



# PROFESSIONAL SERVICES CONTRACT (PROGRAM) MANAGER ON-DEMAND TRAINING AND BEST PRACTICES

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16. Abstract <p>Every year the South Carolina Department of Transportation (SCDOT) spends millions of dollars hiring consultants to provide professional services in support of its planning, design, construction and maintenance operations. It is essential that professional service program managers have the experience and knowledge necessary to effectively and consistently procure and manage these professional consultants. In order to address program manager training needs that were identified during a pilot training session held in Columbia, SC in November 2012 for SCDOT employees, this research project was initiated with the following objectives: a) investigate the online training programs of state transportation agencies across the U.S. and develop a recommended "Best Practices" for online training; b) incorporate best practices to develop up to 10 (12-15 minute length) online training modules for program managers; and c) develop exam questions for each training module that could be used to test comprehension and understanding of the material covered by each module.</p> <p>The objectives were met by conducting a detailed review of relevant publications and past studies, development and distribution of an online survey that facilitated the collection of data from ten state DOTs, and a series of telephone interviews with nine state agencies in order to collect additional details concerning their online training programs. The information collected from the state agencies during this process permitted the research team to develop a knowledge base of the current practice of online training among transportation agencies. This insight coupled with the lessons learned from the literature search was utilized to develop 10 online training modules for SCDOT Professional Services Program Management. Upon completion of these training modules, each was pilot tested to simulate the experience of a 'new' user. Feedback from the pilot tests was incorporated in the final modules, which were then posted on SCDOT's intranet for employee access.</p> <p>Based on the findings from this research program and a review of the current database of online training on SCDOT's Learning Management System (LMS), recommendations have been prepared for SCDOT's consideration. The research team's recommendations are provided to SCDOT in an effort to continue the improvement of management practices and associated training development for dissemination and standardization of procedures. The recommendations are as follows:</p> <ol style="list-style-type: none"> <li>(1) To continue the efforts made on this current research effort, SCDOT should request feedback through short surveys to solicit employees' opinions of the training modules based on (a) ease of use; (b) clarity of material; (c) quality of the material; and (d) quality of the training experience.</li> <li>(2) SCDOT should use the method and module development approach employed with this project to improve trainings in other areas of SCDOT's business practices. The four areas of research and development suggested for future training initiatives include: 1) Local Public Agency Administered Projects; 2) Staffing Procedures and Best Practices; 3) Pre-Construction and Project Set-up; and 4) Design-Build Project Delivery.</li> </ol>					
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## **EXECUTIVE SUMMARY**

Every year the South Carolina Department of Transportation (SCDOT) spends millions of dollars hiring consultants to provide professional services in support of its planning, design, construction and maintenance operations. As a result of this demand, it is essential that professional service program managers have the experience and knowledge necessary to effectively and consistently procure and manage these professional consultants. In order to address program manager training needs that were identified during a pilot training session held in Columbia, SC in November 2012 for SCDOT employees, this research project was initiated with the following objectives: a) investigate the online training programs of state transportation agencies across the U.S. and develop a recommended “Best Practices” for online training; b) incorporate best practices to develop up to 10 (12-15 minute length) online training modules for program managers; and c) develop exam questions for each training module that could be used to test comprehension and understanding of the material covered by each module.

In order to create training sessions that addressed specific training needs and efficiently delivered the desired content, this research project solicited efforts for establishing the current practice of developing online training modules. The 10 online training modules developed in this research project are expected to meet the needs for training project managers in contract management at SCDOT, while ensuring consistent practices among employees and augmenting department leaders’ training duties. The study of the current practices in the development, delivery, and assessment of online training at state DOTs and experiences gained through the concurrent development of the training modules led to the conception of an asynchronous online training development process for SCDOT.

The study of the current practice of design and delivery of online training has revealed that transportation agencies are shifting from traditional face-to-face training to online training programs. Findings from this research show that a majority of the participants from both the survey and telephone interviews had extensive online training programs for their employees. The remainder were making progress toward providing more online training options for employee use. Moreover, all of the DOTs that participated in the online survey and telephone interviews expressed their willingness to substantially increase online training programs. Two-thirds of the interviewed DOTs made online training compulsory for their employees, which depicts the inclination of these DOTs toward making online training programs a part of the core DOT capability building efforts. More than half of the interviewed DOTs mentioned that they offer certification through online training offerings. All but one of the interviewed DOTs have the capability to build and produce online training in-house; however, these DOTs also closely work

and collaborate with consulting agencies, universities, and third party vendors to produce online training modules.

Effective strategies for building successful online training were also investigated in this research project. DOTs suggested that the use of interactive components in the training modules are key elements to engage the trainees for longer periods of time. In order to build interactive training modules, embedded learning games and audiovisual instructions are used to increase the learner's satisfaction with the online environment. An analysis of the responses from the interviewed DOTs revealed that training modules of shorter duration (i.e., 15-30 minutes) maintained the trainee's attention most successfully. Important considerations for selecting delivery platforms include interactive and user-friendly options. The DOTs were found to have a varied opinion regarding the use of mobile applications for training interfaces on tablets, which is likely because online training is considered an emerging concept for many state DOTs.

With accessible online modules, professionals have the ability to develop their skillset efficiently and effectively, which can facilitate capacity building for transportation professionals. Online learning sustains its effectiveness if maintained and updated regularly. This research project revealed that online training can have a distinct impact on learning and it can be easily tailored to target individual needs.

The objectives were met by conducting a detailed review of relevant publications and past studies, development and distribution of an online survey that facilitated the collection of data from ten state DOTs, and a series of telephone interviews with nine state agencies in order to collect additional details concerning their online training programs. The information collected from the state agencies during this process permitted the research team to develop a knowledge base of the current practice of online training among transportation agencies. This insight coupled with the lessons learned from the literature search was utilized to develop 10 online training modules for SCDOT Professional Services Program Management. Upon completion of these training modules, each module was pilot tested to simulate the experience of a 'new' user. Feedback from the pilot tests was incorporated in the final modules, which were then posted on SCDOT's intranet for employee access. Additionally, the process established by this research effort for the development of online training can be applied to future implementation of asynchronous online training by other SCDOT divisions.

During the development of online training it was found that the training modules can be most effectively and efficiently produced when: a) foundational content is consolidated and approved upfront; b) stylistic choices are made with the audience in mind; and c) modules are designed, built, and approved by a combination of content experts, creative developers, and agency champion.

# 1. INTRODUCTION

Hiring consultants to provide professional services in support of its planning, design, construction, and maintenance projects is a major expenditure for SCDOT. Despite the extensive use of professional consultants, SCDOT personnel responsible for procuring and administering professional service contracts (Program Managers) have received minimal formal training on contract procurement and administration.

Federal funding is typically involved in consultant contracts, exposing SCDOT to potential risks associated with the violation of federal requirements. In addition, SCDOT personnel have a responsibility to the public to administer state funds in the most responsible and efficient manner. For these and other reasons, it is essential that professional services program managers have the experience and knowledge base to effectively and consistently execute professional services contracts and manage professional consultants.

In order to eliminate some of these risks, SCDOT sponsored a research project titled “Professional Services Contract (Program) Manager Development and Certification Strategy” (SPR 696). The primary objectives of this research effort were to identify current SCDOT contract management policies and practices and develop a formal training manual for SCDOT Program Managers. A Contract (Program) Manager Training Manual was published in 2012 as a result, and in November of the same year a pilot training session was held to disseminate the training information.

The research team led a training session for the project’s steering committee and 32 trainees, each having present or previous experience with contract management. The pilot training, which lasted approximately 6.5 hours, was held at the Columbia Metropolitan Convention Center and conducted using a classroom style format. The primary presenters were members of the research team with SCDOT leadership and subject matter experts (SMEs) participating to generate in-depth discussions on selected topics.

At the end of the training event, participants evaluated the session on a number of criteria. According to the results, the trainees responded positively to the presentation content and delivery and were pleased that SCDOT offered a formal training session. However, a number of the attendees expressed concerns that day-long training sessions, delivered periodically on an annual or semi-annual basis, may not sufficiently address program manager training needs. In addition, a number of attendees suggested that in-class sessions may not be the most efficient way to deliver

training. A significant number of the attendees recommended that the training material be divided into smaller, more topic and user specific sections that could be accessed online and available on-demand. This is similar to the findings of SPR 696, which also recommends that SCDOT breaks down program manager training material into topic specific sections that can be accessed online and on-demand by program managers.

In order to address the program manager training needs efficiently and effectively, the following objectives were established:

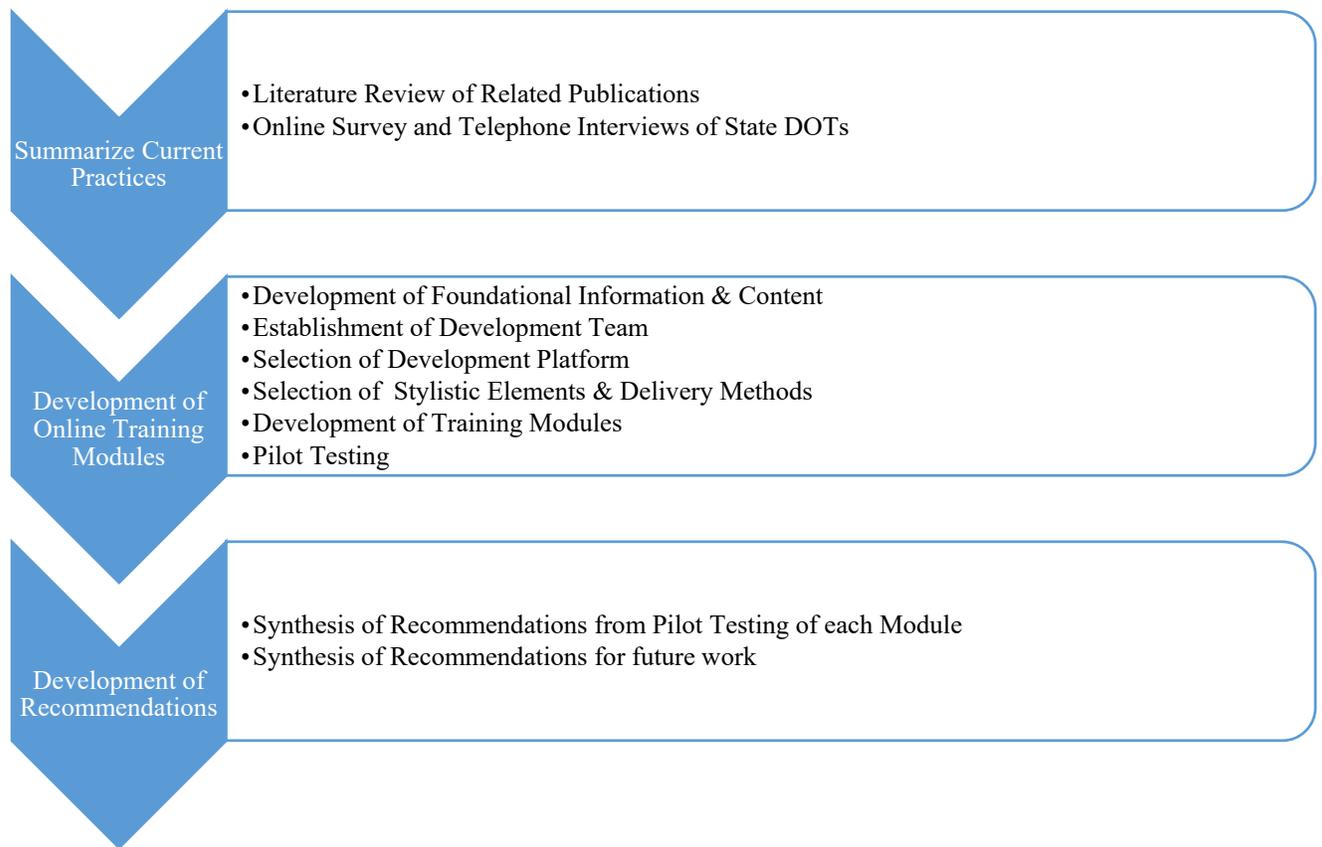
1. Investigate the online training programs of state and federal transportation departments. Based on the findings, develop recommended “Best Practices” for online training for professional services program management.
2. Develop up to 10 online training modules, each 12-15 minutes in length, on program manager procurement and/or administration topics selected by the research team and the SCDOT Steering Committee. Ensure the training offerings are multi-media modules, incorporating graphics, video, and audio to convey topic specific content. Select a training module format that is compatible with SCDOT’s intranet to facilitate departmental hosting of the training modules and provide ease of access by SCDOT personnel. Conduct a pilot test of the first course offering (module) completed. Based on input from participants and the Steering Committee, adjust production of subsequent modules as necessary.
3. Develop exam questions for each training module that could be used to test comprehension and understanding of the material covered by the module. Use module exam questions to serve as the foundation for training certification should SCDOT elect to pursue program management certification at a future date.

## **2. METHOD**

In order to accomplish the objectives of the research project, the research team began by conducting a detailed review of publications from educational institutions, professional organizations, federal agencies, and individual state transportation agencies. In addition, accessible online training modules of several state DOTs were thoroughly reviewed. Then, these reviews were used to establish a baseline understanding of the state of the practice and to develop an online survey, which the research team sent to all State DOTs. After receiving the results of the survey, the research team conducted detailed telephone interviews with select survey respondents and DOTs of interest. The results of the literature review, online survey, and telephone interviews were analyzed to identify the current practices of design and delivery of on-demand (asynchronous) online training.

Subsequently, these results and other lessons learned from the literature and state agency reviews, online survey responses, and telephone interviews were incorporated in the development of 10 online training modules related to SCDOT's procurement and administration of Professional Services Contracts. Upon completion of these modules, each was pilot tested by an individual with no personal involvement in the project in order to simulate the experience of a 'new' user. Based on these pilot tests, the modules were finalized and posted on SCDOT's intranet.

Based on the findings of this research effort, along with a comprehensive review of the current database of online training on SCDOT's Learning Management System (LMS), a list of recommendations was prepared for SCDOT's consideration. Fig. 1 shows an overview of the method employed in conducting this research project, which is discussed in greater depth later in this report.



**Fig. 1.** Overview of Study Method

### **3. PROCEDURE FOR DETERMINING CURRENT PRACTICE**

The current state of the practice for design and delivery of online training was determined through a literature search, an evaluation of the online survey responses collected from various state DOTs, and an analysis of responses received during telephone interviews with select state DOTs. The following sections of this report discuss the detailed procedure for developing the current practice for design and delivery of online training.

#### **3.1 Review of Published Literature and Online Training Products**

To determine the current practice for design and delivery of online training, the research team began by reviewing published literature from educational institutions, professional organizations, federal agencies and individual state transportation agencies. Several accessible online training modules of a number of state DOTs were thoroughly reviewed. This review helped to refine the format of the next phase of the study.

#### **3.2 Summary of the Online Survey Responses Collected from State DOTs**

One of the objectives of this research project included development of an understanding of the current practices of DOT online training. In this phase, an online survey questionnaire was developed in order to solicit input from state DOTs. The questions asked in the survey were posed to gain an understanding regarding the development and management of an online training environment for transportation professionals' capacity building. The survey response included feedback from the DOTs of ten states, which included Virginia, New Jersey, Indiana, Florida, Connecticut, California, Montana, Washington State, Minnesota, and Missouri DOTs, in addition to the Ministry of Transportation & Infrastructure, B.C. Canada.

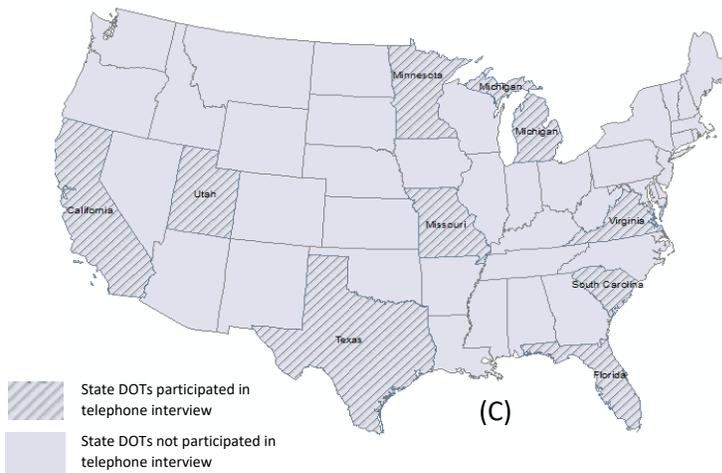
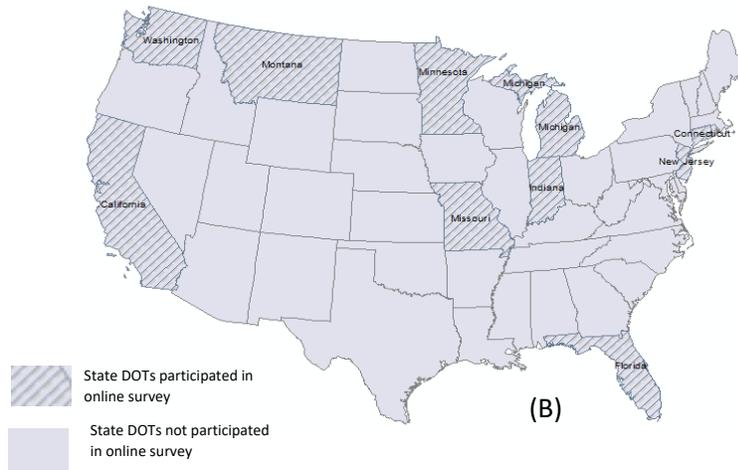
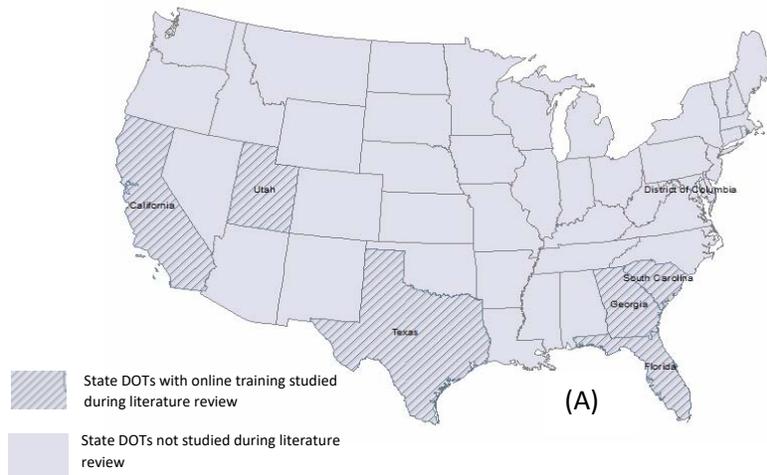
#### **3.3 Summary of the Telephone Interview Results from State DOTs**

Participants of the online survey were invited to participate in a telephone interview to allow the research team to investigate, in detail, the design and delivery of their online training programs. The goal of the telephone interviews was to identify categories that were internally consistent, but distinct from one another (i.e., internal congruence and external divergence). The process was not one of "searching for the exhaustive and mutually exclusive categories of a

statistician”, but instead to identify the salient categories of meaning held by the participants (Marshall and Rossman 2010). The topics of the interviews were focused on the preferred design, delivery and maintenance methods of online trainings developed by the state DOTs. Important aspects of online training, such as the adaptation rate, number of training modules developed annually, long term visions associated with the training development, and structure of the online training development team were investigated.

Boyce and Naele suggested that, while choosing interviewees, samples should be selected in a way that best represents the diverse group of organizations (Boyce and Naele 2006). In order to improve the data quality, information was sought from individuals who had organizational knowledge and online training program expertise and involvement (Gummesson 2000). A standard questionnaire, which was prepared for the telephone interview, was provided to each participant prior to the interviews to facilitate the discussions. The interview outline was developed to supplement the information previously obtained through the self-administered online survey. The discussion topics were chosen to provide additional insight regarding module design, development, application and management of each DOT’s online training program.

This phase of the research solicited telephone interviews from all 10 DOTs who responded to the online survey; 6 of these DOTs agreed to be interviewed. In addition to these 6 DOTs, 3 DOTs that did not participate in the survey but that were identified in the literature review agreed to participate in the telephone interview. In total, interviews were conducted with the following state DOTs: Minnesota DOT, Washington DOT, Florida DOT, Missouri DOT, Virginia DOT, California DOT, Utah DOT, Texas DOT, and South Carolina DOT. The duration of each interview was an hour or more. The research team conducted these 9 telephone interviews over a period of several months. Fig 2. (A), (B), and (C) present the distribution of state DOTs responding to the online survey and telephone interviews respectively.



**Fig. 2.** States (A) studied in literature review (Phase 1) (B) responded to online survey (Phase 2) and (C) participated in telephone interview (Phase 3)

## **4. CURRENT PRACTICE**

Upon completion of the literature review, online surveys, and telephone interviews, the results were summarized and analyzed. This section of the report presents the findings.

### **4.1 Findings from Review of Published Literature and Online Training Products**

An extensive literature search was performed, which included the review of online training in education and transportation systems. In order to gain insight regarding online training practiced by the DOTs, accessible online training modules from DOT websites were studied to identify the current state of the practice, including subject delivery methods and design choices in modules. The following sections present the results from the literature review.

#### **4.1.1 Online Learning in Educational Institutions**

Distance learning programs are typically initiated with the development of an electronically supported learning environment (Ford & Kraiger, 1995). Educational institutions such as colleges and universities adopted this system prior to elementary and secondary-level schools, and online tutorials expanded as Internet access increased (Peterson & Bond, 2004). With the advancement of technology and verification of the benefits of distance learning programs, more educational institutions have introduced online courses. A study by Allen and Seaman (2007) found that educational institutes are leaning toward online education because it improves student access and increases the rate of degree completion. Also, most educational institutions are investigating a cost-effective way of delivering education in light of prevailing budgetary constraints (Tallent-Runnels et al., 2006), and research has shown that distance education/e-learning has been considered a cost-effective delivery method of teaching and learning (Boyce & Neale, 2006). A study by Bates (2001) found that the delivery method of e-learning/online training becomes more cost-effective with an increase in class size. It has also been suggested that a rapid growth of computer-based online training not only reduces cost but also increases capabilities (Brown, 2001). Few studies revealed that there is a similarity between the outcome of online training and instructor-led training (Gaddis, Napierkowski, Guzman, & Muth, 2000; Jaggars & Bailey, 2010; Poirier & Feldman, 2004). Another research revealed that, in a web-based course, students who participated in online discussions achieved a greater mean score in assignments than the mean score of the students participated in face-to-face discussion groups (Campbell, Gibson, Hall, Richards, & Callery, 2008). The growing number of students in online courses is evident from a

study involving more than 2,800 colleges and universities, which found that online enrollment increased from 9.6% in 2002 to 32% in 2011 (Allen & Seaman, 2013).

#### **4.1.2 Online Learning for Capacity Building in Public Agencies for Transportation Officials**

Online learning can be linked to the development of leadership skills that can foster capacity building among a wide group of people (Forbes, 2004). The concept of capacity building is divided into three distinct levels: individual, institutional, and societal (U.S. Department of the Treasury, 2012). Leadership capacity is regarded as a method to enhance self-renewal of the institution or organization (Peterson & Bond, 2004). A 2001 survey (Forbes, 2004) including 201 respondents, 7% of which were government officials, revealed that the respondents were interested in online training because it enhanced skills, improved job performance, and provided a format to track progress with an online learning management system (LMS). To balance budgetary constraints and increased infrastructure demand, some DOTs have either expanded/improved their training offerings or embraced technologies to increase efficiency (Bausman, Chowdhury, & Tupper, 2013). The dynamic environment in the workplace demands a versatile, and constantly evolving, employee skillset that has led many organizations, including state DOTs, to adopt an online training program. Several instructional reasons, including instant access from outside the institution and opportunities for international and collaborative learning, have been identified as fundamental motives to use Internet or web training (Bates, 2001).

As a part of the literature review, online searches for accessible training modules from DOT websites were completed to identify design criteria of the modules and delivery methods that DOTs are implementing for building the professional competency of their employees. During the searches, seven DOTs were found to have accessible online training that could be accessed by external parties. Online trainings of these DOTs (California, District of Columbia, Florida, Georgia, Texas, Utah, and South Carolina DOTs) and the Federal Highway Administration (Caltrans, 2013; Florida Department of Transportation [FDOT], 2016; Texas Department of Transportation [TxDOT], 2016; Utah Department of Transportation [UDOT], 2016) were accessed, and the research team analyzed their content and design characteristics. Those results are presented in the following sections.

#### ***4.1.2.1 Developer of the Modules***

Investigation of the online programs determined that DOT personnel were involved in the development of their agency's training modules. An analysis of the accessible online training programs indicated that most of the studied DOTs had the manpower and resources to develop and update the modules for specific participant groups.

#### ***4.1.2.2 Number of Modules***

It was determined that most of the accessible DOT training modules were not divided into multiple modules, and there was no consistent relationship between the number of modules and the time limit of the training. Time allocation was depended on the depth of the subject matter and training required.

#### ***4.1.2.3 Branding of DOT with the Developed Modules***

A brand name is an organization's identity, and can be a sign, term, symbol, design, or combination of these that helps that organization differentiate its products/services from those of other organizations (Kotler & Armstrong, 2013). More precisely, branding helps create loyalty and helps develop a persona of a product, which eventually benefits the organization (Cunningham, 2006). Due to these advantages, a strong majority (71%) of the organizations were found to use the logo of their organizations in the training programs.

#### ***4.1.2.4 Incorporation of Link of Website Containing Documents in the Training Module***

Trainees often need to have access to specific websites containing information and resources that are supplementary to the training content to support the effort of the training. Providing links to the documents rather than showing the documents directly in the training modules can be an effective training approach. The majority of the DOTs (71%) used a graphic or logo with an embedded link to direct users to those websites. The remainder used the actual URL of the website to forward the participants to a desired destination with additional information/resources.

#### ***4.1.2.4 Use of Interactive Components in Training Modules***

Only three of the training programs reviewed were found to contain evaluation quizzes embedded within the modules to measure learning retention of the participants. More than half (57%) had interactive components within the training modules which Bonk found to be less monotonous than standard PowerPoint slides. According to a survey conducted by Bonk (2002),

the lack of interactive components was deemed as an obstacle in the adoption of online training. Moreover, he found that one in every five survey respondents think that one of the barriers of online learning system is the lack of interest. The inclusion of quizzes or learning games helps to overcome monotony and increase the interactivity, especially for certificate-based training modules.

#### ***4.1.2.5 Host of the Training Website***

A strong majority of the studied DOTs (80%) training modules were hosted on the DOT website. In addition, the DOTs did not rely on external partners to update and maintain their training modules.

## **4.2 Findings from Survey Response Analysis**

After completion of the literature review from online published materials and online training in education and transportation systems that are available online, the research team conducted an online survey with 10 DOTs participating and the Canadian Ministry of Transportation & Infrastructure. The findings from the survey are detailed below.

### **4.2.1 Types of Training for Management**

A study by Schnitman (2007) states that online training can cover a majority of the specific learning areas and can be very effective in improving professional skills. As such, DOTs offer several types of training options for their employees, which include in-person training, in-class training, and online training. Half of the respondents indicated that they offer all three types of training, and online training is provided by more than 60% of the DOTs.

### **4.2.2 Developer of the Online Training Modules**

Four DOTs indicated that their DOT personnel are responsible for developing their online training modules. They indicated that their DOTs have sufficient internal manpower to maintain the training modules on their DOT website. The findings from the surveyed DOTs somewhat align with a study conducted by Aziz, Isbell, Marcus, Miles, and Tesolowsky (2005) who determined that nearly one fourth of the state DOTs developed their courses internally. A comparison between the result of that study and the DOT survey responses from this current study indicated that DOTs are becoming more involved in the development of their online training modules. Additional survey data found that only 27% of the DOT respondents involved external contractors in the development of their training modules.

### **4.2.3 Educational Institution Involvement**

A few state DOTs (20%) utilized educational institutions during the development of online training modules. Forty percent of the DOTs did not engage any universities for module development but either built training modules in-house or procured modules from third-party developers. The rest of the DOTs do not offer online training.

### **4.2.4 Expansion of Online Training Programs**

Survey results showed that online delivery will be assuming an expanding role in future DOT training. More than half of the DOTs surveyed stated they expected to develop and deliver more online training relative to other formal training methods. This would indicate the increasing acceptability for online delivery.

### **4.2.5 Number of Online Training Modules**

With online delivery, it is necessary to determine the optimal number of training modules. However, the data collected in this study do not provide any definitive guidance. Findings from this study indicated that an equal number of the participants had less than five modules or greater than 10 modules in their online training program, and that only 20% of the respondents had an online program with five to 10 training modules.

### **4.2.6 Scopes of Improvement**

One of the most important advantages of an online training program is the improvement in the quality of instruction rather than a reduction in cost (Brown, 2001). This would indicate the need to ensure the continuing efficacy of the training. The research team sought to identify the focus of improvements to support an effective online training program. In their response to the survey, several DOTs identified areas, or features, of their online training program for improvement. They suggested enhancing the flexibility of updating materials and addressing specific issues within the training modules, providing further guidance and best practices, and augmenting training modules with other platforms like WebEx (an online meeting platform).

## **4.3 Findings from Telephone Interview Analysis**

After completion of the online survey and analysis of the survey results, the research team conducted telephone interviews of nine different DOTs (Minnesota DOT, Washington State DOT, Florida DOT, Missouri DOT, Virginia DOT, California DOT, Utah DOT, Texas DOT and South

Carolina DOT) for further investigation of the state DOTs current practice of design and delivery method of online training for their employees. The findings from the telephone interviews are as follows.

#### **4.3.1 Adaptation Rate of Online Training Compared to In-class Training**

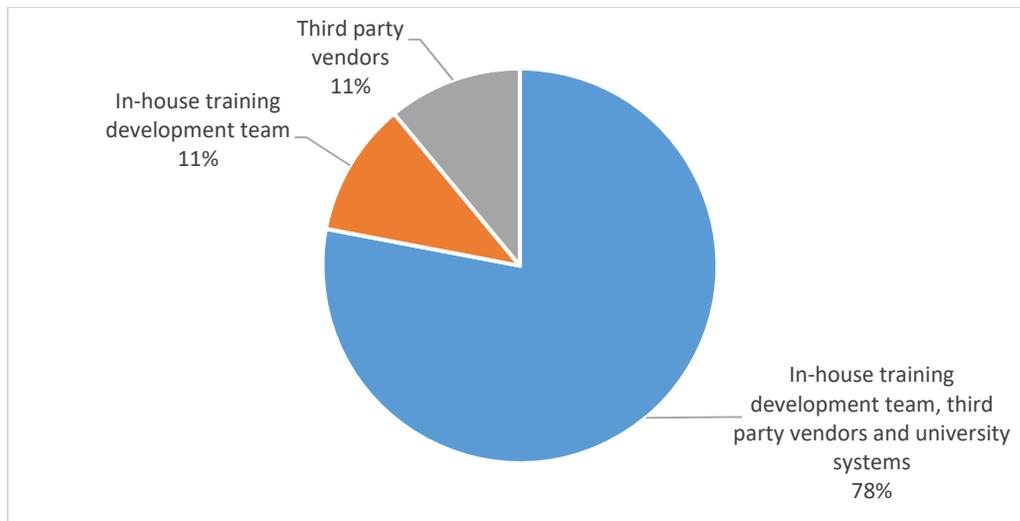
Interview results revealed that the percentage of an agency's training program delivered online varied from 15% to 60%. Only one of the interviewees indicated that their agency provided 100% of its training in an online format for new employees. Although most agencies currently provide instructor-led in-class training, all of the participant DOTs expressed a desire to offer more online training to increase the skillsets of their employees.

#### **4.3.2 Online Training Requirements for DOT Employees**

All of the state DOTs indicated to have certain training requirements for their employees: Some training sessions are compulsory for all, whereas other requirements are task-specific. Interview results showed that two-thirds of the interviewed DOTs ask their employees to participate in compulsory online training, which is then tracked through the LMS to evaluate performance. The rest of the DOTs who indicated not having any minimum requirements regarding online trainings provide online training courses for employees' capacity building.

#### **4.3.3 Online Training Module Development Team**

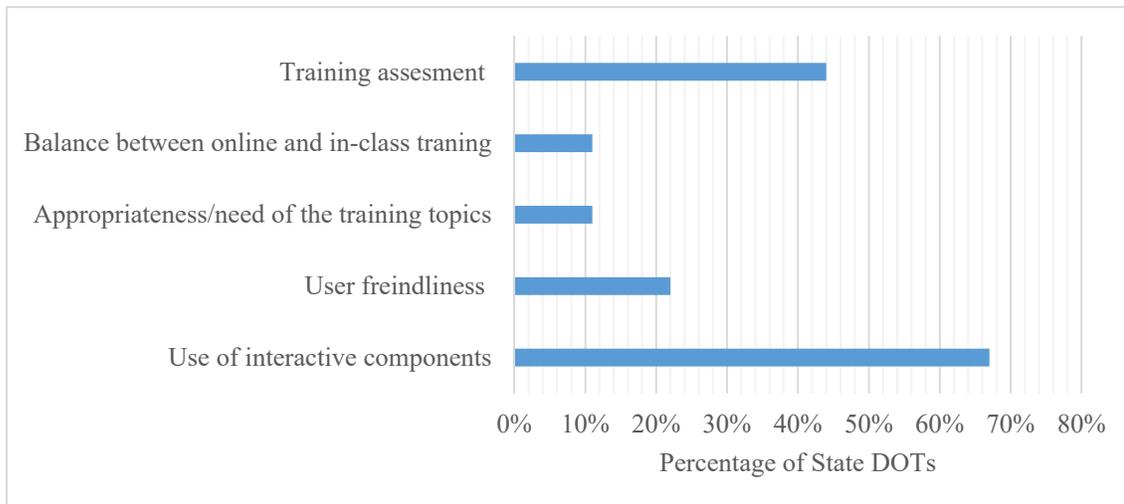
Each state DOT indicated they have different compositions of personnel and expertise on their online training development team as presented in Figure 3. Note also in Figure 3 that a majority of the state DOTs (78%) participating in this phase of the study used both in-house and external expertise to develop online training. Among these DOTs, some specified that they have an e-learning team consisting of writers and producers, who consult with different departments' subject matter experts (SMEs) to build the training content. Others worked simultaneously with their state university systems and/or adjunct groups of qualified developers along with an in-house team consisting of designers, producers, and SMEs. Only one DOT developed their online training independently, without the assistance of any external entity. In addition, only one DOT depended solely on third-party vendors to produce online training modules, and this DOT offered only a limited amount of generic online training to their employees.



**Fig. 3.** Online Training Development Team Composition

#### 4.3.4 Effective Strategies for Online Training

In the case of in-class training sessions, social and communicative interaction among teachers and students is one of the integral parts of the learning experience (Ni, 2013). Therefore, the inclusion of interactive components in online training is essential to mimic that environment (Mitchell et al., 2016 & Islam et al., 2016). As shown in Figure 4, a majority (two-thirds) of the state DOTs that participated in the telephone interview identified interactivity as a key factor influencing the success of their online training programs. The interviewed DOTs indicated that a simple narrated PowerPoint is not an effective delivery method because employees quickly lost interest. Such PowerPoints can be made effective, however, if video snippets, gamification, and animation are interspersed throughout. Participants advised that the training modules should be designed in a way that encourages participants to remain engaged in the training. A couple of the state DOTs thought training content should be designed in a user-friendly way for Boomers, Xers, and Generation Y. They stated that the newer generation of employees usually demands more online training with access using electronic tablets or smart phones, whereas older users generally prefer instructor-led training. This dichotomy presents a critical challenge for the training designers. Although most of the interviewees were committed to the increasing use of online training, some found that a perfect blend of online and instructor-led training can result in a better experience for the trainees.



**Fig. 4. States Identification of Effective Online Training Strategies**

In blended training sessions, many of the state DOTs offered a prerequisite training portion in an online format, prior to commencing the in-person training, which usually lasted for 4 to 8 hr. With this method, trainees were getting the theoretical knowledge from the online modules, and then during the in-class training, they were able to consult and interact with the instructor(s) and participate in situational exercises. A primary objective of the blended approach was to combat the major drawback of online training, which is the lack of activity of the participants that can lead to attention loss.

The findings from the study revealed that DOTs typically included online quizzes after the completion of certain modules to determine participants’ familiarity with the knowledge to proceed with further training. Based on the observations from a number of the DOTs (44%), online training with embedded quizzes and questions dispersed throughout the training module helped assess participants’ understanding.

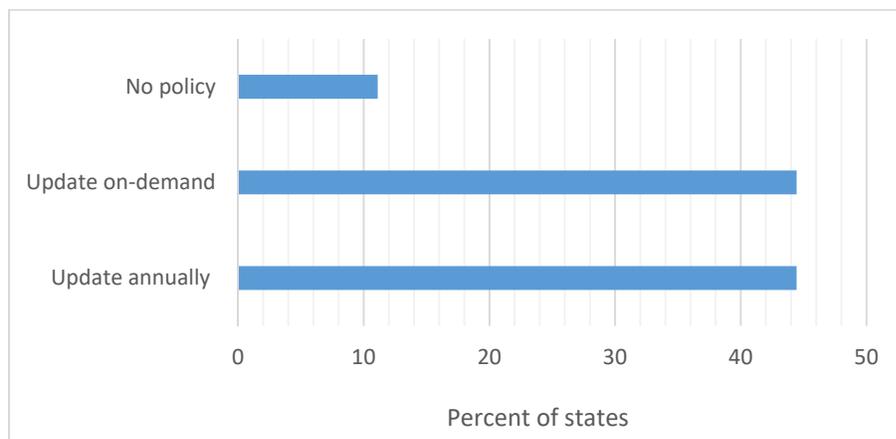
**4.3.5 Certification and Professional Development through Online Training**

A majority of the interviewed DOTs had a certification process in place that was linked to their online training program. Each DOT used their own criteria for awarding a certificate or professional development hours to their employees. Some DOTs mentioned they used their online training platform as a recertification process through which employees were required to recertify every 3 to 5 years of their employment. Test scores of each employee were tracked by an LMS and shared with the employee’s respective department that would subsequently provide a certification to the employee. However, some DOTs did not offer a certification program for online

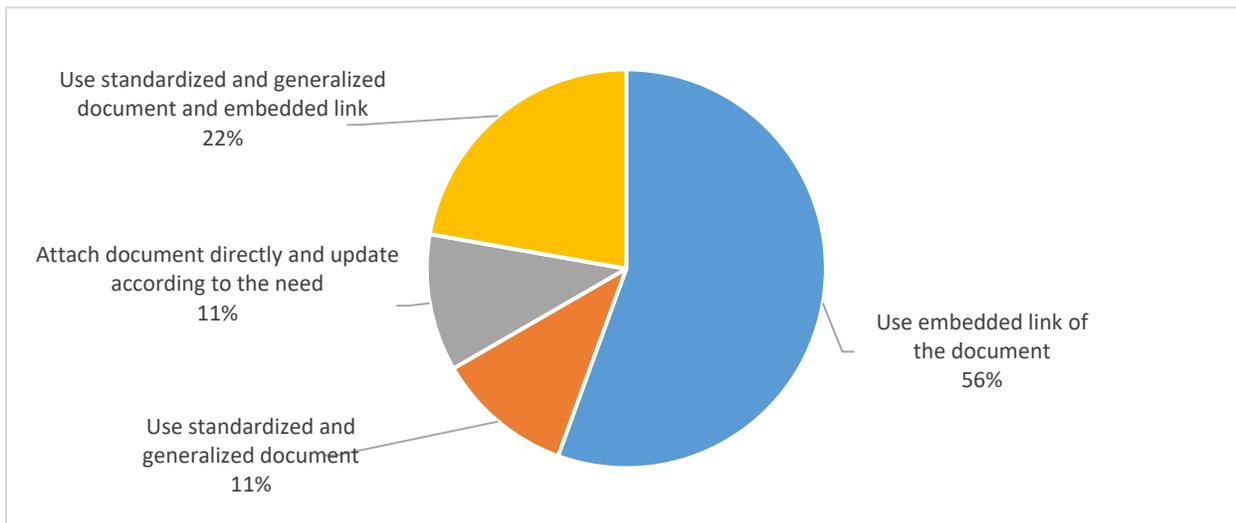
training. Nevertheless, the employees would participate in training to build their own professional development hours.

#### 4.3.6 Maintenance Scheduling Practice for Training Modules

An established maintenance schedule for updating old online training modules found to be practiced by 44% of DOT interviewees as shown in Figure 5. These agencies reviewed and/or updated their online training modules each year, or more often should the need arise. However, an equal number of DOTs did not maintain any regular schedule for updating their training modules. These DOTs indicated that retrofitting the training modules depended on evolving stakeholder needs and changing state and federal regulations and/or procedures. Interviewees mentioned that content updates were typically performed subsequent to notification from the SMEs or content owner that the material had changed and required updating. In some cases, content may simply become outdated and/or replaced with entirely new content (new course). Only one DOT mentioned they do not have a policy in place for updating the online training modules, due to lack of resources.



**Fig. 5.** State Identification of Maintenance Schedule for Training Module Strategies



**Fig. 6.** Strategies for Increasing the Shelf Life of the Training Modules

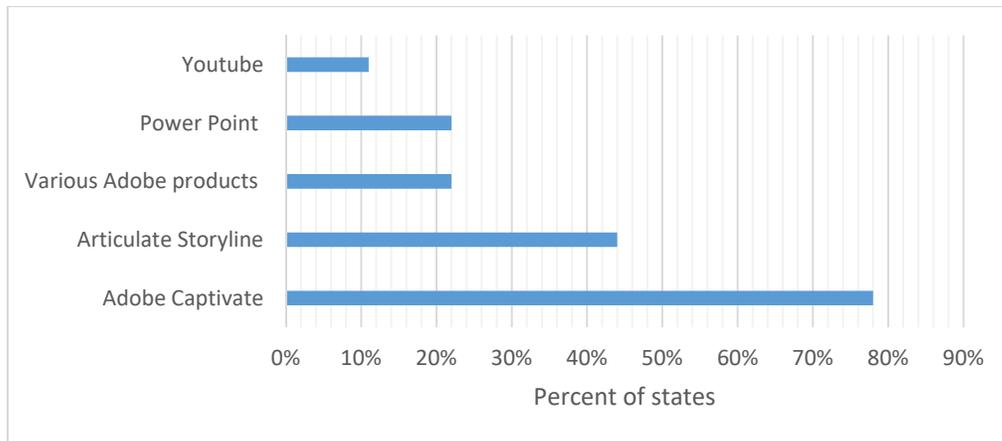
#### 4.3.7 Strategies for Increasing the Shelf Life of the Training Modules

Building durable training modules was found to be the most desirable goal of the state DOTs. But documents used in the training modules often needed to be updated with changes in organizational approach or changes in state or federal law. This could result in a limited shelf life of the training modules. Figure 6 presents the strategies adapted by different state DOTs to increase the shelf life of online training modules. A majority of the participating DOTs (56%) noted that they do not directly incorporate documents or written agency procedures in the online modules. Instead, they provided a link to the documents and/or procedures. With this approach, document changes and updates were “linked” to source documents maintained in a repository. This permitted referenced (linked) material in the training module to remain current without continually updating the training module every time a source document was modified. In addition, one DOT noted that they had adopted the policy of minimizing content in their training modules that was susceptible to frequent change.

#### 4.3.8 Online Training Platform

Figure 7 identifies the different online training platforms utilized by the DOTs. A majority (78%) of the state DOTs use Adobe Captivate as their training platform. Adobe Captivate was one of the preferred training platforms because of its flexibility, ease of use, and availability of tutorials for the creation of online presentation modules (Chandirasekar, 2014). Captivate permits online training developers to create dynamic and engaging projects in a single software package. Articulate Storyline was another training platform that was used by 44% of the state DOTs

interviewed. Articulate users selected this platform because of its capabilities, ease of use, and ability to directly convert a PowerPoint presentation into an e-learning course. Other delivery platforms utilized by the agencies included Adobe Flash, Adobe Photoshop, and Adobe Connect. One unique platform mentioned by a DOT was YouTube for broadcasting training to their employees.



**Fig. 7. Online Training Platforms Utilized**

#### **4.3.9 Accessibility of Online Training through Tablets and Mobile Phones**

The results from the interviews regarding accessibility of online training through a user-friendly platform were varied. A third of the DOTs provided online courseware in their LMS so that employees could access via their office computers. A couple of the DOTs were inclined to design online training with user-friendly media (i.e., mobiles/tablets). Some DOTs opposed the idea of using mobiles/tablets and were more conservative with respect to the training platforms. The reasons behind not providing online training in a handy platform were also varied among the participating DOTs. Some DOTs (22%) implied that mobile applications could be a burden for employees, and a small minority mentioned that their policy was to engage the employees in training inside the office room during the office hours. The state DOTs who did not use any mobile application or electronic tablets in their training platform had online SharePoint sites for their training and development section and had developed a computer-based training library, where all online training courses were accessible. Our study revealed that online training was a new idea in most DOTs, and majority of the participating DOTs were still struggling to find a platform to achieve the maximum desirable outcome.

#### **4.3.10 Duration of the Training Modules**

All of the DOTs interviewed mentioned that lengthy training modules make it difficult to maintain the attention of the trainees. A third of the interviewees suggested that 15 to 30 minutes was the optimum duration for each segment whereas several other DOTs considered up to 45 to 60 minutes to be the ideal length for training modules. In most cases, the interviewees suggested that module duration was dependent on the content. The duration of a training program on each topic varied from 7 to 8 hours to a maximum of 16 hours, and most programs were each typically broken into small segments ranging from 15 to 45 minutes.

#### **4.3.11 Feedback Collection from the Trainees**

Almost all the state DOTs emphasized the collection of feedback from the trainees to help the training developers adapt the training program to address the needs of the participants. A strong majority (78%) of the participating state DOTs collected feedback and critique from their trainees upon completion of each training module. However, the feedback process and data collection procedure varied from state to state. Most of the states collected feedback from participants regarding online training content and delivery method by providing a standard set of questions. Two DOTs (22%) developed software connected to the LMS for feedback collection from the trainees. The few DOTs that had yet to establish a feedback collection method recognized the need and were investigating options for implementation

#### **4.3.12 Long Term Visions Regarding Online Training**

Based on the insight obtained during the interviews, it was clear that state DOTs were increasing their online training offerings. Results indicated that two thirds of the interviewed DOTs already had an extensive pool of online training modules for their employees and were continuing to expand their offerings. Online training had been so successful for two of the DOTs (22%) that they were planning to convert a major portion of their traditional instructor-led training to online, on-demand training, webinar, broadcasts, and/or tele-trainings to reduce training cost and enhance participation. Those respondents who currently lack an extensive online training program, however, also saw the need to expand their offerings through the development of an LMS to provide different mediums of training online. Some were also contracting with e-learning vendors to provide shorter, targeted training to enhance employee job performance. Only one of the participating DOTs indicated that their long-term vision is to provide all the trainings in both

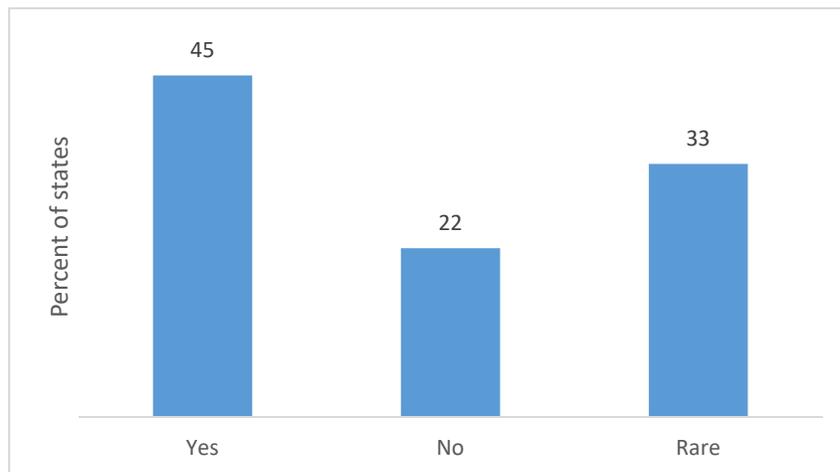
instructor-led classes and online courses. They believed it is very important to make trainings available in both forms so that the individual had the flexibility to take the training in the format most comfortable to them.

#### 4.3.13 Access Control of Training Modules

The majority (78%) of DOTs interviewed stated that they control access to their online training program, which was typically controlled either through the use of passwords or the posting of training material behind the agency’s firewall on their secured intranet. Only one agency permitted external users (nonemployees) access to their online offerings without a password or other authentication.

#### 4.3.14 Use of Videos of SMEs

All respondents indicated the value-added nature of both multimedia and video to online training modules. They felt it increased trainee attentiveness, enhanced retention of the material, and elevated participant engagement. All of the DOT respondents used some videos in their training program, with many regularly incorporating video clips to emphasize certain topics or training material. However, there was a difference of opinion, as shown in Figure 8, regarding the use of SMEs videos. Results indicated that a third of DOTs did not typically incorporate video using “in-house” SMEs or agency personnel. They felt that it limited the shelf life of the training module should agency leadership and/or status of the SMEs change. However, most DOTs (44%) did use SMEs video in training modules, believing that regardless of the status of a particular SME, his or her expertise in that subject matter was still valid nonetheless.



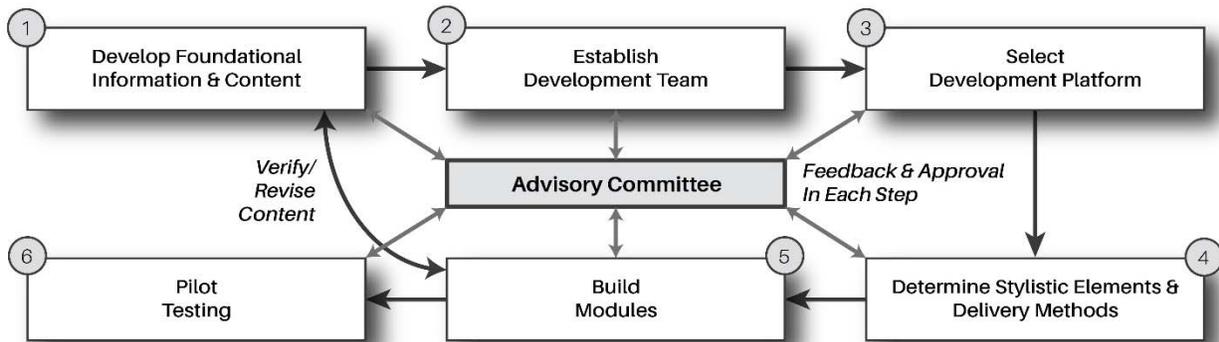
**Fig. 8.** Use of videos of SMEs by state DOTs

#### **4.3.15 Performance Assessment of Trainees**

All DOT respondents indicated that effective performance assessment is an essential element of an online training program. Their assessment process systematically collected feedback from the trainee to permit the agency to gauge the efficacy of the training program. All of the DOTs typically incorporated multiple assessment techniques to validate learning. A quiz was normally included at the completion of a training module. In addition, knowledge checks throughout the training module were commonly incorporated.

## 5. ONLINE TRAINING MODULE DEVELOPMENT

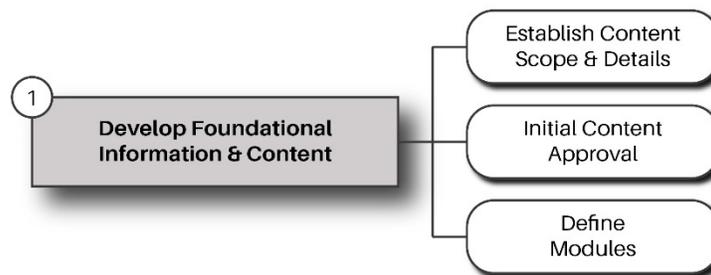
Once the research team determined the current practice of design and delivery of online training modules, the lessons learned were incorporated to develop 10 training modules for SCDOT. The process for development of online training modules was divided into 6 steps, which are presented and discussed in following sections. The process is shown in Figure 9.



**Fig. 9.** Overview of asynchronous online training development process

### 5.1 Step 1. Development of Foundational Information & Content

The first step in developing online training was to establish the training content’s scope and details (Fig 10). The research team had previously created the Contract Manager Training Manual for SCDOT and held a corresponding training session on site in Columbia, SC. In both the manual and the training session, the content disseminated was given positive feedback and considered both complete and favorable. The content was proven effective through validation from the individuals that would be applying the information received, regardless of the delivery method used to convey it.



**Fig 10.** Overview of Step 1

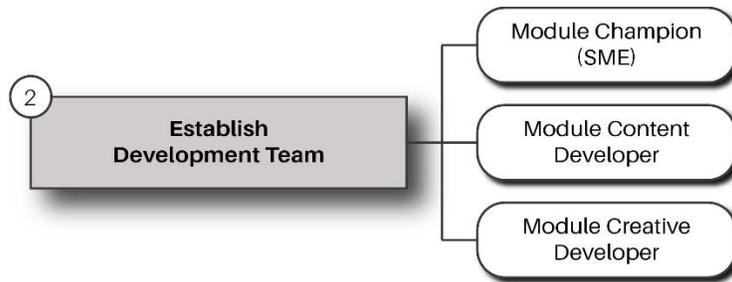
In addition to ensuring that the content of the training is comprehensive and effective, this step facilitated initial content approval. Failing to emphasize the approval of training content early in the process could have disrupted design and development steps at later stages. The content presented throughout this project can have significant legal and financial ramifications on the agency. If foundational content had not been amalgamated and approved by SCDOT upfront, individual module development could have been more difficult and time-consuming.

The research team had collected, correlated, and assessed current SCDOT practices, policies, and procedures for professional services contract management and developed a procedures manual for the agency in a previous research effort. This thorough and intensive effort documented current practices in professional services contract management at the SCDOT. This procedures manual, along with the department directive(s) used in its development, established foundational content for the online training.

Development of this procedures manual also facilitated the final element of base content formation: module definition. A significant impetus for transferring the training from a traditional, in-class method to an asynchronous online platform was the duration of the training. Dividing training material into multiple modules allowed users the flexibility to choose topics of interest/need. Appropriately segmenting foundational content was crucial to defining natural divisions in the content and module development.

## **5.2 Step 2. Establishment of Development Team**

The second step in the online training development process was to establish the module development team (Fig 11). Three critical roles were identified throughout this research project: *module champion*, *content developer*, and *creative developer*. Dividing the responsibilities among these three positions provided a reasonable work-load for each (especially advantageous to SCDOT personnel) while efficiently utilizing the skillsets of each. While foundational content was developed and approved in Step 1, verification and refinement of content was a necessary sub-step for each module. To obtain these periodic reviews and approvals, an efficient review process was established.



**Fig. 11.** Overview of Step 2

Designating a *module champion* as an approval granting authority, rather than review of each module by the entire advisory committee, proved to be the more efficient and effective process. The role and responsibilities of this individual included providing resources and information concerning any identified knowledge gaps in the foundational content, as well as reviewing and approving module storyboards for their content accuracy. While developing the training modules, champions were members of the SCDOT advisory committee that led teams in the department applicable to a particular module, allowing them to utilize personnel under their leadership to review and approve each module’s content. Because the module champions were preparing training for their own employees, they were more inclined to ensure the included content was accurate and extensive.

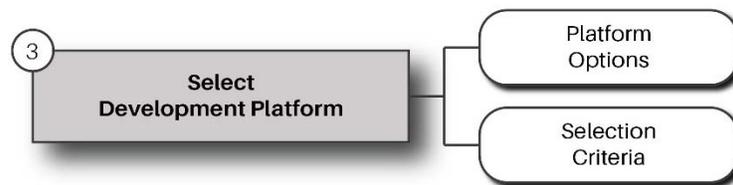
The content developer and creative developer were the hands-on members of the team in terms of actual module creation. The content developer was responsible for developing the module narrative based on the foundational content and any additional and/or revised content gained through communication with the module champion. The creative developer had the responsibility of transferring the approved narrative into an educationally and audio/visually stimulating format.

The content developer had intimate knowledge of agency procedure manuals, directives, and documents and had professional experience regarding module content allowing them to recognize possible knowledge gaps or inconsistencies.

### 5.3 Step 3. Selection of Development Platform

The third step in the online training development process was to select the development platform (Fig. 12). An extensive list of e-learning software, their capabilities, and selection criteria

to consider had been compiled by the Advanced Distributed Learning (ADL) instructional design team (Berking 2014).



**Fig. 12.** Overview of Step 3

Key criteria considered when selecting a development platform included the following:

### **5.3.1 Desired Capabilities**

Before platforms can be evaluated for their usefulness in a project, the development team had to determine which capabilities were desired. Defining and prioritizing these capabilities was crucial to narrowing down the list of potential choices. The primary desired capabilities of training programs were multimedia functionality, a variability of assessment techniques, built-in interactions, and ease of use.

### **5.3.2 Developer Skillset and Experience**

This was the most important criterion that the research team followed while developing the training modules. E-learning platforms range in ease of use and flexibility of design, often with a trade-off between the two. There are platforms that allow the user complete control over nearly every element of the interface, but require greater time and effort from the creative developer. Other platforms offer the user less control, but require less time and effort from the creative developer. These features were considered and evaluated in accordance with the developer's skillset. The experience and ability of the creative developer were highly important in the selection of a platform.

### **5.3.3 Assessment Features**

Many online training programs were used to evaluate and certify users. The assessment capabilities of a platform were therefore an important consideration in this project.

### **5.3.4 Developer Training and Support**

Initial training for e-learning tools in the form of short tutorials are available for most platforms. However, training for more complicated designs and functions is typically found

through platform online communities and forums. Therefore, the popularity and number of users of a particular platform was an important selection criterion, as the availability of community and forum-based training increases with a larger developer base.

### 5.3.5 Output Characteristics

The learning management system (LMS) used by SCDOT dictated the type of files that can be uploaded for viewing by users and tracking by system administrators. It was imperative to ensure that the selected platform produced output compatible with the SCDOT's existing intranet LMS.

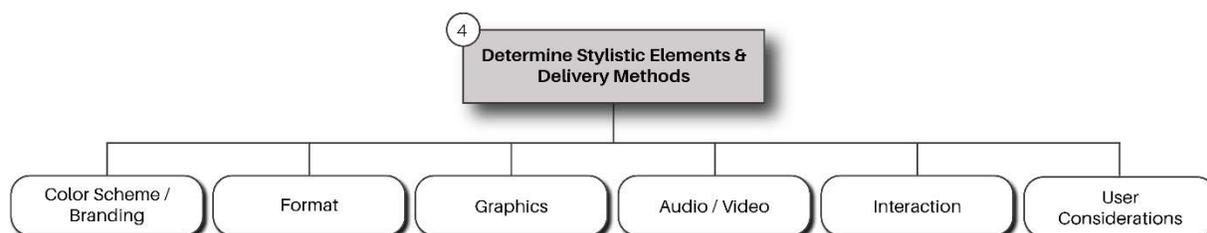
### 5.3.1 Final Platform Selection

Considering the preceding selection criteria, the research team narrowed the selection to *Adobe Captivate* and *Articulate Storyline*. Both delivery platforms are popular in the e-learning community and have wide use among DOTs interviewed (all agencies used one of these two platforms). Both were evaluated through e-learning community forums and trial periods. While similar in breadth of use in the industry, these programs did have differences worth noting.

The primary desired capabilities of training programs were multimedia functionality, a variability of assessment techniques, built-in interactions, and ease of use. The creative designer in this research project was a transportation engineering graduate assistant with limited knowledge in graphic communications software and animation design. Therefore, as long as the desired capabilities were present, the determining factor in platform choice was the learning curve. *Adobe Captivate* presented a significantly steeper learning curve but allowed greater flexibility and control in design. *Articulate Storyline*, on the other hand, with a user-interface mirrored after PowerPoint and functionality designed for the *Microsoft Office Suite* user, provides a more familiar platform. Considering that both options were similarly equipped for the desired capabilities, *Articulate Storyline* was the most desirable choice because it catered to the existing skillset of the designer. Its wide user base with various forums, threads, and tutorials also functioned as a more-than adequate learning environment.

## 5.4 Step 4. Determine Stylistic Elements and Delivery Methods

With the foundational content developed, the development team established, and the authoring platform selected, the subsequent step in the process was to determine the stylistic design elements of the training and delivery methods (Fig. 13).



**Fig. 13.** Overview of step 4

### 5.4.1 Color Scheme / Branding

A crucial element of this step was the training color scheme and branding. The color choices in a learning environment are far from arbitrary. Branding decisions have large ramifications on the training and are difficult to adjust later in development. Therefore, ample feedback was obtained for each design option. In this case, SCDOT had recently undergone a website re-design with a Blue/Orange color scheme. SCDOT’s website is used frequently by employees and is becoming the standard cloud storage location for files, forms, and directives. Due to the frequency of use by employees and the fact that external files linked in the training would send users to the website, the color scheme and branding package for this training were mirrored after SCDOT website colors. This color package obtained the most favorable feedback from the advisory committee and was adopted as the training standard.

### 5.4.2 Format

A second delivery element to consider was format. The default screen size ratio on many e-learning authoring tools is 4:3. Until recent years, standard computer screen sizes were designed this way. However, the computer and monitor industry is rapidly transferring to a widescreen standard – typically 16:9. The selection between these formats for an online training was dictated by the equipment on which the training will be viewed by the user.

### 5.4.3 Graphics

The use of graphics (i.e., pictures, icons, graphs, tables, charts, etc.) played a vital role in delivery. The initial design of the training was text-heavy; it disseminated information, but left committee members unengaged. In an effort to garner the viewer’s attention, the use of graphics was expanded.

SCDOT has a depository of agency photographs. This proved to be a valuable resource in two ways. First, the various pictures were found to be applicable in a wide range of uses throughout the training. Second, the use of photos from agency projects personalized the training and significantly enhanced the level of attention of agency personnel in subsequent pilot tests.

Another important lesson learned regarding graphics involved the use of characters, or images of people used repeatedly to represent an individual in a specific role in the administration of professional services consultants. In this research project, much of the training addressed the roles, responsibilities, and duties of agency personnel at different points of the contract management process. A key principle in The National Center on Universal Design for Learning (UDL) universal design guidelines is to provide multiple means of representation (Rose 2011). In order to reinforce the roles and responsibilities of each SCDOT personnel mentioned in the training, the same character pictures were used each time said personnel were addressed. Based on the feedback from various pilot tests, both negative and positive, the graphics of an online training warrant extra attention, effort, and resources.

#### **5.4.4 Audio / Video**

In a similar vein, audio/video inclusion and quality greatly enhanced the learning experience by providing another means of representation. The original plan for this training was to incorporate SCDOT subject matter experts speaking on camera about key topics in each module. However, as the survey of transportation agencies progressed and feedback from the SCDOT advisory committee was obtained, the use of video was abandoned. In surveys of transportation agencies, all interviewed respondents noted some form of video use in training modules. However, agencies also advocated for using hired actors rather than agency employees. Agency SME's, while knowledgeable about the topic, are not trained in communicating on camera. The turnover in transportation agencies was also a caution given by respondents. An SME leaving an agency may give the training an appearance of being old and outdated. The SCDOT advisory committee echoed these two concerns; and, as the quality of the modules was improved through the use of graphics, interactions, and animations, the need for video to engage learners was minimized. Because a goal in the development of the online training program for SCDOT was user engagement, audio narration was incorporated to enhance the learning experience.

A lesson learned was the tradeoffs encountered when selecting a narrator. On one hand, there is a significant advantage to having a narrator that is knowledgeable of the content and able

to provide nuanced speech (i.e., emphasis, pause, inflection) in recording module scripts. However, this narrator is typically not trained in recording and may not have a professional narrator's voice. Both the content expert and professional speaker were considered for the narration of this training. Ultimately, the research team selected a professional narrator, as this proved to provide a level of quality that reinforced the legitimacy of the training.

A final element of audio recording to consider was the setting. Many e-learning authoring tools enable designers to record audio at their personal computers. However, this lower quality of recording detracts from the professionalism of the training. In this case, the research team opted to seek the use of a professional studio for recording. The research team decided that the cost of securing such services provided audio quality that enhanced the value of the training.

#### **5.4.5 Interaction and Animation**

Another valuable and impactful lesson learned regarded the use of interaction and animation in the training modules. These two methods were employed in this training program to enhance the learning experience and retain the user's attention. An interaction is defined as an element of the module in which the user is not simply watching or listening but responding (i.e., clicking, dragging, etc.) to activities on the screen. In development of the initial module, the main content of the module was delivered on screen without any breaks, and assessment was included at the conclusion of the module. The feedback received from the advisory committee was that it was "boring," "lengthy", and "unengaging."

In subsequent modules, animation was incorporated and the assessment questions were distributed throughout the module, leading to far more positive feedback. However, certification through robust assessment was a goal of SCDOT, and providing questions throughout the module, while beneficial from an engagement standpoint, did not sufficiently assess and document the learner's retention of the content. A compromise placed difficult assessment questions at the close of each module to serve as the basis for program certification and included simpler, more interactive assessment questions periodically throughout the module to keep the learner engaged. This format was met with enthusiasm by the SCDOT advisory committee and was adopted as the training program standard.

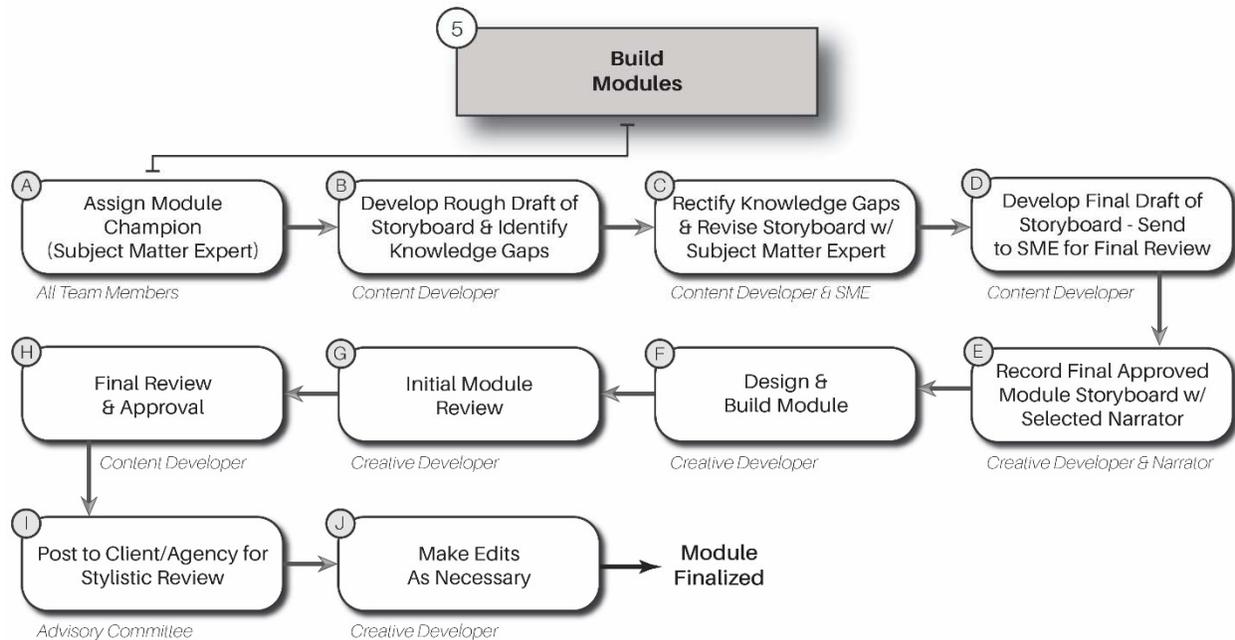
#### **5.4.6 User Considerations**

Implicit in each of the above stylistic and delivery decisions are user considerations. The audience dictated each choice. The user's age, computer savviness, and experience with the content guided many, if not all, of the decisions regarding content appearance and delivery. Pilot testing with an advisory committee and module champions proved invaluable in this research project. The committee was comprised of leaders of professional services departments who would be using and promoting the training, and were able to evaluate training effectiveness for the end user. Select project managers completed pilot tests and provided feedback as well.

### **5.5 Step 5. Build Modules**

Steps 1 through 4 in the online training development process were initial steps leading to the actual building of the modules. Early decisions regarding base content, team members and roles, authoring platform, and style/format were paramount in the foundation for efficient and consistent training module development. In the development of the 10 modules for SCDOT's professional services contract management training program, the process for building online training modules (Fig. 14) was developed through an iterative process of trial and error to identify the most effective process.

Initially, module development began with the content developer reviewing base content related to the module of interest and creating a storyboard dictating the scope, sequence, graphics, and narration of content for the module. The creative developer then led recording of narration audio, built the module in the authoring platform, and distributed it to the advisory committee for review. Feedback from committee members was expansive and addressed the modules' content, style, and delivery. The style and delivery changes were simple fixes, however, changes to content were a challenge. In addition to being time-intensive, the re-recording process negatively affected the quality of the module. Despite using a professional narrator and studio, re-recordings had slight variations in sound that were noticeable to the user. The extra editing and re-work of the first module led to an unreasonably long development timeframe. A more efficient process and involvement of personnel in both development and approval had to be achieved. For the subsequent modules, the training development team and advisory committee arrived at the final process shown in Fig. 14, and described in depth below.



**Fig 14.** Overview of Step 5

### 5.5.1 Step 5A. Assign Module Champion (i.e., SME)

The primary and most important step for each module was the assignment of a module champion or subject matter expert. The champion acted as the point of contact between the content developer and the agency and was granted authority by the advisory committee to approve content for his or her module. This individual had ultimate responsibility for filling knowledge gaps identified by the content developer (see Step B in Fig 14) and granting permission to proceed with recording. There was an understanding between all parties that content for the module was finalized when it has been approved by the module champion. Adding this step minimized revisions, re-recording issues, and the total module development timeline. It also maximized the skillsets of advisory committee members. Assigning module champions allowed committee members to provide more focused input and improved committee buy-in, which ultimately led to higher quality and accuracy.

### 5.5.2 Step 5B. Develop Rough Draft of Storyboard & Identify Knowledge Gaps

Similar to the initial process, the development of a module began with a draft storyboard by the content developer. The content for the storyboard was initially gleaned from foundational content (Fig. 9, Step 1). Identified knowledge gaps or inconsistencies in this content were brought to the attention of the module champion.

### **5.5.3 Step 5C. Rectify Knowledge Gaps & Revise Storyboard with SME**

The module champion was responsible for rectifying knowledge gaps and inconsistencies. In the development of these modules, the module champion often assembled a team of employees under his or her supervision in the agency to assist in this process. This communication was typically conducted via virtual meetings. For more complicated content, in-person meetings between the champion and content/creative developers were necessary.

### **5.5.4 Step 5D. Develop Final Draft of Storyboard – Send to SME for Final Review**

Based on feedback from the module champion, the content developer created a final draft of the module storyboard for submission to the champion. Subsequent review and approval by the agency champion closed content editing and permitted the initiation of the module build.

### **5.5.5 Step 5E. Record Final Approved Module Storyboard with Narrator**

It was at this point in the process that primary responsibility shifted from the content developer to the creative developer. The creative developer guided the narrator through narration rather than simply handing a script to a third party. Insight into module content and knowledge of how it will be incorporated into the module allowed the creative developer to provide guidance to the narrator during script recording. The recording step was a critical piece of module development, so it was essential to perfect the script early in the development process. The timing of the narration served as a basis for the timing of the entire module and every individual slide.

### **5.5.6 Step 5F. Design & Build Module**

With content finalized and script narrated, the creative developer was then able to create the module according to the determined stylistic elements. The developer had creative license to modify these elements as needed; however, it was found that changing creative expression and standards from module-to-module negatively impacted the continuity of the training. In order to have a more effective training program, the content developer consistently followed stylistic choices made in Step 4 in each module.

### **5.5.7 Step 5G. Initial Module Review**

After completion of the initial draft, the creative developer enlisted the services of a pilot testing team to review the module. In this research project, fellow graduate assistants were tasked with detecting functional errors in the modules. The goal of this step was to ensure that the agency received a fully functional module for final content approval, alleviating the menial errors that can take away from the overall presentation of the content.

### 5.5.8 Step 5H. Final Development Team Review and Approval

After being deemed functional by the creative developer, each module's content was reviewed by the content developer prior to being sent to the agency for final review. It was the responsibility of the content developer in this step to ensure that the presentation of information is consistent with approved content.

### 5.5.9 Step 5I. Client / Agency Stylistic Review

With content approved during initial stages of module development, the remaining approval was that of style and functionality. The completed module was distributed to advisory committee members to confirm that the module meets the agency's expectations regarding content delivery and the learning environment. Desired changes were communicated to the development team with the understanding that this is the *final* opportunity for revision. Allowing an indefinite length and number of review cycles added time to the schedule but was not found to add quality or accuracy. Therefore, hard deadlines for revisions were utilized in this process.

### 5.5.10 Step 5J. Final Editing

The module was considered complete once stylistic or functional changes requested by advisory committee members were incorporated into the module by the creative developer.

## 5.6 Step 6. Pilot Testing

Pilot testing was an important step for this research project prior to final release. While a series of reviews and pilot tests had taken place prior to this point in the process (i.e., by the creative developer, content developer, and advisory committee) it was valuable to obtain insight and feedback from an individual, or group of individuals, whose characteristics mirror that of the intended audience of the training (Fig. 15).

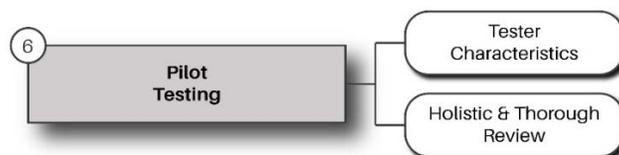


Fig 15. Overview of Step 6

In this research project, the intended audience was employees that were either new to the agency or new to the professional services contract management department. To mirror such employees, the pilot reviewer selected was a recent graduate from the Civil Engineering department. Characteristics of the tester of the training modules were similar to that of the intended audience. The degree, training, and professional experience of the tester, along with a lack of experience in contract management, simulated the intended audience, providing valuable feedback not previously identified. The tester was instructed to perform a holistic and thorough review testing all functionality and paths of the modules, identifying issues from minute (i.e., spelling mistake or improperly cropped image) to significant (i.e., quiz question returning incorrect feedback).

## **6. FINDINGS FROM MODULE DEVELOPMENT EFFORTS**

Lessons learned during the development of the professional services consultant contract management training for SCDOT led to a number of findings to be considered by SCDOT for future use in development of asynchronous online training modules. These are listed and described below

### **6.1 Establish Approved Training Content Upfront**

Revising content can be time-consuming and project crippling, should the agency fail to reach a consensus on module content early in the process. To achieve this, set the goal of establishing approved content upfront and do not begin module development until this goal is met.

### **6.2 Designate Module Champions**

Advisory committees consist of multiple individuals with unique experience, insight, and agency roles. Designate a champion for each subject-specific module as a contact point and content approval authority. Allowing all committee members to review each module ultimately discourages both the committee and development team members without leading to a higher quality product.

### **6.3 Involve Creative Designers in Content Development**

Creative designers (i.e., module developers) are able to design training uniquely tailored to the material when they are confident with the content. This aids in module review timelines and results in training that is more applicable to the audience.

### **6.4 Select E-learning Authoring Software**

A host of asynchronous e-learning authoring software is available. Establish a set of desired capabilities to narrow the number of options and prioritize based on the experience and skillset of the creative designer in final selection.

## **6.5 Provide Ample and Periodic Interactions Throughout Modules**

Regardless of content accuracy, a failure to keep the user's attention will result in ineffective training. Include creative assessments and learning paths to obligate the user to interact with the training, thereby increasing the user's engagement with the material.

## **6.6 Streamline and Restrict the Content Review Process**

Indefinite review cycles significantly lengthen the project schedule and do not elicit thoughtful, succinct feedback. Establish an upfront understanding that review and feedback deadlines must be met and that requested revisions submitted after these deadlines, with the exception of major policy changes or substantial training errors, will not be implemented.

## 7. CONCLUSIONS

In order to create training sessions that addressed specific training needs and efficiently delivered the desired content, this research project solicited efforts for establishing the current practice of developing online training modules. The 10 online training modules developed in this research project are expected to meet the needs for training project managers in contract management at SCDOT, while ensuring consistent practices among employees and augmenting department leaders' training duties. The study of the current practices in the development, delivery, and assessment of online training at state DOTs and experiences gained through the concurrent development of the training modules led to the conception of an asynchronous online training development process for SCDOT.

The study from the current practice of design and delivery of online training has revealed that transportation agencies are shifting from traditional face-to-face training to online training programs. Findings from this research show that a majority of the participants from both the survey and telephone interviews had extensive online training programs for their employees. The remainder were making progress toward providing more online training options for employee use. Moreover, all of the DOTs that participated in the online survey and telephone interviews expressed their willingness to substantially increase online training programs. Two-thirds of the interviewed DOTs made online training compulsory for their employees, which depicts the inclination of these DOTs toward making online training programs a part of the core DOT capability building efforts. More than half of the interviewed DOTs mentioned that they offer certification through online training offerings. All but one of the interviewed DOTs have the capability to build and produce online training in-house; however, these DOTs also closely work and collaborate with consulting agencies, universities, and third party vendors to produce online training modules.

Effective strategies for building successful online training had also been investigated in this research project. DOTs suggested that the use of interactive components in the training modules are key elements to engage the trainees for longer periods of time. In order to build interactive training modules, embedded learning games and audiovisual instructions are used to increase the learner's satisfaction with the online environment. An analysis of the responses from the interviewed DOTs showed training modules of shorter duration (i.e., 15-30 minutes) are the best for maintaining the trainee's attention. Important considerations for selecting delivery

platforms include interactive and user-friendly options. The DOTs were found to have a varied opinion regarding the use of mobile applications for training interfaces on tablets, which is likely because online training is considered an emerging concept for many state DOTs.

With accessible online modules, professionals have the ability to develop their skillset efficiently and effectively, which can facilitate capacity building for transportation professionals. Online learning sustains its effectiveness if maintained and updated regularly. This research project revealed that online training can have a distinct impact on learning and it can be easily tailored to target individual needs.

The study of the current practice of design and delivery of online training provided useful information and created a foundation for development of 10 online training modules. The process established by this research effort for the development of online training can be applied to future implementation of asynchronous online training by other SCDOT divisions.

During the development of online training it was found that the training modules can be most effectively and efficiently produced when: a) foundational content is consolidated and approved upfront; b) stylistic choices are made with the audience in mind; and c) modules are designed, built, and approved by a combination of content experts, creative developers, and agency champions.

## 8. RECOMMENDATIONS

Some recommendations are made to SCDOT that would help to continue the improvement of management practices and associated training development for dissemination and standardization of procedures. First, to continue the efforts made on the current project, SCDOT should request feedback through short surveys of employees' opinions of the training modules based on (a) ease of use; (b) clarity of material; (c) quality of the material; and (d) quality of the training experience. These short surveys will help SCDOT gauge the effectiveness of the training sessions in order to supplement the current findings and provide additional opinions on the product for the improvement of future training development endeavors.

The other recommendations include some of the methods of the research and training efforts performed in this project to improve four other areas of SCDOT. The four areas of research and development for future training include: 1) Local Public Agency Administered Projects; 2) Staffing Procedures and Best Practices; 3) Pre-Construction and Project Set-up; and 4) Design-Build Project Delivery. The details of these four recommendations are outlined below.

### 8.1 Local Public Agency Administered Projects

FHWA has identified 4 major concerns with the management and oversight of Local Public Agency (LPA) administered projects based on project compliance with federal-aid funding, environmental requirements, property acquisition, and proper contract administration (FHWA 2014).

In addition to the concerns expressed by the FHWA, other government entities have conducted audits that have indicated similar issues with the administration of LPA projects, and have posed recommendations for FHWA moving forward, of which FHWA has acknowledged but taken very little action. In January of 2014, the United States Government Accountability Office (GAO) produced an audit report that identified 3 areas of potential risk in project administration completed by local agencies. These noted risks are inability to comply with Federal requirements, ineffective supervision, and improper and wasteful use of Federal funds (USGA, 2014). Prior to this, another audit report, documented in 2011 by the Office of Inspector General (OIG, 2011), found at least one instance of an inability to comply with Federal requirements in 88% of the LPA projects that were reviewed in 4 select states: California, Louisiana, Tennessee, and Texas. After

analyzing the findings of the audit, the OIG made a set of recommendations, which including creating standardized procedures and criteria for the assessment of LPA oversight by the states and developing a procedure for evaluating the efficiency of the LPA corrective action plans. (OIG, 2011)

There is risk and problematic exposure when managing LPA administered projects. Given SCDOT's involvement with LPA projects and desire for continued Federal funding, it is recommended that SCDOT outsource the development of a detailed training program and uniform systematic approach to the administration of Federally-funded projects.

Currently, SCDOT has an online-accessible LPA Academy, with a solid, well-developed framework for public agencies that outline the steps to follow during the administration of LPA projects. However, we believe that the process can be better standardized and simplified through added insight and additional, specific steps that outline and dissect the individual components of the process to save time and money during the administration of these projects. SCDOT can aim to reduce and alleviate risks during the management of these projects through the establishment of a systematic and comprehensive oversight approach with the dissemination of a complete and uniform set of guidelines that outline the LPA project administration process while identifying the means of avoiding previous or anticipated errors.

## **8.2 Staffing Procedures and Best Practices**

Another recommendation for the improvement of management practices at SCDOT is the review and analysis of staffing issues including retention, utilization, hiring, contracting, and training. Due to shrinking revenue sources, SCDOT, along with many DOTs, is forced to do more with less resources including insufficient staff forces. Thus, it is critical for SCDOT to optimally utilize existing workforce to maximize productivity of the organization. However, productivity of staff force depends on the recruitment of workforce with most relevant education and work experiences, retaining skilled workforce and training existing workforce. The objective of this research is to review and analyze staffing issues that SCDOT faces, specifically issues related to new hiring, staff retention, and training. In addition, best practice(s) among other state DOTs and strategies to forecast future staffing needs and the use of consultants to address the flow and weight of the agency's workload will be identified.

For efficient operations and maintenance of the fourth largest state maintained highway system, it is important for SCDOT to develop an effective staffing program to maintain a skilled and experienced workforce to provide fast, safe, and reliable transportation services to South Carolina residents. For this reason, we recommend the review and analysis of staffing issues that DOTs, and specifically SCDOT, face. With this research effort, SCDOT can aim to identify project staffing strategies and establish evaluation techniques that can be utilized to gauge the effectiveness of both current and future strategies. The outcome of this research effort will provide much needed guidelines in hiring new staff considering the diverse skill sets required in the future to perform in diverse SCDOT programs based on the changing needs and environments. Moreover, best retention strategies to support experienced workforce, state-of-the-art capacity building program to prepare workforce for new challenges, and best practices to recruit consultants to complement SCDOT workforce will be identified.

### **8.3 Pre-Construction**

During the literature review conducted as a component of the research portion of this project, research team members reviewed the resources available through SCDOT's Learning Management System. There is one online training module available titled, "SCDOT Operations: Pre-Construction," that is approximately 50 minutes long and outlines the overall structure of SCDOT's pre-construction department. However, after a thorough analysis of the learning portal, the research team was unable to find any modules that outline the steps, procedures, and policies utilized to successfully complete any part of the pre-construction process.

A project's success is dependent on the accuracy and comprehensiveness of the pre-construction documents. The research team recommends that, due to the complexity of pre-construction, SCDOT would benefit from online training modules that outline the procedures and requirements for developing the project scope, schedule, budget, list of deliverables, and assessment of risk. In addition to pre-construction, the research team suggests standardizing and distributing project start-up practices to ensure a consistent and effective start to every project, which can reduce project delays, employee down-time, problems, and redundancy. This research effort will establish a comprehensive approach, format, and/or checklist for each aspect of the pre-

construction effort that can be utilized by SCDOT personnel, contractors, consultants, and Local Public Agencies.

#### **8.4 Design-Build Project Delivery**

Our final recommendation is to introduce an online-training program that outlines the Design-Build project delivery method and specifically points out its variances from traditional Design-Bid-Build projects. The inclusion of the Design-Build department at SCDOT creates diverse functionality to its pre-construction department and should be strengthened through the continued education of SCDOT employees.

The design-build contracting method is very different than the design-bid-build method and its differences should be emphasized. For example, in the design-bid-build delivery method, SCDOT manages separate contracts with the designer and contractor, and SCDOT's role lies both as overseer and as a middleman between the two entities. However, in the Design-Build project delivery method, the owner manages a single contract with a "design-build contractor". In this method, the designer and contractor communicate prior to relaying information to SCDOT, and SCDOT's role becomes project oversight and final approval.

SCDOT's contract and role differs based on the method of project delivery, including the pre-construction process. Differences in pre-construction include the timing and the contents of the Request for Proposal (RFP), the project award process, project start time, and the amount and type of SCDOT risk. Utilizing best practice to address these issues can make a positive impact on the efficiency and effectiveness of project delivery from pre-construction to the finished product.

It is recommended that SCDOT deploy a training program tailored to the Design-Build project delivery method in order to broaden the construction spectrum of SCDOT employees with design-bid-build experience and strengthen SCDOT's Design-Build department. The first step in providing SCDOT employees with the education they need is to develop best practices based on the tried and tested methods of other DOTs. The Design-Build project delivery method is relatively new for state Departments of Transportation, and, as with any new practice, the learning curve can be reduced by using existing best practices.

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**APPENDIX A**  
Questionnaire: Online Survey

May 14, 2014

<< Contact\_Name >>  
<<Institute\_ >>  
<<Blg >>  
<<Address >>  
<<City >>, <<State >> <<Zip\_Code >>

To whom it may concern:

This survey is being sent to you to request insights from your state DOT as part of a study that hopes to cover each region of the country. The survey is part of the South Carolina Department of Transportation's research project titled: "Professional Services Contract Manager On-demand Training and Best Practices". The project objectives are to develop online training modules for contract managers. Survey responses will be critical in determining current best practices nationwide for online training. This survey seeks information that is not readily available online, specifically details on online training modules that your state DOT uses to support contract management activities. Information regarding state-wide on-demand online training trends, issues, management, strategies, and policies is also requested. The survey takes approximately 10 minutes to complete, which may also be completed online if you prefer.

**Please click following link to enter the survey:**

<https://www.surveymonkey.com/s/DVXXHXL>

The survey is attached with the letter; you also have the option mail us the completed survey to the following address.

Thank you very much for participating in this study. We would greatly appreciate your response by May 30, 2014. To ensure your state's confidentiality, only aggregated survey results or non-identifying comments will be published. In return for your assistance, research findings will be shared with all participating agencies. If you have any questions about the content of the survey or wish to share additional information, please feel free to e-mail Dr. Chowdhury at [mac@clermson.edu](mailto:mac@clermson.edu) or call at 864-656-3313.

Sincerely,

Mashrur Chowdhury, Ph.D., P.E., F.ASCE  
Eugene Douglas Mays Endowed Professor of Transportation  
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+1-864-656-3313, [mac@clermson.edu](mailto:mac@clermson.edu)

### General Guideline for Survey Completion

The purpose of this survey is to determine to what extent your state DOT uses online training for assisting contract managers. We accept both hard and softcopy submissions. You may print and complete the survey. Then you may scan and email the completed survey results to either of the following email addresses: [mac@clemsn.edu](mailto:mac@clemsn.edu) and [sakibk@g.clemsn.edu](mailto:sakibk@g.clemsn.edu). You may also mail it to the address above.

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### Survey Questions

#### Training Availability

- 1) Which type of training does your state DOT offer for management?  In-person training  In-class training

Manuals  Online tools

*If any online training is available, proceed to following questions*

- 2) Is there any on-demand online training designed for professional services contract managers?  
 Yes  No

*If yes, enlist the name(s) of the online training(s) below:*

\_\_\_\_\_

\_\_\_\_\_

#### Organizer Information

- 3) Who developed the online training modules for management practice?  DOT  External Contract

*If developed by external contract, enlist the name(s) of the organization(s):*

\_\_\_\_\_

\_\_\_\_\_

- 4) If the modules were developed with the help of external contractor, was there any educational institution involved?  Yes  No

- 5) Does your DOT have any previous experience organizing any formal in-class training?  Yes  No

#### Online Training Information

- 6) Is the online training program expanding?  Yes  No

- 7) Is the training program available 24/7?  Yes  No

- 8) Is the entry of the training program restricted?  Yes  No

- 9) What is the number of online training modules?  Less than 5  5-10  Greater than 10

- 10) What is the frequency of the training?  Per week  Per month  Per year  Other

*If the answer is 'Other', state below how often the training takes place*

- 11) What application platform is used for the online training?  Articulate  Adobe presenter

Adobe Captivate  Other

*If the answer is 'Other', list the name of the platform which is used for the training*

- 12) If online training modules can be improved in any way, list briefly below

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**Contact Information**

Thank you for sharing your knowledge with us to complete this survey. We sincerely appreciate your support. Please provide us your contact information so we can contact you should we have questions and so we can share our results.

- 1) Name: 

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- 2) Organization name: 

---
- 3) Department: 

---
- 4) Title: 

---
- 5) Email: 

---

**Comments and any known issues**

Please add additional comments about on-demand online training practices (particularly for professional service contract managers) available in your state that are relevant to this study. Please also list any document or website links that will aid in our assessment of best practices for online training related to state DOT contract management tasks.

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*Thank you for your time completing this survey. If there is anyone else who might contribute further to this study please forward the survey to them.*

**APPENDIX B**  
Questionnaire: Telephone Interview

**Project title: 'Professional Services Contract Manager On-demand Training and Best Practices'  
South Carolina Department of Transportation**

**Interview Questionnaire  
Best practices in Online Training**

1. What is the percentage of online training vs in-class training provided by your DOT?
2. How large is your DOT's online training i.e., number of courses, hours of training and categories of topics?
3. Do you have any long term vision for online training?
4. Do you have any minimum training requirement for employees in different divisions and expectations on annual basis?
5. How your training programs are developed? Were those done internally or externally? How you have put those training programs together?
6. How much training content are the e-learning team developing each year? Is it 2 hours a year or 50 hours a year?
7. Do you have any learning management system for tracking the online trainings taken by employees?
8. What is the most effective delivery method for online training? How are you approaching the modules? Is it power point narrated with video or something else?
9. Are the e-learning programs tied to any certification? Do the participants get any professional development points or hours?
10. Is it possible to see one of the training modules developed by the e-learning team of your DOT?
11. Do the e-learning team incorporate video of subject matter experts or leaders in the training modules?
12. Based on the experience on e-learning what are the strategies that work and what are the approaches that do not work?
13. When do you usually update your training modules?
14. When some kind of documents are used in a training module and if that document changed after a certain amount of time then what does the e-learning team do about those documents or what is the policy to increase the shelf life of the training modules?
15. What percentage of online training is for operations vs design or procurement?

16. Where in the organizational structure does the e-learning team fit?
17. What platform does the e-learning team use for delivery? Is it adobe presenter, captivate, articulate or story line? How do the employees access to the training? Is it through online or the e-learning team has developed some kind of mobile app for that?
18. When a module is developed for delivery what is the duration of each module and the whole training?
19. Does the e-learning team takes any kind of feedback from the trainees?
20. How do they measure the performance of trainees? Do you use quiz after every module or one quiz after the whole training?
21. How do they manage multi generation of employees?
22. Does the e-learning team perform any pilot testing?
23. How much does it cost for per hour of training excluding the cost for subject matter experts?
24. Are all the training modules password protected? Are the modules available only to the employees