

# Local Technical Assistance Program Support on Computer-based FDOT Intersection Control Evaluation (ICE) Training

**BDV25-977-78**

**Deliverable 4 - Final Report**

Prepared For  
**Florida Department of Transportation**



Prepared By  
**Center for Urban Transportation Research  
University of South Florida**



**July 31, 2022**

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# **Local Technical Assistance Program Support on Computer-based FDOT Intersection Control Evaluation (ICE) Training**

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## **Deliverable 4: Final Report**

**Submitted to:**



**Florida Department of Transportation (FDOT)**

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## Disclaimer

The opinions, findings, and conclusions expressed in this publication are those of the authors and not necessarily those of the State of Florida Department of Transportation.

## Metric Conversion Table

SYMBOL	WHEN YOU KNOW	MULTIPLY BY	TO FIND	SYMBOL
<b>LENGTH</b>				
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km

SYMBOL	WHEN YOU KNOW	MULTIPLY BY	TO FIND	SYMBOL
<b>AREA</b>				
in <sup>2</sup>	squareinches	645.2	square millimeters	mm <sup>2</sup>
ft <sup>2</sup>	squarefeet	0.093	square meters	m <sup>2</sup>
yd <sup>2</sup>	square yard	0.836	square meters	m <sup>2</sup>
ac	acres	0.405	hectares	ha
mi <sup>2</sup>	square miles	2.59	square kilometers	km <sup>2</sup>

SYMBOL	WHEN YOU KNOW	MULTIPLY BY	TO FIND	SYMBOL
<b>VOLUME</b>				
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft <sup>3</sup>	cubic feet	0.028	cubic meters	m <sup>3</sup>
yd <sup>3</sup>	cubic yards	0.765	cubic meters	m <sup>3</sup>
NOTE: volumes greater than 1000 L shall be shown in m <sup>3</sup>				

SYMBOL	WHEN YOU KNOW	MULTIPLY BY	TO FIND	SYMBOL
<b>MASS</b>				
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")

SYMBOL	WHEN YOU KNOW	MULTIPLY BY	TO FIND	SYMBOL
<b>TEMPERATURE (exact degrees)</b>				
°F	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	°C

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16. Abstract Florida is among the top states in the U.S. regarding intersection-related traffic fatalities, and the Florida Strategic Highway Safety Plan (SHSP) identified intersection safety as one of the Emphasis Areas. The Florida Department of Transportation (FDOT) has developed an Intersection Control Evaluation (ICE) manual and conducted in-classroom ICE trainings to promote intersection safety evaluation process. In-classroom training has several disadvantages, such as the limited class size due to venue capacity, pre-determined delivery schedules and locations, and associated travel and lodging cost to attendees. Computer-based trainings (CBTs) provide a good alternative to overcoming these limitations. Therefore, this project provided technical support through the Florida Local Technical Assistance Program (LTAP) on the development of the ICE CBT to meet the training needs of the statewide transportation workforce. In detail, based on the understanding on the ICE manual and existing in-person training materials, the project team developed an Instructional Media Design Package (IMDP) highlighting essential modules for the ICE CBT, and then developed the slide decks and video script for each training module/lesson after the IMDP was approved. Two main CBT sections were developed, where the Engineer/Manager Section provides a good understanding of the foundational ICE concepts, and the Analyst Section offers the details of ICE analysis procedure. The project team also coordinated with FDOT Organizational Development Office to make sure the final deliverables meet the requirement for CBT production. The final product of this project offers a self-pace workforce development approach on the ICE process for statewide transportation professionals.			
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Special thanks go to Jack Freeman and Britt Zebleckes of Kittelson & Associates, Inc. for sharing all Intersection Control Evaluation (ICE) in-person training materials, further presentations made relevant to the updates regarding Safe System Intersection (SSI) approach in ICE Manual, as well as all their insights and suggestions on the computer-based ICE training development during the entire period of this project.

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## Executive Summary

Intersection safety has been identified as one of the Emphasis Areas for the State of Florida, according to the Florida Strategic Highway Safety Plan (SHSP). The Intersection Control Evaluation (ICE) process quantitatively evaluates several intersection control scenarios (alternatives) and ranks these alternatives based on their operational and safety performance. The Florida Department of Transportation (FDOT) has developed an ICE manual and conducted in-classroom ICE trainings to promote the intersection safety evaluation process. Computer-based trainings (CBTs) overcome the limitations of in-classroom trainings with respect to the limited class size due to venue capacity, pre-determined delivery schedules and locations, and associated travel and lodging cost to attendees, etc., and offer an efficient self-paced professional training approach. Therefore, this project provided technical support through the Florida Local Technical Assistance Program (LTAP) on the development of the ICE CBT to meet the training needs of the statewide transportation workforce.

The project team developed an Instructional Media Design Package (IMDP) highlighting essential modules and lessons for the ICE CBT. With the IMDP approved by the project manager and based on the existing in-classroom ICE training materials and the current version of ICE manual, the project team developed the slide decks and associated video scripts for each lesson. The project team also coordinated with the Multimedia Production Team at the FDOT Organizational Development Office to make sure the final deliverables met the requirements for CBT production. There are two main CBT Sections developed, and each Section contains multiple modules with one or more lessons. To be specific, the Engineer/Manager Section provides a good understanding of the foundational ICE concepts and includes five modules. The Analyst Section offers the details of ICE analysis procedure, and consists of eleven modules. The final product of this project offers a self-paced workforce development approach to the ICE process for statewide transportation professionals.

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## 1. Introduction

Intersections are designed points of conflict in all roadway systems, including U.S. and State highways, County roads, and local streets. Conflict points always exist at intersections due to the crossing or merging paths of different modes of traffic. Limiting the number of conflict points at an intersection not only reduces crash occurrences and injury severity outcomes, but also improves the mobility and operational efficiency of the intersection and roadways in its vicinity.

In 2015, Florida ranked as the #1 state in the U.S. with the most intersection-related traffic fatalities. With more than 30 percent of all traffic fatalities occurring from intersection-related crashes, the Florida Strategic Highway Safety Plan (SHSP) identified intersection safety as one of the top Emphasis Areas for the state (Florida Department of Transportation, 2021a). In response to this call to action and with direction from leadership, the Florida Department of Transportation (FDOT) has developed an Intersection Control Evaluation (ICE) manual (Florida Department of Transportation, 2022a) to aid in this effort. The ICE process quantitatively evaluates several intersection control scenarios (alternatives) and ranks these alternatives based on their operational and safety performance. To promote the implementation of the ICE process and related workforce development, FDOT uses selected contractors to develop and conduct FDOT ICE in-classroom trainings around the state on a regular basis (Florida Department of Transportation, 2022b).

In-classroom training has multiple advantages, such as a safe and focused training environment, timely Q&A between instructor and attendees, and group assignments and discussions, all of which can enhance the learning process. However, in-classroom training also has several intrinsic disadvantages, including 1) in-classroom training sessions have a limited class size that depends on the training facility, instructor preference, and training agenda settings; 2) in-classroom trainings are generally scheduled in advance based on facility availability, and it is difficult to accommodate emergency shifts or conflict of schedules of potential trainees; and 3) trainees must travel to the training locations, which imposes additional logistical and financial burdens for attendees in regards to travel and lodging. The COVID-19 pandemic has also contributed to difficulties with in-classroom trainings by making it unsafe for large gatherings due to public health and safety concerns.

Computer-based trainings (CBTs) provide a good alternative to overcoming the limitations of in-classroom trainings. CBTs allow trainees to work at their own learning pace and style, both of which can be adjusted to match the individual needs of each trainee, and they are non-judgmental while providing immediate feedback through in-session quizzes or practice questions as the training progresses. The immediate interactive feedback of the CBT system allows trainees to review sections of the material as frequently as needed and allows them to complete the session privately. Based on existing training materials for in-classroom training, there is a strong interest from FDOT to develop a CBT for FDOT ICE training to meet educational needs statewide and better promote the implementation of the ICE process.

The overall goal of this project is to provide technical support through the Florida Local Technical Assistance Program (LTAP) on the development of the computer-based FDOT ICE training to meet the training needs of the statewide transportation workforce. Specifically, this project has the following two objectives:

- Develop an Instructional Media Design Package (IMDP) including a structural framework and content modules for the computer-based FDOT ICE training.

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- Develop a video script for each training content module following the approved IMDP.

Detailed project effort and outcomes to achieve these objects are presented below.

## 2. Instructional Media Design Package (IMDP) for Computer-based ICE Training

The IMDP provides design documentation for the development and production of instructional media and courseware, specifying the number of sections, the number of modules in each section, and the number of lessons in each module, as well as the contents to be covered in each section, module, and lesson. Based on the project team’s understanding on the existing FDOT ICE in-class training materials (updated in 2019) (Florida Department of Transportation, 2022b) and *FDOT Manual on Intersection Control Evaluation* (updated in January 2021) (Florida Department of Transportation, 2022a), the project team developed the following IMDP framework, as was approved by FDOT and shown in Figure 1, to guide the development procedure of the computer-based FDOT ICE training. In this IMDP, the presumption is that the individual lessons of the ICE CBT would be modular independent sessions that could be taken at any time by interested parties. The IMDP was laid out based on two target audiences, corresponding to the two major sections shown in Figure 1:

- Engineer/Manager
- Analyst

In this proposed CBT, the majority of the training sessions were developed based on the existing materials, and new slides were developed as needed. In the existing training materials, two separate courses were originally developed: 1) a half-day session for managers and 2) a full-day session for analysts. In reviewing the ICE materials, including the FDOT ICE Manual and procedure, the ICE analysis is required to be signed and sealed by a Florida-registered Professional Engineer. Thus, for the ICE CBT, the research team suggested that what was formerly called “Manager” training be renamed “Engineer/Manager” or perhaps just “Engineer” to emphasize that it is an engineering function requiring signing and sealing by a Professional Engineer.

Therefore, the proposed IMDP shows the proposed training sections as the Engineer/Manager and the Analyst. The training identified for the Engineer/Manager is a high-level introduction to ICE, the intersection types covered by ICE, the procedures involved, the ICE forms, and the available ICE tools. These modules are conceptual in nature, and do not get deep into the details of performing an ICE evaluation, but instead introduce the concepts and explain the underlying objectives of ICE.

The Analyst training section includes all of the conceptual modules of the Engineer/Manager Section, in order to lay a good understanding of the foundational concepts. These are then supplemented by detailed sessions on the CAP-X, SPICE, and FDOT ICE Tools. These then are followed by examples demonstrating the process of applying ICE including the details of the analysis and filling out the forms.

The two paths reflect a recommended minimum training pathway: The Engineer/Manager receiving the training on the basics and the concepts, and the Analyst obtaining the details of ICE analysis procedure. However, the intended modular layout of the CBT sessions allows for the Engineer/Manager that wants more of the details to also pursue the training in those additional sessions in which they may be interested. It also allows the technician to take individual modules again as needed to refresh their learning and understanding of some of the concepts.

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Within each of the Engineer/Manager and Analyst Sections, a few modules are defined based on the logic of training contents, as shown in Figure 1; similarly, within each module, one or more lessons are also defined following the logic of contents in the corresponding module.

Detailed breakdowns and descriptions of each module and lesson in the Manager/Engineer Section and Analyst Section, including the PowerPoint slide contents in existing in-person training presentations, relevant ICE tools, chapters in the most current FDOT ICE Manual, etc., are further discussed in the next Chapter.

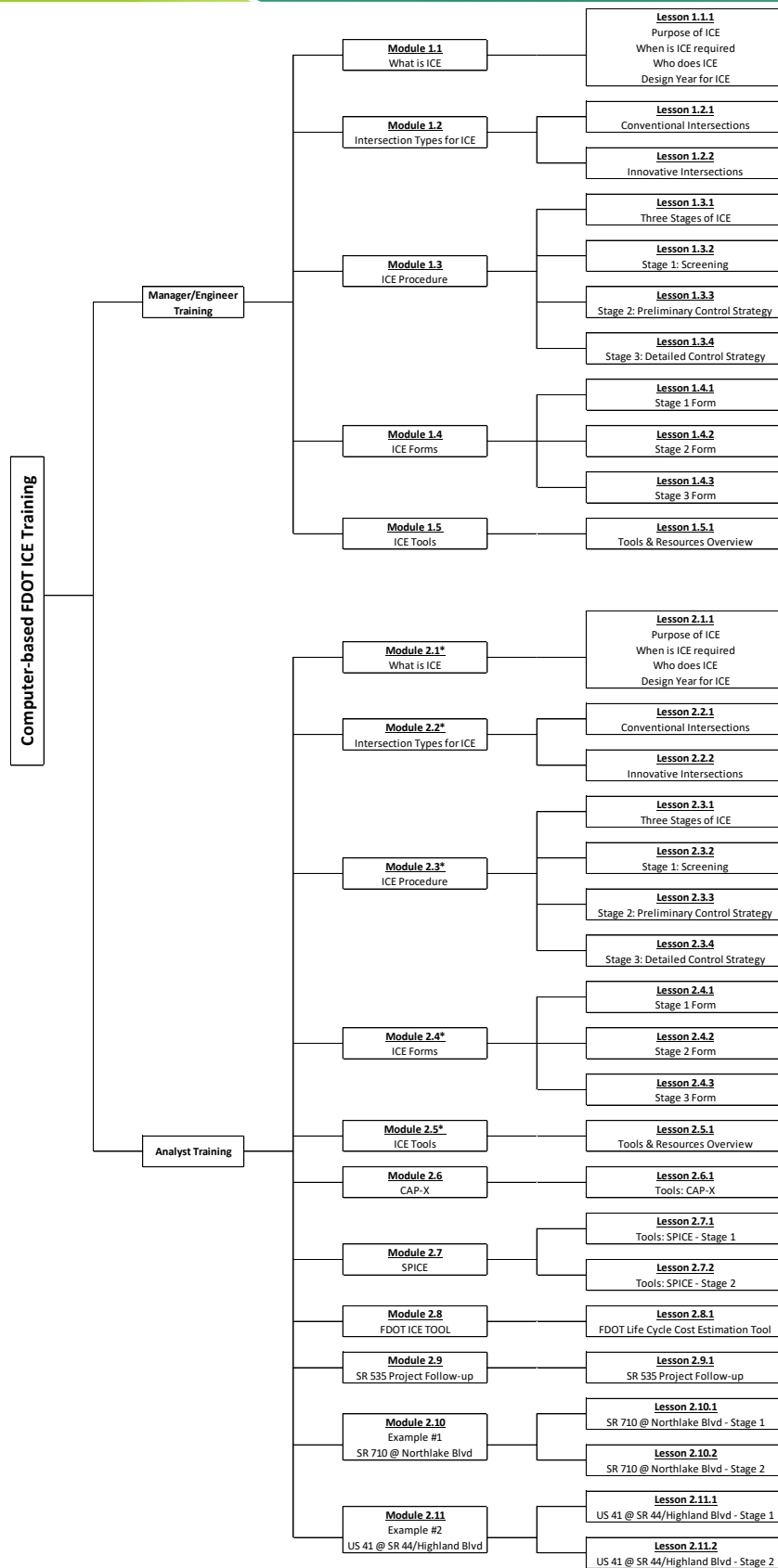


Figure 1 Approved IMDP for Computer-based FDOT ICE Training.

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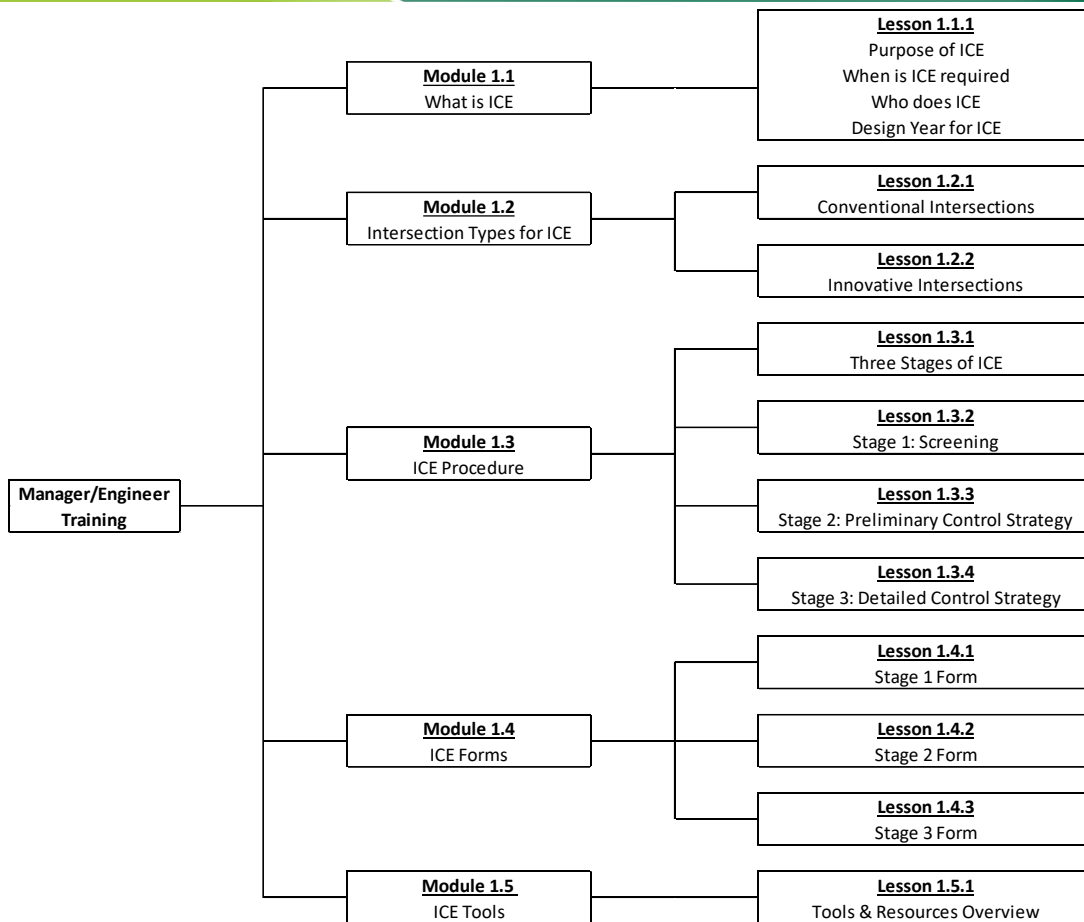
### 3. PowerPoint Slides and Video Script Development by Module/Lesson

With a comprehensive and in-depth understanding on the existing materials for the in-person ICE training and the FDOT ICE manual, and based on the approved IMDP illustrated in Figure 1, the project team reorganized the existing PowerPoint presentations into separate slide decks by each defined module and lesson in the IMDP, and developed comprehensive instructor notes for each module and lesson accordingly. Additional PowerPoint slides were developed as needed to fit the contents covered in each module/lesson based on the project team's understanding. It should be noted that, during the execution of this task, the FDOT ICE manual was updated with a number of revisions and additions as defined in [ICE Bulletin 21-07](#), which was effective on January 1, 2022 (Florida Department of Transportation, 2021b). Therefore, the project team also reviewed and incorporated these changes into the slides and script development for the corresponding lessons to make sure it is up to date and ready for future use.

The project team submitted the draft PowerPoint slide decks and the associated video script for each module/lesson of the ICE CBT to FDOT project manager for review and comments. In addition, the project team also submitted the draft materials to FDOT Organizational Development Office for review and coordinated with them to make sure the final deliverables meet the requirement for CBT production.

The project team also estimated the total length (in minutes) of each lesson based on a normal pace of instructional narration. The importance of the articulation on transportation terminology in a CBT environment was also considered during this process.

Figure 2 and Figure 3 illustrate the detailed modules and lessons for the Manager/Engineer Section and Analyst Section, respectively. A description is also provided on the contents covered in each module, including the PowerPoint slide contents in existing in-person training presentations, relevant ICE tools, chapters in the FDOT ICE Manual, etc.



**Figure 2 IMDP for Manager/Engineer Training Section of Computer-based FDOT ICE Training.**

Figure 2 shows the proposed module/lesson layout of the Manager/Engineer Section in the ICE CBT. Specifically, each module and lesson cover the contents as described below:

**Module 1.1 What is ICE** – This module includes one lesson and covers the general foundation of ICE: the purpose, when is it required, who does it, and the design year considerations. The source information for this is found in the ICE Manual sections 2.1, 2.3, 2.4, and 2.4.2.

**Module 1.2 Intersection Types for ICE** – This module is broken up into two lessons. Lesson 1.2.1 discusses the more conventional intersection types with which we should all be familiar: two-way STOP controlled intersections, multi-way STOP controlled intersections, and signalized intersections. The intent is to discuss and understand these different intersection forms as a foundation for where we are and the challenges that we face. Lesson 1.2.2 focuses on the innovative intersection types and highlights why they may be worth investigating. The benefits and challenges of each of the innovative intersection types are discussed. The source information is found in the ICE Manual Appendix A and there are many slides in both the Manager and Analyst existing training sessions that are used.

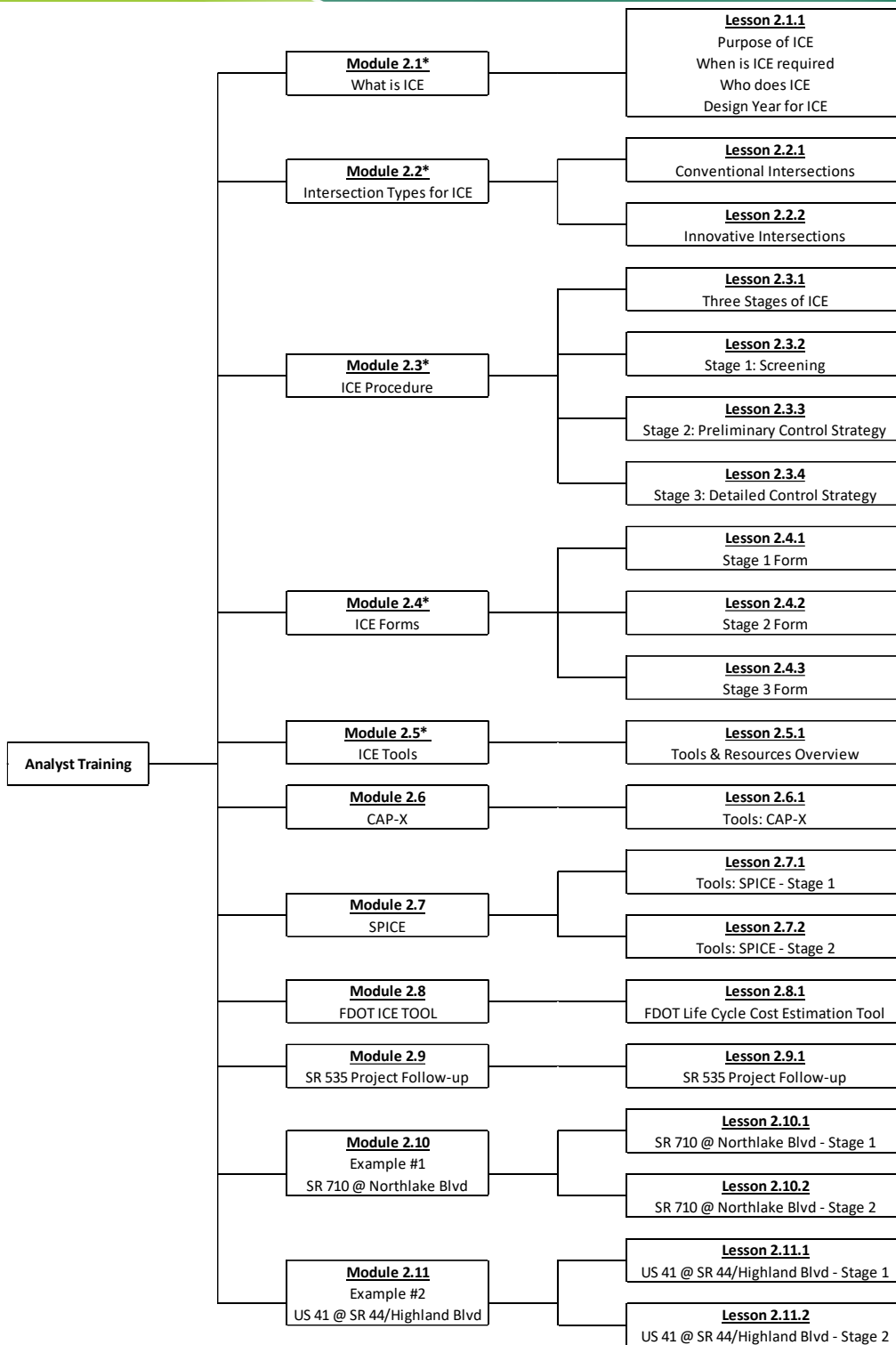
**Module 1.3 ICE Procedure** – The purpose of this module is to explain the ICE procedure and process. The module is broken up into four lessons: Three Stages of ICE, Screening, Preliminary Control Strategy, and Detailed Control Strategy. The first session is an overview of the process, explaining the three stages. The remaining sessions do a deeper dive into each of the stages and explain in more detail what the goals

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and processes are within each step. The source information for this module is found in the ICE Manual Sections 2.5, 2.5.1, 2.5.2, and 2.5.3.

**Module 1.4 ICE Forms** – This module is intended to explain the data that is needed in the ICE forms: where it comes from, where it goes on the forms, and how it is used. The module is broken into three lessons – one lesson for each ICE Stage and its associated form. The source information for this module is found in the ICE Manual Appendix B.

**Module 1.5 ICE Tools** – This module includes one lesson and is intended to give a high-level overview of the tools and resources necessary for performing ICE analysis. It is not intended to get too deep into the use of any of the tools, but just to give an overview and understanding of which tool or resource might be applicable to which stage. The source information for this module is found in ICE Manual section 2.6.



**Figure 3 IMDP for Analyst Training Section of Computer-based FDOT ICE Training.**

Similarly, Figure 3 shows the proposed module/lesson layout of the Analyst Section in the ICE CBT. Specifically, each module and lesson cover the contents as described below:



**Modules 2.1 through 2.5** – These modules are identical to Modules 1.1 through 1.5 above. If after time it appears that there should be different material here, these sessions can be modified as required. The intent in repeating them here is to give the Analyst users the foundational concepts of ICE prior to introducing the details that will be found in the following sessions.

**Module 2.6 CAP-X** – This module is intended to give a deeper dive into the use of the CAP-X tool, and includes one lesson. The source material for this module is based on the existing Manager training slides 39-70.

**Module 2.7 SPICE** – This module consists of two lessons based on Stage 1 and Stage 2 level ICE evaluations. The source materials for these sessions are based on the existing Manager training slides 71-90 and 118-133.

**Module 2.8 FDOT ICE Tool** – This module covers FDOT’s Life Cycle Cost Estimation Tool, and includes one lesson. It is a detailed look at how to use the tool and what it gives you. The source materials for this session come from the existing Manager training slides 134-152.

**Module 2.9 SR 535 Project Follow-up** – This module covers a project that was in the original Manager training, and includes one lesson. In the approved IMDP, the “Engineer / Manager” training is conceptual and high-level in nature. This was moved into the “Analyst” training since it was more detailed than high-level managers may need. The source information for this module is found in the Manager training slides 153-163.

**Module 2.10 Example #1 SR 710 @ Northlake Blvd** – This module is comprised of two lessons: One each for the two stages of ICE analysis required for Example #1. This is a detailed dive into this example and includes robust explanations of the process and the considerations. The information for these two sessions is found in the Analyst training slides 24-142.

**Module 2.11 Example #2 US 41 @ SR 44/Highland Blvd** - This module is comprised of two lessons: One each for the two stages of ICE analysis required for Example #2. Like the previous Module, this is a detailed dive into this example and includes robust explanations of the process and the considerations at this location. The information for these two sessions is found in the Analyst training slides 144-204.

Due to the overall size of these materials, the final video script and corresponding instructional presentation slide decks for each module and lesson were properly archived on CUTR File Transfer Protocol (FTP) server and submitted as a package. The FTP link to these materials was submitted separately for limited access purpose before they are finally approved and published in the CBT format.

It is noted that,

- As shown in Figure 1, Modules 2.1-2.5 are identical in contents to Modules 1.1-1.5, which provide a high-level overview of ICE process and therefore are mandatory training modules for both engineers/managers and analysts. They are numbered differently solely for demonstrating how these training contents were organized for Engineers/Managers Training session and Analysts Training session. Therefore, in this deliverable, the video scripts were only developed for Module 1.1-1.5, and they only need to be recorded once when producing the CBT based on the submitted script.
- Stage 3 analysis in the ICE procedure is only needed when a single control strategy cannot be identified as the preferred option at the end of Stage 2. Stage 3 requires a more in-depth analysis

and/or public vetting of control strategy options, and should be a rare occurrence. Therefore, there is no need to develop a separate case study to demonstrate the application of Stage 3 analysis.

Table 1 below summarizes the total number of slide pages for each proposed lesson following the IMDP, as well as the estimated length based on a normal pace of narration.

**Table 1 Number of Slide Pages and Estimated Instruction Length (in minutes) for Each Session.**

Section	Module	Lesson	Number of Pages	Maximum Length (minutes)*
<b>Manager (Engineer) / Analyst</b>	Module 1.1/2.1	Lesson 1.1.1/2.1.1	30	23
	Module 1.2/2.2	Lesson 1.2.1/2.2.1	20	15
		Lesson 1.2.2/2.2.2	105	79
	Module 1.3/2.3	Lesson 1.3.1/2.3.1	17	13
		Lesson 1.3.2/2.3.2	19	14
		Lesson 1.3.3/2.3.3	29	22
		Lesson 1.3.4/2.3.4	12	9
	Module 1.4/2.4	Lesson 1.4.1/2.4.1	19	14
		Lesson 1.4.2/2.4.2	28	21
		Lesson 1.4.3/2.4.3	10	8
	Module 1.5/2.5	Lesson 2.5.1	27	20
<b>Analyst</b>	Module 2.6	Lesson 2.6.1	25	19
	Module 2.7	Lesson 2.7.1	29	22
		Lesson 2.7.2	13	10
	Module 2.8	Lesson 2.8.1	28	21
	Module 2.9	Lesson 2.9.1	13	10
	Module 2.10	Lesson 2.10.1	49	37
		Lesson 2.10.2	69	52
	Module 2.11	Lesson 2.11.1	22	17
	Lesson 2.11.2	40	30	
<b>Total</b>			<b>604</b>	<b>459</b>

\*It is noted that, to avoid overloaded contents and excessive length, FDOT Multimedia Development requires no more than 45 seconds of instruction on a single slide page. The maximum length for each module is estimated with the assumption of 45 seconds per page, rounded up to integer numbers in minutes, considering necessary pauses and transitions between pages.

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## 4. Conclusions

Intersection Safety has been identified as one of the Emphasis Areas for the state of Florida, according to the Florida SHSP. The ICE process quantitatively evaluates several intersection control scenarios (alternatives) and ranks these alternatives based on their operational and safety performance. The FDOT has developed an ICE manual and conducted in-classroom ICE trainings to promote intersection safety evaluation process. CBTs overcome the limitations of in-classroom trainings with respect to the limited class size due to venue capacity, pre-determined delivery schedules and locations, and associated travel and lodging cost to attendees, etc., and offer an efficient self-paced professional training approach. Therefore, this project provided technical support through the Florida LTAP on the development of the ICE CBT to meet the training needs of the statewide transportation workforce.

In this project, the project team developed an IMDP highlighting essential modules and lessons for the ICE CBT. With the IMDP approved by the project manager and based on the existing in-classroom ICE training materials and the current version of ICE manual, the project team developed the slide decks and associated video scripts for each lesson. The project team also coordinated with the Multimedia Production Team at FDOT Organizational Development Office to make sure the final deliverables meet the requirement for CBT production.

There were two main CBT Sections developed, and each Section contains multiple modules, each of which is made up of one or more lessons:

- Engineer/Manager Section provides a good understanding of the foundational ICE concepts, and includes the following:
  - Module 1.1 – What is ICE
  - Module 1.2 – Intersection Types for ICE
  - Module 2.3 – ICE Procedure
  - Module 2.4 – ICE Forms
  - Module 1.5 – ICE Tools
- Analyst Section offers the details of ICE analysis procedure, and includes the following:
  - Module 2.1 – Module 2.5: Same as Module 1.1 through Module 1.5 in the Engineer/Manager Section
  - Module 2.6 – CAP-X
  - Module 2.7 – SPICE
  - Module 2.8 – FDOT ICE Tool
  - Module 2.9 – SR 535 Project Follow-up Case Study
  - Module 2.10 – Example 1: SR 710 @ Northlake Blvd
  - Module 2.11 – Example 2: US 41 @ SR 44/Highland Blvd

The final product of this project offers a self-pace workforce development approach on the ICE process for statewide transportation professionals.

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