrew Hoenig	GDOT Innovative Delivery
Dustin O'Quinn	HNTB Corporation

FLASH TRACK READINESS TOOL RESULTS FOR SR 299 AT I-24

Representatives from the project team were asked to assess the project's readiness for Flash Tracking using the CII-developed module of the CII Flash Track Readiness tool. The module assesses six project areas: 1) Contractual Readiness; 2) Delivery Readiness; 3) Organizational Readiness; 4) Cultural Readiness; 5) Planning Readiness; and 6) Execution Readiness. Table 4 presents the participants' assessment of readiness for Flash Tracking in these areas. Figure 3 provides a screenshot of these results in the tool's dashboard.

Table 4: SR 299 at I-24 Readiness Assessment for Flash Tracking

No.	Questions	Scores
1	**Overall Readiness**, to undertake the Flash Track Project?	7.8
2	**Contractual** consideration readiness?	7.1
3	**Project Delivery** consideration readiness?	7.8
4	**Organizational** consideration readiness?	7.6
5	**Cultural** consideration readiness?	8.4
6	**Planning** consideration readiness?	7.7
7	**Execution** consideration readiness?	7.9

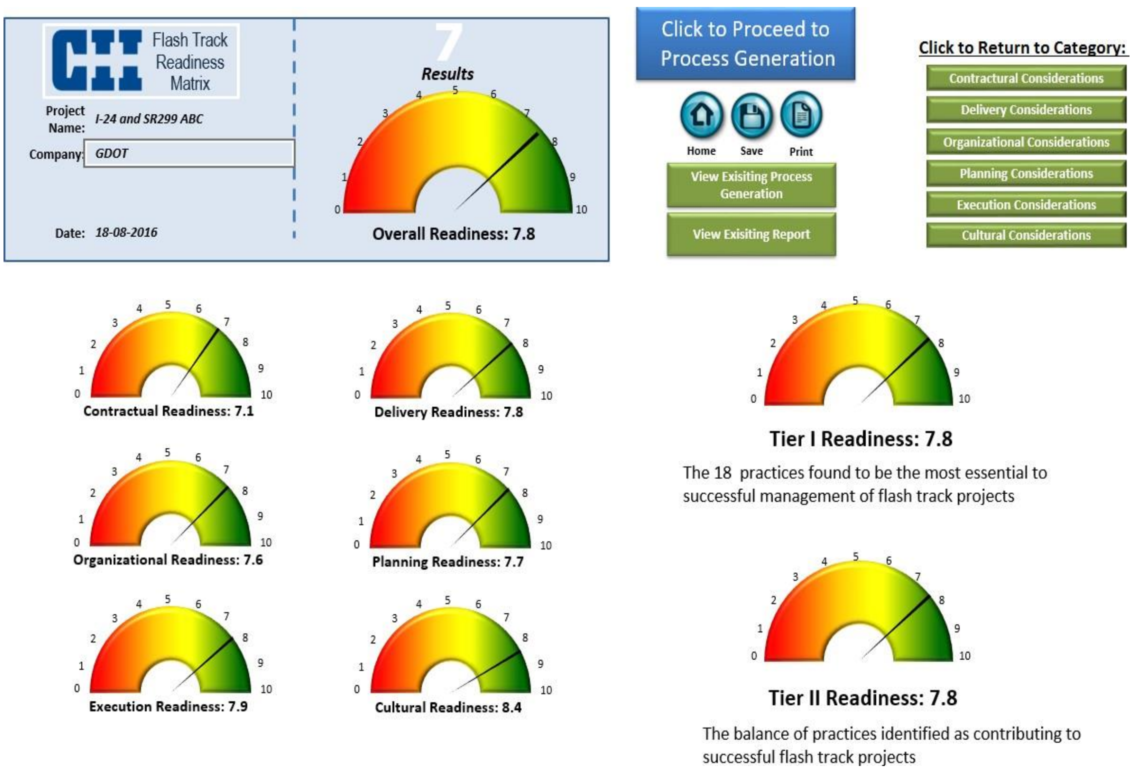

Figure 3: CII Flash Track Readiness Tool Results for SR 299 at I-24 Bridge

Table 4 and Figure 3 both show that the project team was most ready for Flash Tracking in the Cultural category (with a score of 8.4 out of 10) and in the Execution category (with a score of 7.9). In the Organizational category, the project identified "Using team building and partnering practices" as a key concern.

SR 299 AT I-24 BRIDGE REPLACEMENT PROJECT POSITIVES AND CHALLENGES

Presented below are the questions about project readiness the project team answered about the positives and challenges they encountered in the six CII-developed project assessment areas. Also listed are the answers to each question.

1. Contractual Readiness

What are some issues the project experienced related to ***Contractual*** considerations?

Contractual Positives	Contractual Challenges
• Clear, specific, scoping requirements were set for the project. A draft request for proposals was used. • Performance based specifications were established. There was a disincentive for late completion. However, an incentive for early completion was not part of a contract. • Contract strategies were tailored to project-specific conditions. That is why the contract specified the use of either of the only two methods: slide-in, and self-propelled modular transport (SPMT). • Inclusion of all construction activities within the ROW was a positive contractual consideration.	• The Design-Build team had a limited 56-hour closure window, causing team members to hold detour meetings, and establish outreach with the Tennessee Department of Transportation. • Federal funds were pulled, and then later restored, causing GDOT to re-advertise. No pre-let procurement efforts were utilized.

2. Project Delivery Readiness

What are some issues the project experienced related to ***Project Delivery*** considerations?

Project Delivery Positives	Project Delivery Challenges
• Procurement was done using Best Value procurement. • The Design-Build team brought in the subject matter experts (SMEs) during the actual deck move. • GDOT's move of engaging some SMEs during RFP development and the cost estimation phase was a positive project delivery consideration.	• An attempt at relocating the utilities was made, but it couldn't be done. • The technical percentage could have been higher. The technical proposal was only 25 percent, and this was considered as a project delivery challenge. • Using 3D modeling for updating a common database was not feasible on a $7.27 million project.

3. Organizational Readiness

What are some issues the project experienced related to ***Organizational*** considerations?

Organizational Positives	Organizational Challenges
• Delegating the decision making to the project level was a strong organizational positive. • GDOT worked on dedicating resources from each SME field to support the Innovative Delivery Program. • SMEs were brought in as needed, to better engage the owner's representatives. • Staffing with multi-skilled personnel was done by bringing in national ABC experts.	• Establishing a fully integrated project team was a challenge, since the project scale did not yield to a more integrated team. • A federal training program was required. • It was a challenge to empower the project team because the Design-Build team lacked leadership personnel.

4. Cultural Readiness

What are some issues the project experienced related to ***Cultural*** considerations?

Cultural Positives	Cultural Challenges
• One of the positive cultural considerations was legislative approval of the best value pilot ABC project. • GDOT was an active, involved, and fully committed owner.	• One of the challenges that the project faced was getting the baseline schedule approved. • Executive alignment among the contracted parties was a challenge and wasn't engaged. A plausible reason for this was the size of the project.

5. Planning Readiness

What are some issues the project experienced related to ***Planning*** considerations?

Planning Positives	Planning Challenges
• Considering the speed of fabrication and construction during the selection of design alternatives, the positive planning consideration here was that the project was ABC from the start. • GDOT recognized and managed additional Flash Track risks by making decisions that allowed the Design-Build team to be successful.	• There was a possibility of having a more integrated project controls process. • The Design-Build team struggled with critical path items and finished the designs at the eleventh hour.

6. Execution Readiness

What are some issues the project experienced related to ***Execution*** considerations?

Execution Positives	Execution Challenges
• Using eBuilder as a document and process tracking system helped simplify the approval procedures. • Using the SPMT method for construction reduced the construction cost. • Monthly project review meetings were conducted.	• Co-locating the project team was a challenge, since the scale of project did not justify it. • Dedicating full-time personnel to the project was a challenge, since resources were limited.

SR 299 AT I-24 BRIDGE REPLACEMENT POTENTIAL BEST PRACTICES SUMMARY TABLE

After conducting the project team interviews, facilitating discussions, and performing an independent analysis of the project, the researchers prepared a table of the potential best practices for successful Flash Tracking. (See Table 5.) Moreover, these potential best practices, along with descriptions of their implementation and benefits, were cross-referenced against the 47 existing CII Flash Track best practices and the 19 VDOT Flash Track best practices. In the table, the practices that were found to have no corresponding CII and VDOT best practices are labeled "New." This collection of practices was further analyzed through the Delphi process and AHP to generate the GDOT Best Practices. (See Appendix II for the full list of the CII best practices, and Section 9 for all the VDOT best practices.)

Table 5: SR 299 at I-24 Bridge Replacement Potential Best Practices Summary

No.	Best Practices from SR 299	Description of Implementation/ Benefits	Corresponding CII & VDOT Best Practices[1]	Relevant CII and VDOT Best Practices[2]
1.	Establishing the Bridge Fabrication Facility near the Project Location **(New)**	Easier transportation of bridge elements Better coordination Reduced costs due to proximity to the site	—	**39.** Considering Speed of Fabrication and Construction during the Selection of Design Alternatives **41.** Co-location of Project Team (Owner, Designer, Builder, and/or Vendors) **62.** Implementing Smarter Work Zones to Dynamically Manage Traffic and Reduce Work Zone Impacts

No.	Best Practices from SR 299	Description of Implementation/ Benefits	Corresponding CII & VDOT Best Practices[1]	Relevant CII and VDOT Best Practices[2]
2.	Considering 3D and 4D Modeling of the Execution Sequence during the Schematic Design **(New)**	Ensures a greater awareness level Provides more possible alternatives Provides with a 3D animation	—	**17.** Engaging Operations and Maintenance Personnel in the Development and Design Process
3.	Considering 3D and 4D Modeling of the Execution Sequence during the Detailed Design **(New)**	Drawings and specifications identified by stages in execution sequence process drawings Execution sequence process drawings developed	—	**17.** Engaging Operations and Maintenance Personnel in the Development and Design Process

Table 6 presents the newly identified potential best practices identified from the SR 299 at I-24 project.

Table 6: SR 299 at I-24 New Potential Best Practices Progress

No.	Practices	SR 299 I-24
1.	Establishing the Bridge Fabrication Facility near the Project Location	SR 299 I-24 (1)
2.[3]	Considering 3D and 4D Modeling of the Execution Sequence during Schematic Design	SR 299 I-24 (2)
3.	Considering 3D and 4D Modeling of the Execution Sequence during Detailed Design	SR 299 I-24 (3)

[1] The term "Corresponding Practices" refers to the existing best practices that are very similar to the best practices developed from the project.
[2] The term "Relevant Practices" refers to the existing practices that are somewhat related to the project's best practices. It also refers to any practice that enables the best practices developed from the project.
[3] This practice did not make the statistical cut. (See Section 8 for more about the Delphi process and the statistical criteria used.

SECTION 4 - JIMMY DELOACH CONNECTOR

PROJECT OVERVIEW

The Jimmy Deloach Connector is a 3.1-mile limited access four-lane highway, beginning at an at-grade "T" intersection with State Route (SR) 307/Bourne Avenue and terminating at the existing eastern end of the Jimmy Deloach Parkway. It not only connects State Route 80 and State Route 21/Augusta Highway, but also runs parallel to SR 21/Augusta Highway. This project included the construction of six bridges, new interchanges at Grange Road and Sonny Dixon, and 11-acre area of wetland mitigation. This expedited delivery project was completed in May 2016.

The limited access roadway consists of four 12-foot wide travel lanes (two in either direction), separated by a median barrier with four-foot-wide inside shoulders and 6.5-foot-wide paved outside shoulders. This roadway has a posted speed limit of 55 mph.

Following is the timeline of the project:

- Project concept was completed in 2010.
- Project was funded with $100 million worth of bonds sold by the state in 2011.
- Project was awarded to the Design-Build team on December 2, 2011.
- Ground-breaking took place on October 17, 2013.
- Project was completed on May 27, 2016.

Project Team

This project was the product of a partnership between GDOT and the awarded Design-Build team. The prime contractor on the Design-Build team was Archer Western

Contractors, and the prime designer was Michael Baker International (formally the LPA Group). The different GDOT entities participating in this project were Innovative Delivery, Traffic Operations, and District 5. Other project stakeholders were Georgia Port Authority, Chatham County, the City of Savannah, and the City of Port Wentworth.

Challenges

Following are the numerous challenges faced during construction:

- Geotechnical issues presented some of the most important challenges, including settling, piling, friction issues, and the need for wetland mitigation and ground improvements.
- ROW acquisition, particularly on industrial and residential tracts, proved difficult and affected the project schedule.
- Utility relocation was included in the Design-Build contract. However, the utility companies did not provide enough pre-bid information. Some even refused to provide pre-bid information.
- Construction on Bridge 1 was delayed by Georgia Power’s purchase of its ROW.
- Environmental permitting and mitigation also presented significant challenges, since the environmental permitting issues that emerged during Value Engineering necessitated numerous design changes.

Project Map

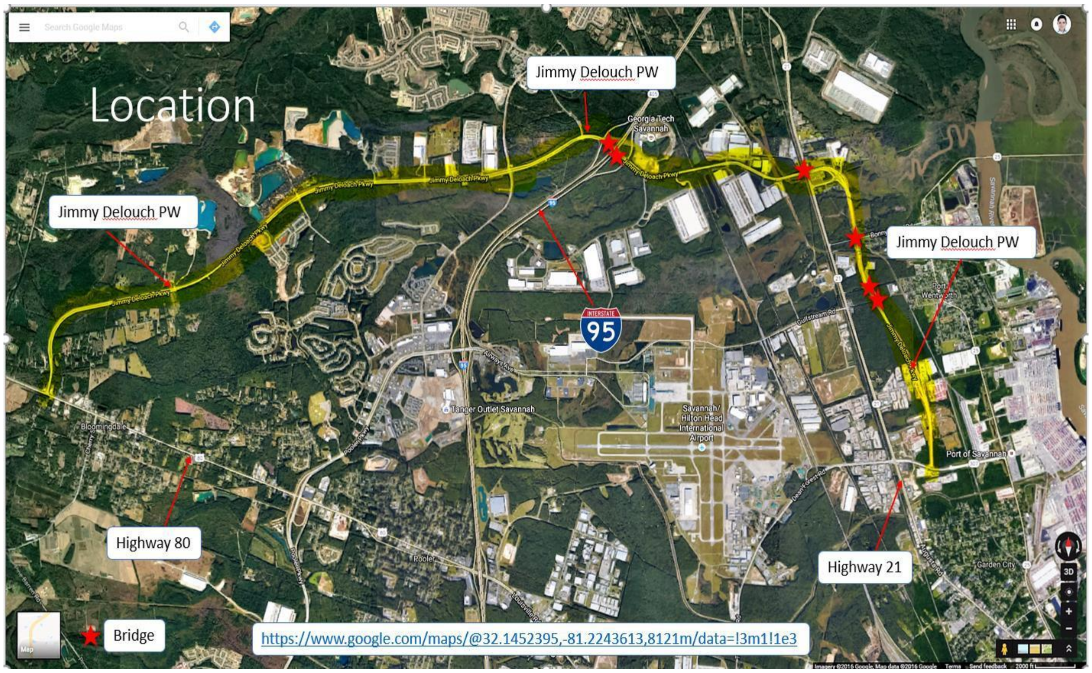

Figure 4: Jimmy Deloach Connector Project Map

OVERALL SUCCESS OF JIMMY DELOACH CONNECTOR

Taking into account the challenges, positive considerations, lessons learned, and Readiness Assessment scores, the research team concluded that the Jimmy Deloach Connector was a successful Flash Track project. (See Figure 5 and Figure 6 for the project's Flash Track readiness scores.)

ASSESSMENT OF READINESS FOR FLASH TRACKING

The meeting for this project took place on October 14, 2016. During this meeting, the researchers discussed the project team's readiness to carry out the project on a Flash Track basis. With the input of the SMEs, the researchers identified new Flash Track best practices and documented lessons learned.

Meeting Attendees

Table 7 below shows all the attendees of the Jimmy Deloach project meeting.

Table 7: Jimmy Deloach Connector Meeting Attendees

Name	Company
Andrew Hoenig	GDOT Innovative Delivery
Brad Gowen	Holt Consulting Company
Thomas Montgomery	Michael Baker International
Brian Woods	Archer Western
Saurabh Bhattacharya	Parsons Transportation Group Inc.
Cory Knox	GDOT District 5 Construction
Richard O'Hara	GDOT Innovative Delivery

FLASH TRACK READINESS TOOL RESULTS

Project team members or their representatives were asked to assess the project using both modules of the Flash Track Readiness Toolkit (i.e., the 47 CII-developed practices/categories and the 19 VDOT-developed practices/categories). Figure 5 presents a screenshot of the results of this assessment using CII-developed Flash Track Readiness tool.

As shown in Figure 5, the project had a very high score in terms of project delivery readiness (with a score of 8.6 out of a possible 10 points). The high degree of readiness in this area led to success in all other project areas. The three practices that scored the lowest (each with a score of 5) were in three different categories:

- Using Highly Integrated 3D Modeling with All Major Users Updating a Common Database (Delivery)
- Delegating Authority to the Project Level (Organizational)
- Co-locating the Project Team (Execution).

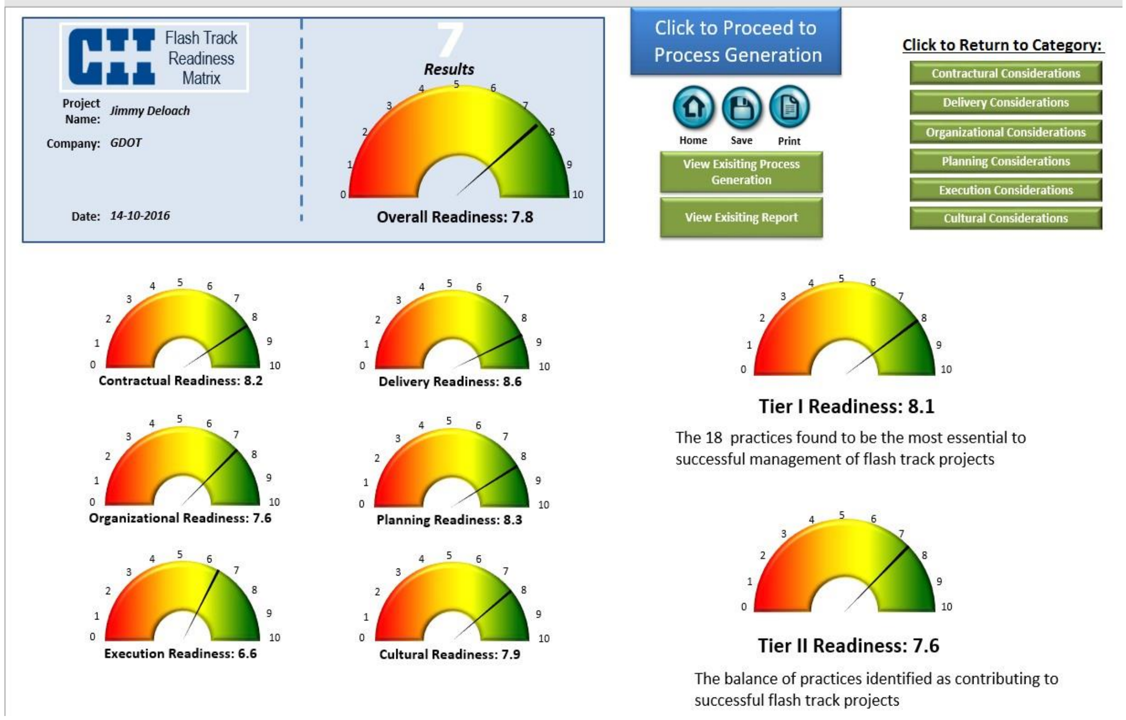

Figure 5: CII Flash Track Readiness Tool Results for Jimmy Deloach Connector

Figure 6 presents a screenshot of the results of the VDOT Flash Track Readiness assessment module. The categories in this module are as follows: (1) Right of Way & Utilities Readiness; (2) Operations & Public Engagement Readiness; (3) Safety Readiness; (4) Contractual Readiness; (5) Planning, Evaluation, and Environmental Readiness; and (6) Execution Readiness. As the figure shows, the project's highest score (9.7) was in the Safety category.

The three lowest scoring practices (each with a score of 5) were in three different categories:

- Having Early Engagement of Utility Owners (ROW & Utilities)
- Using Incentives to Encourage Earlier Project Completion (Contractual)
- Utilizing an Integrated Document Management System for Tracking Requests for Information (RFIs), Quality Assurance/Quality Control (QA/QC), Submittals, and

Other Documents (Execution).

Figure 6: VDOT Flash Track Readiness Tool Results for the Jimmy Deloach Connector

JIMMY DELOACH CONNECTOR PROJECT POSITIVES AND CHALLENGES

Presented below are the questions the project team members answered about the positives and challenges they encountered in four project readiness assessment areas. Also listed are the answers given to each question.

1. Contractual Readiness

What are some issues the project experienced related to ***Contractual*** considerations?

Contractual Positives	Contractual Challenges
• Additional allowances for lane closure and for utilities. • Better ROW considerations by including the ROW in the Design-Build contract. The schedule was the driver for having ROW in the Design-Build contract.	• Reducing risks through the collective efforts of all stakeholders was a challenge, as the City of Savannah was difficult to align with. • Funding early critical efforts was challenging because better geotech was needed upfront. • Change management was more challenging during design than during construction. • Because ROW was in the Design-Build contract, contractual incentives should have been included for the design-builder. • Other key challenges included environmental, utility, geotechnical, and ROW acquisition, among others.

2. Delivery Readiness

What are some issues the project experienced related to ***Delivery*** considerations?

Delivery Challenges
• Engineering, Procurement, and Contracting (EPC) company used 3D modeling, but GDOT did not use it. • GDOT should have done best value procurement of Design-Build. (However, it was not allowed by law at that time.) • Focusing on procurement decisions on construction priorities was a challenge because the project had some ROW issues.

3. Planning Readiness

What are some issues the project experienced related to ***Planning*** considerations?

Planning Positives	Planning Challenges
• Most design was completed before construction.	• It would have been better to have the design process broken down.

4. Execution Readiness

What are some issues the project experienced related to ***Execution*** considerations?

Execution Positives
• Staged construction based on ROW was easier. • Delivered on time, and under budget

JIMMY DELOACH CONNECTOR POTENTIAL BEST PRACTICES SUMMARY TABLE

After conducting interviews, facilitating discussions, and performing an independent analysis of the project, the research team created a table summarizing the potential best practices critical to the success of a Flash Track project. (See Table 8.) Moreover, these potential best practices, along with descriptions of their implementation and benefits, were cross-referenced against the 47 existing CII Flash Track Best Practices and the 19 VDOT best practices. In the table, the practices that were found to have no corresponding CII and VDOT best practices are labeled "New." This collection of practices was further analyzed through the Delphi process and AHP, ultimately to generate the GDOT Best Practices. (See Appendix II for the full list of the CII best practices, and Section 9 for all the VDOT best practices.)

Table 8: Jimmy Deloach Connector Potential Best Practices Summary

No.	New Best Practices from Jimmy Deloach	Description of Implementation/Benefits	Corresponding CII & VDOT Best Practices	Relevant CII and VDOT Best Practices
1.	Phasing Environmental Permits to Match Phased Construction **(New)**	Environmental permitting was required for 100% of the project. But GDOT worked on getting phased permitting and allowed the construction to proceed in phases.	-	**51.** Having Early Utility and ROW Coordination; Engaging Construction Personnel during Design and during Environmental Document Preparation, Etc. **58.** Conducting Environmental Permitting and Scope Development in Parallel
2.	Overlapping Environmental and ROW Acquisition **(New)**	Permitting and ROW would have taken two times longer if the traditional process had been followed.	-	**50.** Starting ROW Acquisition during Conceptual Design (20% to 50% Design) **51.** Having Early Utility and ROW Coordination; Engaging Construction Personnel during Design and during Environmental Document Preparation, Etc. **58.** Conduct Environmental Permitting and Scope Development in Parallel **59.** Establishing Programmatic Agreement to Streamline the Process for Handling Routine Environmental Requirements

No.	New Best Practices from Jimmy Deloach	Description of Implementation/Benefits	Corresponding CII & VDOT Best Practices	Relevant CII and VDOT Best Practices
3.	Including ROW, Utility Relocation, and Environmental Mitigation in Design-Build Contract **(New)**	First GDOT Design-Build contract to include ROW acquisition, which accelerated the completion of the project schedule by two years.	-	**1.** Setting Clear, Specific Scoping Requirements **48.** Having Early Engagement of Utility Owners **49.** Having Dedicated Utility Manager Consultants for VDOT and the Designer/Constructor Team **50.** Starting ROW Acquisition during Conceptual Design (20% to 50% Design) **51.** Having Early Utility and ROW Coordination; Engaging Construction Personnel during Design and during Environmental Document Preparation, Etc. **58.** Conducting Environmental Permitting and Scope Development in Parallel **59.** Establishing Programmatic Agreement to Streamline the Process for Handling Routine Environmental Requirements

Table 9 below presents the newly identified potential Flash Track best practices identified from both the SR 299 at I-24 project and the Jimmy Deloach Connector project.

Table 9: New Potential Best Practices identified from the SR 299 at I-24 and Jimmy Deloach Connector Projects

No.	Practice	SR 299 I-24	Jimmy Deloach
1.	Establishing the Bridge Fabrication Facility near the Project Location	SR 299 I-24 (1)	
2.[1]	Considering 3D and 4D Modeling of the Execution Sequence during Schematic Design	SR 299 I-24 (2)	
3.	Considering 3D and 4D Modeling of the Execution Sequence during Detailed Design	SR 299 I-24 (3)	
4.	Phasing Environmental Permits to Match Phased Construction		JD (1)
5.	Overlapping Environmental and ROW Acquisition		JD (2)
6.	Including ROW, Utility Relocation, and Environmental Mitigation in the Design-Build Contract		JD (3)

[1] This practice did not make the statistical cut. (See Section 8 for more about the Delphi process and the statistical criteria used.)

SECTION 5 - RIVERSIDE DRIVE ROUNDABOUTS AT I-285

PROJECT OVERVIEW

The Riverside Drive Roundabouts project is located on Riverside Drive at the interchange with I-285 in Fulton County, Georgia, standing within the city limits of Sandy Springs. The project was a Design-Build safety project identified by the GDOT Office of Traffic Operations to decrease the severity of the number of crashes at the then-existing interchange. The existing conventional diamond interchange consisted of one twelve-foot lane in both directions, with no turn lanes and traffic signals at the entrance and exit ramps. The newly designed $5.6 million interchange converted the existing signalized ramp intersections to single lane roundabouts. The approach to the roundabouts was designed to have two lanes, with one lane used to enter each roundabout, and one lane used as a right turn lane. The project also provided sidewalks on both sides of Riverside Drive and bridge maintenance on the existing Riverside Drive Bridge over I-285.

Project Team

This Design-Build project was the product of a partnership between GDOT and the awarded Design-Build firm. The prime designer on the Design-Build team was Infrastructure Consulting and Engineering, LLC, and the prime contractor was Baldwin-Paving. The different entities of GDOT participating on this project were Innovative Delivery, Traffic Operations, and District 7. One of the major stakeholders of the project was the City of Sandy Springs.

Challenges

The following are the numerous challenges faced during construction:

- One of the challenges facing GDOT was ROW acquisition, with GDOT assuming the risk of not reaching a resolution during the construction phase.
- Since such a roundabout project was the first one built in Georgia, the project faced a lot of naysaying.
- Because of their unfamiliarity with roundabouts, the locals were at first concerned that this project would cause an increase in traffic. In response, GDOT focused much of the initial project development on showing the public that the roundabout would not cause a dramatic increase in traffic. It was particularly important to educate users on how to navigate through the roundabout.
- The budget for design and construction of landscaping was set prior to letting, and the Design-Build team was responsible for coordinating with the City of Sandy Springs on a landscaping design. It was a challenge to balance the budget and execute construction in compliance with the city's vision for the project's landscaping.

Project Map

Figure 7: Riverside Drive Roundabouts Project Map

OVERALL SUCCESS OF RIVERSIDE ROUNDABOUTS AT I-285

After considering the project's positive considerations, challenges, lessons learned, and Readiness Assessment scores, the research team concluded that it was a successful Flash Track project (See Figure 8, Figure 9, and Figure 10 for the Flash Track readiness scores).

ASSESSMENT OF READINESS FOR FLASH TRACKING

The interviews for this project took place on March 17, 2017. During this session, the researchers discussed the readiness of the project team to carry out the project on a Flash Track basis. With the input of the subject matter experts, the researchers identified new Flash Track best practices and documented lessons learned.

Meeting Attendees

Table 10 below shows all the attendees at the Riverside Drive Roundabouts project meeting.

Table 10: Riverside Drive Roundabouts Meeting Attendees

Name	Company
Marlo Clowers	GDOT Office of Innovative Delivery
Scott Zehngraff	GDOT Traffic Operations
Shane Swan	HNTB (GDOT representative)
Jason Walker	Baldwin Paving
Ryan Graves	Arcadis
Tyler McIntosh	Infrastructure Consulting and Engineering, LLC

FLASH TRACK READINESS TOOL RESULTS

Table 11 below presents the overall Flash Track readiness assessments (CII-developed best practices categories), alongside the individual assessments, completed by five of the six participating project members.

Table 11: Riverside Drive Roundabouts Readiness Assessment for Flash Tracking

Questions	All	Owners and Representatives	Design-Build Team
		Overall	Overall
General Readiness to undertake a Flash Track Project	7.7	7.9	8.0
Contractual consideration readiness	8.3	8.0	8.6
Project Delivery consideration readiness	8.4	8.3	8.3
Organizational consideration readiness	8.4	8.3	8.6

Questions	**All**	**Owners and Representatives**	**Design-Build Team**
		Overall	**Overall**
Cultural consideration readiness	8.0	7.9	8.5
Planning consideration readiness	7.5	7.3	7.9
Execution consideration readiness	6.5	7.3	5.9

Project team members or their representatives were asked to assess the project using both modules of the Flash Track Readiness Toolkit (i.e., the 47 CII-developed practices/categories and the 19 VDOT-developed practices/categories). Figure 8 presents a screenshot of the Flash Track Readiness results for the CII developed Flash Track categories, and Figure 9 and Figure 10 present screenshots of the Flash Track readiness results for the VDOT-developed Flash Track categories.

Figure 8 shows that the project scored highest in terms of Organizational and Delivery readiness, which led to success in all other aspects of the project. The practice that scored the lowest (with a score of 4) was Co-locating the Project Team (i.e. the owner, designer, builder, and/or key vendors) in the Execution category.

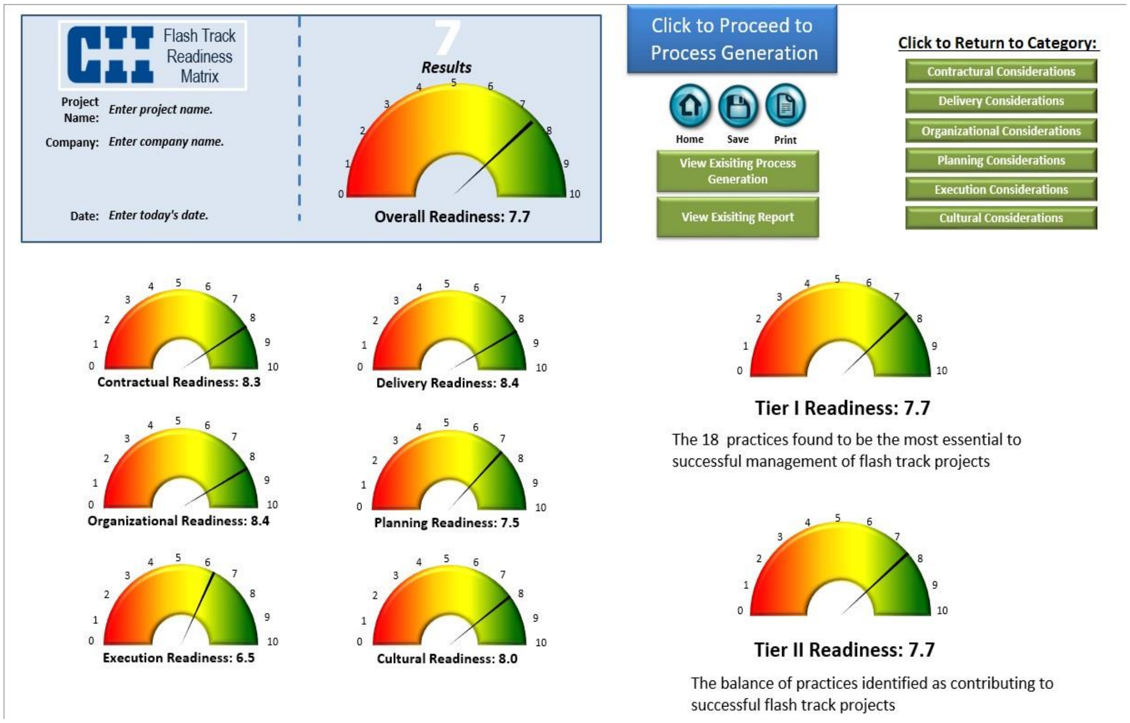

Figure 8: CII Flash Track Readiness Tool Assessment of Riverside Drive Project

When the members of the Design-Build team performed the assessment with the VDOT-developed practices and categories, the highest scoring category was Contractual readiness. (See Figure 9.) This preparedness led to the success in all other aspects of the project. When the owner's representatives performed the VDOT-developed assessment, the highest scoring category was ROW and Utilities. (See Figure 10.) Readiness in these areas led to the success in all other aspects of the project.

Figure 9: Design-Build Team Flash Track Readiness Assessment of Riverside Drive Project (VDOT-developed Practices and Categories)

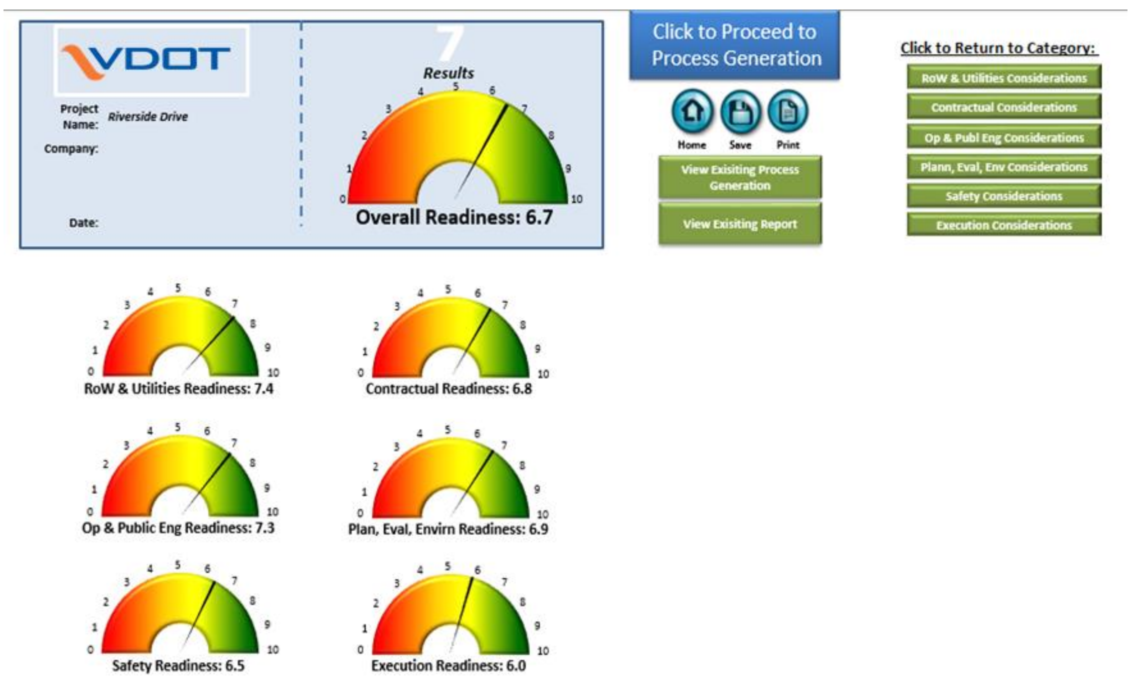

Figure 10: Owner Representative Flash Track Readiness Assessment of Riverside Drive Project (VDOT-developed Practices and Categories)

RIVERSIDE DRIVE ROUNDABOUTS PROJECT POSITIVES AND CHALLENGES

Presented below are the questions the project team answered about the positives and challenges they encountered in six project readiness assessment areas. Also listed are the answers given to each question.

1. Contractual Readiness

What are some issues the project experienced related to ***Contractual*** considerations?

Contractual Positives	Contractual Challenges
• Public Interest Determination allows the utility relocation to be paid for. • ROW acquisition is included in the scope of the Design-Build (D-B) contract. GDOT went ahead and identified the areas that needed to be acquired. This obviated GDOT's need to wait for the traditional period of time for the closing of all the parcels of the project. • Utilities were also included in the scope of the D-B contract. • A utility review period was allowed.	• In the case of ROW acquisition, GDOT assumed the risk of not reaching a resolution.

2. Project Delivery Readiness

What are some issues the project experienced related to ***Project Delivery*** considerations?

Project Delivery Positives	Project Delivery Challenges
• Monthly schedule updates from the D-B team helped GDOT know where they stood in terms of project delivery. • These monthly updates allowed GDOT and the City of Sandy Springs to identify the upcoming bridge closures early on and prepare for and coordinate public outreach. • Tailor-made procurement was specific to the project (one size fits one). • Another project delivery positive was having a two-stage D-B project.	• The budget for design and construction of landscaping was set prior to letting. The D-B team was responsible for coordinating with the City of Sandy Springs on landscaping design. It was a challenge to balance the budget for design and construction in compliance with City of Sandy Springs landscaping vision for the project.

3. Organizational Readiness

What are some issues the project experienced related to ***Organizational*** considerations?

Organizational Positives
• Getting utility owners to attend face-to-face monthly meetings to discuss utility designs and construction got them engaged with the project and with the significant subcontractors. • Stakeholder meetings for everybody involved in the project kept everybody on track and ensured their continuous engagement.

4. Cultural Readiness

What are some issues the project experienced related to ***Cultural*** considerations?

Cultural Positives
• Extra efforts were made to hand out flyers and post information on city Web pages. This heightened public outreach helped a lot. • During concept development and before procurement, several meetings with the Sandy Springs City Council and with individual council members were held to assure them that the project would not increase traffic dramatically.

5. Planning Readiness

What are some issues the project experienced related to ***Planning*** considerations?

Planning Positives	Planning Challenges
• Plan approvals were staged by GDOT to allow construction early on. • Construction started before the final landscape plans were completed.	• This was the only interchange in the surrounding areas, which were in residential zones, while other interchanges in the region were in commercial zones. Thus, GDOT wanted to distinguish this interchange from the others nearby.

5. Execution Readiness

What are some issues the project experienced related to ***Execution*** considerations?

Execution Positives	Execution Challenges
• Notice-to-Proceed (NTP) 1 (preliminary design) and NTP 2 (final design) were done at pretty much the same time. • The number of ROW parcels acquired was minimized through the design. For example, the design eliminated the need to acquire one parcel and minimized the amount required on another. • GDOT worked intensively with the city to inform the public about the two crossings on either side of the interchange. This outreach ensured that the entire community knew about these alternative crossings.	• Due to the high percentage of ROW condemnations, there were some ROW issues with the property owners.

RIVERSIDE DRIVE ROUNDABOUTS POTENTIAL BEST PRACTICES SUMMARY TABLE

After conducting interviews, facilitating discussions, and performing an independent analysis of the project, the research team created a table summarizing the potential best practices critical to the success of a Flash Track project. (See Table 12.) Moreover, these potential best practices, along with descriptions of their implementation and benefits, were cross-referenced against the 47 existing CII Flash Track Best Practices and the 19 VDOT best practices. In the table, all the practices were found to have corresponding CII and VDOT best practices and, thus, none is labeled "New." This collection of practices was further analyzed through the Delphi process and AHP, ultimately to generate the GDOT Flash Track Best Practices. (See Appendix II for the full list of the CII Flash Track Best Practices, and Section 9 for all the VDOT-developed best practices.)

Table 12: Riverside Drive Roundabouts at I-285 Potential Best Practices Summary

No.	Best Practices from Riverside Roundabouts	Description	Corresponding CII & VDOT Best Practices	Relevant CII & VDOT Best Practices
1.	Customizing Procurement to Achieve the Project Objectives	Instructions were customized for the proposers. One of the customized components was the inclusion of the ROW acquisition in the Design-Build contract.	**4.** Establishing Contract Strategies Specifically Tailored to the Project Condition **10.** Focusing Procurement Decisions on Construction Priorities	**2.** Establishing Performance-based Specifications **13.** Employing Innovative Procurement Practices
2.	Identifying ROW Needs in Advance	GDOT went ahead and identified the areas that needed to be acquired. It was then a part of the scope of the contract for the Design-Build team to complete acquisition.	**1.** Setting Clear, Specific, Scoping Requirements **40.** Recognizing and Managing the Additional Flash Track Risks	**4.** Establishing Contract Strategies Specifically Tailored to the Project Condition **22.** Having an Owner with Sufficient Depth of Resources and Strength of Organization **24.** Having an Engaged

No.	Best Practices from Riverside Roundabouts	Description	Corresponding CII & VDOT Best Practices	Relevant CII & VDOT Best Practices
				and Empowered Owner's Engineer (Owner's Representative) **35.** Performing Exhaustive Front-End Planning **50.** Starting ROW Acquisition during Conceptual Design (20% To 50% Design)
3.	Conducting Extensive Public Outreach	Providing public outreach was one commitment for the project. Flyers were handed out about the closures, and signs and short notice closures were put up. The city also had a website to keep the public up to date. The outreach was even customized for some owners.	**55.** Deploying Continual Public Outreach, Media Campaigns, and Dedicated Communications Personnel	**56.** Ensuring Efficient Coordination of Construction with Management of Traffic Issues **57.** Establishing a Project Command Center
4.	Making Monthly Schedule Updates from the Design-Build Team	Monthly schedule updates from the Design-Build team tells the department where it stands in terms of project delivery.	**47.** Conducting Frequent and Effective Project Review Meetings	**53.** Having a Responsible In-charge Engineer/Design-Build Integrator

No.	Best Practices from Riverside Roundabouts	Description	Corresponding CII & VDOT Best Practices	Relevant CII & VDOT Best Practices
5.	Holding Face-to-face Monthly Meetings with Major Stakeholders	Face-to-face monthly meetings to discuss utility designs and construction. Getting utility owners to attend the meeting every month and engage with the project and with the significant subcontractors. This also ensured continuous engagement of stakeholders.	**47.** Conducting Frequent and Effective Project Review Meetings	**53.** Having a Responsible In-charge Engineer/Design-Build Integrator

Table 13 below presents the newly identified potential best practices identified from the SR 299 at I-24, Jimmy Deloach Connector, and Riverside Drive Roundabouts projects.

Table 13: Riverside Drive at I-285 New Potential Best Practices Progress

No.	Practice	SR 299 I-24	Jimmy Deloach	Riverside Drive
1.	Establishing the Bridge Fabrication Facility near the Project Location.	SR 299 I-24 (1)		
2.[1]	Considering 3D and 4D Modeling of the Execution Sequence in 3D during Schematic Design.	SR 299 I-24 (2)		
3.	Considering 3D and 4D Modeling of the Execution Sequence in 3D during Detailed Design.	SR 299 I-24 (3)		
4.	Phasing Environmental Permits to Match Phased Construction.		JD (1)	
5.	Overlapping Environmental and ROW Acquisition.		JD (2)	
6.	Including ROW, Utility Relocation, and Environmental Mitigation in Design-Build Contract.		JD (3)	

[1] This practice did not make the statistical cut. (See Section 8 for more about the Delphi process and the statistical criteria used.)

SECTION 6 – SR 47 AT LITTLE RIVER – BRIDGE REPLACEMENT

PROJECT OVERVIEW

The purpose of this project was to replace the existing, functionally obsolete, historic truss bridge on State Route (SR) 47 over the Little River (Clarks Hill Lake). The $24 million project began at approximately Mile Post (MP) 16.25 in Lincoln County and ended at approximately MP 0.85 in Columbia County. It was initially slated for Design-Bid-Build delivery. But progress on the project was delayed by a number of environmental and design-related challenges. Because these delays made it difficult to meet the intended schedule, the GDOT Office of Innovative Delivery (OID) stepped in to determine whether any new techniques could help get the project back on track. When OID got involved, the project had been designated as a Design-Build (D-B) project, with an A+B component for procurement. This meant that bidders bid not only the cost portion, but also that a time component was involved in the selection of the Design-Build team. The idea was to allow industry bidders to propose project durations to match the means and methods they would use to perform the work.

Project Team

This Design-Build project was the product of a partnership between GDOT and the awarded Design-Build firm. The prime designer on the awarded team was Michael Baker International, and the prime contractor was Scott Bridge Company, Inc. The governmental entities participating in this project were the Georgia Department of Natural Resources (DNR), GDOT OID, and the United States Army Corps of Engineers (USACE).

Challenges

The following are the numerous challenges faced during construction:

- During bidding, engineering emerged as one of the major Design-Build challenges, since the project had geological conditions under water. To help the D-B teams compose their bids, GDOT obtained additional boring data.
- Another challenge was an overhead power line slated for removal. Because a power outage was unacceptable, the pylon had to be taken apart in smaller sections.
- The project used a standard letting process in the Design-Build process, called Special Provision (SP) 999. This process did not allow bridge removal during certain times of the year, but did not provide the rationale for this prohibition. More clarification of this rule would have been helpful.
- During the posting period and during project design, GDOT did not have an approved load and resistance factor design (LRFD) bridge design software. The engineer of record requested that future projects allow the engineers to design substructures with LFRD software tools of their choosing.

Project Map

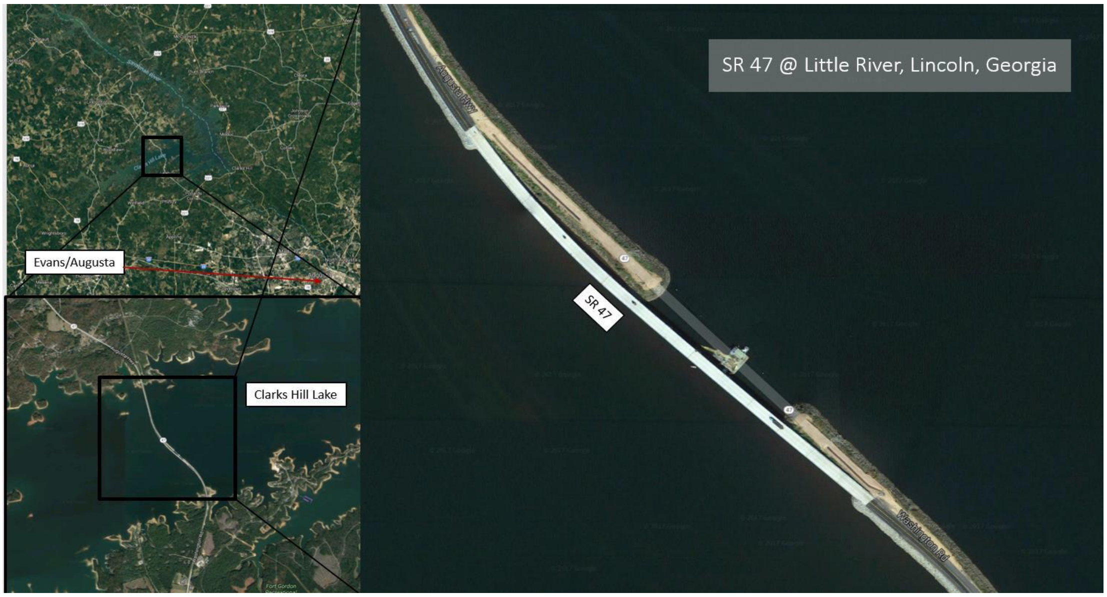

Figure 11: SR 47 at Little River – Bridge Replacement Project Map

OVERALL SUCCESS OF SR 47 AT LITTLE RIVER – BRIDGE REPLACEMENT

After considering the project positives, challenges, lessons learned, and readiness assessment scores, the researchers concluded that the SR 47 at Little River was a successful Flash Track project. Figure 12, Figure 13, and Figure 14 present the project's Flash Track readiness scores.

ASSESSMENT OF READINESS FOR FLASH TRACKING

The researchers interviewed the SMEs on this project on March 17, 2017, discussing the project team's readiness to carry out this project on a Flash Track basis. With this input, the researchers identified new Flash Track best practices and documented lessons learned.

Meeting Attendees

Table 14 shows all the attendees to the SR 47 at Little River project meeting.

Table 14: SR 47 at Little River Meeting Attendees

Name	Company
Marlo Clowers	GDOT-OID
Michael Terrell	Scott Bridge Co. Inc.
Shane Swan	HNTB (GDOT Representative)
Stephen Summers	Scott Bridge Co. Inc.
Rob Lewis	HNTB (GDOT Representative)
Albert Bowman	Michael Baker International
Rusty Merntt	GDOT – District 2

FLASH TRACK READINESS TOOL RESULTS

Table 15 presents the overall Flash Track readiness assessments, alongside the individual assessments, completed by four of the seven participating project members: Marlo Clowers, Rob Lewis, Shane Swan, and Albert Bowman.

Table 15: SR 47 Readiness Assessment for Flash Tracking

Questions	All	Owners and Representatives	Design-Build Team
		Overall	Overall
Overall readiness, to undertake the Flash Track Project	8.5	8.1	8.4
Contractual consideration readiness	7.3	6.8	7.7
Project Delivery Consideration readiness	9.0	8.5	10.0
Organizational consideration readiness	9.2	8.9	9.7
Cultural consideration readiness	8.5	8.8	7.0
Planning consideration readiness	8.3	7.7	10.0
Execution consideration readiness	8.1	8.0	8.8

Project team members or their representatives were asked to assess the project using both modules of the Flash Track Readiness Toolkit (i.e., the 47 CII-developed practices/categories and the 19 VDOT-developed practices/categories). Figure 12 presents a screenshot of the Flash Track readiness results for the CII developed Flash Track categories.

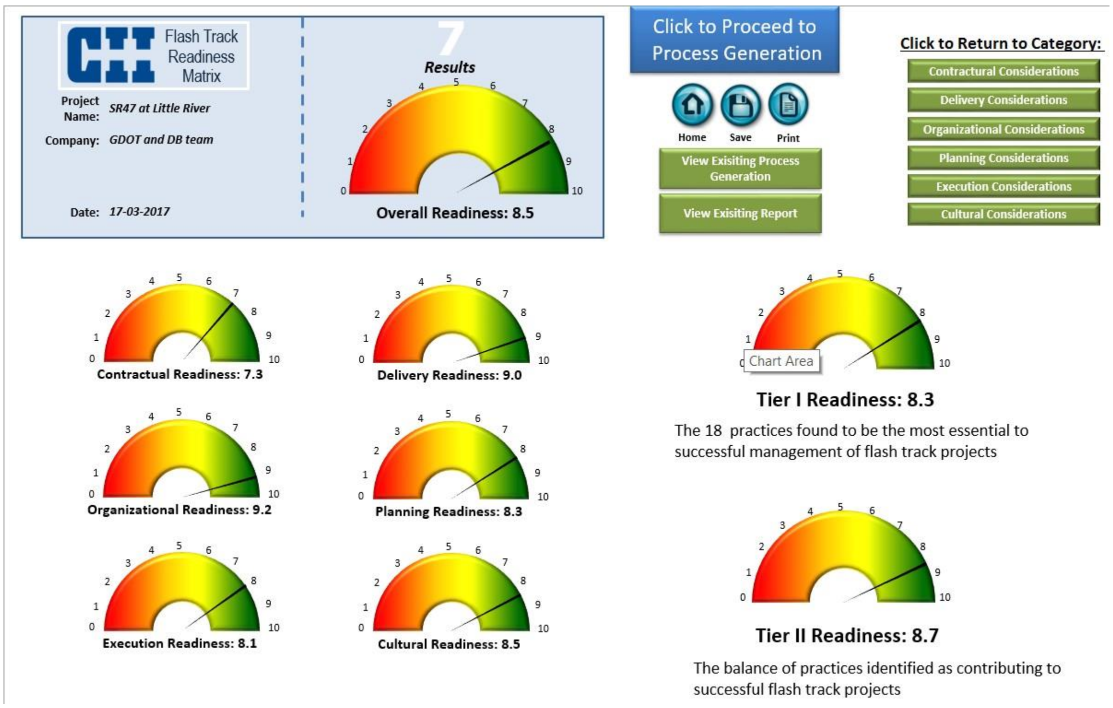

Figure 12: CII Flash Track Readiness Assessment of SR 47 Bridge

Figure 12 shows that the project scored highest in the Organizational and Delivery categories, which led to success in all other aspects of the project. The practice that scored the lowest (with a score of 3) was Establishing Clear Change Management Procedures in the Contractual category.

Figure 13 and Figure 14 present screenshots of the Flash Track readiness results for the VDOT-developed Flash Track categories. Figure 13 shows the Design-Build team members' assessment, which found the highest level of readiness in the Contractual category. The high score in this area led to success in all other aspects of the project. Figure 14 shows the owner representative's assessment, which found the highest level of readiness in the ROW category. The high score in this area led to success in all other aspects of the project.

Figure 13: Design-Build Team Flash Track Readiness Assessment of SR 47 Bridge (VDOT-developed Practices and Categories)

Figure 14: Owner Representative Flash Track Readiness Assessment of SR 47 Bridge (VDOT-developed Practices and Categories)

SR 47 AT LITTLE RIVER PROJECT POSITIVES AND CHALLENGES

Presented below are the questions the project team answered about the positives and challenges they encountered in six project readiness assessment areas. Also listed are the answers given to each question.

1. Contractual Readiness

What are some issues the project experienced related to ***Contractual*** considerations?

Contractual Positives	Contractual Challenges
• Inclusion of the A+B component for procurement was a positive contractual consideration. • Accepting different proposals for the project allowed the Design-Build team to find the best engineering solution for the project for the least possible cost. It also made it possible to have specialty contractors on the project. • Another contractual positive was that the commissioning of the existing bridge was part of the contract. • Early coordination with Georgia Power Transmission (GPT) occurred during development of the request for proposals (RFP). This brought about several contractual requirements including gate installation along the new mainline to the old roadbed. This provided GPT access for facility maintenance. The contract also stipulated timeframes during which GPT could not de-energize its facility. • The agreements under the project's Design-Build contract can be considered partnering (or innovative design group), which entails effective communication and the desire to collaborate. Having such agreements helped establish the mindset for doing a streamlined professional job.	• GDOT did not have an approved LRFD software tool for use on a bridge site. Only after discussions with its bridge office did GDOT review the available LRFD bridge design programs and provide a list of acceptable programs for use on GDOT projects. • One of the areas of improvement with respect to Design-Build utility coordination was early identification of high-risk utilities and the scheduling of meetings with the utility owners during RFP development.

2. Project Delivery Readiness

What are some issues the project experienced related to ***Project Delivery*** considerations?

Project Delivery Positives
• A software tool called eBuilder for document management and submittal tracking accelerated review time. Training for this software program was provided as well. • As bridge plan design and ROW acquisition proceeded, the D-B team received a conditional Notice-to-Proceed 3 for construction on roadway/approach work. This characteristic flexibility of the D-B delivery model supports an accelerated project schedule.

3. Organizational Readiness

What are some issues the project experienced related to ***Organizational*** considerations?

Organizational Positives	Organizational Challenges
• Attendance was mandatory at regularly scheduled project team meetings. • A positive culture of accountability helped the D-B team finish the construction and ROW ahead of time.	• Not enough meetings were held during the design phase.

4. Cultural Readiness

What are some issues the project experienced related to ***Cultural*** considerations?

Cultural Positives
• As issues arose on the project, GDOT personnel and SMEs spent one-on-one time with project decision-makers to help move the project forward. • As a result of the early stakeholder coordination on the project, Scott Bridge had a positive relationship with the U.S. Army Corps of Engineers. The two organizations held meetings during the development of the project's procurement documents. • The project culture fostered a solid team mindset, with all team members focused on the same goals. • In addition to fostering team alignment, the project culture engendered alignment among other stakeholders, e.g., the USACE, DNR, GDOT, and others.

5. Planning Readiness

What are some issues the project experienced related to ***Planning*** considerations?

Planning Positives	Planning Challenges
• The contractor provided monthly schedule updates. • Because scope, schedule, and budget were given so much consideration during planning, the team was able to overcome any complications that arose.	• One of the planning challenges was that, even though the contractor provided monthly schedule updates, these updates did not include payment requests. Thus, the contractor was asked to submit invoices within seven days of these progress reports. • From a schedule perspective, the time it took to drill for drilled shafts presented a challenge to proper work sequencing. • Another challenge was in showing the completion dates beyond the contract dates. Solutions included an option of forcing the completion date to meet the contract date, which, in short, meant creating a second schedule. However, the dates were later shown beyond the contract date, and an explanation was sought from the D-B team.

6. Execution Readiness

What are some issues the project experienced related to ***Execution*** considerations?

Execution Positives	Execution Challenges
• Construction-driven designs were key to interfacing with USACE. • Early coordination with USACE contributed a great deal to project success. While the project was under environmental re-evaluation, construction was allowed to proceed unhindered. • GDOT met all project review deadlines. Even USACE and FHWA expedited their review times to some extent.	• The D-B team sometimes felt that the GDOT oversight was excessive.

Execution Positives	Execution Challenges
• The re-design of one of the bents of the bridge (Bent 12) helped the D-B team save time and meet the project completion date. The existing truss bridge was removed without affecting the operations of the Georgia Power distribution line running alongside it.	

SR 47 AT LITTLE RIVER POTENTIAL BEST PRACTICES SUMMARY TABLE

After conducting interviews, facilitating discussions, and performing an independent analysis of the project, the research team created a table summarizing the potential best practices critical to the success of a Flash Track project. (See Table 16.) Moreover, these potential best practices, along with descriptions of their implementation and benefits, were cross-referenced against the 47 existing CII Flash Track Best Practices and the 19 VDOT-developed best practices. All the practices were found to have corresponding CII and VDOT best practices and, thus, none is labeled "New" in the table. This collection of practices was further analyzed through the Delphi process and AHP, ultimately to generate the GDOT Best Practices. (See Appendix II for the full list of the CII best practices, and Section 9 for all the VDOT best practices.)

Table 16: SR 47 Bridge Replacement Potential Best Practices Summary Table

No.	Best Practices from SR 47	Description	Corresponding CII & VDOT Best Practices	Relevant CII & VDOT Best Practices
1.	Including an A+B Component for Procurement, in the D-B Contract	This meant that bidders bid not only on the cost portion, but that a bid on a time component was also taken into consideration in the selection of the D-B team. GDOT wanted to complete the project as quickly as possible, and the A+B component helped in this regard. Since the scope of this project was a bit complex, adding the A+B component in the contract helped the D-B compete beyond just the low-bid competition.	**13.** Employing Innovative Procurement Practices	-
2.	Conducting Initial Meetings with Primary Stakeholders	Initial meetings with two primary stakeholders (USACE and Georgia Power) helped, because the Flash Track concept and project goals were explained during the meetings. Their understanding helped in the long run.	**47.** Conducting Frequent and Effective Project Review Meetings	**53.** Having a Responsible In-charge Engineer/D-B Integrator

No.	Best Practices from SR 47	Description	Corresponding CII & VDOT Best Practices	Relevant CII & VDOT Best Practices
3.	Holding Each Other Accountable in Monthly Meetings	The positive culture of accountability in monthly project progress meetings helped the D-B team finish construction and ROW ahead of time. Ensuring that everyone attended regular project team, ready to hold each other accountable, helped speed up the progress.	**47.** Conducting Frequent and Effective Project Review Meetings	**8.** Reducing Risks through Collective Efforts of All Stakeholders **26.** Accepting a Non-traditional Paradigm Or Mindset **30.** Having Open Communication and Transparency **32.** Having an Open-minded Team
4.	Using the Digital Document Management System to Track Submittals	A paperless document management system called eBuilder was used to track the submittals. By automating the review process, this software tool accelerates review time. Training and use of this tool was provided for in the RFP.	**65.** Utilizing an Integrated Document Management System for Tracking RFIs, QA/QC, Submittals, and Other Documents	**42.** Simplifying Approval Procedures

No.	Best Practices from SR 47	Description	Corresponding CII & VDOT Best Practices	Relevant CII & VDOT Best Practices
5.	Ensuring Early Stakeholder Coordination	Scott Bridge had a positive relationship with USACE, which was a result of the early stakeholder coordination. These two organizations held meetings during the development of the procurement documents for the project.	**48.** Having Early Engagement of Utility Owners 51. Having Early Utility and ROW Coordination; Engaging Construction Personnel during Design and during Environmental Document Preparation, Etc.	**8.** Reducing Risks through Collective Efforts of All Stakeholders **15.** Involving Contractors, Trades, and Vendors in the Design Phase **17.** Engaging Operations and Maintenance Personnel in the Development and Design Process **34.** Emphasizing Coordination Planning during the Design Process **56.** Ensuring Efficient Coordination of Construction with Management of Traffic Issues
6.	Creating a Solid and Aligned Project Team with a Mindset of Working Together on the Same Goal	Not just project team members, but other stakeholders (e.g., USACE, DNR, GDOT, and others) were aligned towards a common project goal.	**3.** Aligning Project Participants' Interests through Contract **33.** Creating Executive Alignment among the Contracted Parties	**1.** Setting Clear, Specific Scoping Requirements

Table 17 presents the newly identified potential best practices identified from the SR 299 at I-24 project, the Jimmy Deloach Connector project, the Riverside Drive Roundabouts project, and the SR-47 at Little River project.

Table 17: SR 47 Bridge New Potential Best Practices Progress

No.	Practice	SR 299 at I-24	Jimmy Deloach	Riverside Drive	SR 47
1.	Establishing the Bridge Fabrication Facility near the Project Location	SR 299 I-24 (1)			
2.[1]	Considering 3D and 4D Modeling of the Execution Sequence during Schematic Design	SR 299 I-24 (2)			
3.	Considering 3D and 4D Modeling of the Execution Sequence during Detailed Design	SR 299 I-24 (3)			
4.	Phasing Environmental Permits to Match Phased Construction		JD (1)		
5.	Overlapping Environmental and ROW Acquisition		JD (2)		
6.	Including ROW, Utility Relocation, and Environmental Mitigation in D-B Contract		JD (3)		

[1] This practice did not make the statistical cut. (See Section 8 for more about the Delphi process and the statistical criteria used.)

SECTION 7 - LITERATURE REVIEW OVERVIEW

An extensive literature review was conducted to identify fast track practices that could facilitate Flash Track efforts. The TRB, FHWA, and American Society of Civil Engineers (ASCE) databases were a few of the sources for the journals reviewed. Although the review yielded 43 potential Flash Track practices, not all of them were new. The concepts underlying a few of these new practices also underpinned the existing 47 CII-developed practices and 19 VDOT-developed practices.

Pursuing the research objective of identifying new and different Flash Track practices, the researchers did a side-by-side comparison of the 43 new practices and the 66 previously developed CII and VDOT practices, discarding any redundant practices. In addition to performing this cross-verification, the research team held a few brainstorming sessions to distill the remaining practices. As a result of this process, the team was able to reduce the set of 43 new practices to 13, discarding the other 30 that corresponded with existing practices.

Table 18 lists these 13 new practices. These practices were further analyzed through the Delphi Process and AHP, to generate Flash Track best practices for GDOT.

Table 18: Literature Review Potential Best Practices

Potential Best Practices	Source
Using Existing Open-ended Contracts to Procure Time-critical Elements	Transportation Research Board: Journal of the Transportation Research Board [9]
Considering Ongoing Operations When Planning and Scheduling a Brownfield Construction Project	
Performing Exhaustive Lane Closure Planning	
Providing an Extended Mobilization Period	
Using Pre-construction Analysis Software to Evaluate and Select Alternative Project Scenarios	Transportation Research Board: Journal of the Transportation Research Board [13]
Using Software to Assist with Scheduling of Portland Cement Concrete Pavement, Given Design, Construction, and Environmental Factors	Federal Highway Administration [14]
Pre-fabricating Project Elements That Are on the Critical Path	Federal Highway Administration [14]
Considering Both Inter-phase and Intra-phase Concurrency for Design and Construction Packages	American Society of Civil Engineers (ASCE): Pipelines Division Specialty Conference 2006 [15]
Considering Innovative Construction Materials That Accelerate Construction	American Society of Civil Engineers (ASCE): Structures Congress 2006 [16]
Having Sub-surface Utility Engineering	American Society of Civil Engineers (ASCE): Pipelines 2014 [17]
Building Mock-ups of Pre-fabricated Components to Address Potential Constructability Challenges Prior to Shipping	American Society of Civil Engineers (ASCE): Journal of Performance of Constructed Facilities [18]
Implementing Construction-driven Design	2014 Design Training Expo [19]
Collecting Lessons Learned from Similar Projects	Federal Highway Administration: Public Roads Magazine [20]

Table 19 presents the newly identified potential best practices identified from the SR 299 at I-24 project, the Jimmy Deloach Connector project, the Riverside Drive Roundabouts project, the SR 47 at Little River project, and the literature review.

Table 19: New Best Practices Progress from Literature Review

No.	Practice	SR 299 I-24	Jimmy Deloach	Riverside Drive	SR 47	Lit Review
1.	Establishing the Bridge Fabrication Facility near the Project Location	SR 299 I-24 (1)				
2.[1]	Considering 3D and 4D Modeling of the Execution Sequence during Schematic Design	SR 299 I-24 (2)				
3.	Considering 3D and 4D Modeling of the Execution Sequence during Detailed Design	SR 299 I-24 (3)				
4.	Phasing Environmental Permits to Match Phased Construction.		JD (1)			
5.	Overlapping Environmental and ROW Acquisition		JD (2)			
6.	Including ROW, Utility Relocation, and Environmental Mitigation in D-B Contract		JD (3)			
7.	Using Existing Open-ended Contracts to Procure Time-critical Elements					LR (1)
8.[2]	Considering Ongoing Operations When Planning and Scheduling a Brownfield Construction Project					LR (2)
9.	Performing Exhaustive Lane Closure Planning					LR (3)
10.[3]	Providing an Extended Mobilization Period					LR (4)
11.	Using Pre-construction Analysis Software to Evaluate and Select Alternative Project Scenarios					LR (5)
12.	Using Software to Assist with Scheduling of PCC Pavement, Given Design, Construction, and Environmental Factors					LR (6)
13.	Pre-fabricating Project Elements That Are on the Critical Path					LR (7)

No.	Practice	SR 299 I-24	Jimmy Deloach	Riverside Drive	SR 47	Lit Review
14.	Considering Both Inter-phase and Intra-phase Concurrency for Design and Construction Packages					LR (8)
15.	Considering Innovative Construction Materials That Accelerate Construction					LR (9)
16.	Having Sub-surface Utility Engineering					LR (10)
17.[4]	Building Mock-ups of Pre-fabricated Components to Address Potential Constructability Challenges Prior to Its Shipping					LR (11)
18.	Implementing Construction-driven Design					LR (12)
19.	Collecting Lessons Learned from Similar Projects					LR (13)

[1,2,3,4] This practice did not make the statistical cut. (See Section 8 for more about the Delphi Process and the statistical criteria used.)

SECTION 8 - DELPHI PROCESS AND VALIDATION

The majority of the data analysis was conducted during a meeting hosted by GDOT in June 2017. At this meeting, the researchers conducted the Delphi Process, performed validation, and gave a brief overview of the AHP method.

VALIDATION PROCESS AND FINAL SELECTION

The Delphi Process was used to validate each new best practice. Through this technique, the research team elicited the opinions of a panel of subject matter experts to obtain a group response to each practice [21]. Achieving this group consensus on the practices was critical to determining whether the practices were essential to Flash Tracking. The researchers conducted the process by preparing a questionnaire addressing the 13 practices from the literature review and the six practices distilled from the structured interviews.

The experts were asked to assess how essential they considered each practice for Flash Tracking, on a six-point Likert scale. The values of the scale were as follows: 1-Strongly Disagree; 2-Disagree; 3-Moderately Disagree; 4-Moderately Agree; 5-Agree; 6-Strongly Agree. A practice with score of "6" meant that it was highly essential for Flash Tracking. Appendix I presents the Delphi session questionnaire.

ADDITIONAL BEST PRACTICES FROM SUBJECT MATTER EXPERTS

To encourage feedback and suggestions from the SMEs, a section at the end of the questionnaire sought additional feedback. The respondents' comments and suggestions led to the identification of two additional new practices. A thorough cross-verification of these two practices against the 47 existing CII best practices and 19 VDOT best practices was performed to ensure that these practices were in fact new. A new Delphi questionnaire was prepared for these two practices, and the experts were asked to rate the degree to which these practices were essential to Flash Tracking, using the six-point Likert scale. Table 20 presents these two new practices.

Table 20: GDOT Best Practices from Validation

Collecting Accurate Geotechnical (Sub-surface) Data to Reduce Risk.
Making Timely Decisions through the Use of Workshops.

ADDITIONAL BEST PRACTICES PROGRESS SUMMARY

Table 21 presents the newly identified potential Flash Track best practices identified from the SR 299 at I-24 project, the Jimmy Deloach Connector project, the Riverside Drive Roundabouts project, the SR 47 at Little River project, the literature review, and the validation process.

Table 21: GDOT New Best Practices Validation Process

No.	Practice	SR 299 I-24	Jimmy Deloach	Riverside Drive	SR 47	Lit Review	Validation
1.	Establishing the Bridge Fabrication Facility near the Project Location	SR 299 I-24 (1)					
2.	Considering 3D and 4D Modeling of the Execution Sequence during Schematic Design	SR 299 I-24 (2)					
3.	Considering 3D and 4D Modeling of the Execution Sequence during Detailed Design	SR 299 I-24 (3)					
4.	Phasing Environmental Permits to Match Phased Construction		JD (1)				
5.	Overlapping Environmental and ROW Acquisition		JD (2)				
6.	Including ROW, Utility Relocation, and Environmental Mitigation in the D-B Contract		JD (3)				
7.	Using Existing Open-ended Contracts to Procure Time-critical Elements					LR (1)	
8.	Considering Ongoing Operations When Planning and Scheduling a Brownfield Construction Project					LR (2)	
9.	Performing Exhaustive Lane Closure Planning					LR (3)	
10.	Providing an Extended Mobilization Period					LR (4)	
11.	Using Pre-Construction Analysis Software to					LR (5)	

No.	Practice	SR 299 I-24	Jimmy Deloach	Riverside Drive	SR 47	Lit Review	Validation
	Evaluate and Select Alternative Project Scenarios						
12.	Using Software to Assist with Scheduling of Portland Cement Concrete Pavement, Given Design, Construction, and Environmental Factors					LR (6)	
13.	Pre-fabricating Project Elements That Are on the Critical Path					LR (7)	
14.	Considering Both Inter-phase and Intra-phase Concurrency for Design and Construction Packages					LR (8)	
15.	Considering Innovative Construction Materials That Accelerate Construction					LR (9)	
16.	Having Sub-surface Utility Engineering					LR (10)	
17	Building Mock-ups of Pre-fabricated Components to Address Potential Constructability Challenges Prior to Shipping					LR (11)	
18.	Implementing Construction-driven Design					LR (12)	
19.	Collecting Lessons Learned from Similar Projects					LR (13)	
20.	Collecting Accurate Geotechnical (Sub-surface) Data to Reduce Risk						V (1)

No.	Practice	SR 299 I-24	Jimmy Deloach	Riverside Drive	SR 47	Lit Review	Validation
21.	Making Timely Decisions through the Use of Workshops						V (2)

FINAL SELECTION

Once the subject matter experts completed their evaluations, the results were analyzed statistically. In this analysis, the research team calculated a mean, mode, and standard deviation for each practice. To reach consensus on whether any of the 21 practices are essential for Flash Tracking, the researchers used the following scoring criteria for each one:

a. A mode of 5 (Agree) or 6 (Strongly agree).

b. A standard deviation of less than 1 (if the mode is 5), and less than 2 (if the mode is 6).

Given these criteria, the statistical outer limit (1σ) of the collective responses would be at least 4 (moderately agree). Based on the combinations of these criteria, four out of the 21 practices were discarded (highlighted in gray in Table 22.) The remaining 17 were verified through the Delphi Process as new Flash Track practices.

Table 22: GDOT Validation Process Results

Practice Number	Number of Responses						Mode	St. Dev.
	Strongly Disagree 1	Disagree 2	Moderately Disagree 3	Moderately Agree 4	Agree 5	Strongly Agree 6		
1	0	0	2	0	4	0	5	0.9
2	0	1	1	2	1	1	4	1.3
3	0	1	0	1	2	2	5&6	1.4
4	0	0	0	2	2	2	5	0.8
5	0	0	0	2	3	1	5	0.7
6	0	0	0	0	1	5	6	0.4
7	0	1	0	0	2	3	6	1.4
8	0	0	0	4	0	2	4	0.9
9	0	0	0	2	2	2	4&5&6	0.7
10	0	0	2	3	1	0	4	0.8
11	0	0	1	1	4	0	5	0.5
12	0	0	2	0	3	1	5	0.9
13	0	0	0	1	4	1	5	0.6
14	0	0	0	1	2	3	6	0.7
15	0	0	0	2	2	2	4&5&6	0.8
16	0	0	0	1	1	4	6	0.8
17	0	0	0	3	2	1	4	0.7
18	0	0	0	2	2	2	4&5&6	0.8
19	0	0	0	0	1	5	6	0.4
20	0	0	0	1	3	2	5	0.7
21	0	0	1	0	5	0	5	0.7

Criteria for acceptance: St.Dev. < 1, if the Mode is 5; St.Dev. < 2, if the Mode is 6.

SECTION 9 – RESULTS

BEST PRACTICES CATEGORIES BY GDOT

The Construction Industry Institute developed 47 Flash Track Best Practices. These practices are divided into six categories: 1) Planning; 2) Execution; 3) Organizational; 4) Cultural; 5) Delivery; and 6) Contractual. In this research, the new GDOT Flash Track Best Practices are divided into four new categories: 1) Right-of-Way and Utilities Considerations; 2) Contractual Considerations; 3) Planning/Evaluation/Environmental Considerations; and 4) Execution Considerations. Table 23 presents the practices in each category, numbering them in a sequence starting after the 66 combined CII and VDOT practices.

Table 23: GDOT New Best Practices Categories

	ROW & Utilities
67	Overlapping Environmental and ROW Acquisition
68	Including ROW, Utility Relocation, and Environmental Mitigation in Design-Build Contract
69	Having Sub-surface Utility Engineering
	Contractual
70	Using Existing Open-ended Contracts to Procure Time-critical Elements
	Planning, Evaluation, Environmental
71	Considering 3D and 4D Modeling of the Execution Sequence during Detailed Design
72	Phasing Environmental Permits to Match Phased Construction
73	Performing Exhaustive Lane Closure Planning
74	Collecting Lessons Learned from Similar Projects
75	Gathering Accurate Geotechnical (Sub-surface) Data to Reduce Risk
76	Using Software to Assist with Scheduling of PCC Pavement, Given Design, Construction, and Environmental Factors
77	Considering Both Inter-phase and Intra-phase Concurrency for Design and Construction Packages

Execution	
78	Establishing the Bridge Fabrication Facility near the Project Location
79	Using Pre-construction Analysis Software to Evaluate and Select Alternate Project Scenarios
80	Pre-Fabricating Project Elements That Are on the Critical Path
81	Considering Innovative Construction Materials That Accelerate Construction
82	Implementing Construction-driven Design
83	Making Timely Decisions through the Use of Workshops

ANALYTIC HIERARCHY PROCESS (AHP)

The seventeen new practices were divided into four categories: 1) Right-of-Way and Utilities; 2) Contractual; 3) Planning, Evaluation, and Environmental; and 4) Execution. The SMEs used an Excel spreadsheet with AHP calculations to make comparisons between all possible pairs of practices in each category. These pairwise comparisons were made on a nine-point scale. Table 24 defines each of the values on this scoring scale [10].

Table 24: AHP Scoring for GDOT Best Practices

Score	Definition	Explanation
1	Equal importance of practices	The practices are equally important.
3	Moderate importance of one practice over another	One practice is slightly more important than another.
5	Strong importance of one practice over another	One practice is strongly favored over another.
7	Very strong importance of one practice over another	One practice is very strongly favored over another.
9	Extreme importance of one practice over another	One practice is favored over another to the highest possible extent.
2,4,6,8	Intermediate importance values	Middle values between the odd number scores

Using their knowledge, experience, and judgment, the SMEs gave a score for every pairwise comparison. Table 25 provides an example of pairwise comparisons of three practices. The comparison scores were carefully formulated in a matrix, such as the one shown in Figure 15. All diagonal elements of the matrix have a value of 1, because they represent a comparison of the same practices. The elements below the diagonal elements are the reciprocals of the elements above the diagonal.

Table 25: AHP Comparison Table for GDOT Best Practices

Practice Number	Extreme Importance	Very Strong Importance	Strong Importance	Moderate Importance	Equal Importance	Moderate Importance	Strong Importance	Very Strong Importance	Extreme Importance	PN
PN 1	9	7	5	3	1	3	5	7	9	PN 2
PN 1	9	7	5	3	1	3	5	7	9	PN 3
PN 2	9	7	5	3	1	3	5	7	9	PN 3

$$\begin{array}{c} \\ PN1 \\ PN2 \\ PN3 \end{array} \begin{array}{c} \begin{array}{ccc} PN1 & PN2 & PN3 \end{array} \\ \begin{bmatrix} 1 & i & j \\ 1/i & 1 & k \\ 1/j & 1/k & 1 \end{bmatrix} \end{array}$$

Figure 15: Pairwise Comparison Matrix

To ensure thoughtful comparisons of the practices, meeting attendees were given one week to complete their assessments. Software developed by the research team was used to input the comparison scores and calculate the weights. This calculation involved raising the matrix values by a power of 10, summing the values in each row, and then dividing each sum by the total sum of all the rows. Moreover, to keep the comparisons in check, a consistency ratio of 0.1 was not to be exceeded. The software calculated the consistency as soon as the comparison scores were input, which helped AHP participants become aware of any inconsistencies in their comparisons immediately. The calculation of the geometric mean of all the weights from all AHP participants gave the final weights for the practices.

AHP Participants

After the pairwise comparisons had been made, AHP was used to rank the new GDOT-specific best practices. Seven SMEs were selected to perform the AHP process (See Table 26).

Table 26: AHP Participants for GDOT Best Practices

Name	Company
Saurabh Bhattacharya	Parsons Transportation Group Inc.
Ryan Graves	Arcadis
Marlo Clowers	GDOT-OID
Andrew Hoenig	GDOT-OID
Shane Swan	HNTB
Brian Woods	Archer Western
Albert Bowman	Michael Baker International

Each participant completed a full comparison of practices in each category. Once all of the participants had submitted their results, the researchers could rank the new best practices, assigning weight to the practices within each category, and to the categories themselves.

AHP Results

After performing the weighting calculations for the 17 new GDOT-developed best practices, the research team assigned an identification number to each one, continuing the sequence of the 66 practices previously developed by CII and VDOT. Therefore, the 17 GDOT-developed best practices start at number 67 and end at number 83. Table 27 shows the final results of this process.

Since the Contractual category has only one practice, a pair-wise comparison was not possible. This practice (number 70) was, therefore, compared with the three in the

Contractual category of the VDOT-developed set of practices (practices 52, 53, and 54). This cross-comparison was consistent with the researchers' long-term plans of combining the VDOT and GDOT Flash Track practices into a single set within the appropriate categories.

To show the importance of the practices in each category, the practices are listed with their respective weights (See Table 27). As the table shows, practices 69, 53, 75, and 82 were the most important in their respective categories.

Table 27: GDOT Flash Track Best Practices and their AHP Weights

	ROW & Utilities	**Weight**
67	Overlapping Environmental and ROW Acquisition	14.8%
68	Including ROW, Utility Relocation, and Environmental Mitigation in Design-Build Contract	38.0%
69	Having Sub-surface Utility Engineering	47.3%
	Consistency Ratio	**0.000**
	Contractual	**Weight**
52	Using Incentives to Encourage Earlier Project Completion (VDOT practice)	21.5%
53	Having a Responsible In-charge Engineer/Design-Build Integrator (VDOT practice)	47.5%
54	Employing Allowances for Certain Bid Items As a Means of Risk Sharing (VDOT practice)	18.0%
70	Using Existing Open-ended Contracts to Procure Time-critical Elements	12.9%
Consistency Ratio		**0.005**

	Planning, Evaluation, Environmental	Weight
71	Considering 3D and 4D Modeling of the Execution Sequence during Detailed Design	7.2%
72	Phasing Environmental Permits to Match Phased Construction	22.5%
73	Performing Exhaustive Lane Closure Planning	14.8%
74	Collecting Lessons Learned from Similar Projects	13.7%
75	Collecting Accurate Geotechnical (Sub-surface) Data to Reduce Risk	23.1%
76	Using Software to Assist with Scheduling of PCC Pavement, Given the Design, Construction, and Environmental Factors	9.4%
77	Considering Both Inter-phase and Intra-phase Concurrency for Design and Construction Packages	9.3%
	Consistency Ratio	**0.009**
	Execution	**Weight**
78	Establishing the Bridge Fabrication Facility near the Project Location	8.5%
79	Using Pre-construction Analysis Software to Evaluate and Select Alternative Project Scenarios	6.7%
80	Pre-fabricating Project Elements That Are on the Critical Path	20.1%
81	Considering Innovative Construction Materials that Accelerate Construction	17.2%
82	Implementing Construction-driven Design	28.0%
83	Making Timely Decisions through the Use of Workshops	19.3%
	Consistency Ratio	**0.011**

Figure 16 presents the organizational structure for the GDOT-developed best practices and their weights.

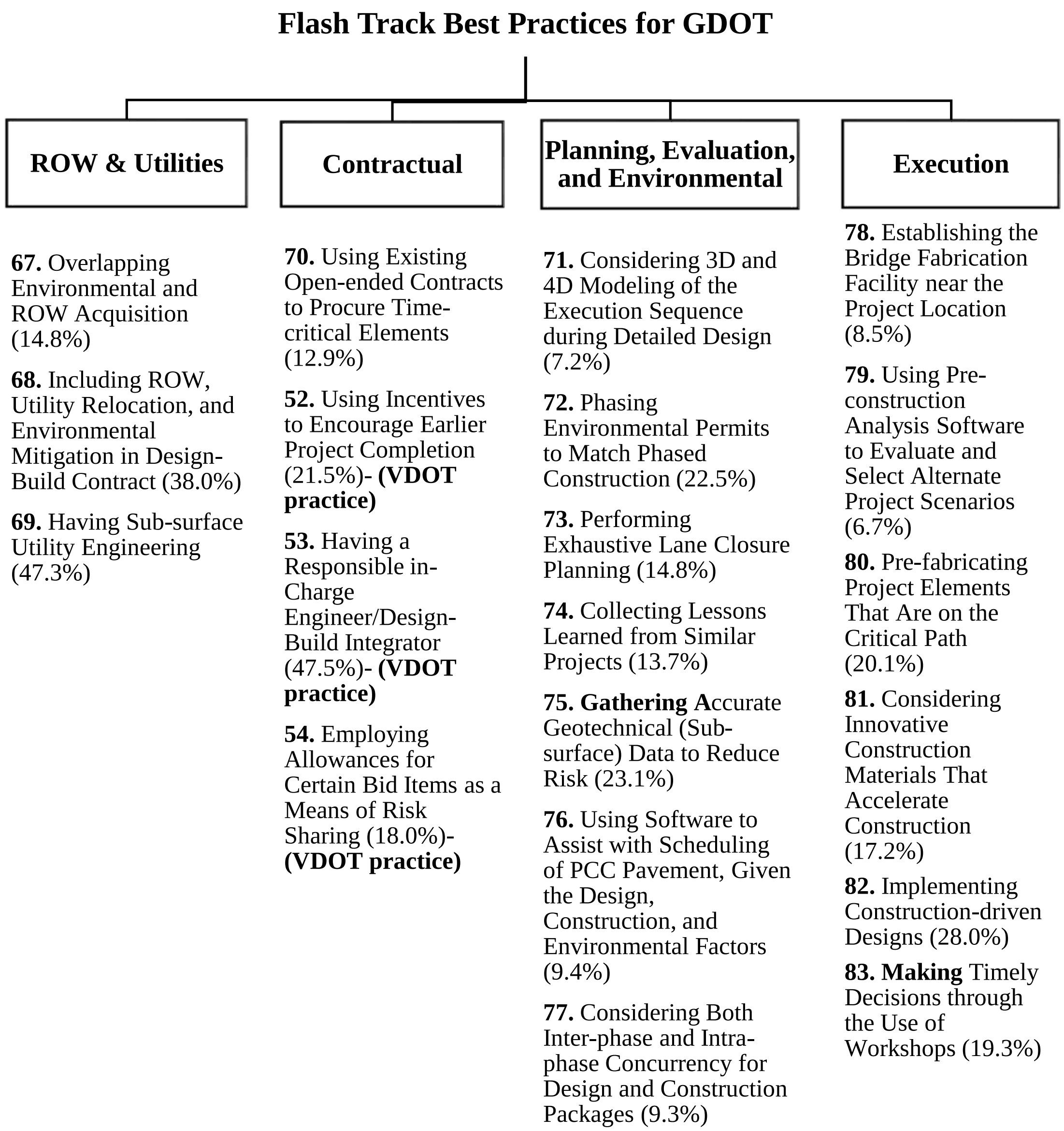

Figure 16: Organizational Structure for GDOT Best Practices

RISKS AND MITIGATION STRATEGIES FOR GDOT BEST PRACTICES

During a meeting hosted by GDOT on June 26, 2017, six representatives of stakeholders from four GDOT Flash Track projects participated in a charrette, to collectively identify the risks, barriers, and risk mitigation strategies for each of the 17 new Flash Track practices. (See Table 28 for a list of the charrette participants.) The researchers compiled detailed descriptions of these risks, barriers, and mitigation strategies in the Playbook (See Appendix III). The toolkit provides their detailed descriptions of implementation measures for each practice (See Appendix IV).

Table 28: Participants in the Risk Identification Meeting

Name	Company
Saurabh Bhattacharya	Parsons Transportation Group Inc.
Ryan Graves	Arcadis
Andrew Hoenig	GDOT-OID
Thomas Montgomery	Michael Baker International
Marlo Clowers	GDOT-OID
Shane Swan	HNTB

BEST PRACTICES CATEGORIES DEVELOPED BY VDOT

This section summarizes the research that was carried out by professors Dr. Jesus M. de la Garza and Dr. Pardis Pishdad-Bozorgi in collaboration with the Virginia Department of Transportation (VDOT) and the Virginia Transportation Research Council (VTRC). This research focused on identifying, assessing, and validating best practices crucial for the successful completion of accelerated, or Flash Track, construction projects.

Research Methods

Research methods included data collection through a literature review and structured interviews with VDOT Flash Track project personnel. To identify Flash Track best practices uniquely applicable to VDOT projects, the researchers used the content of the 47 previously developed CII Flash Track Best Practices as a startup platform—first, to verify their applicability to VDOT project operations, and second, to expand them.

To identify new Flash Track best practices, the research team conducted case studies of two VDOT projects that were changed from traditional to Flash Track delivery: the I-95 Expressway Lanes project, which produced four new best practices; and the US 29 Solutions project, from which seven new practices were identified. Furthermore, the research team collected seven additional best practices from its review of the literature on accelerated project delivery. Subsequently, during a Delphi-method validation session to determine the essentiality of these practices for Flash Tracking, SMEs identified three additional best practices. The statistical analysis performed on the results from the Delphi study disqualified two of the 21 new best practices, leaving a total of 19 new VDOT-specific Flash Track best practices.

Finally, the research team developed an Excel-based VDOT-specific Flash Track toolkit module to help stakeholders assess their readiness to undertake Flash Track projects. This module was added to the previously developed CII Flash Track Readiness Assessment Toolkit, which contained the 47 original CII Flash Track Best Practices.

Research Layout

After a thorough investigation of these case study projects, along with a comprehensive literature review and input from VDOT SMEs, 19 new best practices were identified. These 19 new best practices needed to be incorporated into the CII Flash Track Toolkit and implemented on projects for Flash Tracking success. The researchers assigned new identification numbers to the 19 new practices, following the sequence of the first 47 CII practices. Thus, the 19 VDOT-developed best practices start at number 48 and end at number 66.

Lastly, the AHP method was used to determine the relative importance of these newly identified best practices. Every category lists the practices according to their weights. Practices 50, 52, 55, 58, 63, and 64 were the most important in their respective categories. Nevertheless, the weights are only an indication of a practice's importance within its respective category. To pursue a successful Flash Track project, a fulsome implementation of all the practices, with the utmost care, is of the essence. The final VDOT results are shown in Table 29 and Figure 17.

Table 29: VDOT Flash Track Best Practices and their AHP Weights

Categories	Weight
Right-of-Way and Utilities	14.1%
Contractual	13.4%
Operations and Public Engagement	10.4%
Planning, Evaluation, Environmental	16.4%
Safety	26.6%
Execution	19.1%
Consistency Ratio	**0.012**

	ROW and Utilities	Weight
48	Having Early Engagement of Utility Owners	30.5%
49	Having a Dedicated Utility Manager Consultants for VDOT and the Designer-Constructor Team	13.5%
50	Starting ROW Acquisition During Conceptual Design (20% to 50% Design)	33.3%
51	Having Early Utility and ROW Coordination; Engaging Construction Personnel during Design and during Environmental Document Preparation, Etc.	22.7%
	Consistency Ratio	**0.003**

	Contractual	Weight
52	Using Incentives to Encourage Earlier Project Completion	41.8%
53	Having a Responsible In-Charge Engineer/Design-Build Integrator	38.9%
54	Employing Allowances for Certain Bid Items As a Means of Risk Sharing	19.3%
	Consistency Ratio	**0.006**

	Operations and Public Engagement	Weight
55	Deploying Continual Public Outreach, Media Campaigns, and Dedicated Communications Personnel	45.5%
56	Ensuring Efficient Coordination of Construction with Management of Traffic Issues	41.6%
57	Establishing a Project Command Center	12.9%
	Consistency Ratio	**0.001**

	Planning, Evaluation, Environmental	Weight
58	Conducting Environmental Permitting and Scope Development in Parallel	63.6%
59	Establishing Programmatic Agreements to Streamline the Process for Handling Routine Environmental Requirements	12.6%
60	Having a 30-Day State-owned Float Activity As a Predecessor to the Scheduled Completion Date, to Absorb Critical Delaying Events Occasioned by the State.	23.8%
	Consistency Ratio	**0.004**

	Safety	Weight
61	Establishing a Shuttle Bus Service for Construction Workers from a Common Parking Lot to the Jobsite	11.2%
62	Implementing Smarter Work Zones to Dynamically Manage Traffic and Reduce Work Zone Impacts	27.0%
63	Ensuring Worker/Public Health and Safety	61.8%
	Consistency Ratio	**0.000**

Execution		Weight
64	Developing a Planned Issue Resolution Process	42.6%
65	Utilizing an Integrated Document Management System for Tracking RFIs, QA/QC, Submittals, Etc.	30.8%
66	Utilizing a Lane Closure Time Bank	26.6%
	Consistency Ratio	**0.001**

Flash Track Best Practices for VDOT

- **ROW & Utilities** (14.1%)
  - 48. Having Early Engagement of Utility Owners (30.5%)
  - 49. Having Dedicated Utility Manager Consultants for VDOT and Designer-Constructor Team (13.5%)
  - 50. Starting ROW Acquisition during Conceptual Design (33.3%)
  - 51. Having Early Utility and ROW Coordination (22.7%)
- **Contractual** (13.4%)
  - 52. Using Incentives to Encourage Earlier Project Completion (41.8%)
  - 53. Having a Responsible In-Charge Engineer/Design-Build Integrator (38.9%)
  - 54. Employing Allowances for Certain Bid Items as a Means of Risk Sharing (19.3%)
- **Operations & Public Engagement Considerations** (10.4%)
  - 55. Deploying Continual Public Outreach, Media Campaigns, and Dedicated Communications Personnel (45.5%)
  - 56. Ensuring Efficient Coordination of Construction with Management of Traffic Issues (41.6%)
  - 57. Establishing a Project Command Center (12.9%)
- **Planning, Evaluations, & Environmental Considerations (**16.4%)
  - 58. Conducting Environmental Permitting and Scope Development in Parallel (63.6%)
  - 59. Establishing Programmatic Agreements to Streamline the Process for Handling Routine Environmental Requirements (12.6%)
  - 60. Having a 30-Day State-owned Float Activity As a Predecessor to the Scheduled Completion Date, to Absorb Critical Delaying Events Occasioned by the State (23.8%)
- **Safety Considerations** (26.6%)
  - 61. Establishing a Shuttle Bus Service for Construction Workers from a Common Parking Lot to the Jobsite (11.2%)
  - 62. Implementing Smarter Work Zones to Dynamically Manage Traffic and Reduce Work Zone Impacts (27.0%)
  - 63. Ensuring Worker/Public Health and Safety (61.8%)
- **Execution** (19.1%)
  - 64. Developing a Planned Issue Resolution Process (42.6%)
  - 65. Utilizing Integrated Document Management System for Tracking RFIs, QA/QC, Submittals, etc. (30.8%)
  - 66. Utilizing a Lane Closure Time Bank (26.6%)

Figure 17: Organizational Structure for VDOT Best Practices

xDOT FLASH TRACK TOOLKIT

GDOT and VDOT best practices were combined into one consolidated framework, called xDOT, to provide a source for the best practices for flash-track transportation projects.

To create the xDOT framework, the VDOT (19) and GDOT (17) best practices were re-organized and grouped into a new set of categories: 1) ROW and Utilities; 2) Pre-construction; 3) Contractual; 4) Planning; 5) Information Management; 6) Execution; and 7) Traffic Management. As shown in Table 30, four out of these seven categories were also defined for VDOT and GDOT (ROW and Utilities, Contractual, Planning, and Execution).

Table 30: Flash Track Categories

VDOT Categories	GDOT Categories	xDOT Categories
1. ROWand Utilities 2. Contractual 3. Operations & Public Engagement 4. Planning, Evaluation, Environmental 5. Safety 6. Execution	1. ROWand Utilities 2. Contractual 3. Planning, Evaluation, Environmental 4. Execution	1. ROW and Utilities 2. Pre-construction 3. Contractual 4. Planning 5. Information Management 6. Execution 7. Traffic Management

The seven xDOT categories were defined after grouping the 36 best practices according to their similarities or relation. To avoid having an excessive number of comparisons to make in the AHP process, the research team determined that each category should have no more than six best practices. This limit also ensured that the categories were all similar in size . Still, the similarities between the best practices and their relevance to the categories were the main logic for their groupings.

After assigning the new best practices to the xDOT categories, the research team gave them their new identification numbers, following the sequence of the first 47 CII practices. Thus, the 36 xDOT best practices start at number 48 and end at number 83. Table 31 provides the old and new numbering for this combined set of new best practices.

Table 31: Old and New Numbering for xDOT Best Practices

Source	Practice Number Old (Figures 16 & 17)	Practice Number New xDOT (Figure 19)
VDOT	48	**48**
	49	**50**
	50	**53**
	51	**49**
	52	**52**
	53	**58**
	54	**51**
	55	**60**
	56	**58**
	57	**61**
	58	**62**
	59	**80**
	60	**78**
	61	**76**
	62	**54**
	63	**56**
	64	**63**
	65	**64**
	66	**65**
GDOT	67	**82**
	68	**69**
	69	**55**
	70	**66**
	71	**67**
	72	**77**
	73	**83**
	74	**81**
	75	**70**
	76	**71**
	77	**79**
	78	**68**
	79	**57**
	80	**72**
	81	**73**
	82	**74**
	83	**75**

The xDOT best practices are shown in Table 32.

Table 32: xDOT Best Practices Categories

ROW and Utilities	
48	Having Early Engagement of Utility Owners
49	Having Early Utility and ROW Coordination
50	Having Dedicated Utility Manager Consultants for xDOT and the Designer-Constructor Team
51	Having Sub-surface Utility Engineering
52	Overlapping Environmental and ROW Acquisition
53	Starting ROW Acquisition during Conceptual Design (20% - 50% Design)

Pre-Construction	
54	Conducting Environmental Permitting and Scope Development in Parallel
55	Gathering Accurate Geotechnical (Sub-surface) Data to Reduce Risk
56	Establishing Programmatic Agreements to Streamline the Process for Handling Routine Environmental Requirements
57	Using Pre-construction Analysis Software to Evaluate and Select Alternative Project Scenarios

Contractual	
58	Having a Responsible In-charge Engineer/Design-Build Integrator
59	Including ROW, Utility Relocation, and Environmental Mitigation in Design-Build Contract
60	Using Incentives to Encourage Earlier Project Completion
61	Employing Allowances for Certain Bid Items As a Means of Risk Sharing
62	Using Existing Open-ended Contracts to Procure Time-critical Elements

Planning	
63	Having a 30-Day State-Owned Float Activity As a Predecessor to the Scheduled Completion Date, to Absorb Critical Delays Occasioned by the State
64	Considering 3D and 4D Modeling of the Execution Sequence during Detailed Design
65	Phasing Environmental Permits to Match Phased Construction.
66	Using Software to Assist with Scheduling of Portland Cement Concrete (PCC) Pavement, Given the Design, Construction, and Environmental Factors

Planning	
67	Considering Both Inter-phase and Intra-phase Concurrency for Design and Construction Packages
68	Establishing the Bridge Fabrication Facility near the Project Location

Information Management	
69	Collecting Lessons Learned from Similar Projects
70	Developing a Planned Issue Resolution Process
71	Utilizing an Integrated Document Management System for Tracking Requests for Information (RFIs), QA/QC, Submittals, and Other Time-Sensitive Documents

Execution	
72	Pre-Fabricating Project Elements That Are on The Critical Path
73	Considering Innovative Construction Materials that Accelerate Construction
74	Implementing Construction-driven Design
75	Making Timely Decisions through the Use Of Workshops
76	Establishing a Project Command Center
77	Establishing a Shuttle Bus Service for Construction Workers, Take Them from a Common Parking Lot to the Job Site

Traffic Management	
78	Ensuring Efficient Coordination of Construction with the Management of Traffic Issues
79	Utilizing a Lane Closure Time Bank
80	Deploying Continual Public Outreach, Media Campaigns, and Dedicated Communications Personnel
81	Ensuring Worker/Public Health and Safety
82	Performing Exhaustive Lane Closure Planning
83	Implementing Smarter Work Zones to Dynamically Manage Traffic and Reduce Work Zone Impacts

Analytic Hierarchy Process (AHP) for xDOT

Using the Business Performance Management Singapore (BPMSG) AHP Online System (https://www.bpmsg.com/), the research team deployed the Analytic Hierarchy Process to perform pairwise comparisons and determine the relative weights of each practice. This tool works entirely on the cloud, establishing a centralized online repository of information through the BPMSG website. This online platform provides access to stakeholders to complete their pairwise comparisons. To develop a hierarchy for this online data entry, the research team used the defined structure for the seven categories of the 36 new best practices.

The pairwise comparison process involved the stakeholders selecting the most important best practice in each pair, and then assessing the extent to which the practice selected is more important than the one not selected. Table 33 presents an example of a pairwise comparison, and Table 34 shows the AHP scoring rubric. This process was iterative for all possible pairwise comparisons in a category until all comparisons were made.

Table 33: Pairwise Comparison Example for xDOT Best Practices

Preferred Best Practice			**Equal**	**How much more?**							
Practice 1	*or*	Practice 2	1	2	3	4	5	6	7	8	9

To establish the relevance and congruence of the data, the online tool also verified the Consistency Ratio (CR) of the expert input. The CR should be no more than 10 percent. The AHP process was developed to compare the best practices for each category and also to compare the categories.

Table 34: AHP Scoring for xDOT Best Practices

Score	Definition	Explanation
1	Equal importance	The practices are equally important
3	Moderate importance of one practice over another	One practice is slightly more important over another
5	Strong importance of one practice over another	One practice is strongly favored over another
7	Very strong importance of one practice over another	One practice is very strongly favored over another
9	Extreme importance of one practice over another	One practice is favored over another to the highest possible extent
2,4,6,8	Intermediate importance values	Middle values between the odd number scores

After the experts submitted their input, the online tool processed the inputs and assigned the weights for each best practice and categories.

AHP Participants

Fourteen subject matter experts performed the AHP ranking of the xDOT best practices. Seven of them were part of VDOT and the other seven were part of GDOT (see Table 35). Each participant completed a full comparison of each category. Once all participants had submitted their assessments, the AHP online tool automatically computed the weights for the practices and the categories.

Table 35: AHP Participants for xDOT Best Practices

Name	District
Christiana Briganti Dunn	VDOT
Hal Jones	VDOT
Helen Cuervo	VDOT
James Loftus	VDOT
John Lynch	VDOT

Name	District
Bill Cuttler	VDOT
Scott Fisher	VDOT
Dustin O'Quinn	GDOT- HNTB
Rob Lewis	GDOT- HNTB
Marlo Clowers	GDOT-OID
Thomas Montgomery	Michael Baker International
Richard O'Hara	GDOT-OID
Andrew Hoenig	GDOT-OID
Shane Swan	GDOT-HNTB

AHP Results

The 14 SMEs from VDOT and GDOT assessed the relative importance of the 36 xDOT Flash Track practices, based on their knowledge and experience, determining which practice and category are more important than the other.

Table 36 shows the results of the AHP group consensus for the xDOT Categories. The consensus indicator specifies the agreement on the category priorities between the 14 SMEs. If the value is below 50 percent, there was no consensus among the participants. This was the case of the Contractual category. The average group consensus for all the categories was 64.1 percent (Moderate), with a Consistency Ratio (CR) of 0.5 percent. Planning was the category with the highest level of agreement between the SMEs (76.8 percent). Information (Info) Management and Contractual were the categories with the lowest level of agreement, 54.5 and 49.9 percent respectively. Since the CR obtained for all seven categories was less than 10 percent, the SMEs' judgments are assumed to have been reasonably consistent and coherent.

Table 36: Results of the AHP Group Consensus for the xDOT Categories

xDOT Categories	AHP Group Consensus		CR
	Indicator	Level	
Planning	76.8%	High	0.50%
Execution	70.7%	Moderate	0.90%
Traffic Management	67.6%	Moderate	0.50%
ROW and Utilities	66.9%	Moderate	0.80%
Pre-Construction	62.3%	Low	0.20%
Information Management	54.5%	Low	0.12%
Contractual	49.9%	Very Low	0.50%
All, Average	64.1%	Moderate	0.50%

Figure 18 shows the AHP results for the xDOT and CII categories. The most important xDOT categories are: 1) Execution (21.9 percent), 2) Contractual (21.2 percent), and 3) Traffic Mangement (15.9 percent). On the other hand, the top three CII categories are 1) Planning (22.2 percent), 2) Execution (19.4 percent), and 3) Organization (17.1 percent).

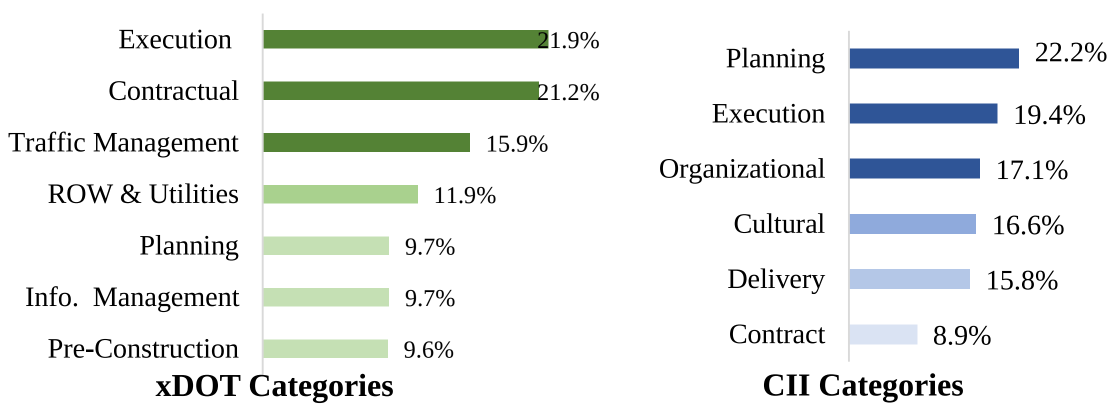

Figure 18: Consolidated Global Priorities of the xDOT (Left) and CII (Right) Best Practices

Figure 18 lists the final weights for the xDOT categories, and Figure 19 provides the organizational structure of the xDOT best practices. To incorporate the practices identified through the VDOT and GDOT research, the research team developed the xDOT Playbook and Flash Track Readiness Toolkit (See Appendices III and IV).

Flash Track Best Practices for xDOT

ROW & Utilities (11.9%)

48. Having Early Engagement of Utility Owners (19.0%)

49. Having Early Utility and ROW (20.6%)

50. Having Dedicated Utility Manager Consultants for xDOT and the Designer-Constructor Team (12.8%)

51. Having Sub-surface Utility Engineering (14.7%)

52. Overlapping Environmental and ROW Acquisition (17.1%)

53. Starting ROW Acquisition during Conceptual Design (20% - 50% Design) (15.8%)

Pre - Construction (9.6%)

54. Conducting Environmental Permitting and Scope Development in Parallel (32.9%)

55. Gathering Accurate Geotechnical (Sub-surface) Data to Reduce Risk (22.1%)

56. Establishing Programmatic Agreements to Streamline the Process for Handling Routine Environmental Requirements (34.2%)

57. Using Pre-construction Analysis Software to Evaluate and Select Alternate Project Scenarios (10.8%)

Contractual (21.2%)

58. Having a Responsible In-charge Engineer/Design-Build Integrator (22.2%)

59. Including ROW, Utility Relocation, and Environmental Mitigation in Design-Build Contract (18.0%)

60. Using Incentives to Encourage Earlier Project Completion (21.6%)

61. Employing Allowances for Certain Bid Items as Means of Risk Sharing (17.8%)

62. Using Existing Open-ended Contracts to Procure Time-critical Elements (20.4%)

Planning (9.7%)

63. Having a 30-day State-owned Float Activity as a Predecessor to the Scheduled Completion Date, to Absorb Critical Delays Occasioned by the State (10.0%)

64. Considering 3D and 4D Modeling of the Execution Sequence during Detailed Design (10.0%)

65. Phasing Environmental Permits to Match Phased Construction (28.3%)

66. Using Software to Assist with Scheduling of PCC Pavement, Given the Design, Construction, and Environmental Factors (10.7%)

67. Considering Both Inter-phase and Intra-phase Concurrency for Design and Construction Packages (26.3%)

68. Establishing the Bridge Fabrication Facility near the Project Location (14.7%)

Information Management (9.7%)

69. Collecting Lessons Learned from Similar Projects (17.6%)

70. Developing a Planned Issue Resolution Process (41.9%)

71. Utilizing an Integrated Document Management System for Tracking RFIs, QA/QC, Submittals, and Other Time-sensitive Documents (40.5%)

Execution (21.9%)

72. Pre-fabricating Project Elements That Are on the Critical Path (15.7%)

73. Considering Innovative Construction Materials That Accelerate Construction (13.8%)

74. Implementing Construction-driven Designs (31.6%)

75. Making Timely Decisions through the Use of Workshops (19.0%)

76. Establishing a Project Command Center (14.9%)

77. Establishing a Shuttle Bus Service for Construction Workers, Taking Them from a Common Parking Lot to the Jobsite (5.1%)

Traffic Management (15.9%)

78. Ensuring Efficient Coordination of Construction with Management of Traffic Issues (16.3%)

79. Utilizing a Lane Closure Time Bank (7.5%)

80. Deploying Continual Public Outreach, Media Campaigns, and Dedicated Communications Personnel (19.3%)

81. Ensuring Workers/Public Health and Safety (36.2%)

82. Performing Exhaustive Lane Closure Planning (10.0%)

83. Implementing Smarter Work Zones to Dynamically Manage Traffic and Reduce Work Zone Impacts (10.7%)

Figure 19: Organizational Structure for xDOT Best Practices

Figures 20 and 21 show the consolidated global priorities for the xDOT best practices and CII best practices, respectively. The global priority for each practice was determined by multiplying its weight with the weight of the corresponding category. Based on these results, the most important xDOT best practices are as follows: 1) Implementing Construction-driven Design (6.9 percent); 2) Ensuring Worker/Public Health and Safety (5.8 percent); and 3) Having a Responsible In-charge Engineer/Design-Build Integrator (4.7 percent). In the case of CII, the top three best practices are the following: 1) Selecting Appropriate Construction Methods (4.6 percent)**;** 2) Procuring Long Lead Time Items (4.5 percent); and 3) Ensuring Sufficient Critical Path Resources (3.9 percent).

The identification of each best practice priority or importance in the execution of a Flash Track delivery helps owners determine which practices should be included as a requirement in the request for qualifications (RFQ) and in the request for proposals (RFP) and which other practices would be preferred to have it. In fact, some of the positives encountered in VDOT and GDOT projects, which were described by their SMEs, are now vetted Flash Track best practices. Examples of these are as follows:

- The inclusion of additional allowances for a lane closure and for utilities
- The inclusion of the ROW consideration in the D-B contract
- Design completed before construction
- The inclusion of utilities in the scope of the D-B contract
- Monthly schedule updates from the D-B team
- Tailor-made procurement specific to the project
- Face-to-face monthly meetings to discuss utility designs and construction

- Extra efforts made to hand out the flyers, better community outreach, and web pages from the city
- The inclusion of the A+B component for procurement
- Use of software as a document management system to track submittals
- Use of video simulations to explain the project to the public

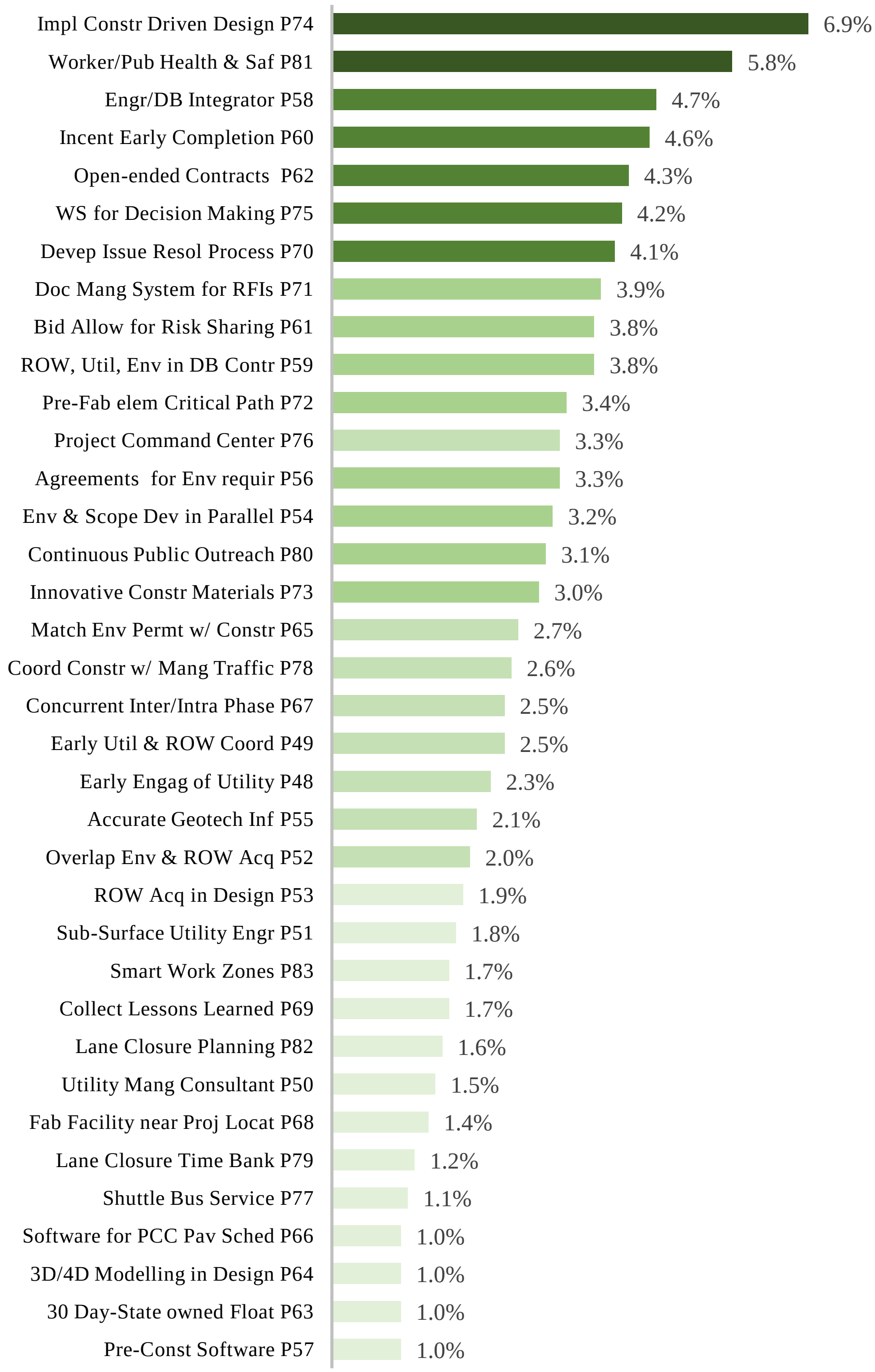

Figure 20: Consolidated Global Priorities for the xDOT Best Practices

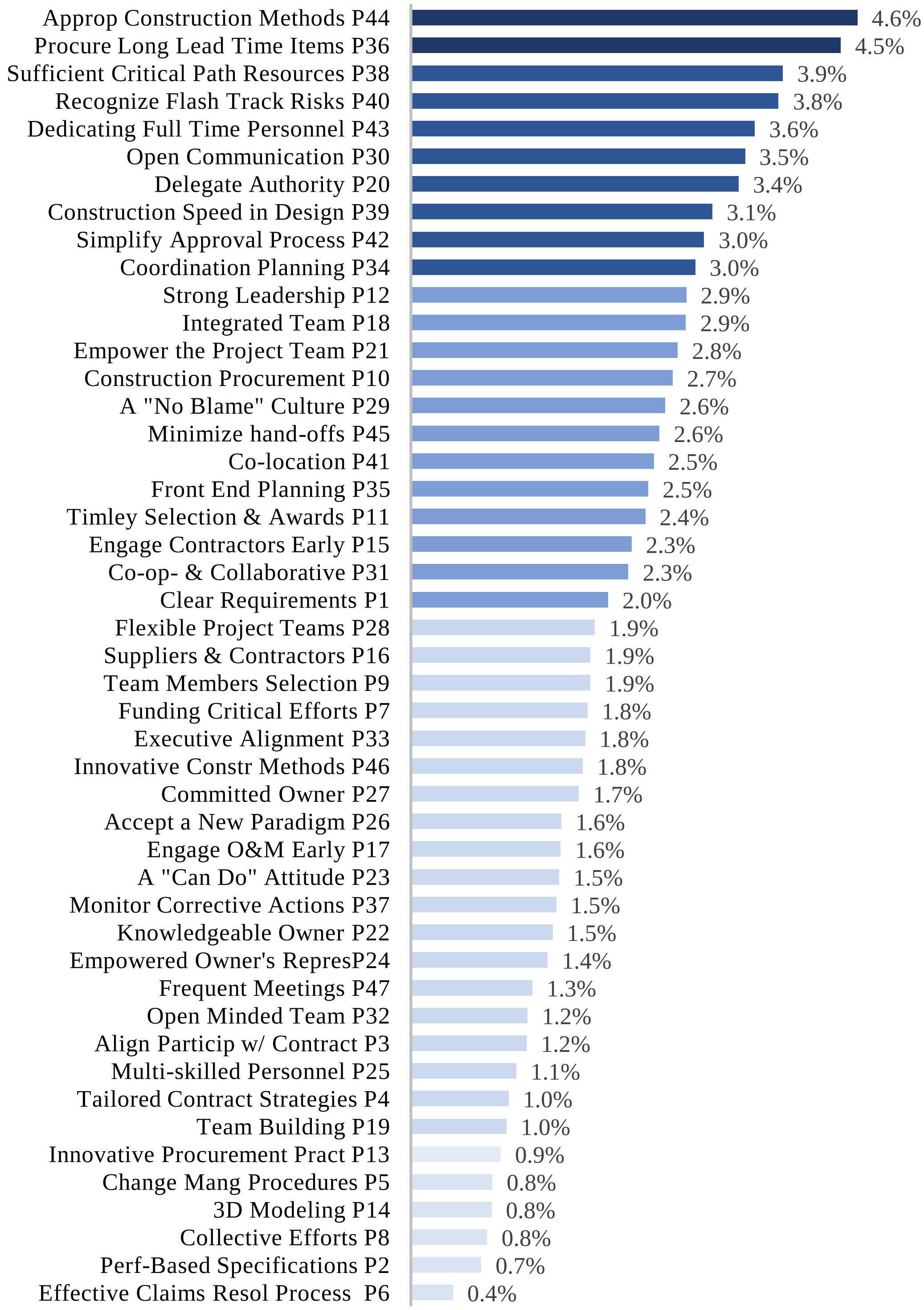

Figure 21: Consolidated Global Priorities for the CII Best Practices

SECTION 10 – CONCLUSION

xDOT IMPLEMENTATION: COURTLAND STREET BRIDGE REPLACEMENT

GDOT awarded the contract for the replacement of the Courtland Street Bridge in Atlanta as part of the Accelerated Bridge Construction (ABC) initiative, and in support of the Metropolitan Atlanta Rapid Transit Authority (MARTA) efforts to update local routes. The project used a Design-Build approach for the quick development needed to limit traffic disruptions in the area.

The principal investigators of this research team recommended that GDOT incorporate the following best practices for Flash Tracking into the Courtland Street Bridge request for proposals and instructions to proposers (RFP-ITP). They identified the placeholder sections for these insertions:

B.2.1.4

Proposer shall include references from prior clients, attesting to the team's open communication, transparency, and cooperative and collaborative culture.

C.2.

c) Proposer shall discuss and demonstrate knowledge of 4D modeling or other schedule/staging/conflict simulation or modeling software.

C.4.1

f) Proposer shall demonstrate its plans to engage key suppliers and key specialty subcontractors early on during the design phase as providers of time-saving innovations.

g) Proposer shall demonstrate its plans to establish and co-locate a fully integrated project team, including design, construction, key specialty contractors and suppliers, traffic management personnel, utility providers, and commissioning and operations personnel.

h) Proposer shall demonstrate its plans to engage a dedicated traffic manager and utility management personnel early on in the design process.

i) Proposer shall designate a Responsible-in-Charge Engineer/Design-Build Integrator.

C.4.2

d) Proposer shall demonstrate its plans to adopt construction-driven design and construction-driven procurement strategies.

e) Proposer shall demonstrate its plans to ensure worker/public health and safety.

f) Proposer shall develop a preliminary risk register.

Project Overview

Located in downtown Atlanta, the Courtland Street Bridge had deteriorated and was in need of replacement. The replacement bridge was designed to have the same length (~1,600 feet) and the same number of lanes as the current bridge (i.e., one lane on each direction for a total two lanes). The bridge had difficult right-of-way conditions, which were to remain the same (60 ft.), including access to ramps. The bridge also passed over a railway section and a number of transportation hubs for the city of Atlanta, and was reconfigured to allow higher clearance for future transportation facilities.

The winning bid for this project was $21 million. The project started in January 2018 and was completed and operational in October 2018.

Project Team

The Design-Build team GDOT chose for the Courtland Street Bridge Replacement project was C.W. Mathews Contracting Company and Michael Baker International.

Challenges

The following were the numerous challenges of the project:

- Six-month-long detour for the duration of the bridge replacement
- Limited right-of-way and limited space for the construction crew
- Management of vehicular and pedestrian traffic was critical

Project Map

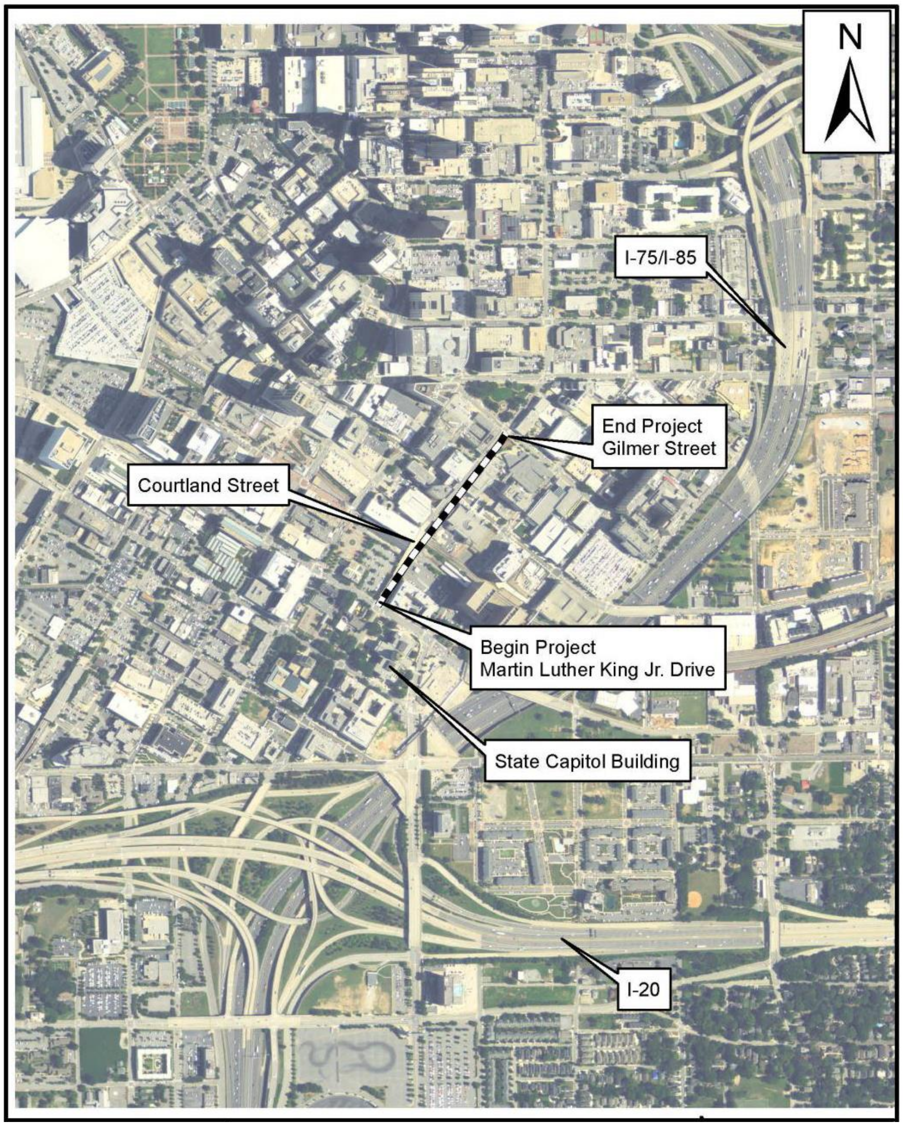

Figure 22: Courtland Street Bridge Replacement Project Map

xDOT Flash Track Readiness Tool Results

Project team members, or their representatives, were asked to assess the project's Flash Track readiness based on the CII and xDOT modules of the Flash Track Readiness Toolkit. Figures 23 and 24 show the overall readiness scores obtained for the CII (9.7) best practices and the xDOT best practices (7.8), respectively. The screenshot in Figure 23 shows that, for the CII-developed categories, the project scored highest in Delivery and Planning readiness (with scores of 10 out of 10), followed by Cultural readiness (with a score of 9.8). The screenshot in Figure 24 shows that, for the xDOT categories, the project scored highest in ROW & Utilities readiness (with a score of 10), followed by readiness in Pre-construction (with a score of 9.9). Figures 25 and 26 show the project's readiness scores on both assessments after completion. Figure 25 shows the highest scoring CII categories were Contractual (9.9) and Planning (9.8). Figure 26 shows that Planning and Traffic Management had the highest scores (both 10 out of 10).

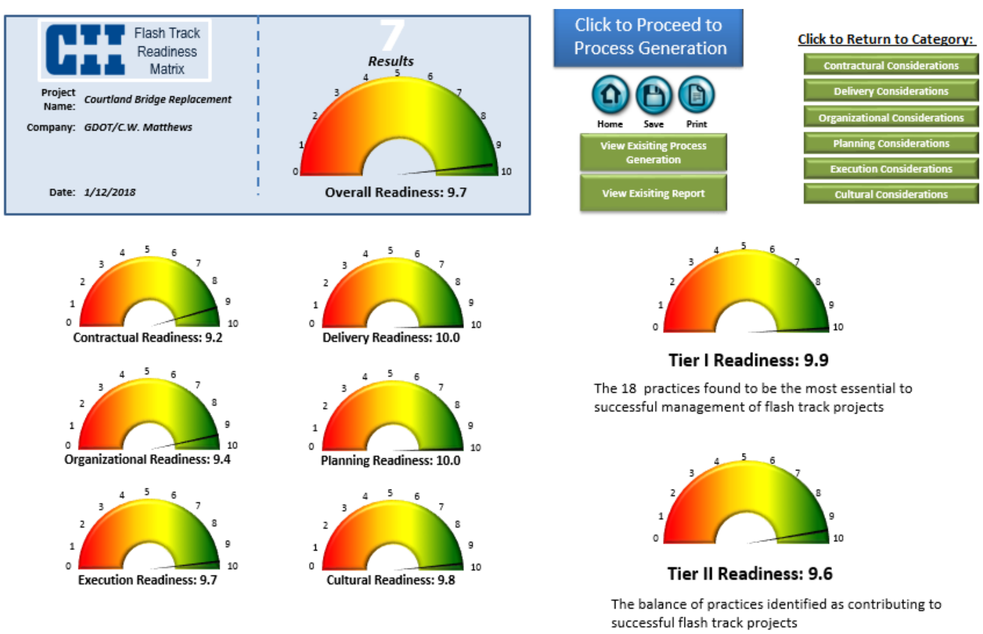

Figure 23: CII Flash Track Readiness Tool Results for the Courtland Street Bridge Replacement at Outset

Figure 24: xDOT Flash Track Readiness Tool Results for the Courtland Street Bridge Replacement Project at Outset

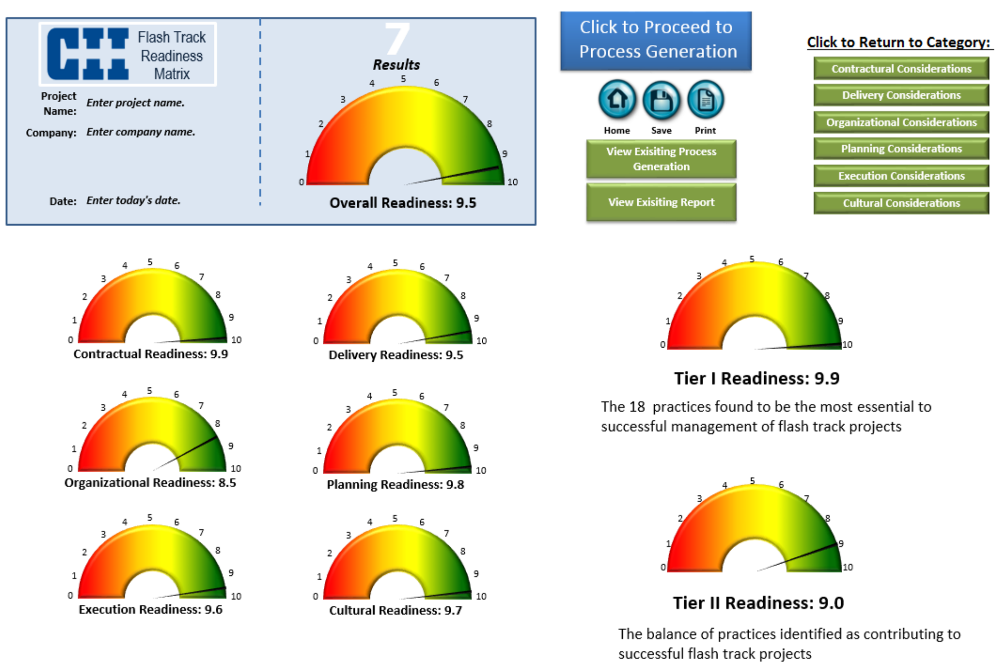

Figure 25: CII Flash Track Readiness Tool Results for the Courtland Street Bridge Replacement at Completion

Figure 26: xDOT Flash Track Readiness Tool Results for the Courtland Street Bridge Replacement at Completion

Assessment of Readiness For Flash Tracking

The meeting for this project took place on January 12, 2018 to introduce the Flash Track research to the Design-Build team. In this session, project team members were asked to use both the CII and xDOT Flash Track Best Practices modules to assess their readiness to execute the Courtland Street Bridge project on a Flash Track basis.

Meeting Attendees

Table 37 below shows all the attendees of the Courtland Street Bridge Replacement meeting.

Table 37: Courtland Street Bridge Replacement Meeting Attendees

Name	Company
Richard O'Hara	GDOT -OID
Albert Bowman	Michael Baker International
Darryl D. VanMeter	GDOT-OID
Andrew Hoenig	GDOT-OID
Lisa Woods	HNTB
Mike Nadolski	C.W. Matthews Contracting Company

WORKFLOW PROCESS MODEL FOR FLASH TRACK PROJECTS

In an article in the American Society of Civil Engineers (ASCE) *Journal of Construction Engineering and Management*, the research team formalized a reengineered workflow process for successful Flash Tracking, given the acronym cPEpC to represent early project collaboration before procurement, engineering, and construction begins. (See Figure 27.) More specifically, the lower case "c" stands for construction-driven design and denotes the committed and collaborative engagement of downstream stakeholders at project outset; the capital "P" stands for procurement of strategic and long lead items; the capital "E" stands for engineering; the lower case "p" stands for the procurement of the remaining items for the project; and the capital "C" stands for construction.

Technical Note

Workflow Process Model for Flash Track Projects

Jesús M. de la Garza, Dist.M.ASCE[1]; and Pardis Pishdad-Bozorgi, A.M.ASCE[2]

Abstract: Prior studies explored and identified the interrelationships of various flash track practices and concepts. This research formalizes a reengineered workflow process for successful flash tracking, known as cPEpC (little c stands for committed and collaborative engagement of downstream stakeholders at the onset of the project, big P stands for procurement of strategic and long lead items, E stands for engineering, little p stands for procurement of balanced items, and big C stands for construction). The cPEpC model is centered around the notion of the importance of building a fully integrated team by engaging key specialty contractors and vendors early on during the conceptual and detailed scoping phases. cPEpC formalizes the committed involvement of both contractors and specialty contractors as well as facilities operators and managers early in the project. In essence, it enables a construction-driven and operation and maintenance (O&M)–driven design philosophy or method of directing the design development process by injecting into it, at the outset, substantial knowledge and experience about means and methods of construction and considerations for O&M. cPEpC requires a heightened degree of concurrency among procurement, design, and construction, while maintaining safety, quality, and the risk tolerance that is needed to manage the volatility inherent in flash track projects. This paper contributes to the body of knowledge by formalizing the cPEpC workflow process and by providing empirical evidence of its implementation in a first-to-market flash track project in the food and consumer products industry. **DOI: 10.1061/(ASCE)CO.1943-7862.0001501.** *© 2018 American Society of Civil Engineers.*

Author keywords: Project planning and design; Fast track; Concurrent engineering; Design-construction integration; Project acceleration; Colocation; Relational contracting; Schedule-driven projects; Construction-driven designs.

Figure 27: Workflow Process for Flash Track Projects

Workflow Process for Flash Track Projects [22]: de la Garza, J. M., & Pishdad-Bozorgi, P. (2018). "Workflow Process Model for Flash Track Projects." *Journal of Construction Engineering and Management*, 144(6): 06018001-1 thru 06018001-6.
https://doi.org/10.1061/(ASCE)CO.1943-7862.0001501

Here is the presentation the authors made to GDOT's Office of Innovative Delivery to introduce cPEpC delivery approach.

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Pardis Pishdad-Bozorgi, PhD Jesus M. de la Garza, PhD

VirginiaTech

An Innovative Project Delivery Approach for Flash Track Projects

Construction Industry Institute®

Virginia Department of Transportation

Georgia Department of Transportation

August 2, 2018

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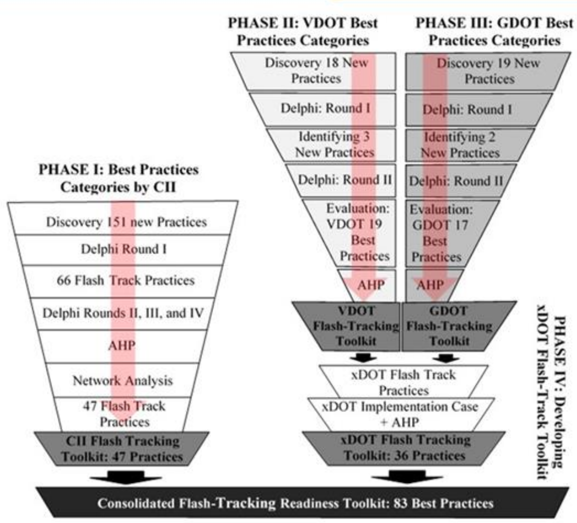
VirginiaTech



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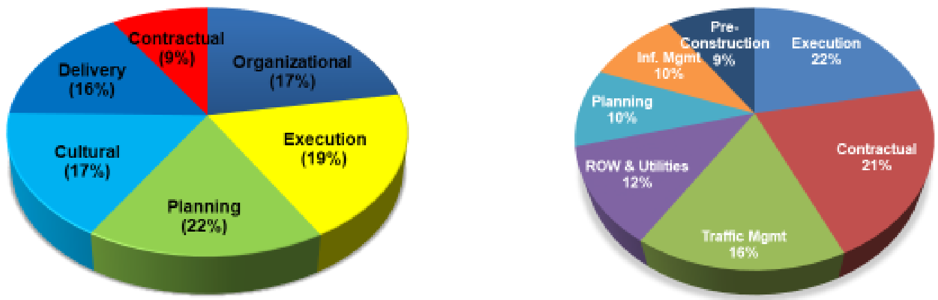
CII	xDOT
47 Essential Practices	**36 Essential Practices**



Flash Track Categories

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Here are a few examples of what it takes to Flash Track…

- ✓ **Fully Integrated** Team
- ✓ **Early Involvement** of key participants
- ✓ **Relational Contracts**
- ✓ **Open-ended Contracts**
- ✓ **Trust**
- ✓ **Co-location**
- ✓ **Full Time** personnel
- ✓ **Multi-skilled**, **Can-do** Attitude and **Assertive** personnel
- ✓ **Construction-driven Design**
- ✓ **Responsible in-Charge** Engineer for DB
- ✓ People with **Flash Track Experience**
- ✓ **Greatest & Best**!...Good isn't good enough!
- ✓ **Delegation of Authority** to team level
- ✓ **Simplify Approval** procedures and **Fund Early** critical efforts
- ✓ **Design for Flash Track**
- ✓ Ensuring Workers/Public **Health & Safety**

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Here are a few examples of what GDOT already does…

- ✓ Utilizing an integrated document management system for tracking RFIs, QA/QC, submittals, etc.
- ✓ Selecting team members and staff on the basis of their fast track experience or qualifications.
- ✓ Co-location of project team (owner, designer, builder, and/or key vendor).
- ✓ Having early engagement of utility owners.
- ✓ Having early utility and ROW coordination.
- ✓ Having sub-surface utility engineering (SUE).
- ✓ Deploying continuous public outreach, media campaigns, and dedicated communications personnel.
- ✓ Ensuring efficient coordination of construction with management of traffic issues
- ✓ Phasing Environmental permits to match phased construction
- ✓ Performing Exhaustive Lane Closure Planning
- ✓ Accurate data in terms of existing geotechnical (sub-surface) information to reduce risk

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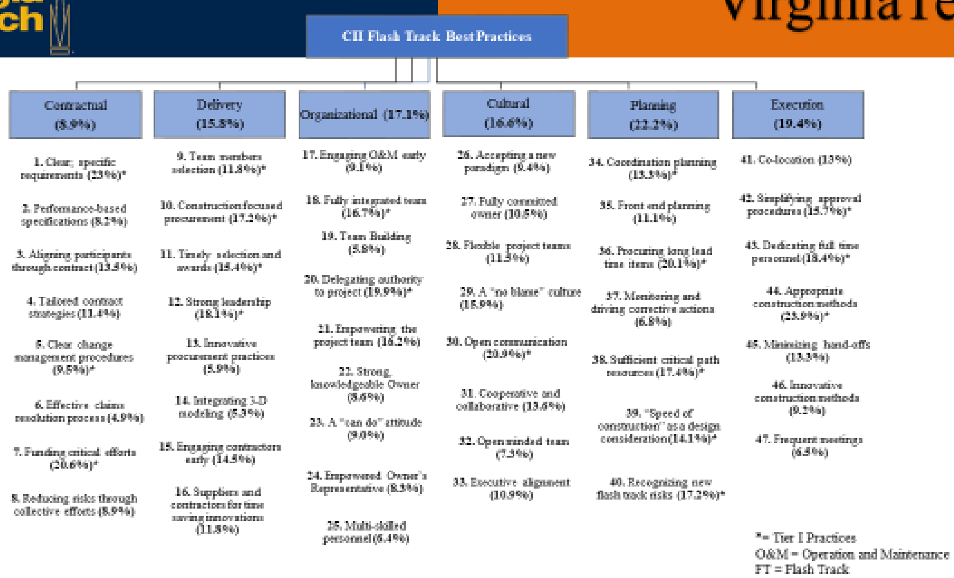

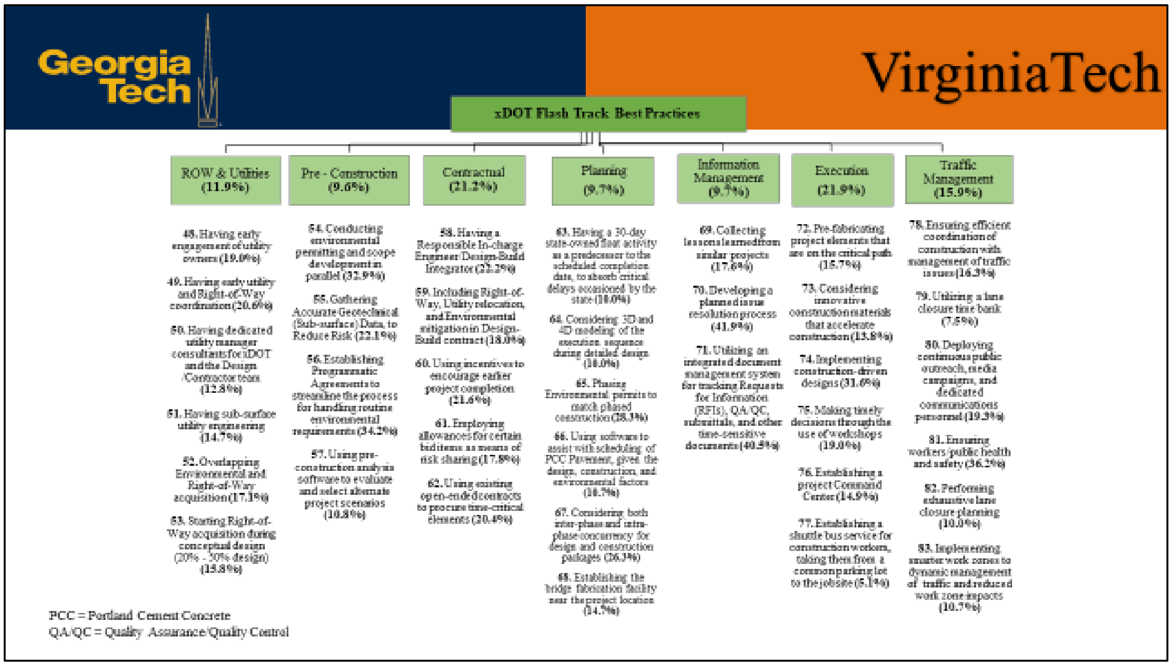
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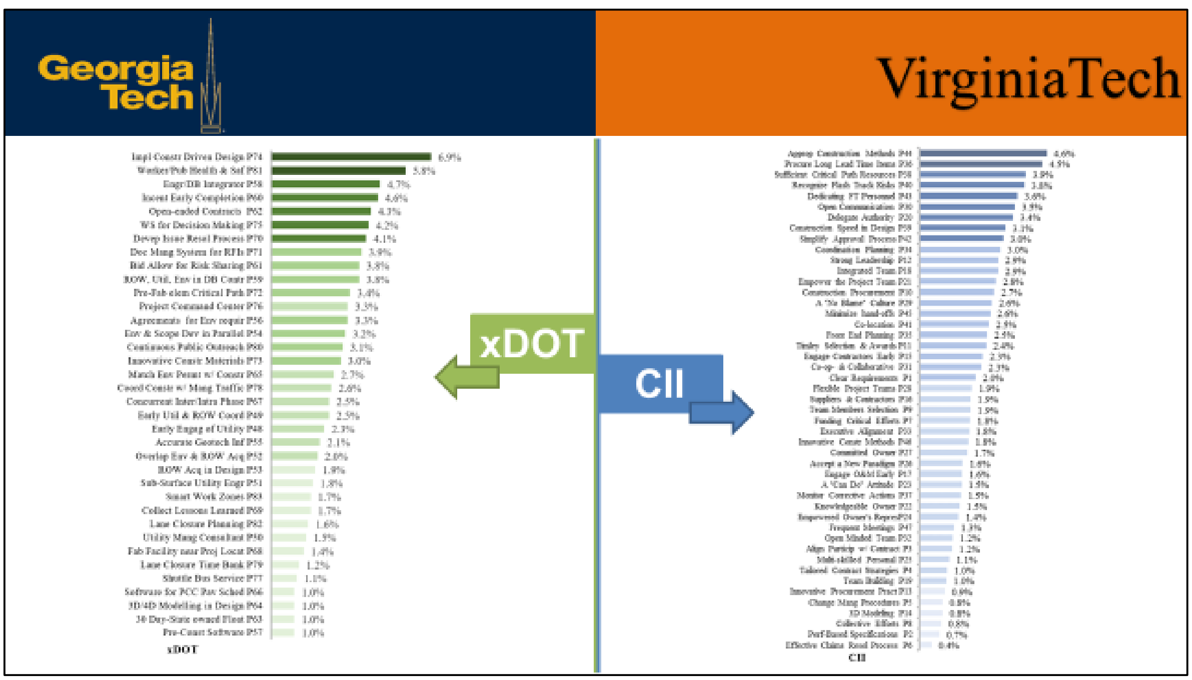
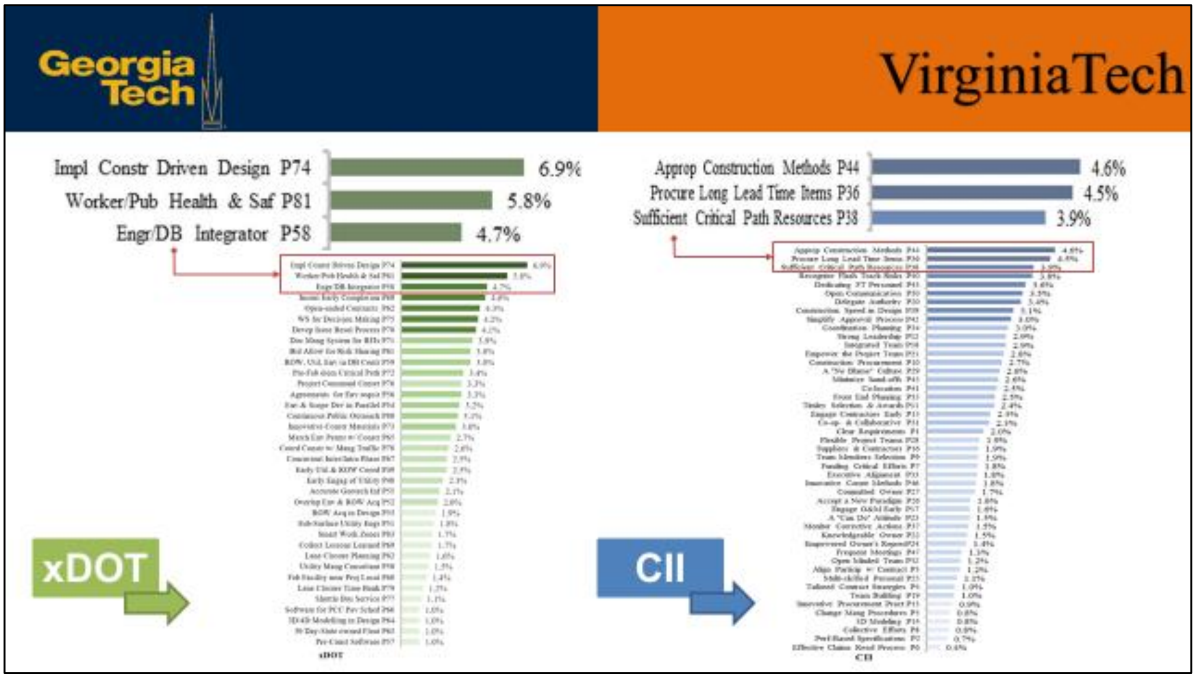
xDOT Flash Track Best Practices
ROW & Utilities (11.9%)
48. Having early engagement of utility owners (19.0%)
49. Having early utility and Right-of-Way coordination (20.6%)
50. Having dedicated utility manager consultants for xDOT and the Design /Contractor team (12.8%)
51. Having sub-surface utility engineering (14.7%)
52. Overlapping Environmental and Right-of-Way acquisition (17.1%)
53. Starting Right-of-Way acquisition during conceptual design (20% - 30% design) (15.8%)
Pre - Construction (9.6%)
54. Conducting environmental permitting and scope development in parallel (32.9%)
55. Gathering Accurate Geotechnical (Sub-surface) Data, to Reduce Risk (22.1%)
56. Establishing Programmatic Agreements to streamline the process for handling routine environmental requirements (34.2%)
57. Using pre-construction analysis software to evaluate and select alternate project scenarios (10.8%)
Contractual (21.2%)
58. Having a Responsible In-charge Engineer Design-Build Integrator (22.2%)
59. Including Right-of-Way, Utility relocation, and Environmental mitigation in Design-Build contract (18.0%)
60. Using incentives to encourage earlier project completion (21.6%)
61. Employing allowances for certain bid items as means of risk sharing (17.8%)
62. Using existing open-ended contracts to procure time-critical elements (20.4%)
Planning (9.7%)
63. Having a 30-day state-owned float activity as a predecessor to the scheduled completion date, to absorb critical delays occasioned by the state (10.0%)
64. Considering 3D and 4D modeling of the execution sequence during detailed design (10.0%)
65. Phasing Environmental permits to match phased construction (28.3%)
66. Using software to assist with scheduling of PCC Pavement, given the design, construction, and environmental factors (10.7%)
67. Considering both inter-phase and intra-phase concurrency for design and construction packages (26.3%)
68. Establishing the bridge fabrication facility near the project location (14.7%)
Information Management (9.7%)
69. Collecting lessons learned from similar projects (17.6%)
70. Developing a planned issue resolution process (41.9%)
71. Utilizing an integrated document management system for tracking Requests for Information (RFIs), QA/QC, submittals, and other time-sensitive documents (40.5%)
Execution (21.9%)
72. Pre-fabricating project elements that are on the critical path (15.7%)
73. Considering innovative construction materials that accelerate construction (13.8%)
74. Implementing construction-driven designs (31.6%)
75. Making timely decisions through the use of workshops (19.0%)
76. Establishing a project Command Center (14.9%)
77. Establishing a shuttle bus service for construction workers, taking them from a common parking lot to the jobsite (5.1%)
Traffic Management (15.9%)
78. Ensuring efficient coordination of construction with management of traffic issues (16.3%)
79. Utilizing a lane closure time bank (7.5%)
80. Deploying continuous public outreach, media campaigns, and dedicated communications personnel (19.3%)
81. Ensuring workers/public health and safety (36.2%)
82. Performing exhaustive lane closure planning (10.0%)
83. Implementing smarter work zones to dynamic management of traffic and reduced work zone impacts (10.7%)
PCC = Portland Cement Concrete
QA/QC = Quality Assurance/Quality Control


Georgia Tech
VirginiaTech
Impl Constr Driven Design P74 6.9%
Worker/Pub Health & Saf P81 5.8%
Engr/DB Integrator P58 4.7%
Incent Early Completion P60 4.6%
Open-ended Contracts P62 4.3%
WS for Decision Making P75 4.2%
Devlp Issue Resol Process P70 4.1%
Doc Mang System for RFIs P71 3.9%
Bid Allow for Risk Sharing P61 3.8%
ROW, Util, Env in DB Contr P59 3.8%
Pre-Fab elem Critical Path P72 3.4%
Project Command Center P76 3.3%
Agreements for Env requir P56 3.3%
Env & Scope Dev in Parallel P54 3.2%
Continuous Public Outreach P80 3.1%
Innovative Constr Materials P73 3.0%
Match Env Permit w/ Constr P65 2.7%
Coord Constr w/ Mang Traffic P78 2.6%
Concurrent Inter/Intra Phase P67 2.5%
Early Util & ROW Coord P49 2.5%
Early Engag of Utility P48 2.3%
Accurate Geotech Inf P55 2.1%
Overlap Env & ROW Acq P52 2.0%
ROW Acq in Design P53 1.9%
Sub-Surface Utility Engr P51 1.8%
Smart Work Zones P83 1.7%
Collect Lessons Learned P69 1.7%
Lane Closure Planning P82 1.6%
Utility Mang Consultant P50 1.5%
Fab Facility near Proj Locat P68 1.4%
Lane Closure Time Bank P79 1.2%
Shuttle Bus Service P77 1.1%
Software for PCC Pav Sched P66 1.0%
3D/4D Modelling in Design P64 1.0%
30 Day-State owned Float P63 1.0%
Pre-Const Software P57 1.0%
xDOT
xDOT
CII
Approp Construction Methods P44 4.6%
Procure Long Lead Time Items P36 4.5%
Sufficient Critical Path Resources P38 3.9%
Recognize Flash Track Risks P40 3.8%
Dedicating FT Personnel P43 3.6%
Open Communication P30 3.5%
Delegate Authority P20 3.4%
Construction Speed in Design P39 3.1%
Simplify Approval Process P42 3.0%
Coordination Planning P34 3.0%
Strong Leadership P12 2.9%
Integrated Team P18 2.9%
Empower the Project Team P21 2.8%
Construction Procurement P30 2.7%
A 'No Blame' Culture P29 2.6%
Minimize hand-offs P45 2.6%
Co-location P41 2.5%
Front End Planning P35 2.5%
Timely Selection & Awards P11 2.4%
Engage Contractors Early P13 2.3%
Co-op & Collaboration P31 2.3%
Clear Requirements P1 2.0%
Flexible Project Teams P28 1.9%
Suppliers & Contractors P16 1.9%
Team Members Selection P9 1.9%
Funding Critical Efforts P7 1.8%
Executive Alignment P33 1.8%
Innovative Constr Methods P46 1.8%
Committed Owner P27 1.7%
Accept a New Paradigm P26 1.6%
Engage O&M Early P17 1.6%
A 'Can Do' Attitude P23 1.5%
Monitor Corrective Actions P37 1.5%
Knowledgeable Owner P22 1.5%
Empowered Owner's RepresP24 1.4%
Frequent Meetings P47 1.3%
Open Minded Team P32 1.2%
Align Particip w/ Contract P3 1.2%
Multi-skilled Personnel P25 1.1%
Tailored Contract Strategies P4 1.0%
Team Building P19 1.0%
Innovative Procurement Pract P33 0.9%
Change Mang Procedures P5 0.8%
3D Modeling P14 0.8%
Collective Efforts P8 0.8%
Perf-Based Specifications P2 0.7%
Effective Claims Resol Process P6 0.4%
CII


Georgia Tech
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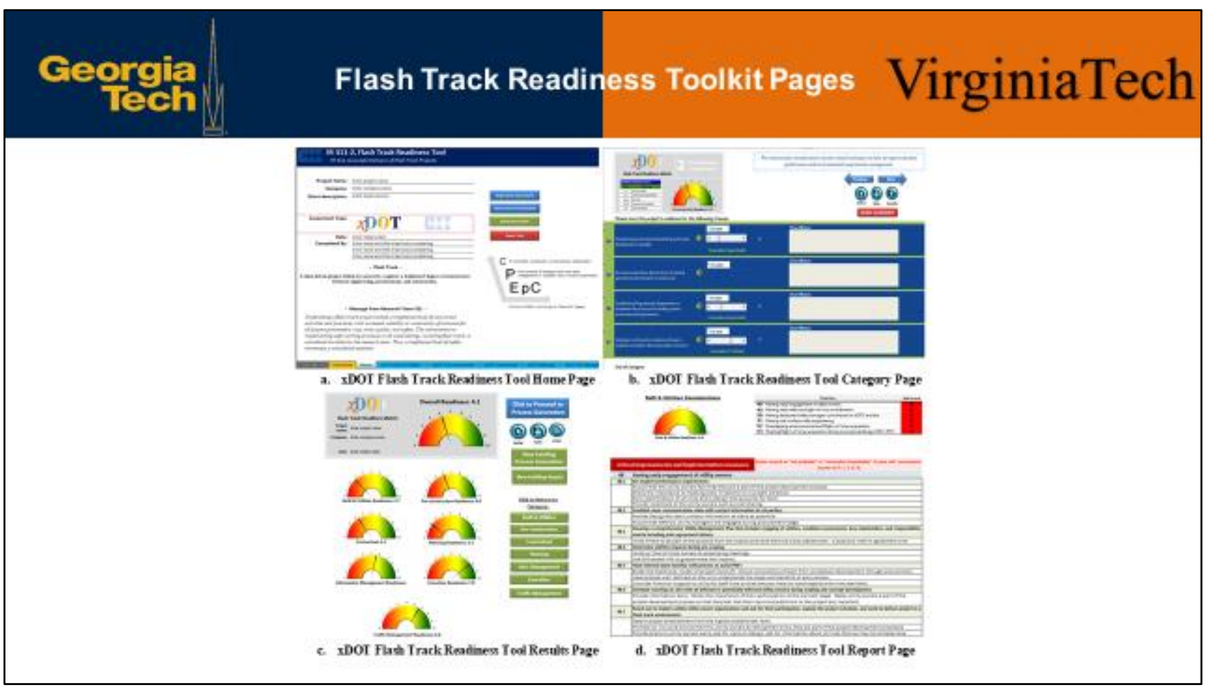
Impl Constr Driven Design P74 6.9%
Worker/Pub Health & Saf P81 5.8%
Engr/DB Integrator P58 4.7%
Approp Construction Methods P44 4.6%
Procure Long Lead Time Items P36 4.5%
Sufficient Critical Path Resources P38 3.9%
xDOT
CII


Georgia Tech
Flash Track Readiness Toolkit Pages
VirginiaTech
a. xDOT Flash Track Readiness Tool Home Page
b. xDOT Flash Track Readiness Tool Category Page
c. xDOT Flash Track Readiness Tool Results Page
d. xDOT Flash Track Readiness Tool Report Page

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xDOT Playbook:

A Pocket Guide

Become Familiar with the Playbook

- *Home* — Main table of contents
- *Index* — Index of Key Words
- *Topic* — Table of contents by Topic
  - → Project Staff
  - → Traffic Management
  - → Operation & Maintenance
  - → Project Execution
  - → Documentation & Procedures
  - → Issues Resolution
  - → Project Planning

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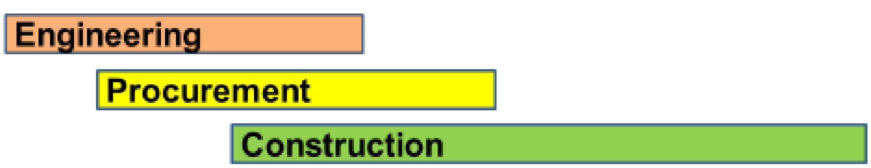
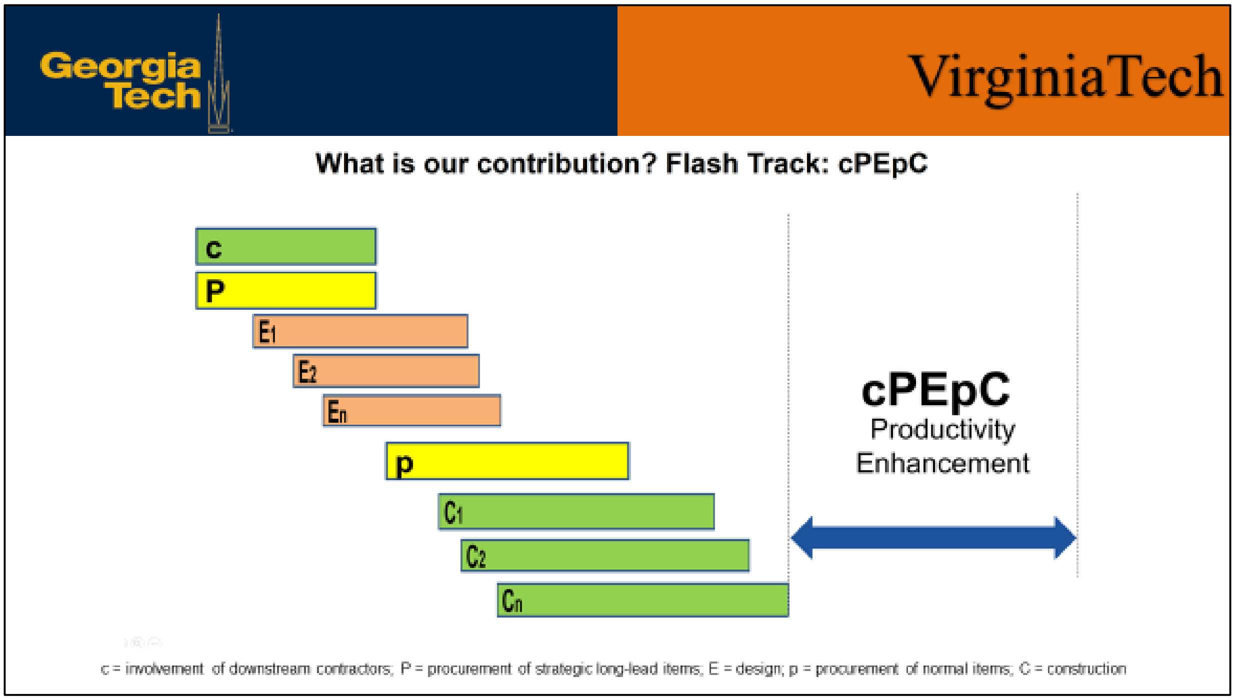
Fast Track: EPC, a.k.a. DB

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What is our contribution? Flash Track: cPEpC
c
P
E1
E2
En
p
C1
C2
Cn
cPEpC
Productivity
Enhancement
c = involvement of downstream contractors; P = procurement of strategic long-lead items; E = design; p = procurement of normal items; C = construction

SECTION 11 - RECOMMENDATIONS FOR FUTURE RESEARCH

Speed and quality of construction have always been a driving factor in the construction industry. In today's era of technically complex projects and increased regulatory environments, a variety of concepts and delivery methods have been defined all striving to satisfy the ever-increasing demand for faster project delivery. In spite of this, much of the construction industry continues to suffer from excessive costs and delayed completions due to the construction industry's fragmentation, excessive litigation, short-termism, lack of trust, and lack of collaboration within the client/design/construction team. As Owners, like GDOT, are increasingly demanding faster project delivery from concept to completion, a higher level of fast tracking is needed offering greater predictability and even faster project deliveries. Flash Track projects are faced with a high degree of chaos given the heightened degree of concurrency between scope definition, engineering, procurement, and construction. Design-Build coupled with Flash Tracking practices offers a viable opportunity to increase the reliability of time-driven projects. Future research is needed to develop Flash Tracking implementation guidelines that would complement the existing Design-Build Manual. These standardized implementation guidelines can be captured in an appendix to the Design-Build Manual.

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APPENDIX I

VALIDATION RUBRIC FOR FLASH TRACK PRACTICES

According to your experience, provide your assessment for each of the following practices with respect to the following statement:

The concept or practice is <u>essential</u> for the success of a GDOT Flash Track project.

Using existing open-ended contracts to procure time-critical elements.

	Strongly Disagree	Disagree	Moderately Disagree	Moderately Agree	Agree	Strongly Agree
ESSENTIAL	O	O	O	O	O	O

Providing an extended mobilization period.

	Strongly Disagree	Disagree	Moderately Disagree	Moderately Agree	Agree	Strongly Agree
ESSENTIAL	O	O	O	O	O	O

Considering ongoing operations when planning and scheduling a brownfield construction project.

	Strongly Disagree	Disagree	Moderately Disagree	Moderately Agree	Agree	Strongly Agree
ESSENTIAL	O	O	O	O	O	O

Performing exhaustive lane closure planning.

	Strongly Disagree	Disagree	Moderately Disagree	Moderately Agree	Agree	Strongly Agree
ESSENTIAL	O	O	O	O	O	O

Using pre-construction analysis software to evaluate and select alternative project scenarios.

	Strongly Disagree	Disagree	Moderately Disagree	Moderately Agree	Agree	Strongly Agree
ESSENTIAL	O	O	O	O	O	O

Using software to assist with scheduling of PCC pavements, given the design, construction, and environmental factors.

	Strongly Disagree	Disagree	Moderately Disagree	Moderately Agree	Agree	Strongly Agree
ESSENTIAL	O	O	O	O	O	O

Pre-fabricating project elements that are on the critical path.

	Strongly Disagree	Disagree	Moderately Disagree	Moderately Agree	Agree	Strongly Agree
ESSENTIAL	O	O	O	O	O	O

Considering both inter-phase and intra-phase concurrency for design and construction packages.

	Strongly Disagree	Disagree	Moderately Disagree	Moderately Agree	Agree	Strongly Agree
ESSENTIAL	O	O	O	O	O	O

Considering innovative construction materials that accelerate construction.

	Strongly Disagree	Disagree	Moderately Disagree	Moderately Agree	Agree	Strongly Agree
ESSENTIAL	O	O	O	O	O	O

Having sub-surface utility engineering.

	Strongly Disagree	Disagree	Moderately Disagree	Moderately Agree	Agree	Strongly Agree
ESSENTIAL	O	O	O	O	O	O

Building mock-ups of pre-fabricated components to address potential constructability challenges prior to its shipping.

	Strongly Disagree	Disagree	Moderately Disagree	Moderately Agree	Agree	Strongly Agree
ESSENTIAL	O	O	O	O	O	O

Implementing construction-driven designs.

	Strongly Disagree	Disagree	Moderately Disagree	Moderately Agree	Agree	Strongly Agree
ESSENTIAL	O	O	O	O	O	O

Collecting lessons learned from similar projects.

	Strongly Disagree	Disagree	Moderately Disagree	Moderately Agree	Agree	Strongly Agree
ESSENTIAL	O	O	O	O	O	O

Based on your experience, we would welcome any thoughts on any other practices that are absolutely essential for the success of GDOT Flash Track projects.

APPENDIX II

CII FLASH TRACK BEST PRACTICES

Categories	Weight
Contract Considerations	8.9%
Delivery Considerations	15.8%
Organizational Considerations	17.1%
Cultural Considerations	16.6%
Planning Considerations	22.2%
Execution Considerations	19.4%

	Contract Considerations	Weight
1	Setting Clear, Specific Scoping Requirements	23.0%
2	Establishing Performance-based Specifications	8.2%
3	Aligning Project Participants' Interests through Contract	13.5%
4	Establishing Contract Strategies Specifically Tailored to the Project Condition	11.4%
5	Establishing Clear Change Management Procedures	9.5%
6	Establishing an Effective Claims Resolution Process	4.9%
7	Funding Early Critical Efforts	20.6%
8	Reducing Risks Through Collective Efforts of All Stakeholders	8.9%

	Delivery Considerations	Weight
9	Selecting Team Members and Staff on the Basis of Their Fast Track Experience or Qualifications	11.8%
10	Focusing Procurement Decisions on Construction Priorities	17.2%
11	Making Timely Selection and Awarding Contracts to Subcontractors	15.4%
12	Staffing with Personnel with Strong Leadership Capabilities	18.1%
13	Employing Innovative Procurement Practices	5.9%
14	Highly Integrated 3-D Modeling, with All Major Users Updating a Common Database	5.3%
15	Involving Contractors, Traders, and Vendors in the Design Phase	14.5%
16	Seeking Out Suppliers and Specialty Contractors As a Source for Time-saving Innovations	11.8%

	Organizational Considerations	Weight
17	Engaging Operations and Maintenance Personnel in the Development and Design Processes	9.1%
18	Establishing a Fully Integrated Project Team, Including Design, Construction, Specialty Contractors, Commissioning, and Operations Personnel	16.7%
19	Using Team Building and Partnering Practices	5.8%
20	Delegating Authority to the Project Level (Maximize Decision-making Authority to the Project Level)	19.9%
21	Empowering the Project Team (Each Organization Led by an Empowered Leader)	16.2%
22	Having an Owner With Sufficient Depth of Resources and Strength of Organization	8.6%
23	Selecting Personnel with a Can-Do Attitude and Willingness to Tackle Challenging Tasks	9%
24	Having an Engaged and Empowered Owner's Engineer (Owner's Representative)	8.3%
25	Staffing with Multi-skilled Personnel	6.4%

	Cultural Considerations	Weight
26	Accepting a Non-Traditional Paradigm Or Mindset	9.4%
27	Having an Active, Involved, and Fully Committed Owner	10.5%
28	Establishing Flexible Project Teams That Avoid Rigid Hierarchy	11.5%
29	Maintaining a No-Blame Culture and Mutually Supportive Environment	15.9%
30	Having Open Communication and Transparency	20.9%
31	Staffing with Cooperative And Collaborative Personnel	13.6%
32	Having an Open-Minded Team	7.3%
33	Creating Executive Alignment Among the Contracted Parties	10.9%

	Planning Considerations	Weight
34	Emphasizing Coordination Planning During the Design Processes	13.3%
35	Performing Exhaustive Front-End Planning	11.1%
36	Identifying and Procuring Long Lead Items	20.1%
37	Monitoring and Driving Corrective Actions Through The Project Controls Process	6.8%
38	Providing Enough Resources to Critical Path Items	17.4%
39	Considering Speed of Fabrication and Construction during the Selection	14.1%

	of Design Alternatives	
40	Recognizing and Managing the Additional Flash Track Risks	17.2%

Execution Considerations		**Weight**
41	Co-Location of Project Teams (Owner, Designer, Builder, and/or Key Vendors)	13.0%
42	Simplifying Approval Procedures	15.7%
43	Dedication of Full-Time Personnel to the Project	18.4%
44	Selecting Appropriate Construction Methods	23.9%
45	Minimizing Handoffs	13.3%
46	Employing Innovative Construction Methods	9.2%
47	Frequent and Effective Project Review Meetings	6.5%

APPENDIX III

xDOT PLAYBOOK

xDOT Playbook:

A Reference Guide for Flash Tracking

xDOT Playbook:

A Pocket Guide

Become Familiar with the Playbook

Home — Main table of contents

Index — Index of Key Words

Topic — Table of contents by Topic

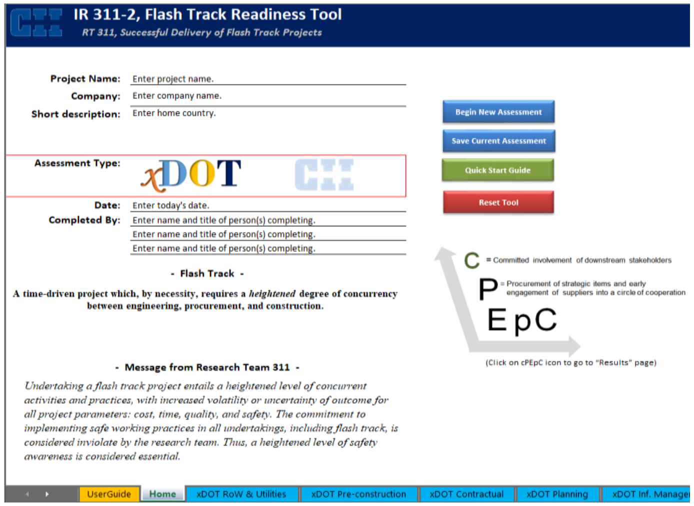
- → Project Staff
- → Traffic Management
- → Operation & Maintenance
- → Project Execution
- → Documentation & Procedures
- → Issues Resolution
- → Project Planning

APPENDIX IV

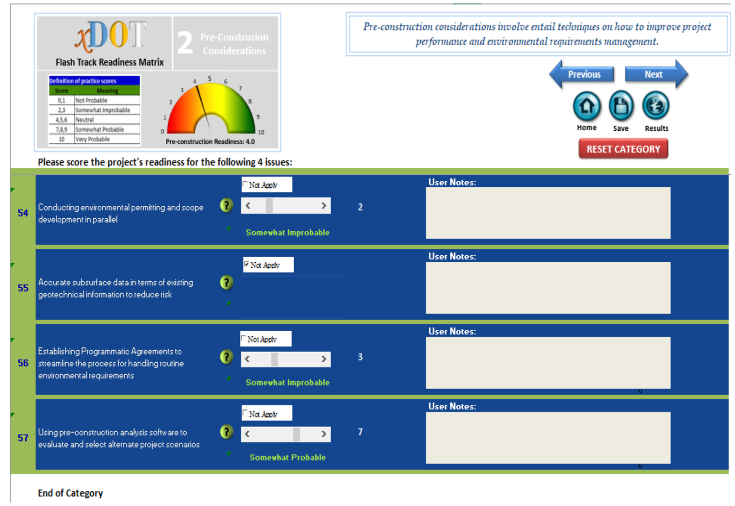
xDOT TOOLKIT

A toolkit was developed to assist stakeholders in determining how prepared they are to undertake a Flash Track project. The consolidated Flash Track readiness tool is a Microsoft Excel-based application that incorporates the 47 CII best practices and categories and the 36 xDOT best practices and categories. Figure 28 below shows the layout of the main sections of the xDOT Flash Track readiness tool: Home Page, Category Page, Results Page, and Report Page.

In the Home Page, either the user can select to begin evaluating their project readiness level with the CII or xDOT Flash Track practices (Figure 28.a). Each assessment is completely independent. The seven xDOT categories are presented in a different worksheet (Figure 28.b). The evaluation of each practice consists of assigning a readiness score based on the team's assessment of the issue concerning the practice. When the evaluation for each of the practices is completed, the final readiness score is shown in the Results tab of the workbook (Figure 28.c). This score is shown as an overall project score as well as by category. Finally, the toolkit displays improvement and implementation measures for the best practices with scores equal to or lower than seven in the Report page (Figure 28.d).

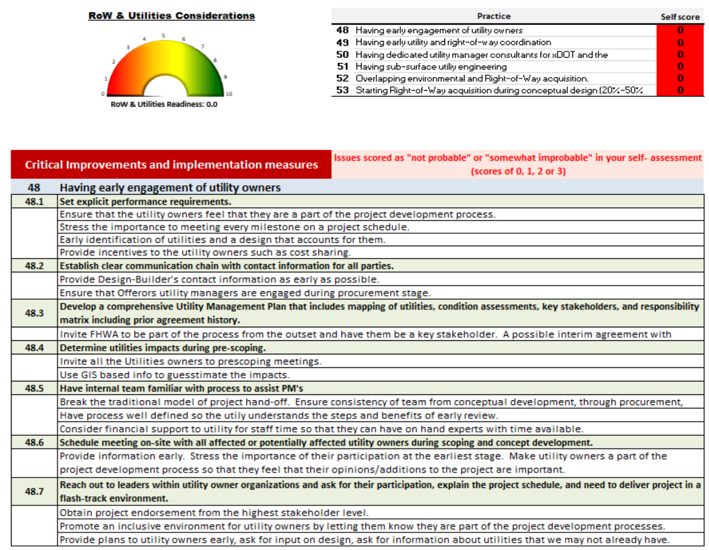


a. xDOT Home Page



b. xDOT Category Page

c. xDOT Results Page



d. xDOT Report Page

Figure 28: xDOT Toolkit Layout