SCAN TEAM REPORT

NCHRP Project 20 68A, Scan 15-01

Developing And Maintaining Construction Inspection Competence

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Acknowledgments

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Scan 15-01
Developing and Maintaining Construction Inspection Competence

REQUESTED BY THE

American Association of State Highway and Transportation Officials

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Abbreviations and Acronyms

AASHTO	American Association of State Highway and Transportation Officials
ACI	Association of Construction Inspectors
ADA	Americans with Disabilities Act
ALDOT	Alabama Department of Transportation
APWA	American Public Works Association
ATSSA	American Traffic Safety Services Association
BMT	Bureau of Materials & Tests
BTSD	Business Technology Support Division
CAPA	Colorado Asphalt Pavement Association
Caltrans	California Department of Transportation
CBT	Computer-based training
CDOT	Colorado Department of Transportation
CEG	Civil Engineering Graduate
CEI	Consultant Engineering Inspection, Consultant Engineering Inspector
CEU	Continuing Education Unit
CI	Construction Inspector
CICP	Construction Inspector Certification Program
CPII	Certified Public Infrastructure Inspector (American Public Works Association)
CPM	Critical Path Method
CPSD	Capital Project Skill Development, now known as Project Delivery Professional Development (Caltrans)
CFR	Code of Federal Regulations
CT	Construction Technician
CTDOT	Connecticut Department of Transportation
CTQP	Construction Training Qualification Program
DCE	District Construction Engineer
DE	District Engineer
DOT	Department of Transportation
EA	Engineering Assistant
EDC	Employee Development Center
EDP	Employee Development Plan, Employee Development Program
EIT	Engineer-in-Training
EPS	Engineering Physical Science
ETOP	Engineer Training Orientation Program
FDOT	Florida Department of Transportation
FHWA	Federal Highway Administration
HMA	Hot Mix Asphalt
IA	Independent Assurance

IAP	Independent Assurance Program
ILT	Instructor-Led Training
JIT	Just in Time
LMS	Learning Management System
LPA	Local Public Agency
LTAP	Local Technical Assistance Program
MAP-21	Moving Ahead for Progress in the 21st Century
M&R	Materials and Research
NDOR	Nebraska Department of Roads
NETTCP	NorthEast Transportation Training and Certification Program
NHI	National Highway Institute
NHS	National Highway System
NICET	National Institute for Certification in Engineering Technologies
NRC	Nuclear Regulatory Commission
ODOT	Oregon Department of Transportation
OJT	On-the-Job Training
PCC	Portland Cement Concrete
PCI	Precast/Prestressed Concrete Institute
PCET	Professional Civil Engineer Trainee
PM	Project Manager
QSM	Quality System Manual
SCORM	Sharable Content Object Reference Model
SME	Subject Matter Expert
SWPPP	Stormwater Pollution Prevention Plan
T4T	Training for Trainers (Caltrans)
TC3	Transportation Curriculum Coordination Council (AASHTO)
TET	Transportation Engineering Technician (Caltrans)
TETP	Transportation Engineering Training Program (Colorado Department of Transportation)
TRB	Transportation Research Board
TxDOT	Texas Department of Transportation
UDOT	Utah Department of Transportation
VDOT	Virginia Department of Transportation
WAQTC	Western Alliance for Quality Transportation Construction
WBS	Work Breakdown Structure
WSDOT	Washington State Department of Transportation

Executive Summary

This report summarizes findings from a domestic scan of construction inspection competence within transportation agencies and other organizations. The purpose of this scan was to investigate what agencies are doing to develop and maintain a skilled construction inspector (CI) workforce in the face of an aging workforce, changing missions, shifting priorities, and shrinking budgets.

A scan team consisting of state departments of transportation (DOTs) and the Federal Highway Administration (FHWA) was formed to guide the scan and develop findings, recommendations, and dissemination actions. Scan team members brought a diversity of construction inspection experience, an understanding of DOT management, and knowledge of workforce challenges to the table. The scan team members' contact information and biographical sketches are provided in Appendix A and Appendix B, respectively.

Scan team members met on two occasions over the course of the scan. The first meeting was an organizational meeting to determine what information needed to be collected. Appendix C provides results of the desk scan. The primary result of the meeting was the creation of a set of amplifying questions. The second meeting was held in October 2016 to facilitate information gathering and sharing between the team and invited host agencies. In all, scan participants reviewed training and competency development activities of nine state DOTs (Alabama, California, Colorado, Florida, Georgia, Nebraska, Oregon, Virginia, and Texas), one federal agency (FHWA), and two associations (American Association of State Highway and Transportation Officials [AASHTO] re:source and American Public Works Association). Key contact information and the workshop agenda are provided in Appendix D and Appendix E, respectively.

The scan investigated the following topics:

- **Organizational knowledge transfer/knowledge management initiatives**
  Knowledge management methods used to capture, document, and share knowledge of construction inspection practices within state DOTs and with industry partners.

- **Training programs**
  Key to understanding the role training plays in developing and maintaining competency is knowing how the training is developed, how it is delivered (i.e., modality or method of delivery), who delivers the training, who is eligible to participate in the training, how program development is budgeted, and how the training is documented.

- **Qualifications and certifications**
  Recognition of the regional and national certifications related to construction inspection.

- **Career path management (employee cross-training)**
  Learning what agencies are doing internally to develop their employees to assume the role and responsibilities of a CI.

- **Expand innovations and new technologies**
  Knowing what technologies are used to develop training materials and deliver training to current and future CIs.

- **Consultant engineering inspection (CEI)**
  Understanding how state DOTs are using CEI services and how consultant inspectors are qualified to inspect construction projects.

- **Organizational hiring (recruiting) and retention practices**
  Understanding what state DOTs are doing to recruit CIs, including the skills and competencies they look for when screening potential candidates.

While scan team members and scan participants were interested in competency development programs designed for technicians involved in construction testing, materials testing is beyond the scope of this scan. Participating states included technician-related information in their responses to the scan's amplifying questions. The list of amplifying questions and host agency responses are provided in Appendix F and Appendix G, respectively. Texas DOT's responses are provided in Appendix H.

This report presents information collected from host agencies concerning training and competency development activities designed to develop and maintain the competency of their CI workforce. Presented within the report are findings, conclusions, and recommendations developed from agency responses to amplifying questions and from information exchanged at the scan meeting.

Introduction

Background

State transportation agencies are currently losing a tremendous amount of institutional knowledge as long-term employees retire and overall staffing levels are decreased. An area of specific concern is the loss of experienced CIs. The increasing complexity of construction methods and the use of more varied contracting methods have added challenges to agencies' efforts to develop and maintain their competence in construction inspection.

Scan Purpose and Scope

The purpose of the scan was to identify training and competency development activities designed to develop and maintain CI competencies.

A construction inspector is defined as one whose primary responsibility is to verify that contractor work meets standards and specifications by observation and measurement. Another commonly used title is construction technician. A construction technician is a broader term that could include testing lab, survey, and office personnel involved in performing testing and processing payments for the contractor.

The scope of this scan involved investigating leading states, counties, metropolitan areas, municipalities, and other transportation agencies.

Scan Team

The scan team had representation from each of the four American Association of State Highway Transportation Officials (AASHTO) regional associations. Representatives from state departments of transportation (DOTs) and the Federal Highway Administration (FHWA) were invited to guide the scan and develop findings, recommendations, and dissemination actions. Robert Wight, director of Construction, Utah DOT (UDOT) from AASHTO Region 4 chaired the team.

Scan team members brought a diversity of construction experience and an understanding of DOT management and workforce challenges to the table. Member positions with their home agencies represented critical areas of construction, including construction and materials, contract administration, and field services.

Scan Approach and Participants

The scan type used was Type 2, in which representatives from participant agencies and organizations, also known as host agencies, are invited to meet with the team at a predetermined location. At this meeting, which was held in San Diego, California, the host agencies presented information to the scan team and discussed the steps they are taking to address challenges related

to maintaining competency levels of construction inspection staff.

Scan team members developed a list of prospective host agencies during an organizational meeting held in Washington, DC, on February 11, 2016. The team created a list of potential host agencies based on individual team members' knowledge of an agency's initiatives in the topic area and each agency's track record in the topic area of interest. The list was then subdivided based on the extent of each agency's activities as they relate to the scan's goals. In the end, all identified agencies were invited.

The host agencies the team invited included nine state DOTs (Alabama, California, Colorado, Florida, Georgia, Nebraska, Oregon, Texas, and Virginia), one federal agency (FHWA) and two associations (AASHTO re:source[1] and the American Public Works Association[2] [APWA]).

Report Organization

This report documents the scan's results and is organized as follows:

- Chapter 2 presents key findings from all aspects of the scan, including the desk scan, the amplifying questions, and the scan meeting.

- Chapter 3 presents a summary of the conclusions and recommendation developed following the scan meeting.

- Chapter 4 identifies actions that scan team members recommend for disseminating findings and fostering adoption of beneficial CI practices.

- Chapter 5 presents a summary of the report.

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1   AASHTO re:source, http://www.aashtoresource.org/
2   American Public Works Association, http://www.apwa.net/

Competency Development Scan Findings and Observations

Findings from the scan were collected from the following sources:

- **Desk Scan** – an investigation of learning and teaching methods transportation agencies use to develop and maintain construction inspection competencies

- **Amplifying Questions** – a collection of specific details related to agency activities supporting development of CI competencies

- **Scan Meeting** – information shared by host agencies relevant to the scan's goals

Desk Scan

The goal of the desk scan is to inform the scan team of learning and teaching methods transportation agencies are using to develop and maintain construction inspection competencies. Desk scan activities include scanning the literature, analyzing secondary data, and creating a list of potential host agencies. The desk scan is presented in its entirety in Appendix C.

Host agencies are agencies and organizations that the scan team invites to participate in its scan meeting. While there, host agency representatives share information on CI training and the competency development activities in which they are engaged
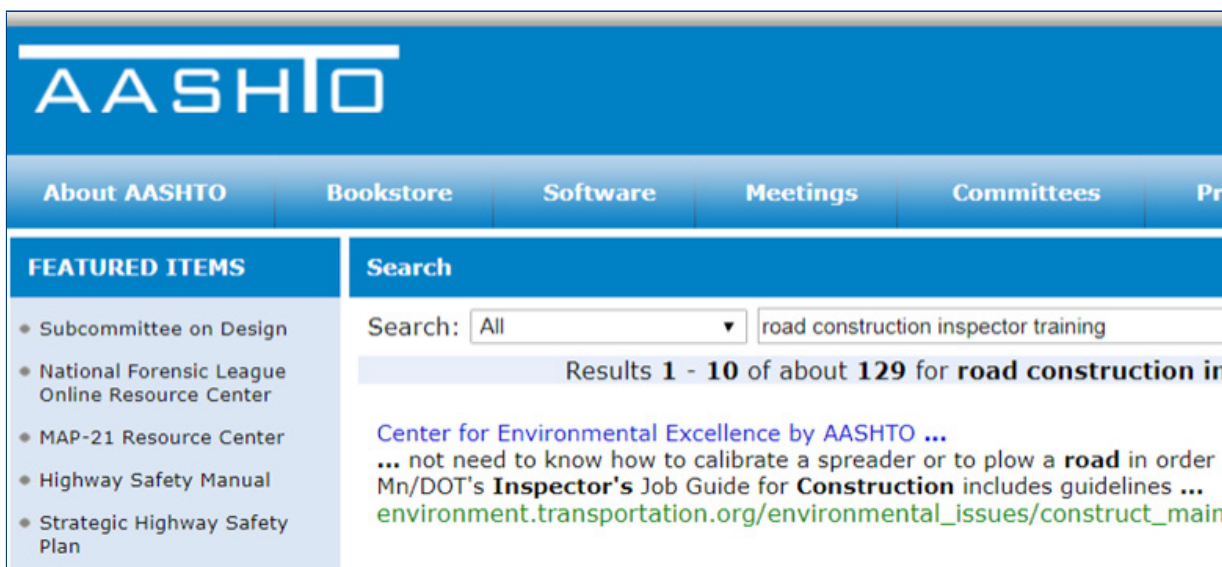
Figure 2.1 AASHTO web search results

The scan team used six search terms singly and in combination to identify potentially relevant material about construction inspection competence development: construction inspector development program, construction inspector, highway construction inspector, transportation construction inspector, and road construction inspector training. Using these terms, the team conducted an online search of AASHTO (shown in Figure 2-1), FHWA, the Transportation Research Board (TRB), and several state DOT and construction-centered websites, including:

- California DOT (Caltrans)

- Colorado DOT (CDOT)

- Connecticut DOT (CTDOT)

- Oregon DOT (ODOT)

- Washington State DOT (WSDOT)

- Association of Construction Inspectors[3] (ACI)

- United States Nuclear Regulatory Commission[4] (NRC)

- National Institute for Certification in Engineering Technologies[5] (NICET)

- NorthEast Transportation Training and Certification Program[6] (NETTCP)

The scan team determined that limited literature is available within the public-sector transportation community concerning CI competency development programs. Information can be found on state DOT websites in the form of construction manuals, pamphlets, policies, or memoranda. The team further determined that the available literature is void of performance objectives, key program elements, best practices, or case study examples of implementation.

There are numerous providers of construction inspection training that address inspector competencies, including the National Highway Institute[7] (NHI), NICET, NETTCP, and AASHTO's Transportation Curriculum Coordination Council[8] (TC3). NICET's and NETTCP's programs offer a certification that is recognized by numerous state DOTs.

Established programs outside the transportation industry and the United States should be analyzed for adaptation. The review located information on the NRC's Construction Inspector Training and Qualification Program[9] and a final report of the United Kingdom's Leicestershire County Council that includes recommendations for highway inspector competency standards for and on behalf of the Institute of Highway Engineers[10].

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3   Association of Construction Inspectors, http://www.aci-assoc.org/
4   U.S. Nuclear Regulatory Commission, https://www.nrc.gov/
5   National Institute for Certification in Engineering Technologies, http://www.nicet.org/
6   NorthEast Transportation Training and Certification Program, https://www.nettcp.com/
7   National Highway Institute, https://www.nhi.fhwa.dot.gov/home.aspx
8   Transportation Curriculum Coordination Council, https://tc3.transportation.org/
9   Construction Inspector Training and Qualification Program, Manual Chapter 1252, NRC Inspection Manual, Issue date: 04/25/11, U.S. Nuclear Regulatory Commission, https://www.nrc.gov/docs/ML1104/ML110470606.pdf
10   Murray P and I Grierson, Highway Inspector Competency Standards, Leicestershire County Council, 2010, http://www.theihe.org/wp-content/uploads/2013/08/LCCFinalReporttoIHE_April2010.pdf

The NRC's Construction Inspector Training and Qualification Program is designed to develop inspector competency in four general areas:

- Legal basis and regulatory processes

- Technical expertise

- Regulatory practices

- Personal and interpersonal effectiveness.

The program includes basic inspector certification, full inspector qualification, and refresher training (NRC Inspection Manual[11].

Amplifying Questions

During the initial meeting in Washington, DC, the scan team developed a list of amplifying questions. These questions are intended to assist in the discussion with host agency representatives and to provide additional insights about the purpose of the scan. The questions are focused on the areas the team deemed most critical to developing an understanding of how agencies are addressing the challenge of developing and maintaining construction inspection competencies. The list of amplifying questions is presented in its entirety in Appendix F.

The team was interested in collecting information from host agencies from seven key areas:

1. **Organizational knowledge transfer/knowledge management initiatives**
   The team considered it important to capture information from the invited host agencies regarding any knowledge management methods they are using to capture, document, and share knowledge of construction inspection practices within their organization and with their industry partners. These activities may include peer exchanges, mentoring programs, academies, and communities of practice.

2. **Training programs**
   The team questioned host agency representatives about their training programs. Key to understanding the role training plays in developing and maintaining competency is knowing how the training is developed, how it is delivered (i.e., modality or method of delivery), who delivers the training, who is eligible to participate in the training, what the operating budget is, and how the training is documented. For example, to the question of what methods are used to deliver training, agencies responded that they use hands-on, online, just-in-time (JIT), video-based, and instructor-led methods to deliver training.

3. **Qualifications and certifications**
   The team members were aware of regional and national certifications related to construction inspection. They wanted to know if state agencies recognized these certifications and if they are a requirement for their construction inspection staff. In addition, team members wanted to know if consultants must have the same certifications as agency personnel.

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11 Inspection Manual Chapters, U.S. Nuclear Regulatory Commission,
   https://www.nrc.gov/reading-rm/doc-collections/insp-manual/manual-chapter/

Aside from knowing what certifications are recognized and required, the team was interested in learning of any incentives agencies are offering for earning and maintaining a recognized certification. Some states reported that having a construction inspection certification is a requirement of the job. Caltrans reported that it offers a pay incentive for earning and maintaining a certification. For example, Transportation Engineering Technicians are eligible for additional pay for working in construction and having completed the Boot Camp training.

4. **Career path management (employee cross-training)**
   The team was interested in learning what agencies are doing in terms of developing employees internally to assume the roles and responsibilities of a CI. For example, the scan team members wanted to know if any agencies are actively cross-training or allowing employees to job shadow in the construction area.

   Additionally, the team was interested in learning what competencies and skills one would need to be a competent CI. Mindful of a typical CI career ladder, team members wanted to know what milestones inspectors would need to achieve as they move up the career ladder.

5. **Expand new innovations and technologies**
   While numerous types of technology support the CI, including equipment and applications, the team was interested in knowing what technology agencies are using to develop training materials and deliver training to current and future CIs. The team was interested in not only how technology is being used to train inspectors, but also what technology is being used to develop the skills necessary to become and remain competent inspectors.

6. **Consultant engineering inspection (CEI)**
   The team sought information on whether agencies are using CEI services, to what extent, and how they validate CEI that providers have trained personnel. Additional areas of interest included risk-Based audits, differential pay for night and weekend work, and special guidance for accelerated constructions schedules.

7. **Organizational hiring (recruiting) and retention practices**
   The team was interested in learning what agencies are doing to recruit CIs, including what skills and competencies they look for when screening potential candidates.

Figure 2.2   Competency development and maintenance approaches

Figure 2-2 depicts how four of the categories listed above answer the critical question, "What are agencies doing to develop and maintain construction inspection competence within their organization?"

Each category was segregated into more-defined areas of interest. Team members wanted to capture information on mentoring programs, pre-retirement knowledge management activities, best practices sharing within the organization, and methods of delivering training (e.g., hands-on training, JIT training. Finally, career path information was important. Within the career path category, the team sought information on activities such as cross-training and job shadowing.

The team designed amplifying questions for each of the key areas. The scan team developed the questions through a process that consisted of a member recommending a question, which the remaining team members then vetted. Once the team was satisfied with the list of amplifying questions, a team member whose state was a host agency tested the list.

Scan Meeting

The scan team and invited host agencies met over four days to share information regarding ongoing training and competency development activities within their respective agencies. Host agencies presented information on their activities based upon amplifying questions they received. Each day ended with a group discussion focused on information shared by that day's presenting agencies. The group discussion included each participant sharing two observations from that day's presentations and resulted in a substantial list of findings described by participants as being significant. A sample of the daily findings is presented in Table 2-1.

Sample of Daily Significant Findings

Day One
- Wide variety of training programs; variance in course offerings
- Neighboring states perform differently despite sharing borders, contractors, resources, etc.
- One size does not fit all

Day Two
- Standardized use of math placement test; open book exam, remediation for learners who do not pass the exam
- Involvement with T3 could be used for the basis of a certification program
- Involve industry and universities in curriculum content development

Day Three
- Instructor certification program (three levels); computer-based training for some of the basic info
- Partnership with community colleges
- Inspectors and inspector trainees are generally high school graduates

Table 2.1   Competency development and maintenance approaches

Sample of daily significant findings

The team compiled the daily findings into a comprehensive list and then segregated them into 12 categories. Those categories, not coincidentally, align with areas highlighted by the amplifying questions, which the presenting agencies used to develop their presentations.

A final group discussion was conducted at the end of the week. The 12 categories from the week's daily group discussions were presented to the group on day four. Participants were encouraged to share their findings from each of the 12 categories.

Findings and Observations

The following is a discussion of the scan team's findings and observations from the desk scan, amplifying questions, and scan meeting.

Organizational Knowledge Transfer/Knowledge Management Initiatives

Included in this category is the concept of mentoring, which state DOTs use to develop CIs. According to how DOTs use mentoring, it can be defined as the intentional effort to place a less experienced or rookie CI with a more-experienced or senior inspector to develop competency though on-the-job training (OJT) or job shadowing.

Most of the invited agencies reported that they do not have a formal mentoring program. Those that answered the question about whether their agency uses mentoring to develop CIs revealed that their efforts are mostly informal and involve placing a less experienced inspector with a more experienced inspector.

With the loss of institutional knowledge and experience in part due to retirements prevalent among states, agencies like Virginia DOT (VDOT) are investigating using retired construction managers and senior inspectors as mentors. The scan team found that some states, in special

situations, have authorized retired CIs to teach DOT courses. At a minimum, these approaches allow for the transfer of institutional knowledge from the more experienced inspector to the less experienced inspector.

Caltrans and Texas DOT (TxDOT) come closest to administering a formal mentoring program. Caltrans reported having a formal department-wide mentoring program open to all employees at all levels that is administered by the Division of Human Resources. TxDOT reported that it has more-experienced inspectors train inexperienced inspectors while working in the field. It is successful in developing mentors by selecting experienced inspectors, training them in the agency's instructor training program, organizing them, and encouraging them to seek and initiate mentee-mentor relationships.

State DOT Competency Development/Training Programs

The scan team determined that each host agency has an active competency development program for its CIs. Host agencies with competency development programs include:

- Alabama – Engineering Assistant Hands-on Rotation Program and Engineering Training Orientation Program

- California – Project Delivery Professional Development Program

- Colorado – Transportation Engineering Training Program

- Florida – Construction Training Qualification Program

- Georgia – Engineering Skills Development Program

- Nebraska – Construction Inspector Certification Program

- Oregon – All inspectors required to have ODOT's General Construction Inspection certification

- Texas – Inspector Development Program

Apart from Florida, the host agencies report that they administer a competency development program comprising a mix of internal and external instructor-led courses delivered primarily by agency-qualified instructors and using a variety of methodologies.

Since 1998, Florida DOT (FDOT) has contracted first with University of Florida then with RedVector[12] for the development, delivery, and administration of FDOT's Construction Training Qualification Program[13].

Like FDOT, TxDOT contracts for the delivery of training to CIs, both CEI and internal. Although a third party administers each state's programs, both state DOTs retain approval authority over curriculum content and instructors.

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12 RedVector, https://www.redvector.com/

13 Construction Training Qualification Program, Florida Department of Transportation, http://www.ctqpflorida.com/

The scan team found that successful competency development programs have these six elements in common, which are discussed in the following sections:

- Budget

- Content development and instructional design

- Delivery modalities

- Exams and proficiency testing

- Instructors

- Manuals and publications

Budget

The information that the scan team collected revealed no consistent approach to training budgeting for CI development. Training budgets ranged from $0 to a potential $7.7 million. The Nebraska Department of Roads (NDOR) reported that all training is lumped into one training budget, while the operating budget for TxDOT's Inspector Development Program is considered a divisional expense of construction.

States also varied in how they budgeted staff salaries. States that included this information in their responses reported that staff salaries pays for staff time and training time or it is charged to crew budgets and is not included in the CI training program budget.

Content Development and Instructional Design

The scan revealed that there is no shortage of training materials for developing CI competency. All presenting agencies have a curriculum of core classes designed to develop and maintain the skills and abilities required of a competent CI.

A review of the information collected reveals that the reporting states agree to some degree on the processes and resources needed for development. The areas on which they agree include the need:

- For input from subject matter experts (SMEs) and from instructors

- For instructional designers to develop content and instructional materials

- To use developmental applications, such as Adobe Captivate[14]

- For a well-defined scope, audience analysis, and learning objectives

- For psychometrics for test development and how to use available resources

- For a process for testing new courses

- For regular content review, audits, and updates, including tests

- To use an accepted instructional design model

- To define any supplemental materials that need to go with the training

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14 Adobe Captivate, Adobe Systems Incorporated, http://www.adobe.com/products/captivate.html

Delivery Modalities

A single training delivery approach does not work well for all state DOTs. For that reason, most DOTs have sought alternative methods that combine the flexibility of online learning with a broad range of more traditional learning methodologies, such as instructor-led training.

From the amplifying questions and the scan meeting presentations, the scan team found that 28% (as shown in Table 2-2) of host agencies deliver a large percentage of their training using instructor-led training, while 43% report they deliver much of their training using a blended approach of hands-on, on-the-job, and JIT training. Caltrans reported that it delivers 50% of its training via e learning or web based training.
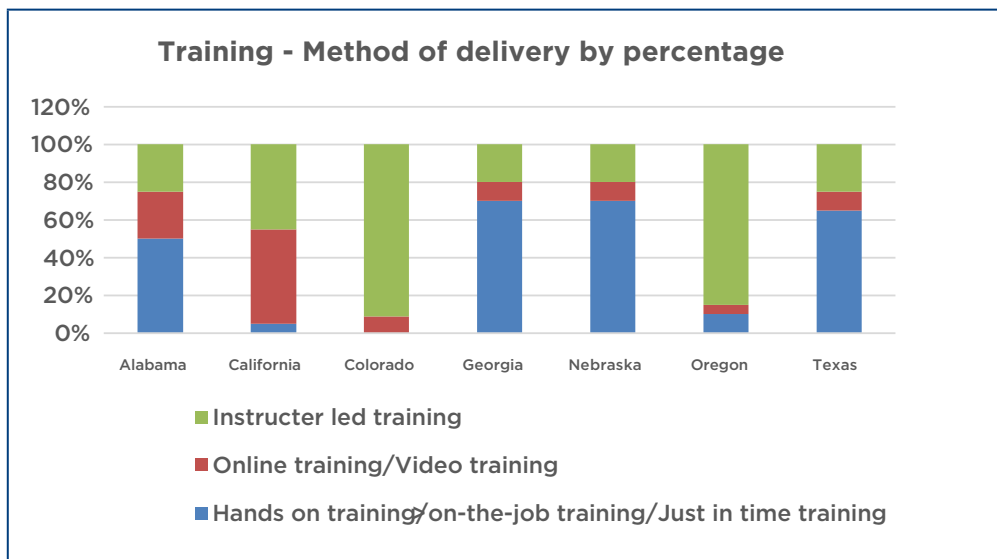
Table 2.2   Method of training delivery

State DOT use of wikis, gamification, and YouTube (short on-demand videos) has become commonplace. Their use is transforming otherwise mundane subjects into fun and rewarding learning experiences—turning employees into "continual learners" and improving overall knowledge transfer and retention.

Despite the growth in online delivery, many of the host states reported that they continue to use job aids, pocket guides, and job books to deliver training.

Exams and Proficiency Testing

Two-thirds of host agencies report using exams of some kind. Approaches to testing and requirements for testing vary from state to state. Caltrans uses an entrance or placement exam for Transportation Engineering Technicians hoping to be placed on a hire list. Colorado, Florida, Georgia, Oregon, and Texas use written exams following courses to validate that CIs have gained the knowledge necessary to be effective. Colorado reports that all CIs, whether they are from CDOT or are consultants, must demonstrate proficiency by passing an exam and earning certification within eight developed categories of inspection training.

While some host agencies limit testing to post-course exams, Florida requires inspectors to pass proficiency tests on field and lab testing methods.

The team found that at least two states (Oregon and Washington) allow inspectors to challenge their CI exams. In Oregon, training is available, but not required, for each of the inspector certifications. Experienced inspectors may choose to challenge the certification examination without attending training.

At WSDOT, all certification requirements may be completed either by completing the required training courses successfully and then passing the examinations or by taking the examinations without first completing the training courses.

Passing scores also varied. In Oregon, inspectors must demonstrate minimum competency, with a minimum exam score of 80%. In Colorado, however, employees and consultant employees are required to achieve a minimum exam score of 70% for the Basic Highway Math, Basic Highway Plan Rading, and the Basic Construction Surveying tests.

Interest in how best to develop exam questions peaked during Lowell Patton's discussion of the American Public Works Association's (APWA's) Certified Public Infrastructure Inspector[15] (CPII) program. All exam questions have an answer that relates to a definitive written source. Exam questions test on concepts, not regional values.

Regardless of the type of testing used to validate CI competency, the scan team found that there is interest in learning more about how DOTs address several aspects of testing, including:

- Minimum passing scores

- Open book/closed book

- Time allotment restrictions

- Proficiency versus written tests

- Appropriate content to ensure compliance (ensure content relates to learning objectives)

- Written exams (paper or electronic, testing environment, proctored or not, ADA compliance)

- Test development

- Handling inspectors who cannot pass an exam

Instructors

Critical to the success of any training is the instructor, who influences the learning that takes place in the training environment and the transfer of that learning to the work environment. Because of this, it was critical for the scan team to learn from the invited agencies how they identify and develop internal instructors.

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15 Certified Public Infrastructure Inspector, American Public Works Association,
    https://www.apwa.net/MYAPWA/Events/Professional_Development/Certification/Public_Infrastructure_Inspector__CPII_/Apwa_
    Public/Education_and_Events/Certifications/CPII.aspx?hkey=6d59f32b-cfc9-4c03-b92c-1f8a2f33298b

Agencies indicated that they use instructor candidates who have some level of expertise in construction inspection; these SMEs can volunteer or are recommended. California, Colorado, and Texas require specialized training for instructors that includes the development of skills all instructors need, including how to deliver instruction, engage learners, and create a positive learning environment.

Manuals and Publications

The scan team found that state DOTs make extensive use of their respective construction-related manuals and publications for training purposes. For example, host agencies indicated that they use job aids, pocket guides, and job books that include information excerpted from procedure manuals that is critical for CIs to know.

With changes in construction technology and the increasing number of inexperienced inspectors, state DOTs are under pressure to maintain current construction procedure manuals. Many host agencies report that they maintain printed copies of specifications and construction manuals while also offering electronic versions.

> Preparing inspectors for roadway projects is critical to ensuring projects are completed according to plans and specifications.
>
> *Jeff Benefield, Assistant State Construction Engineer, Alabama DOT*

Consultant Engineering Inspection Training and Competency Development

States approach competency development differently when it comes to consultant engineer inspectors. Florida reported that 100% percent of CIs are CEIs. All of Florida's CEIs are required to successfully complete its Construction Training Qualification Program, which is administered by a third party (RedVector). In contrast, Texas uses a mix of CEIs and internal inspectors, all of whom are required to complete the same competency development program, which is administered by a third party. TxDOT allows outside participants into agency classes.

Qualifications and Certifications

The scan team was interested in learning as much as possible of the existence and acceptance of documented CI qualifications and certifications and wanted to know each host state's requirements in terms of qualifications and/or certifications. Scan team members identified third-party certification programs, then asked participants if they recognized and required any of the third-party certifications for their inspection staff or consultant inspection staff.

The responses to the amplifying questions indicated that some states use agency-specific certifications that are developed internally and some states use a combination of agency-specific and regional certifications. Colorado reported that it uses an inspector qualification board of directors to develop and implement its qualifications development program.

Although participating states differ in their approach to certifying CIs, their programs have the same elements in common (i.e., formal training, OJT, proficiency demonstration, and a written exam). Two elements were missing from the common elements that are considered important and for which no information was collected via the amplifying questions: specified recertification intervals and a process for disqualification or decertification. These elements surfaced in discussions and presentations at the scan meeting.

Two host agencies, Oregon and APWA, reported that they certify their inspectors for five years.

Proposed Generic Construction Inspector Development Framework

The scan revealed several programs that could serve as generic inspector development programs, either in part or as a whole. Programs identified include NETTCP and TC3. Of the two, TC3 is a nationally recognized resource for CI training. According to Mark Chaput (Michigan DOT), TC3 helps states and other transportation partners leverage resources and save money at a critical time for infrastructure investment. Currently 33 state DOTs support TC3 and 25 states are using TC3-produced online courses.

Despite the existence of regional and national programs, the scan meeting revealed no one best solution for an inspector development and certification program. Therefore, participants discussed the need for a national or regional framework for a CI development and certification program to be developed. No decision was made regarding how or whether to move forward with developing a framework; however, a follow-up study was suggested.

American Public Works Association Certified Public Infrastructure Inspector

APWA representative Lowell Patton made a presentation to scan participants regarding APWA's CPII program. He discussed the program's elements in detail, including its development, its governance structure, and the elements of a feasibility study conducted by APWA leadership.

Perhaps the most practical of the elements discussed by Patton were the program's components, which include the application process, the examination, and the recertification application process. Scan team members were particularly interested in how the exam questions are developed. The APWA workshop is intended to increase skills and knowledge but is not geared to help the program's participants pass the exam. Scan participants noted that inspector candidates who attend the workshop and have the appropriate experience should pass the exam. Andy Alvarado (Caltrans) noted that in developing questions, APWA tried not to make the questions too regional. Participants of the scan meeting were impressed that the exam questions test for the application of knowledge rather than recall. All questions have an answer that relates to a definitive written source. Participants noted that the exam tests on construction inspection concepts rather than on regional standards.

Scan participants were interested in the program's recertification process. Patton reported that certifications are good for five years and that APWA has completed one round of recertification since the program was put in place. Recertification requirements include:

- A minimum of 5.0 Continuing Education Units (CEUs) (50 hours of instruction) or successful completion of the exam for recertification (The CEUs need to be awarded for attending classes at national congress or from an approved list of chapter workshops, as long as it is some sort of training in some sort of construction instruction.)

- Continued agreement, in writing, to adhere to the APWA Standards of Professional Conduct[16]

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16 Standards of Professional Conduct, American Public Works Association,
    http://www2.apwa.net/documents/organization/standardsofconduct.PDF

- No felony conviction related to the practice of public infrastructure inspection

- Payment of the application fee

Technology

As it relates to training delivery and technology, perhaps one of the biggest changes discussed at the scan meeting was the introduction of an audience response system (aka iClicker[17]). ODOT reported:

> One strategy that is used in several classes is an "audience response" component to the training where the instructor has questions prepared with multiple-choice answers to choose from. Getting feedback from the answers allows instructors to gauge how well the class is understanding the material and allows them to adjust how they deliver the material as needed. The responses are anonymous so it allows students to answer without the stigma of having answers that were wrong.
>
> *Greg Stellmach, Quality Assurance Engineer, Oregon DOT*

The scan team observed that all reporting host agencies are currently able to develop and deliver training using technology despite challenges related to purchasing and maintaining state-of-the-art training development and delivery technologies.

Partnerships – Industry and Academia

The scan team found that many of the host agencies have partnered in the past or currently have active partnerships with industry and/or academia for the development of competent CIs. The scan team learned the following:

- **Alabama** partners with the National Center for Asphalt Technology[18] and Roadtec[19] to deliver needed training to CIs.

- **California** partners with industry members, sharing in the presentation (both provide instructors), attendees (both provide students), and cost (for example, one provides the facility and one provides the materials).

- **Florida** has an active contract with RedVector for its Construction Training Qualification Program.

- **Nebraska** partners with the Nebraska Local Technical Assistance Program and The Associated General Contractors – Nebraska Chapter[20].

- **Texas** primarily delivers training for its Inspector Development Program as in-house training; however, it partners with multiple vendors for the delivery of all other training to TxDOT and CEIs.

Resources

The scan team found that while there are concerns regarding the availability of resources for

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17 iClicker, Macmillan Learning, https://www.iclicker.com/
18 National Center for Asphalt Technology at Auburn University, http://eng.auburn.edu/research/centers/ncat/
19 Roadtec, Astec Industries, Inc., https://www.roadtec.com/
20 The Associated General Contractors of America, https://www.agc.org/

the development of CI competency, there does not appear to be a common theme among the host agencies. Through their answers to amplifying questions and their presentations, the host agencies indicated that the resources impacting their training and development activities include:

- Appropriate staffing levels for training

- Budgeting for present and future expenditures

- Lack of funding, qualified staff, equipment, and facilities for the training program (instructional systems design and IT support)

- The ability to leverage the use of federal funds

- The ability to leverage external resources, such as TC3

- Access to a pool of instructors

- Access to a learning management system and its related expenses

- Time and resources to develop a regional program

Staffing and Hiring Practices

Questions regarding host agency staffing and hiring practices garnered a variety of findings, ranging from MAP-21's veteran's employment provisions[21] to CI staffing levels based on construction workload to demonstrating the need to legislators for more inspectors. Perhaps the most telling finding related to the ability of construction management to staff CI positions and hire personnel for this role is its involvement in the interview and selection process.

Information shared by host agencies indicates that tension exists in the selection and hiring of new CIs. In one case, hiring managers have no input in the selection process. At another DOT, the interview and selection process allows hiring managers to review resumes and applications prior to face-to-face interviews with potential candidates.

The scan team was interested in learning what skills or competencies agencies look for in potential recruits. The team found that, for many agencies, requirements are based on educational background and years of work experience; this is because positions can vary regarding which skills and competencies are appropriate. A list of primary competencies Colorado looks for in recruits is included in Colorado's responses to the amplifying questions (see Appendix G).

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21 MAP-21 Veteran Employment Provisions, https://www.fhwa.dot.gov/map21/qandas/qavet.cfm

Competency Development Conclusions and Recommendations for State DOTs

The conclusions and recommendations expressed in the following sections are those of the scan committee. Recommendations were developed from information collected from the host agencies participating in the scan. Readers may wish to modify the following recommendations to meet their own circumstances or state's requirements.

I.   Mentoring

Host agencies reported using formal and informal mentoring. Caltrans and TxDOT administer mentor programs with more structure than the other host agencies. The Caltrans Division of Human Resources administers the program, which is open to all employees. Host agencies taking the informal approach pair experienced inspectors with less experienced instructors.

TxDOT's program is unique among host agencies in that mentors assist outside their normal geographical work areas. In some cases, a mentor or other division or district staff will be asked to assist in developing an inspector or inspector work group.

- Conduct additional study to identify successful private industry programs to replicate.
- Develop a framework for a mentoring program for CI development.

II.   Training and Competency Development

Content Development/Instructional Design

Following the host state presentations, the team concluded that a training program's success relies on it being designed based on the principles of how people learn and by using a systematic process. The ADDIE model is one such systematic process. ADDIE is the generic process traditionally used by instructional designers and training developers. The model consists of five phases: analysis, design, development, implementation, and evaluation. Other models include the the Dick and Carey Systems Approach and Jerold Kemp's Instructional Design.

Another component to content development and instructional design is pairing instructional designers with CI SMEs. Instructional designers are trained in the principles of how people learn, while the CI SME has intimate knowledge of competencies required for a CI and the benefit of having experience as an inspector.

- Adapt an instructional design framework when developing a CI course.

Delivery Modalities

State DOTs use a combination of cognitive and behavioral approaches to deliver training, ranging from lectures and e-learning to OJT and mentoring. State DOTs have access to technology, including high-speed internet, which provides greater access to training resources that allow for self-study or JIT learning opportunities. Additionally, success has been demonstrated using video training through YouTube or other delivery means. Job aids, pocket guides, and job books are still effective means of delivering training.

- Consider blending various modes of training delivery based on agency resources, geography, generational differences, learning styles, and content.

- Evaluate and implement new delivery methods.

Exams/Testing

Presenting agencies reported success when exams measure knowledge application rather than data recall. Psychometric tests are an example of exams that measure knowledge application. APWA's CPII certification exam is an example of this type of exam.

The use of psychometric tests aided in creating fair and effective test questions. Psychometric tests are designed to measure a candidate's suitability for a role based on the required personality characteristics and aptitude (or cognitive abilities).

The scan team concluded that there is lack of consistency state to state regarding passing scores on exams or measurement methods related to inspector competence.

- Measure knowledge application rather than data recall.

- Write exams against training learning objectives.

- Evaluate exams for effectiveness on an as-needed basis.

- Establish policies or processes for determining exam protocol (i.e., prerequisites, remediation, and open- or closed-book).

Instructors

The scan team concluded that it is important to have qualified instructors. Host agencies reported that they develop qualified instructors by providing instructor training. Utilizing SMEs with field experience (i.e., in-house or within the industry) in the development and delivery of training has been demonstrated to be effective and more beneficial for students. Instructor training ranges from basic training on basic principles on how adults learn to certification programs that cover all elements of training delivery.

An instructor quality assurance program has been shown to ensure high-quality instruction.

- Train instructors on effective delivery methods and adult learning principles.

- Create a pool of SMEs for the development and delivery of training content.

- Institute a quality assurance program to manage the instructor pool.

Manuals/Publications

Many states presented excellent examples of job aids, job books, and pocket guides for use in training, retaining, and developing CIs by using supplemental reference materials. States use both electronic and hard-copy versions for effective development efforts. Several states provided examples of documentation of their certification/training through manuals.

- Evaluate other state transportation agencies' use of manuals and publications for adaptation to use in training.

- Explore hosting manuals/publications and video content on the TC3 website as a means of sharing or disseminating information.

Consultant Engineering Inspection Training and Competency Development

There was no consensus among host agencies about whether or not to provide training to CIs. Most presenting states and scan team members agree that there needs to be a process to establish and verify minimum qualifications of CIs. In addition, any process should include a rating system designed to rate the CI's performance. Host agencies that reported requiring internal CI certifications also require the same certifications of consultant inspectors.

- Apply qualifications (see recommendation under Qualifications and Certifications) required of internal inspectors to consultant inspectors.

- Develop a standard certification program for consultant inspectors.

- Consider a graduated approach to developing qualified CIs (i.e., apprentice, journeyman, and master).

III.   Qualifications and Certifications

Host agencies have developed internal certification programs for CIs that have tiered approaches, with general and specialty certifications. For example, ODOT offers a General Construction Inspector certification. It teaches inspectors via its Construction Manual, Manual of Field Test Procedures, Qualified Products List, and Non-Field Tested Materials Acceptance Guide.

An example of a specialty certification is the Colorado Asphalt Pavement Association[22] (CAPA) Asphalt Inspection certification. CDOT explains that, "A person working on an asphalt overlay would need the prerequisites plus the CAPA asphalt inspection [certification]."

Regional and national certifications can be a way for states with limited training resources to ensure general inspector qualifications. APWA's CPII certification is one example of what a national certification could look like. NETTCP's certifications are examples of a successful framework for a regional certification program.

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22 Colorado Asphalt Pavement Association, http://co-asphalt.com/

- Establish or adapt a certification program for CIs.
- Establish requirements for personnel qualification/certification.
- Create a program that includes:
  - Formal training
  - OJT
  - Specified recertification intervals
  - Proficiency demonstration
  - A written exam
  - A process for disqualification or decertification

IV. Technology

Participating states report that it is a challenge to get the hardware necessary to take advantage of existing training tools. States report funding and IT policies/security issues are two resources that limit use of state-of-the-art technologies. Some states reported innovations with the use of technology in the development and delivery of training programs; all participating states acknowledged improved efficiencies. The states' inability to access and leverage technology may limit their ability to develop an effective certification/training program.

- Leverage technology wherever feasible to increase the effectiveness, efficiency, and quality of training.
- Leverage technology in the development and delivery of training.

V. Partnerships – Industry and Academia

There are demonstrated successes in partnering with industry and academia for the development and delivery of training programs. State DOTs can design, develop, and deliver instruction. However, partnerships with industry and academia add value to CI development because they help make training more efficient, focused, and impactful. Partnerships also add value because they help ensure equivalent competencies.

Contracting aspects of training and certification are challenging to some agencies and their partners.

- Engage industry partners and academia to leverage resources.
- Engage industry partners and academia to develop sustainable construction inspector development programs.

VI. Resources

Host agencies report challenges related to having sufficient resources to meet the challenge of developing the competencies of CIs. The uncertainty of resources and the response to competing priorities makes it a challenge to sustain a CI competency development program. Host agencies report SMEs are in both high demand and low supply.

- Leverage national and regional instructional resources such as TC3, NHI, NETTCP, and the Western Alliance for Quality Transportation Construction[23] (WAQTC).

- Assign qualified staff dedicated to managing training programs for CIs.

- Develop a sustainable pool of experienced SMEs.

VII. Staffing and Hiring Practices

Despite the lack of programs designed to recruit CIs, states reported success in recruiting and hiring them from colleges and universities with internship programs. Inability to hire additional CIs, along with an increase in construction programs, has led to an increase in hiring consultant CIs.

- Establish CI qualifications and/or certifications required to perform the job.

- Establish screening and hiring practices that ensure necessary aptitude.

- Establish recruiting practices that include targeting midcareer and retired CIs.

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23 Western Alliance for Quality Transportation Construction, http://www.waqtc.org/

Dissemination Strategies and Actions

The scan team identified strategies and actions that scan team members, AASHTO, TRB, U.S. DOT, state DOTs, and other organizations can pursue to disseminate the results of this scan. Strategies and actions include presenting the results of the scan at TRB and AASHTO annual, regional, and subcommittee meetings. Scan team members identified several related organizations that would benefit from a presentation of the scan results, including:

- TC3

- National Local Technical Assistance Program Association[24]

- The Associated General Contractors of America[25]

- American Road & Transportation Builders Association[26]

- Northeast Association of State Transportation Officials[27]

- American Council of Engineering Companies[28]

- National Transportation Training Directors[29]

- Washington-Area Council of Engineering Laboratories[30]

Many of the recommended actions were initiated directly following the scan meeting and are ongoing.

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24 National Local Technical Assistance Program Association, http://www.nltapa.org/
25 The Associated General Contractors of America, https://www.agc.org/
26 American Road & Transportation Builders Association, http://www.artba.org/
27 Northeast Association of State Transportation Officials, http://nasto.org/
28 American Council of Engineering Companies, http://www.acec.org/
29 National Transportation Training Directors, http://nttdonline.org/index.php
30 Washington Area Council of Engineering Laboratories, https://www.wacel.org/

Summary

The information provided in this report was collected from state DOTs that recognize the challenge of developing and maintaining their CI workforce. This report should serve as affirmation to each state DOT actively working to develop its CI workforce. For other state DOTs, the information should provide a road map for the training and competency development of their CIs.

The challenges of developing and maintaining a competent inspector workforce are clear, regardless of whether a state DOT is making progress in its efforts to develop CIs or is in the beginning stages. It is also clear that the participating agencies have taken up the challenge and appear to be successful.

The scan team set out to investigate what state DOTs are doing to ensure a well-trained and competent construction inspection workforce. It was determined that mentoring, training programs, use of qualified CEI personnel, acceptance of regional and/or national certifications, and hiring and staffing practices are the key elements of success in the efforts of state DOTs to develop and maintain a competent construction inspection workforce. All participating state DOTs are using different aspects of these key elements in varying combinations to meet their respective needs.

Mentoring

Caltrans and TxDOT reported using a formal mentoring program. Several states reported that they use some form of informal mentoring to aid in the development of CIs. Host agencies reported pairing inexperienced inspectors with experienced inspectors and using OJT as the primary methods of training.

Training Programs

Each state reported having a training program consisting of a combination of internal and third-party courses delivered by instructors who are SMEs.

Important to the continuation of any training program is knowing the return on investment; however, calculating return on investment for employee development is difficult. Many factors need to be considered, including actual costs, actual learning, and the source of the learning, each of which is difficult to isolate. At the time of the scan meeting, none of the participating states had undertaken a return on investment study.

One metric often used to gauge employee development is time to productivity. Texas reported that the total time to prepare fully certified inspectors requires six months of OJT, three years of ongoing training, and continual mentorship.

Construction Engineering and Inspection

Most participating states report that CEIs are required to complete the same training as their state DOT counterparts. The investigation revealed that DOTs approach CEI skills development differently. Some states open their training to CEIs to the point of sharing instructors and facilities, while others offer courses using the same materials but limit registration to contractors and consultants.

Regional and National Certifications

While the participating state DOTs recognize that regional and national certifications exist, some states accept them and some do not accept them.

Hiring and Staffing Practices

As might be expected, hiring and staffing practices vary from state to state. A critical element of successful hiring and staffing is the ability for Human Resources and Construction to work closely on all aspects of the process.

Consideration should be given to recruiting midcareer and retired CIs; members of each group would add value to any DOT workforce. Midcareer inspectors have technical competence and retired inspectors have technical competence and field experience.

Appendix A
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Appendix B: Scan Team Biographical Sketches

ROBERT WIGHT (AASHTO Chair) is the Director of Construction at the Utah Dept. of Transportation. He earned a bachelor's degree in Civil and Environmental Engineering in 1993 and a master's degree in Engineering Management in 1994 from Brigham Young University. Most of his 20 years at UDOT has been in the construction management and maintenance areas, and is currently leading the implementation of UDOT's e-Construction initiative. He has been a member of the AASHTO Subcommittee on Construction since 2011 and currently serves as the chair of the Safety Environmental and Workforce Development Section. He is also a member of TRB's AFH-10 committee on Construction Management. He is a licensed Professional and Structural Engineer in the State of Utah. He is married and has 5 children and enjoys hiking, running, cycling and climbing.

MARK CHAPUT is the Deputy Bureau Director of Highway Field Services Bureau at Michigan Department of Transportation. He Oversaw the day to day operations of the Bureau responsible for statewide field support services for Construction Operations, Geotechnical Engineering, Pavements and Materials, Maintenance, System Operations, Research Program Administration, ITS Program Administration and Bridge Field Service and Maintenance. Previously, Chaput was the University Region Engineer and managed the roadway networks and operations of the 10 county University Region in central mid Michigan including the cities of Ann Arbor, Jackson and Lansing. He is a graduate of Lawrence Technological University with a bachelor's degree in civil engineering.

ANDREW ALVARADO, P.E. is the Chief of North Region Construction for the California Department of Transportation (Caltrans). Alvarado manages the construction projects on California highways from Sacramento northward. Alvarado has worked on numerous statewide Caltrans teams to improve construction contract administration, including teams who are using new technology and other efficiency best practices to change how contracts are administered. With a very large number of experienced inspectors retiring, Caltrans is focused on hiring the right mix of construction inspection classifications, training them properly, and retaining them for the long run. Alvarado has been a champion in this effort and is looking forward to setting the course for the new generation Caltrans inspectors. Alvarado is a graduate of the University of Texas at El Paso with a bachelor's degree in civil engineering. His is a licensed professional engineer in California.

DAVID HOYNE is the Director of the Construction and Materials Bureau with the Vermont Agency of Transportation in Montpelier VT. David manages the statewide capital construction program, the materials testing laboratory and the geotechnical engineering team. David is a panel member of NCHRP Topic 47-09 Practices for Establishing Contract Completion Dates for Highway Projects, a panel member of NCHRP Task 386 Update of the 2008 Guide Specifications for Highway Construction, and serves on the Engineering Advisory Committee at Vermont Technical College. Hoyne also serves as the Vice-Chair of the AASHTO Subcommittee on Construction. He received his Bachelors of Science in Civil Engineering from the University of New Brunswick, Canada. Hoyne is a registered profession engineer in Vermont.

ROMEO GARCIA is a bridge construction engineer with the construction management team in FHWA's Office of Preconstruction, Construction, and Pavements in Washington DC.   In this position, he leads the advancement of highway bridge construction activities with transportation agencies and private industry. This includes identifying and deploying leading practices and technologies associated with highway bridge construction (i.e. contracting mechanisms, scheduling, equipment, labor, materials, and quality). He has worked with FHWA since 1975 in various States across the country providing oversight of highway and bridge construction projects with a major emphasis on the quality of the completed product. Garcia holds a bachelor's degree in civil engineering from the University of Minnesota and a master's degree in Public Administration from Rutgers University.

ROBERT A. LUTZ is an engineering graduate of Lafayette College in Easton, Pennsylvania and has worked for AASHTO since 1989 in a variety of roles - Laboratory Assessor, Assistant Program Supervisor, Manager of the AASHTO Accreditation Program, and now as the Manager of AASHTO re:source (formerly AMRL), one of AASHTO's largest technical-service programs. In his current role Bob is responsible for the day-to-day operations of AASHTO re:source, including strategic planning, marketing, budgeting, program development, training, and accreditation and auditing activities. Lutz provides technical support to the AASHTO Subcommittee on Materials and the DOTs, serves on several ASTM International committees, and is currently the Vice Chair of ASTM International Committee E36 on Accreditation and Certification. Through his work with the AASHTO Accreditation Program and ASTM International committees, Bob has written requirements for ASTM standards for certification bodies, and has evaluated many certification bodies against these standards. He is also familiar with ISO/IEC 17024, Conformity assessment – General requirements for bodies operating certification of persons. This widely-accepted international standard "provides a global benchmark for personnel certification programs to ensure that they operate in a consistent, comparable and reliable manner worldwide, thereby allowing individuals to have skills that translate across national lines." Bob is an active participant in AASHTO's Transportation Curriculum Coordination Council (TC3) program and has served as a subject-matter expert for several of the courses

JEFF LEWIS is a Construction and Contract Administration Engineer with the FHWA Resource Center's Construction Program Management technical service team. He has been with FHWA for 38 years which prior to his 2007 start with the Resource Center, spent time as a Highway Engineer in Western Federal Lands and Alaska Division and then the California Division (1987-2007) where he served as the Field Operations Engineer. In all of these positions, he was responsible for overseeing the entire project life cycle (cradle to grave), including planning, environmental, design, right-of-way, construction, maintenance, and operations. He serves as secretary on the AASHTO Subcommittee of Construction's Safety, Environmental, Workforce Development Section (since 2000), teaches various NHI classes and participates in NCHRP reports/panels. Mr. Lewis earned a bachelor's of science degree in Civil Engineering from the University of Missouri-Rolla.

RICK A. SMITH is retired from the Georgia Department of Transportation with over twenty-five years of experience in the transportation industry and in training program development and delivery. Before retiring, Rick served as the Department's training director. During his time as training director, Rick served as president of the National Transportation Training Directors. He was also a member of the Transportation Research Board Knowledge Management Task Force. His undergraduate is in civil engineering technology from the University of North Carolina-Charlotte. He has a Master of Business Administration with a concentration in project management and a Master of Science in Human Resources Management. Rick's research interests include learning transfer and knowledge management.

Appendix C:
Desk Scan Results

Literature Review

NCHRP 20-68A Domestic team 15-01 Developing and Maintaining Construction Inspection Competence

Definition:

Inspector - The representative of the Engineer assigned to test materials, make inspections of contract performance, or both. (Michigan DOT, 2012, p. 9)

A search of AASHTO, TRB and Google websites was conducted using the terms construction inspector, highway construction inspector, transportation construction inspector, and road construction inspector training.

Sources found on the AASHTO website include:

- The AASHTO SCOC Environment & Human Resources Qualification/Certification Questionnaire – "Construction Inspection Qualification Survey Results" and PowerPoint titled "Status of Highway Construction Inspector Qualification/Certification Programs" presented by Leonard "Bud" Darby, PE, NICET Civil Engineering Program Administrator. The survey and subsequent PowerPoint were developed between November 2004 and August 2005.

- "Construction Inspection Survey" presented by Francis J. Hood, PE, Idaho Transportation Department

- Transportation Curriculum Coordination Council (TC3) website. The TC3 website – Construction page includes competency matrices required to "execute the work."

Federal Highway Administration Website

In an article from the FHWA's publication Focus (April 2007) introducing new products and courses from TC3, Virginia DOT's adaptation of TC3 curriculum for the development of construction inspection staff is highlighted.

State Agencies with Certification and Training Programs

- Caltrans – No formal program, was their response to the NICET survey. Caltrans indicated they do not require certification as an inspector except in certain areas such as welding. National certifications are required for those specialized areas.

- Colorado DOT – Formal program comprising self-study materials

- Connecticut DOT – Requires consultant inspectors to be NICET certified

- Oregon DOT – Inspectors are required to demonstrate their understanding of the inspection process by passing an examination. Training is available, but not required, for each of the inspector certifications. Experienced inspectors may choose to challenge the certification examination without attending training.

- Washington State DOT – All certification requirements may be completed by either

successfully completing the required training courses and then passing the examinations or the examinations can be taken without completing the training courses.

Other Sources of Construction Inspection Programs

- The Association of Construction Inspectors (ACI) presents itself as, "a leading professional organization for those involved in construction inspection, …"

- Nuclear Regulatory Commission (NRC) – In the "NRC Inspection Manual", Chapter 1252 titled *Construction Inspector Training and Qualification Program,* specifies the training and qualification requirements inspectors.

- National Institute for Certification in Engineering Technologies (NICET) – Currently updating Transportation Construction Certification program.

- NorthEast Transportation Training and Certification Program (NETTCP)

Interviews/E-mail Communications

- NICET – E-mail communication with Ahmed Farouki, senior director, Technical Services

- NTTD – E-mail communication to MaryLeah Coco, president

- NLTAPA – E-mail communication to president

- VDOT – E-mail communication to Maureen Hammer. Response: "We are doing a KM project, yes. Can I put you in touch with Gene Shin and Jimmy White (copied on this e-mail) to get more information?"

The following e-mail was sent to the presidents of NTTD, NLTAPA and VDOT requesting the following information be circulated to their respective members:

A team of state DOT representatives has been assembled to investigate how transportation agencies are addressing the need to maintain competence levels while experiencing the loss of experienced construction inspectors, an increased complexity of construction methods, and use of more varied contracting methods.

Robert Wight (rwight@utah.gov), director of Construction and Materials, Utah DOT, is the AASHTO chair of the team.

This scan team is seeking input from states, counties, metropolitan areas, municipalities, and other transportation agencies regarding teaching and learning methods such as the following examples:

- Mentoring programs
- Hands-on training
- Online training
- Just-in-time training
- Video training
- Public/private training partnerships
- Innovative hiring practices
- Certification testing
- Pay for qualifications

The scan team will consider learning outcomes, measure of success, and how agencies plan to maintain competence in the future.

If you have information relevant to the scan objectives, please forward to Rick Smith at smithra@5-col-laborativetrainingsolutions.com or call him at 843-321-3711

Assessment

Limited Literature on Construction Inspector Development Programs

There is limited literature within the public-sector transportation community CI competency development programs. Available information is found on individual state DOT websites in the form of construction manuals, pamphlets, policies or memorandums. What is available does not describe objectives, key elements, and best practices or case study examples of implementation.

There are numerous providers of construction inspection training that address inspector competencies. These include the National Highway Institute, NICET, NETTCP, and TC3. NICET and NETTCP's programs offer a certification that is recognized by numerous state DOTs.

Established programs outside transportation or the United States should be analyzed for adaptation. The review located information on the Nuclear Regulatory Commission's program and a United Kingdom report establishing inspector competency standards (Murray & Grierson, 2010).

Update existing information

AASHTO's Subcommittee on Construction's survey and subsequent report is the most comprehensive study of state departments of transportation and their efforts to adequately train construction staff. Many of the questions posed in the survey are relevant today. Examples of questions from the survey include, "What strategies do you use to ensure adequately trained staff?" and "Do you require inspector qualifications?"

Consideration should be given to updating the survey and recirculating it to determine what changes have occurred since the original survey was circulated in 2005.

Candidate Agencies for Inclusion in the Scan

The following transportation agencies are recommended for inclusion in the scan:

- State departments of transportation responding to the AASHTO SCOC Environment & Human Resources Qualification/Certification Questionnaire, including:
  - Alabama
  - California
  - Colorado
  - Florida

- Idaho
- Nebraska
- Oregon
- Pennsylvania

The following is a prioritized list of host agencies developed during the scan team's organizational meeting held in Washington, DC, on February 11, 2016. Scan team members are interested in inviting the listed DOTs and organizations to participate in the scan. The team has divided the list into tiers based on individual team members' knowledge of a DOT's initiatives in the topic area. Tier I includes DOTs team members believe have the strongest track record in the topic area of interest.

- Tier I
  - California
  - Texas
  - Pennsylvania
  - Florida
- Tier II
  - Oregon
  - Nebraska
  - Colorado
- Tier III
  - Alabama
  - Georgia
  - South Carolina
  - Idaho
  - Association of General Contractors
  - American Council of Engineering Companies
  - American Society of Civil Engineers
  - American Public Works Association

References

- AASHTO SCOC (n.d.) *Environment & Human Resources Qualification/Certification Questionnaire.* Construction Inspection Qualification Survey Results. Retrieved from: http://search.transportation.org/search?q=construction+inspector&spell=1&site=default_collection&btnG=Search&output=xml_no_dtd&proxystylesheet=aashto_frontend&sort=date:D:L:d1&entqr=3&oe=UTF-8&ud=1&getfields=*&filter=0&u-lang=en&ip=108.24.196.178&access=p

- Focus (April 2007). *Tools for Training a Qualified Transportation Workforce.* Publication Number: FHWA-HRT-07-012. Retrieved from website: http://www.fhwa.dot.gov/publications/focus/07apr/02.cfm

- Michigan DOT (2012) *Standard Specifications for Construction. Section 101.03. p. 9. Retrieved from:* http://mdotcf.state.mi.us/public/specbook/2012/

- Murray, P. & Grierson, I. (2010). *Highway Inspector Competency Standards.* Leicestershire County Council. Retrieved from: http://www.theihe.org/wp-content/uploads/2013/08/LCCFinalReporttoIHE_April2010.pdf

- Nuclear Regulation Council (n.d.). *Construction Inspector Training and Qualification Program.* From NRC Construction Inspection Manual. Manual Chapter 1252. Retrieved from: http://pbadupws.nrc.gov/docs/ML1104/ML110470606.pdf

- Domestic Scan Team 15-01, Organizational meeting in Washington, DC, on Thursday, February 11, 2016

Appendix D:
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Appendix E: Scan Workshop Agenda

NCHRP 20-68A U.S. Domestic Scan Program

Domestic Scan 15-01 Developing and Maintaining Construction Inspection Competence

Workshop

San Diego, CA

Oct 9 ~ 14, 2016

October 9, 2016, Scan Team Kick-Off Meeting – Scan Team ONLY

October 14, 2016, Final Team Meeting – Scan Team ONLY

BAHIA RESORT HOTEL

998 W. Mission Bay Drive, San Diego, California 92109

Telephone 858.539.7700

WORKSHOP SCHEDULE

Sunday Oct 9, 2016	Monday Oct 10, 2016	Tuesday Oct 11, 2016	Thursday Oct 13, 2016	Friday Oct 14, 2016	Saturday Oct 15, 2016t
SCAN TEAM ONLY) Scan team Kick-off meeting from 7 pm to 8pm *(Participants travel to the meeting location)*	Whole day workshop from 8am to 5:30pm	Whole day workshop from 8am to 5:30pm	Whole day workshop from 8am to 5:30pm	(SCAN TEAM ONLY) Scan team final meeting from 8am to 4pm *(Invited participants travel back home)*	Scan team members travel back home

WORKSHOP SCHEDULE

Team Kick-off Meeting (Sunday, Oct 9, 2016)
Hotel conference room: Shell (facing Marina Beach)
(Scan team ONLY)

Start Time	Discussion Topic	Moderator
7:00 pm – 8:00 pm	Brief Kick-off Meeting Review of Final Agenda and Logistics Team Assignment Collect team presentations General Discussion, Rehearsal	Harry Capers Rob Wight Melissa Jiang

Day 1 (Monday, October 10, 2016)
Hotel meeting room: Bay E Ballroom
(Located on the fifth floor of the Front Tower Building)

Start Time	Discussion Topic	Presenter	Moderator
7:00 am	Breakfast (Breakfast Buffet in Bahia Café by using breakfast vouchers)		
8:00 am	Opening and Overview Greeting and Welcome (5 minutes) Welcome and Introduction (40 minutes) Team Introduction Participant Introduction and Expectations Overview of the agenda	Harry Capers Rob Wight, Scan 15-01 AASHTO Chair	
8:45 am	Florida Department of Transportation Presentation	Susan Robeson Darla Hunsicker	Mark Chaput
10:45am	Break		
11:00 am	California Department of Transportation Presentation	Shaun Ng Rita Allan	Andy Alvarado
12:00 pm	Lunch (Plated Lunch on West Bay Beach)		
1:00 pm	California Department of Transportation Presentation (Cont')	Shaun Ng Rita Allan	Andy Alvarado
2:00 pm	Break		
2:15 pm	Colorado Department of Transportation Presentation	Laura Zamora Allison Wilson	David Hoyne
4:15 pm	Open Discussion on Day's Presentations		Rob Wight Rick Smith
4:30 pm	Adjourn for Day (Closing and Announcement)		Harry Capers Rob Wight

Day 2 (Tuesday, Oct 11, 2016)
Hotel meeting room: Bay E Ballroom
(Located on the fifth floor of the Front Tower Building)

Start Time	Discussion Topic	Presenter	Moderator
7:00 am	Breakfast (Breakfast Buffet in Bahia Café by using breakfast vouchers)		
8:00 am	Alabama Department of Transportation Presentation	Jeff Benefield Steve Ingram Pat Alford	Romeo Garcia
10:00 am	Break		
10:15 am	Georgia Department of Transportation Presentation	Jeff Conrad Scott Chambers	Robert Lutz
12:15 pm	Lunch (Plated Lunch on West Bay Beach)		
1:00 pm	Nebraska Department of Roads Presentation	Devin Townsend Jason Lehn	Jeff Lewis
3:00 pm	Break		
3:15 pm	Oregon Department of Transportation Presentation	Greg Stellmach Jaimé Viramontes	Mark Chaput
5:15 pm	Open Discussion on Day's Presentations		Rob Wight Rick Smith
5:30 pm	Adjourn for Day (Closing and Announcement)		Harry Capers Rob Wight

Day 3 (Wednesday, October 12, 2016)
Hotel meeting room: Bay E Ballroom
(Located on the fifth floor of the Front Tower Building)

Start Time	Discussion Topic	Presenter	Moderator
7:00 am	Breakfast (Breakfast Buffet in Bahia Café by using breakfast vouchers)		
8:00 am	Virginia Department of Transportation Presentation	Jimmy White	Andy Alvarado
10:00 am	Break		
10:15 am	Texas Department of Transportation Presentation	Tracy Cain Katie Salter	David Hoyne
12:15 pm	Lunch (Plated Lunch on West Bay Beach)		
1:00 pm	American Public Works Association (APWA) Presentation	Lowell Patton	Romeo Garcia
3:00 pm	Break		
3:15 pm	FHWA Presentation	Romeo R. Garcia Jeff Lewis	Robert Lutz
4:15 pm	AASHTO TC3 Presentation	Mark Chaput	Andy Alvarado
4:45 pm	Open Discussion on Day's Presentations		Rob Wight Rick Smith
5:00 pm	Adjourn for Day (Closing and Announcement)		Harry Capers Rob Wight

Day 4 (Thursday October 13, 2016)
Hotel meeting room: Bay E Ballroom
(Located on the fifth floor of the Front Tower Building)

Start Time	Discussion Topic	Presenter	Moderator
7:00 am	Breakfast (Breakfast Buffet in Bahia Café by using breakfast vouchers)		
8:00 am	AASHTO re:source (formerly AASHTO Materials Reference Laboratory (AMRL)) Presentation	Robert A. Lutz	Jeff Lewis
10:00 am	Break		
10:15 am	Open Panel Discussion – Significant Findings and Conclusions		Rob Wight Rick Smith
12:00 pm	Lunch (Plated Lunch on West Bay Beach)		
1:00 pm	Open Panel Discussion – Significant Findings and Conclusions (Cont')		Rob Wight Rick Smith
3:00 pm	Break		
3:15 pm	Wrap-Up and Closing Session Recommendations Identify Next Steps		Rob Wight Rick Smith Harry Capers
5:00 pm	Adjourn for Day (Closing and Announcement)		Harry Capers Rob Wight

Final Scan Team Meeting (Friday, October 14, 2016)
Hotel conference room: Pacific (Located on the first floor of the
Front Tower Building)
(Scan team ONLY)

Start Time	Discussion Topic	Moderator
7:00 am	Breakfast (Breakfast Buffet in Bahia Café by using breakfast vouchers)	
8:00 am	Scan Team – Team discussion and finalization of Significant Findings, Conclusions and Recommendations	Rob Wight Rick Smith Harry Capers
10:00 am	Break	
10:15 am	Scan Team - Development of Report Outline	Rob Wight Rick Smith
12:00 pm	Lunch (Plated Lunch on West Bay Beach)	
1:00 pm	Scan Team - Development of Draft Dissemination Plan	Greg Waidley, CTC & Associates
5:00 pm	Adjourn Scan Meeting	Harry Capers Rob Wight

Appendix F:
Amplifying Questions

Following are the amplifying questions developed by the scan team. Each scan host agency was asked to provide responses to these questions before the scan meeting and to orient its scan meeting presentation around aspects of these questions.

Amplifying Questions

Organizational Knowledge Transfer/Knowledge Management Initiatives

Communities of Practice

1. Does your agency use any knowledge management or knowledge transfer techniques such as communities of practice to train field inspection technicians? If so, please describe.

2. Does your agency hold or convene annual or other scheduled meetings or workshops with construction inspectors to discuss areas of concern or interest? If so, please describe.

Mentoring Programs

3. Does your agency use mentoring to develop construction inspectors? If so, please describe.

Preretirement Knowledge Management Activities

4. Which techniques does your agency use to capture tacit knowledge or "tribal knowledge" before someone retires (standard work instructions, job shadowing, etc.)? Please explain.

Best Practice Sharing Within the Agency

5. Has your agency conducted "after action reviews" or documented lessons learned or case studies? If so, please describe.

6. What methods or avenues does your agency use to keep inspectors informed of inspection techniques or requirements?

7. How do you convey your decision-making processes/practices (methods, considerations, levels of authority, communications, etc.)?

Procedure Manuals

8. How current are your agency's manuals and guidance documents?

9. How does your agency develop and maintain its manuals and guidance documents?

10. How is this information shared with staff?

Resources

11. Is your agency willing to provide links to online manuals or hard copies of the procedure manuals upon request?

Training Programs

1. Which of the following methods of delivery are used for the development of construction inspector knowledge and skills? To the extent possible, include the percentage of time spent for each method of delivery: a) hands-on training, b) online training, c) JIT training, d) video training, e) instructor-led training.

2. What types of initial construction inspection training does your agency provide?

3. What types of continued construction inspection training does your agency provide?

4. Has your agency developed any online construction inspection training courses and testing? If so, please list/describe.

5. Has your agency modified its training to accommodate millennials? If so, please explain.

6. Does your agency develop specialists or generalists? How long does it take to see results?

7. Does your agency use proficiency testing? If so, please describe.

8. Does your agency use/have employee development plans for your construction inspector job series?

9. How many inspectors does your agency train or certify on an annual basis? How many are DOT? How many are consultants?

10. Are inspectors trained at the DOT or at an off-site location?

11. How many hours of time are involved (preparing material, teaching, certifying, post-activity)?

12. What is the operating budget for this program?

13. Are any fees collected (does your agency charge consultants a fee for receiving the training/certification)?

14. How does your agency identify and develop internal instructors and coaches?

15. How is training developed? Please describe the development process.

16. How is new information communicated (microlearning, standups with talking points, text blasts, social media)?

17. How does your agency assess knowledge transfer for updated information?

18. Has your agency made any adjustments for younger audiences and their learning styles? If so, please explain.

19. Does your agency have requirements for in-service training? How often? How long?

20. How does your agency collect feedback from participants, supervisors, management, contractors, or consultants (surveys, word of mouth)?

21. How is feedback that is collected used?

22. What do you believe are the key elements that make your program successful?

Qualifications and Certifications

23. What qualifications/certifications does your agency require or use for field inspection technicians?

24. What regional (NETTCP, WAQTC, SETFTTQ, M-TRAC, etc.), national (NICET), or other state qualification/certification programs for field inspection does your agency accept or use as an equivalent, if any?

25. Does your agency require or encourage private firm (CEI) field inspection technician personnel to be qualified/certified?

26. Do you offer pay incentives or compensation for certification?

27. What procedures has your agency introduced along the guidelines enumerated under Section 3, paragraph d of the 23 CFR 637 Quality Assurance (QA) Program for sampling and testing[31]:

> The following should be used as guidance for reviewing and revising a technician qualification program:
> 1. Formal training of personnel including all sampling and testing procedures with instructions on the importance of proper procedures and the significance of test results
> 2. Hands-on training to demonstrate proficiency of all sampling and testing to be performed
> 3. A period of on-the-job training with a qualified individual to ensure familiarity with state DOT procedures
> 4. A written examination and demonstrated proficiency of the various sampling and testing methods
> 5. Requalification at 3- to 5-year intervals (data from the IA program can be used as one element of requalification)
> 6. A documented process for retraining or removing personnel that perform the sampling and testing procedures incorrectly
> 7. The following are not appropriate criteria for achieving or maintaining qualification status: grandfathering, the acceptance of a Professional Engineer or Engineer-in-Training certificate, or lifetime qualification."

Career Path Management (Employee Cross-Training)

28. How do you develop the cross-training activities (e.g., contractor/consultant, OJT, informal, formal, manuals, etc.)?

29. What activities are included in your cross-training program (e.g., OJT, job shadow, mentoring, coaching, online training, external training, internal training, job rotation, etc.)?

30. What are the key competencies, skills, and milestones that someone climbing the ladder has to acquire before they are placed in a position of responsibility?

Expand New Innovations and Technologies

31. How is technology used in the development of curriculum?

32. How is technology used in the delivery of training?

33. How is your agency keeping up-to-date and assessing current materials?

34. Is there a set of guidelines on the cadence of when materials are updated?

Innovative Contracting

35. Does your agency utilize a "risk-based audit" approach to construction inspection? If so, please explain.

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31 FHWA Pavements (October 2015.) Quality Assurance, Pavements, Federal Highway Administration, U.S. Department of Transportation, http://www.fhwa.dot.gov/pavement/0637bsup.cfm

36. Does your agency provide special guidance on construction inspection considerations for projects that are on an accelerated schedule? For example, projects that are being constructed during the night or on weekends as well as projects that consist of more than one work shift. If so, please describe.

37. Does your agency provide pay differential for work being performed during the night or on weekends?

38. To what extent does your agency utilize consultant engineering inspection services?

39. Does your agency have a process for confirming that certified construction inspectors are performing their construction inspection duties as required? If so, please describe this process.

40. What certification makes sure the contractor has the skills needed?

41. How does your agency pretest to make sure the contractor can deliver?

Organizational Hiring (Recruiting) and Retention Practices

42. If your agency hires or promotes from within, how do you identify candidate employees?

43. Does your agency recruit field inspection technicians? If so, what skills or competencies does your agency look for in a potential recruit?

44. What is the ramp-up time for new hires?

45. Succession Planning—Does your agency use 9-box grid or other methods to identify and develop internal candidates?

46. Does your agency have a field training opportunity program? What qualifications does someone need to be a coach?

47. What turnover issues, if any, has your agency identified related to construction inspector positions?

48. How does the average retention rate compare to other categories?

49. How do you provide new staff the range of impacts/outcomes affecting or affected by decisions (impact to quality, costs, future projects, claims, etc.)?

Appendix G:
Responses to Amplifying Questions

This appendix was developed largely based on material submitted by scan participants and has been selectively edited for clarity. The main report body includes extracts from this material to illustrate key scan findings.

Questions for which there were no responses have been omitted.

Alabama Department of Transportation

Organizational Knowledge Transfer/Knowledge Management Initiatives

Communities of Practice

1. Does your agency hold or convene annual or other scheduled meetings or workshops with construction inspectors to discuss areas of concern or interest? If so, please describe.

The following meetings/training/workshops are held (frequency shown in parenthesis):

- CE/ME conferences (annual)
- CEME quarterly review meetings (quarterly)
- Area construction in-house meetings (as needed)
- Auburn Transportation Conference (annual)
- Paving Professionals Workshop, Roadtec (annual)
- Qualified Credentialed Inspector refresher training (annual)

Mentoring Programs

2. Does your agency use mentoring to develop construction inspectors? If so, please describe.

   Alabama DOT (ALDOT) does not have a formal mentoring program; however, our areas assign younger inspectors to work under a senior inspector or project manager for teaching and guiding.

Preretirement Knowledge Management Activities

3. Which techniques does your agency use to capture tacit knowledge or "tribal knowledge" before someone retires (standard work instructions, job shadowing, etc.)? Please explain.

   Same response as above—mentoring of younger, less-experienced inspector is done as mentors are available.

Best Practice Sharing Within the Agency

4. Has your agency conducted "after action reviews" or documented lessons learned or case studies? If so, please describe.

   No formal after-action reviews or case studies have been conducted.

5. What methods or avenues does your agency use to keep inspectors informed of inspection techniques or requirements?

   Refresher classes and OJT

6. How do you convey your decision-making processes/practices (methods, considerations, levels of authority, communications, etc.)?

   The testing manual is reviewed annually and updated as new specifications dictate. The Materials Sources & Devices Manual is updated monthly as new products are added. The

Standard Specifications Manual and special provisions are kept current. The Construction Manual has portions that are current; other portions need updating. Guidelines for operation are current. Most construction information memoranda are current; others need to be updated or possibly retired.

Procedure Manuals

7. How current are your agency's manuals and guidance documents?

As specifications change and national standards are updated, so are ALDOT procedures. The Construction Bureau maintains the Standard Specifications Manual. The printed book is updated every few years; the internet version is updated with each specification revision. The Materials and Tests Bureau maintains the Testing Manual, the Materials, Sources, and Devices with Special Acceptance Requirements Manual, and other policies and documents; it updates the internet as each procedure and approved source list is revised. The Construction Bureau uses in-house personnel to develop and maintain its various documents. In some cases, industry review and concurrence is sought when making revisions.

8. How does your agency develop and maintain its manuals and guidance documents?

Area materials and construction engineers are typically notified by e-mail of any revised or new specifications. Specifications, manuals, procedures, etc., are available via intranet and internet. National standards are available to ALDOT personnel via the Materials and Tests page on the intranet. Documents are made available either in printed form or online.

Training Programs

1. Which of the following methods of delivery are used for the development of construction inspector knowledge and skills? To the extent possible, include the percentage of time spent for each method of delivery: a) hands-on training, b) online training, c) JIT training, d) video training, e) instructor-led training.

   a. Hands-on training – 50%

   b. Online training – 5%

   c. JIT training – 0%

   d. Video training – 20%

   e. Instructor-led training – 25%

ALDOT offers classes in Roadway Technician (4-day class with written exam and hands-on training), Earthwork Technician (3-day class with written exam and hands-on training). Videos that show a procedure step by step during the in-class training are used.

2. What types of initial construction inspection training does your agency provide?

Depending on the inspector's assigned duties, the initial training would typically include Roadway Technician, Earthwork Technician, Concrete Technician, and Work Zone Traffic Control. Other initial training is offered within the Employee Development Program for multiple classifications and disciplines. These will be addressed at the meeting.

3. What types of continued construction inspection training does your agency provide?

   Similar courses to those listed in the previous answer. Courses are reoffered as needed based on hiring of new inspectors or the need to keep the certifications of current inspectors up-to-date. Some courses require periodic refreshers. These will be addressed at meeting.

4. Has your agency developed any online construction inspection training courses and testing? If so, please list/describe.

   No, but we are currently developing an online work zone traffic control course for inspectors.

5. Has your agency modified its training to accommodate millennials? If so, please explain.

   No, not in particular.

6. Does your agency develop specialists or generalists? How long does it take to see results?

   Both. Given time, experience, and opportunity, some inspectors become specialists (bridge, paving, grading, etc.). Most inspectors would fall into the generalist category and be used for numerous tasks on a project. The time for development varies with the inspector and experience.

7. Does your agency use proficiency testing? If so, please describe?

   Lab techs are tested annually for proficiency in their duties. New hires are tested within their first two months for math proficiency so placement can be made in proper coursework. Proficiency testing for typing skills is also conducted for our clerical positions.

8. Does your agency use/have employee development plans for your construction inspector job series?

   Yes, an employee development plan (EDP) is used; this will be discussed in depth at the meeting. Construction is one of five EDP disciplines recognized by State Personnel Department.

9. How many inspectors does your agency train or certify on an annual basis? How many are DOT? How many are consultants?

   This varies based on the number of employees hired in a year and the availability of training. Currently, 149 DOT employees are enrolled in the construction discipline of EDP. Consultants do not participate in EDP but do participate in other training.

10. Are inspectors trained at the DOT or at an off-site location?

    They are mostly trained in house; we may have some exceptions.

11. How many hours of time are involved (preparing material, teaching, certifying, post-activity)?

    This varies based on the number of employees hired in a year and the availability of training. Currently, 149 DOT employees are enrolled in the construction discipline of EDP. Consultants do not participate in EDP but do participate in other training.

12. What is the operating budget for this program?

   It's approximately $3M. The Division of Construction continues to staff its training program with three full-time course developers/trainers and a support staff.

13. Are any fees collected (does your agency charge consultants a fee for receiving the training/ certification)?

   DOT employees do not typically pay for training; however, payment is made to vendors and/ or outside training agencies for course development and number of attendees. Consultants are more likely to be assessed a fee for training.

14. How does your agency identify and develop internal instructors and coaches?

   Very few courses are taught by DOT employees; most are taught by vendors. For DOT-taught courses, typically the more seasoned/experienced employees are used as trainers. External instructors/coaches often come from local universities, are industry experts, etc.

15. How is training developed? Please describe the development process.

   SMEs typically provide information to vendors, which in turn develop course material based on expected employee duties, responsibilities, etc.

16. Has your agency made any adjustments for younger audiences and their learning styles? If so, please explain.

   Efforts are being made to include more videos and higher tech applications in training. Also, we recently implemented the use of iClickers (audience response system) in some classes.

17. Does your agency have requirements for in-service training? How often? How long?

   PCETs must complete 15 hours of civil engineering coursework per semester while pursuing a degree in CE. EAs are required to complete a 13-day rotation in four areas within their first seven months of employment. CEGs have rotation options but in-service training is not mandatory.

18. How does your agency collect feedback from participants, supervisors, management, contractors, or consultants (surveys, word of mouth)?

   Post-training evaluations and questionnaires are often used to get feedback. EDP participants are interviewed periodically to get feedback on program effectiveness and course material quality. PCETs are interviewed every six months while in the program for feedback purposes.

19. How is feedback that is collected used?

   Feedback is used for course and program evaluation and improvement.

Qualifications and Certifications

20. What qualifications/certifications does your agency require or use for field inspection technicians?

   - Radiation Safety

   - Roadway Technician

   - Asphalt Level 1

   - Earthwork Technician

   - Concrete Technician

   - Aggregate Technician

   - ACI Concrete Field Testing Technician

   - ACI Concrete Strength Testing Technician

   - PCI Quality Control Technician

   - Temporary Traffic Control for Work Zone Inspections

   - Qualified Credentialed Inspector for Stormwater Inspections

21. What regional (NETTCP, WAQTC, SETFTTQ, M-TRAC, etc.), national (NICET), or other state qualification/certification programs for field inspection does your agency accept or use as an equivalent, if any?

   ALDOT classes cover ALDOT specifications and procedures and are required for all certified technicians. In most cases, asphalt certifications from any other programs are not accepted for inspector certification. For concrete, ACI Field Testing Tech Level 1 and ACI Concrete Strength Testing Tech are accepted. PCI Levels 1, 2, and 3 are accepted for precast and pre-stress certifications.

22. Does your agency require or encourage private firm (CEI) field inspection technician personnel to be qualified/certified?

   Yes, all consultants must be certified the same as ALDOT personnel would be to perform testing or inspections.

23. Do you offer pay incentives or compensation for certification?

   We do not offer pay incentives or compensation for possessing or requiring a certification. Our state compensation staff has determined that the pay grade assigned to the employee's job class already includes compensation for the certifications.

24. What procedures has your agency introduced along the guidelines enumerated under Section 3, paragraph d of the 23 CFR 637 Quality Assurance (QA) Program for sampling and testing?

A. Using AASHTO R 18 as a standard, OJT and competency testing are required. Each materials and test laboratory and each area materials lab has a Quality System Manual that outlines the management, the lab personnel, in-house training, training program for new employees, equipment lists, and calibration lists for each item listed on the equipment list.

B. The area Quality System Manuals are checked annually. During the area lab inspections, lab personnel perform hands-on testing in front of central lab personnel and the test results are compared to those performed by certified central lab personnel. Training classes are offered at most area offices scattered throughout the year and at the NCAT offices in Auburn.

1. All classes cover the ALDOT specifications and procedures. Several exam questions concern where to locate the specification, which specification covers which topic, etc. The instructors are professors at the college level, retired state employees from various states, retired engineers from various agencies, or asphalt or concrete association representatives.

2. Classes have hands-on training and each technician must prove that he or she is proficient during the class. In-house training is given and technicians are evaluated.

3. Most areas require short in-house training and the inspectors are sent to projects with a mentor to learn the procedures and requirements of the inspection.

4. All classes require taking a written exam (a verbal exam is available if requested) with a passing score of 75. Each class also has a hands-on evaluation, which is performed during the class.

5. The Radiation Safety Class is a prerequisite for Roadway Technician, Earthwork Technician, and Asphalt Level 1, 2, and 3 Technician certifications. These certifications are for three years. After three years, the technician must take a radiation safety refresher class and submit to the Working Task Force for the certification BMT form, which highlights the technician's activities. If deemed active by the task force, the technician is recertified. If technician is deemed not active, the initial class must be retaken before the technician will be deemed active and recertified.

6. Each certification has an ALDOT procedure describing the certification program in detail. Each certification has a Certification Board and Working Task Force that oversees the requirements set forth by these procedures and administers the program.

Career Path Management (Employee Cross-Training)

25. How do you develop the cross-training activities (e.g., contractor/consultant, OJT, informal, formal, manuals, etc.)?

    The only cross-training within the EDP is in the EA classification. PCETs and CEGs receive cross-training within their program. Activities were developed through meetings with supervisors in each area of the cross-training.

26. What activities are included in your cross-training program (e.g., OJT, job shadow, mentoring, coaching, online training, external training, internal training, job rotation, etc.)?

    As an example, these are activities from the Civil Engineer Graduate classification:

    ■ Serve as level man on location party

    ■ Serve as bridge inspector

    ■ Plot roadway and bridge alignment

    ■ Calculate earthwork quantities

    ■ Conduct soil sampling

Expand New Innovations and Technologies

27. How is technology used in the development of curriculum?

    There is more incorporation of videos and photos in training; iClickers and smart phones are being incorporated for audience responses. We are also adding an online course with timed sessions and quizzes with varying questions to maintain the integrity of the course.

28. How is technology used in the delivery of training?

    There is more incorporation of videos and photos in training; iClickers are being incorporated for audience responses.

29. How is your agency keeping up-to-date and assessing current materials?

    See our response to question 20 on page G-5. We are also gauging the relevancy of training based on feedback and updating as needed.

30. Is there a set of guidelines on the cadence of when materials are updated?

    No, but training is updated based on industry advancements, specification and practice changes.

Innovative Contracting

31. Does your agency utilize a "risk-based audit" approach to construction inspection? If so, please explain.

    No.

32. Does your agency provide special guidance on construction inspection considerations for projects that are on an accelerated schedule? For example, projects that are being constructed during the night or on weekends as well as projects that consist of more than one work shift. If so, please describe.

   No.

33. Does your agency provide pay differential for work being performed during the night or on weekends?

   No.

34. To what extent does your agency utilize consultant engineering inspection services?

   The percentage of consultant inspectors varies area by area. Some use no consultants, while other areas use a significant percentage of inspectors from the consultant ranks.

35. Does your agency have a process for confirming that certified construction inspectors are performing their construction inspection duties as required? If so, please describe this process.

   Inspectors are evaluated and graded by their supervisor on their annual performance appraisal.

36. What certification makes sure the contractor has the skills needed?

   Contractors are required to maintain the same certifications as all ALDOT personnel. The classes offered allow contractor personnel to take the course at the same time as ALDOT personnel. Each class has 30 slots for attendees (20 ALDOT and 10 contractor/consultant). In the event, there aren't enough ALDOT technicians to fill the allotted slots, contractor/consultants can fill those slots until the class is full.

37. How does your agency pretest to make sure the contractor can deliver?

   Certifications can be checked and audited, but we do not pretest the contractor for competency.

Organizational Hiring (Recruiting) and Retention Practices

38. If your agency hires or promotes from within, how do you identify candidate employees?

   ALDOT operates under a centralized merit system, in which all jobs must be advertised and all candidates ranked. We hire from the outside or promote from within by considering only the top 10 plus ties of the ranked candidates. The job announcements are published and many of our job classes are open for application on a continuous basis. When we have a vacancy or wish to promote someone, we pull a top 10 list (plus ties) from the list of ranked candidates.

39. Does your agency recruit field inspection technicians? If so, what skills or competencies does your agency look for in a potential recruit?

   Field Inspection Technician is a working title for one of many assignments performed by our Engineering Assistant Series. We do not specifically recruit for individual working titles.

The generic Engineering Assistant I job class is the entry-level class we use as the first level of Field Inspection Technician. Applicants are hired with little to no experience and are trained to perform the tasks.

40. What is the ramp-up time for new hires?

Our ramp-up time is about a year. Our employees have a promotional opportunity to the second level in the series after completion of at least one year of experience.

41. Succession Planning—Does your agency use 9-box grid or other methods to identify and develop internal candidates?

We have little in the way of succession planning. Under our strict merit system rules, formally predetermining and grooming someone for a future vacancy is not allowed.

42. Does your agency have a field training opportunity program? What qualifications does someone need to be a coach?

We have an employee development program, which is a combination of OJT performed by the supervisor and classroom training. Both types of training are developed specifically for the job class the employee is in and a possible future job class that the employee is considering.

43. Does your agency have a field training opportunity program? What qualifications does someone need to be a coach?

We have an employee development program, which is a combination of OJT performed by the supervisor and classroom training. Both types of training are developed specifically for the job class the employee is in and a possible future job class that the employee is considering.

California Department of Transportation

Organizational Knowledge Transfer/Knowledge Management Initiatives

Communities of Practice

1. Does your agency use any knowledge management or knowledge transfer techniques such as communities of practice to train field inspection technicians? If so, please describe.

Inspection is broken down by discipline:

- Roadway (or district) inspection

- Structures inspection

- Electrical inspection

- Materials testing

Specialists are developed in the following specialty areas to assist and educate inspectors:

- Landscape

- Traffic management and safety

- Stormwater pollution prevention plan

- Quality assurance

  District specialists meet annually with headquarters SMEs for formal knowledge exchange.

2. Does your agency hold or convene annual or other scheduled meetings or workshops with construction inspectors to discuss areas of concern or interest? If so, please describe.

   The following meetings/training/workshops are held (frequency shown in parentheses):

   - Assistant Resident Engineer (biweekly with safety meeting – field office)

   - Construction Engineer (weekly or biweekly – district)

   - Resident Engineers (annually – district with Headquarters management representatives in attendance)

   - Structures Representatives and Structure Inspectors (annually – statewide)

   - Storm Water Coordinators for Storm Water Pollution Prevention Plan (quarterly – statewide)

   - Traffic Management and Safety (annually – statewide)

   - Construction Engineers (biannually – statewide) [Currently discontinued due to budget constraints, to be reestablished soon.]

Mentoring Programs

3. Does your agency use mentoring to develop construction inspectors? If so, please describe.

   Assistant resident engineers (inspectors) spend time in the field with an experienced assistant resident engineer to acclimate to the field conditions and their responsibilities (aka buddy system). Assistant resident engineers work with other assistant resident engineers to cross-train for all items of work.

   Field office engineers train assistant resident engineers on proper paperwork.

   Resident engineers train field office engineers on their office procedures and expectations within the guidelines of the Construction Manual. Resident engineers provide support to assistant resident engineers.

   Construction engineers provide support to resident engineers and assistant resident engineers. Construction managers provide support to construction engineers. Construction field coordinators (at Headquarters) provide support (coaching) to district construction managers, construction engineers, and resident engineers.

A formal department-wide mentoring program is open to all employees at all levels and is administered by the Division of Human Resources.

Preretirement Knowledge Management Activities

4. Which techniques does your agency use to capture tacit knowledge or "tribal knowledge" before someone retires (standard work instructions, job shadowing, etc.)? Please explain.

   ■ Written procedures are maintained and documented in the Construction Manual.

   ■ Seasoned, experienced staff serve as SMEs for course content development and as instructors for training delivery; they are also used for cross-training.

   ■ An employee who performs a unique function develops a desk manual for that specific task(s).

   ■ A weekly or biweekly district construction engineers meeting is held for knowledge sharing.

   ■ Successor staff job shadow retiring staff for knowledge transfer.

Best Practice Sharing Within the Agency

5. Has your agency conducted "after action reviews" or documented lessons learned or case studies? If so, please describe.

   A committee reviews each project after project completion and documents lessons learned, which are shared with designers for future projects. SMEs exchange lessons learned during the annual statewide meetings held for SMEs. A Contract Administration Process Evaluation is conducted annually to review selected topics for the year, document statewide lessons learned, and identify process improvements.

6. What methods or avenues does your agency use to keep inspectors informed of inspection techniques or requirements?

   We keep inspectors informed through the publication of a construction manual, Construction Procedure Directives, and Construction Policy Bulletins . Manual updates are distributed by e-mail as needed via directives and bulletins.

   The Construction Manual contains policies and procedures related to the duties of construction personnel and is intended as a resource for personnel engaged in contract administration. Construction procedure directives are issued to remind construction personnel of existing policy, whereas Construction Policy Bulletins are new policies that will be included in the manual when it is updated.

   Applicable updates to the Standard Specifications and Standard Plans are included in the project special provisions and project plans (which collectively form the contract documents). Special provisions will also include just-in-time training for contractor and department staff for new technology where applicable.

   In-house training courses are developed to expand on and reinforce the Construction Manual, Standard Specifications, and Standard Plans.

We publish a Flagging Instruction Handbook, Temporary Pedestrian Facilities Handbook, Highway Construction Checklist, Construction Safety Checklists, Code of Safe Practices, and other inspection guidance. These manuals are published for structure CIs: Bridge Construction Records and Procedures Manual, Bridge Deck Construction Manual, Falsework Manual (6/2016), Foundation Manual (10/2015), Prestress Manual 2014, and Trenching and Shoring Manual 2011.

We also keep inspectors informed through information sharing at regular staff meetings.

7. How do you convey your decision-making processes/practices (methods, considerations, levels of authority, communications, etc.)?

We do this through Standard Specifications, the Construction Manual, Construction Procedure Directives, Construction Policy Bulletins , staff expectation memos, and sharing of direction with staff at meetings. The Construction Manual parallels the Standard Specifications and provides all guidance, directly or indirectly, by referencing other state documents.

Procedure Manuals

8. How current are your agency's manuals and guidance documents?

- **Standard specifications and Standard Plans** – The most current standards are 2015 Standard Specifications and 2015 Standard Plans. Updates are included in the project special provisions and project plans at the time of bid. They are in the back of the documents and have precedence over the printed version. Standards are updated every three to five years to incorporate any revised standards. Project documents state which standards are applicable to the contract.

- **Construction manual** – The currently published Construction Manual was last updated in September 2014 to correspond with the 2010 Standard Specifications. Efforts are currently underway to update the manual to parallel the revised sections in the 2015 Standard Specifications.

  As specifications, practices, procedures, and policies change, the Headquarters Division of Construction will issue a construction policy bulletin, which supersedes any conflicting information, guidelines, or instructions in the manual.

  Revisions are made to the manual in the form of a manual change transmittal, which incorporates Construction Policy Bulletins . A manual change transmittal provides a summary of changes to the manual and information on what pages need to be replaced in the hard copy of the manual. When transmittals are issued, the changed pages are added to the manual's full electronic download and electronic sections table with lines in the margin to indicate changes. Footer dates are also changed to match the month the transmittal was issued.

  Construction procedure directives can also be issued periodically to clarify information already contained in the manual, introduce a process change, and remind readers of existing policy, announce a new form, or inform readers of a change in address or contact.

  It is desirable and prudent to use the online version of the full manual and individual

sections for the most current Division of Construction guidance and to make full use of the electronic search capabilities; however, the complete download can be printed. The manual holder is responsible for ensuring that the hard copy of the manual is kept up-to-date when manual change transmittals are issued.

- **Bridge Construction Records and Procedures Manual** – Volume 1 was updated May 17, 2016. Volume 2 was updated August 31, 2015

- **Bridge Deck Construction Manual** – Revision No. 1 updated October 30, 2015

- **Falsework Manual** – Revision No. 39, updated June 29, 2016

- **Foundation Manual** – Revision No. 2, updated October 30, 2015

- **Prestress Manual** – Revision No. 02, updated February 28, 2014

- **Trenching and Shoring Manual** – Updated September 12, 2011

9. How does your agency develop and maintain its manuals and guidance documents?

Manuals and guidance documents are developed and maintained on an as-needed basis.

The Construction Manual is updated on an average of once each year to include the policy and procedure changes that have been made since the last publication. Currently, the Construction Manual is being updated to include the changes corresponding to the 2015 Standard Specifications. The current Construction Manual was published in September 2014 and corresponds to the 2010 Standard Specifications.

All sections of the 2010 Standard Specifications were rewritten to meet the plain language requirements as well as to capture revised Standard Specifications. The 2015 Standard Specifications cleaned up any duplication of content and standardized division and section layouts as well as incorporating revised Standard Specifications.

10. How is this information shared with staff?

It is shared with staff through e-mail announcements, list server blasts, and posting to the website.

Resources

11. Is your agency willing to provide links to online manuals or hard copies of the procedure manuals upon request?

See the links provided below:

- [Construction Contract Standards](#)

- [Construction Manual](#)

- [Construction Procedure Directives](#)

- [Construction Policy Bulletins](#)

- [Bridge Construction Records and Procedures Manual, Volume I](#)

- [Bridge Construction Records and Procedures Manual, Volume II](#)

- [Bridge Deck Construction Manual](#)

- [Other Structure Construction technical manuals](#)

- [Other construction-related manuals and handbooks](#)

Training Programs

1. Which of the following methods of delivery are used for the development of construction inspector knowledge and skills? To the extent possible, include the percentage of time spent for each method of delivery: a) hands-on training, b) online training, c) JIT training, d) video training, e) instructor-led training.

   The Division of Constructions has several categories of training: contract administration, inspection, safety, and stormwater pollution prevention plan (SWPPP). The following is based on the courses in the inspection category.

   a. Hands-on training (less than 5%) – Surveying (field exercise)

   b. Online training (50% and growing) – The department is working to develop new eLearning courses and to transfer older instructor-led training courses to online training format as they are updated.

   c. JIT training (unknown) – JIT training is included in the construction contract for new technology and is administrated by the contractor for both the department and contractor staff.

   d. Video training (only components of courses) – The department developed a formal video training program in the 1990s; however, most of the videos have become outdated and are no longer in use. There is isolated usage of videos to present a specific topic in conjunction with other training methods. Videos are more difficult to edit and do not provide interaction and reinforcement.

   e. Instructor-led training (50% and shrinking) – In 2000, the state legislature approved a special budget to create a training office to oversee the development and delivery of training for project delivery. The division's development team established a list of courses to be developed, maintained, and delivered to division staff. The original training method was instructor-led training.

2. What types of initial construction inspection training does your agency provide?

   Department Human Resources staff provides New Employee Orientation. Construction Safety Orientation is a mandatory training for construction staff prior to going to the project site.

   Construction Boot Camp is for field employees with one to six months of experience. It covers controlling materials, recording contractor activities, making payment to the contractor, and taking environmental issues into consideration. SWPPP training was removed from Construction Boot Camp and became separate courses due to the extensive requirements of these courses.

3. What types of continued construction inspection training does your agency provide?

   - ADA inspection

   - Concrete pavement inspection

   - Drainage inspection

   - Dust control on construction projects

   - Earthwork inspection

   - Electrical inspection

   - HMA inspection

   - Landscape inspection

   - Surveying for construction

   - Temporary pedestrian facilities

   - Temporary traffic control

   - Traffic management for construction

   - Traffic stripes and pavement markings

4. Has your agency developed any online construction inspection training courses and testing? If so, please list/describe.

   Various construction contract administration/inspection courses, including:

   - ADA Inspection (under redevelopment*)

   - Concrete Pavement Inspection (under redevelopment*)

   - Dust Control on Construction Projects

   - Earthwork Inspection

   - HMA Basics

   - Temporary Pedestrian Facilities

   - Temporary Traffic Control

   - Traffic Stripes and Pavement Markings

     *Updating materials and converting to eLearning.

5. Has your agency modified its training to accommodate millennials? If so, please explain.

   The movement from traditional classroom-based training to online training is a means to leverage decreasing assets with available technology. Decreasing assets is more than just monetary; it is also the reduction in qualified staff to teach courses. Some districts indicate that they have very few millennial inspectors due a lack of recent hiring.

6. Does your agency develop specialists or generalists? How long does it take to see results?

   Specialists within the Division of Construction are well-established positions (i.e., the positions have been around for many years). The specialty areas are:

   ■ Structure Inspection – Structural Engineering Associate

   ■ Electrical Inspection – Electrical Engineer Classification

   ■ Landscape Specialist – Landscape Architect Classification

   ■ Material Tester – Transportation Engineering Technician (TET) or materials and research engineering associate

   ■ SWPPP Inspection – Selected from current staff or the environmental engineer pool

   ■ Traffic Management & Safety – Selected from current staff

   Results vary, depending on specialty areas and the initial classifications hired on.

7. Does your agency use proficiency testing? If so, please describe.

   TETs require an entrance exam to be placed on a hiring list. Material Testers must maintain their certification for each acceptance test that they perform; certification is maintained by the Caltrans Independent Assurance Program. Resident Engineers are encouraged to complete the resident engineer certificate program.

8. 8Does your agency use/have employee development plans for your construction inspector job series?

   Depending on their specific supervisors, some employees developed their individual development plan based on their self-development goals and after consultation with their supervisors. Supervisors have the authority to determine training needs and employees can only attend training after receiving their supervisor's approval. However, there is no specific individual development plan for the CI job series.

9. How many inspectors does your agency train or certify on an annual basis? How many are DOT? How many are consultants?

   Department-developed courses are for state employees only. Exceptions are when the training is offered to the public (e.g., for small-business recruitment and participation), to contractors (e.g., for extra work billing system), to local agencies, etc. Consultants are expected to be trained by their employer, not by the DOT.

   Since September 2012, Construction staffing has experienced a 22% decrease statewide. As budgets decrease and staffing changes are minimal (especially with no new hires), there is little to no demand for training. In 2015, 167 staff attended inspection-based courses (safety and SWPPP courses were excluded), equating to 1667 hours; compared to 2011, during which 915 staff attended, equating to 12,556 hours.

10. Are inspectors trained at the DOT or at an off-site location?

Mostly in-house training, although we may have some exceptions.

11. How many hours of time are involved (preparing material, teaching, certifying, post-activity)?

- **Course developers:** The Division of Construction headquarters has three full-time permanent senior transportation engineers on staff to develop and maintain construction courses.

- **SMEs:** Knowledgeable staff at the Headquarters and district levels provide time (from their respective budgets) to assist course developers.

- **Instructors (traditional in-class courses):** Knowledgeable statewide senior transportation engineers provide time (from their respective budgets) to attend a training for trainers (T4T), then teach the course(s) in their geographical area.

- **Training coordinators:** This position is staffed with an administrative classification with the duties of coordinating training in their area. Coordination includes assessing area needs, announcing the course(s) schedule, reserving a room(s), printing course materials, purchasing classroom supplies, enrolling staff, and managing instructors. Staffing levels are one full-time employee at headquarters and one part-time employee (from their respective budgets) in each district or region (percent of duties varies per district).

- **Supervisors:** Supervisors review employee training needs and approve training request.

12. What is the operating budget for this program?

The Office of Capital Project Skill Development (CPSD) was formed in 2000 to coordinate the training development effort for the capital outlay support program (aka Project Delivery), which includes the divisions of Design, Construction, Project Management, Engineering Services, Environmental, and Right-of-Way. The state budget provided funding for the CPSD's efforts at $12 million per year for three years.

In 2016, CPSD was renamed Project Delivery Professional Development and its operating budget dropped to $2 million per year (for operating expenditures). Out of this $2 million, the Division of Construction received approximately $170,000 per year in operating budget to fund all its training needs, including training materials, consultant contracts, and travel expenditures. In addition to that annual operating budget, the division continues to staff its training program with three full-time course developers/trainers and a support staff.

13. Are any fees collected (does your agency charge consultants a fee for receiving the training/certification)?

Consultants are required to be trained by their organization prior to working for the department; consultants do not attend department training. In special situations, consultants have been authorized to hire retired state staff to teach a state course with state materials. The consultant bore all direct costs associated with the course.

14. How does your agency identify and develop internal instructors and coaches?

    A request is issued to the district or region to identify SME who could assist in developing the training material and to provide two to three instructors for a newly developed course. For specialty topics, the specialist in that field would become the instructor. For all other courses, volunteers or management-selected senior transportation engineers are the instructors.

    Instructors are encouraged to attend a generic T4T on general teaching skills and are required to attend the course-specific T4T. If the trained instructor must be replaced after a course T4T is held, then the potential new instructor is required to attend the course in a neighboring district as a student.

15. How is training developed? Please describe the development process.

    - **Topic selection:** Topics are prioritized and selected through statewide surveys and upper management input.

    - **Content:** Content is based on the state documents (Construction Manual, Standard Specifications, and Standard Plans) and any relevant background knowledge. SMEs, both in headquarters and in the districts, are solicited to provide input and contribute training materials (e.g., examples and best practices).

    - **Delivery method:** The current policy is to develop the material as an online (eLearning) course whenever possible. If there is a time constraint for training delivery, the course may be offered first as a traditional instructor-led training and then it will be transformed into an eLearning course.

    - **Course materials**

        - **In-Class:** PowerPoint, student manual (where applicable), and instructor manual

        - **eLearning:** Adobe Captivate sharable content object reference model (SCORM) hosted by Moodle[32] on a state server and a student manual (where applicable)

16. How is new information communicated (microlearning, standups with talking points, text blasts, and social media)?

    We communicate it via Construction Policy Bulletins, Construction Procedure Directives, e mail announcements, list server blasts, and posting to the website.

17. How does your agency assess knowledge transfer for updated information?

    Headquarters construction field coordinators review and monitor statewide field activity for consistency with current standards.

18. Has your agency made any adjustments for younger audiences and their learning styles? If so, please explain.

    We have created interactive eLearning to motivate the learner to stay engaged with the materials as opposed to relying on self-motivated learners to read a manual or click through

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32 Moodle™, https://moodle.org/

a PowerPoint.

19. Does your agency have requirements for in-service training? How often? How long?

   ■ **Structures Inspectors:** Annual 16 hours training, and winter training on different select topics each year

   ■ **District Inspectors:** Annual safety and as mandated by Headquarters Construction

   ■ **Material Testers:** As stated in the Independent Assurance Manual[33]

20. How does your agency collect feedback from participants, supervisors, management, contractors, or consultants (surveys, word of mouth)?

   ■ **Traditional in-class courses:** Pre- and post-course content knowledge check questions (Level 2) and post quality/effectiveness of the course questions (Level 1). The Learning Management System administers all questions; however, completion of questions is not a requirement of course completion.

   ■ **Online courses (eLearning):** Post quality/effectiveness of the course questions (Level 1). Questions are administered within the course and are a requirement of course completion.

21. How is feedback that is collected used?

   It is used to improve the course content and better prepare the learner for taking the course.

22. What do you believe are the key elements that make your program successful?

   One element is maintaining and improving on an established training program. Training can become cyclical with the pattern of hiring. In the past, as the number of new hires increased, the training effort would increase. Then the cycle would reach the point of rest when new hires diminished—so goes the training effort. Large breaks in the training development cycle can result in loss of training documents such that course creation is often starting from the beginning, consuming additional resources. It is easier to update a course's content to current standards than it is to recreate a course from scratch.

Qualifications and Certifications

23. What qualifications/certifications does your agency require or use for field inspection technicians?

   Only material testers are required to maintain certification through the Independence Assurance office.

24. What regional (NETTCP, WAQTC, SETFTTQ, M-TRAC, etc.), national (NICET), or other state qualification/certification programs for field inspection does your agency accept or use as an equivalent, if any?

   None.

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33 Independent Assurance Manual, California Department of Transportation,
   http://www.dot.ca.gov/ia-rsp/IA_reports/2005_IA_Manual.pdf

25. Does your agency require or encourage private firm (CEI) field inspection technician personnel to be qualified/certified?

    No.

26. Do you offer pay incentives or compensation for certification?

    - **Registered Professional Engineers** receive an automatic jump to Range D in their classification, with a corresponding pay raise.

    - **Structural, Electrical, and Telecommunications Engineers** receive a Recruitment and Retention pay differential of $300 per month.

    - **TET's** have a retention bonus for years or experience or education level ($423 or $636) and an additional pay differential for working in construction and having completed the Boot Camp training ($241/month).

27. What procedures has your agency introduced along the guidelines enumerated under Section 3, paragraph d of the 23 CFR 637 Quality Assurance (QA) Program for sampling and testing?

    The Independent Assurance Program[34] (IAP).

Career Path Management (employee cross-training)

28. How do you develop the cross-training activities (e.g., contractor/consultant, OJT, informal, formal, manuals, etc.)?

    Our developed courses are available to all staff in Construction. With the development of eLearning courses, other division staff have access to construction courses. The department works through AGC and other organizations when developing a joint course with the contractor (e.g. Joint Training for Material Testing Certification).

    JIT training, when needed, is included in construction contracts. The contractor facilitates the training, a specialist presents it, and both contractor and department personnel attend.

    We identify a training need, identify SMEs or volunteers, develop/provide T4T, or conduct informal training within the work group.

29. What activities are included in your cross-training program (e.g., OJT, job shadow, mentoring, coaching, online training, external training, internal training, job rotation, etc.)?

    Roadway (district) inspectors receive training on all topics, including electrical, landscape, and structures, even if they do not inspect those items, so there is an awareness of what is required. The department provides some joint training with the contractors: Partnering, Construction Zone Enhanced Enforcement Program and HMA QCQA (now obsolete). The department provides training in a formalized Rotational Professional Engineering Development Program to all newly hired engineers. In addition to online training, informal training such as OJT, job rotation, and mentoring programs are available. All state manuals are available on the internet.

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34 Independent Assurance Program, Office of Roadway Materials Testing, Materials Testing and Engineering Services, California Department of Transportation, http://www.dot.ca.gov/hq/esc/Translab/ormt/IA_reports/

30. What are the key competencies, skills, and milestones that someone climbing the ladder has to acquire before they are placed in a position of responsibility?

- **Resident Engineers** (TE, Range D) have a defined career path to complete training as described in the resident engineer certificate program. Upper management recognizes them for achieving this accomplishment.

- **Construction Engineers** (senior TE), first-level supervisors, must be licensed engineers, pass a promotional exam, and go through the interview process.

- Other possible attributes: possession of technical and soft skills, completion of resident engineer workshop, resident engineer certificate, and other lab testing certificates

Expand New Innovations and Technologies

31. How is technology used in the development of curriculum?

We use SurveyMonkey[35] for input from learners, supervisors, and management statewide. We use e mails and webinars (Adobe Connect[36]) for communication.

32. How is technology used in the delivery of training?

We use:

- Our intranet for communicating program information

- The Moodle platform on a department server for hosting eLearning courses

- A learning management system for registering students for traditional and eLearning courses and tracking course completion

- E-mail for course announcements.

33. How is your agency keeping up-to-date and assessing current materials?

A developer is assigned to each course and is responsible for the content. Feedback on course issues is received from instructors for traditional courses and learners for eLearning courses.

34. Is there a set of guidelines on the cadence of when materials are updated?

With constantly changing department documents, most courses have items that could be updated. Course content is reviewed based on various factors.

- Is the course still teachable? For traditional courses, can the instruction delivery be changed? For eLearning, can a simple information block be added?

- Is there a current demand for the course? How many learners statewide need the course? Everyone may have already been trained and the division has no new staff to train or the changes are major and all field-based staff will be required to take the course.

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35 SurveyMonkey, https://www.surveymonkey.com/
36 Adobe Connect, Adobe Systems Incorporated, http://www.adobe.com/products/adobeconnect.html

■ Are there issues in the field (e.g., poor inspection resulting in an unacceptable product)?

■ Is the training required due to a consent decree order?

Innovative Contracting

35. Does your agency utilize a "risk-based audit" approach to construction inspection? If so, please explain.

   During staffing reductions, the division has developed levels of inspections and distributed them statewide. Inspection levels are being incorporated into the Construction Manual for all highway construction items of work.

36. Does your agency provide special guidance on construction inspection considerations for projects that are on an accelerated schedule? For example, projects that are being constructed during the night or on weekends as well as projects that consist of more than one work shift. If so, please describe.

   Night and weekend work is standard operating procedure for urban areas. Supervisors schedule staff to cover extended night shifts and 72-hour weekend closures as efficiently as possible.

37. Does your agency provide pay differential for work being performed during the night or on weekends?

   Union contracts specify the pay differential for night work. TETs are members of Bargaining Unit 11, Service Employees International Union 1000. TEs are members of Bargaining Unit 9, Professional Engineers in California Government.

38. To what extent does your agency utilize consultant engineering inspection services?

   Consultants are hired to smooth out peak work demands, preventing excessive hiring and substantial layoffs.

39. Does your agency have a process for confirming that certified construction inspectors are performing their construction inspection duties as required? If so, please describe this process.

   Starting in 2000, we began performing annual contract administration process evaluations statewide. Headquarters office chiefs and districts nominate a list of potential review topics; Headquarters selects the final topics. Headquarters hires a consultant to review the selected topics, with assistance and support provided by both Headquarters and districts SMEs.

   Supervisors are responsible for checking the work of their staff routinely and performing a periodic individual development plan for each employee.

   There is no specific process to certify inspectors, who are civil engineers or engineering technicians. Some material testing requires certification that is done periodically through testing.

40. What certification makes sure the contractor has the skills needed?

Contractor license.

41. How does your agency pretest to make sure the contractor can deliver?

   Contractors and subcontractors are required to be registered with the Department of Industrial Relations. Registration confirms that a contractor or subcontractor has workers' compensation insurance coverage, a valid Contractors State License Board license, no delinquent unpaid wage or penalty assessment owed to any employee or enforcement agency, no federal or state debarment, and no registration violation in the past 12 months.

Organizational Hiring (Recruiting) and Retention Practices

42. If your agency hires or promotes from within, how do you identify candidate employees?

   The department advertises the available position through an e-mail blast and on its website. Selection is through competitive application process, promotional exams and position-specific interviews.

43. Does your agency recruit field inspection technicians? If so, what skills or competencies does your agency look for in a potential recruit?

   Selection is based on experience in similar work, knowledge of engineering and construction practices, familiarity with construction plans, ability to analyze complex situations, ability to make effective and viable decisions, problem-solving skills, the ability to communicate effectively, and the possession of soft skills.

   - **TETs**: Two years of education beyond 12th grade in engineering or surveying or equivalent work experience. They are required to pass a math-based exam and are ranked on a hiring list per their score.

   - **TEs (Range A)**: Graduation from a four-year curriculum in civil engineering accredited by the Accreditation Board for Engineering and Technology[37].

44. What is the ramp-up time for new hires?

   Ramp-up time is dependent on the on new hire's experience and the on the task to be performed. Experienced staff coach new hires, who attend related training classes. It typically takes three to six months for a new, green employee to be productive.

45. Succession Planning—Does your agency use 9-box grid or other methods to identify and develop internal candidates?

   No.

46. Does your agency have a field training opportunity program? What qualifications does someone need to be a coach?

   Yes, there is a rotation program for field staff. Coaches need to have experience, technical knowledge, and be willing to coach another.

47. What turnover issues, if any, has your agency identified related to construction inspector

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37   Accreditation Board for Engineering and Technology, http://www.abet.org/

positions?

Entry-level engineers with a four-year engineering degree and EIT certificate will move up through the career ranks and leave the field inspector-level position. TETs have limited upward mobility and provide a more stable inspection force.

The aging of existing staff makes it difficult to maintain the different shift requirements. As inspectors leave, so does the knowledge. Productivity/quality is impacted until that experience is replaced by another. We have experienced a lack of hiring new staff into inspector positions in recent years.

48. How does the average retention rate compare to other categories?

Most districts experience higher turnover in senior/supervisory classifications. Most leave to work for the private sector, which offers better pay.

49. How do you provide new staff the range of impacts/outcomes affecting or affected by decisions (impact to quality, costs, future projects, claims, etc.)?

We provide it through coaching, mentoring, and sharing past experiences/lessons learned.

Colorado Department of Transportation

Organizational Knowledge Transfer/Knowledge Management Initiatives

Communities of Practice

1. Does your agency use any knowledge management or knowledge transfer techniques such as communities of practice to train field inspection technicians? If so, please describe.

Construction Inspector Certification Program and Registration Information

Eight categories of inspection training have been developed:

- Basic Highway Math*

- Basic Construction Surveying*

- Basic Highway Plan Reading*

- Basic Materials

- Excavation and Embankment*

- Asphalt Paving Inspection

- Concrete Construction Inspection

- Stormwater Management and Erosion Control

*CDOT has developed self-study manuals for these entry-level certification courses.

All CIs—whether from CDOT or a consultant—must demonstrate proficiency by passing an exam and earning certification within the developed categories.

2. Does your agency hold or convene annual or other scheduled meetings or workshops with construction inspectors to discuss areas of concern or interest? If so, please describe.

   CDOT conducts a residency visit annually, which is combined with a mixture of staff and other topics and materials training.

Mentoring Programs

3. Does your agency use mentoring to develop construction inspectors? If so, please describe.

   CDOT does not have a mentoring program for CIs.

Preretirement Knowledge Management Activities

4. Which techniques does your agency use to capture tacit knowledge or "tribal knowledge" before someone retires (standard work instructions, job shadowing, etc.)? Please explain.

   CDOT does not have a formal process for knowledge transfer.

Best Practice Sharing Within the Agency

5. Has your agency conducted "after action reviews" or documented lessons learned or case studies? If so, please describe.

   CDOT does not have a requirement or formal process for documenting lessons learned.

6. What methods or avenues does your agency use to keep inspectors informed of inspection techniques or requirements?

   CDOT distributes changes by notifying resident engineers, including information at the annual residency visits, and has a website that provides updated information.

Procedure Manuals

7. How current are your agency's manuals and guidance documents?

   CDOT updates the Construction Manual as needed with construction bulletins and conducts and prepares a formal update every five years.

8. How does your agency develop and maintain its manuals and guidance documents?

   CDOT has formal process to distribute the construction bulletins to staff by e-mail. These updates are also available on the CDOT Bulletins and Manuals website[38].

9. How is this information shared with staff?

   An e-mail memo is distributed to the resident engineers and other staff when the updates are made.

Training Programs

1. Which of the following methods of delivery are used for the development of construction

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38 Bulletins and Manuals, Business Center, Colorado Department of Transportation,
   https://www.codot.gov/business/designsupport/bulletins_manuals

inspector knowledge and skills? To the extent possible, include the percentage of time spent for each method of delivery: a) hands-on training, b) online training, c) JIT training, d) video training, e) instructor-led training.

a. Online self-study manuals – 9%

b. Instructor Led Training – 91%

2. What types of initial construction inspection training does your agency provide?

There are self-study manuals for four of the entry-level certification courses: Basic Highway Math, Basic Highway Plan Reading, Basic Surveying, and the Excavation & Embankment Manual.

3. What types of continued construction inspection training does your agency provide?

CDOT has a series of engineering courses:

- Core Curriculum (gives a high-level view of the project lifecycle)

- Materials Training (in development)

- Writing for Engineering Professionals

- Survey Basics

- Plan Checking

- Reading Structural Plans

- CPM Scheduling

- Construction Project Administration

- Managing Contract Time

4. Has your agency developed any online construction inspection training courses and testing? If so, please list/describe.

In fiscal year 2017, we are developing an e-learning course for materials.

5. Has your agency modified its training to accommodate millennials? If so, please explain.

CDOT has not modified training for millennials.

6. Does your agency develop specialists or generalists? How long does it take to see results?

CDOT does not develop specialists. The training offered at CDOT would be categorized as training for generalists.

7. Does your agency use proficiency testing? If so, please describe.

Yes, for the core tests (math, plan reading, and surveying). The employee or consultant employee is required to achieve a score of at least 70% for the Basic Highway Math, Basic Highway Plan Reading and the Basic Construction Surveying tests.

8. Does your agency use/have employee development plans for your construction inspector job series?

   CDOT has a program and uses career mapping to help guide supervisors and employees. These maps are in development.

9. How many inspectors does your agency train or certify on an annual basis? How many are DOT? How many are consultants?

   Based on monthly tests given by CDOT, it is estimated that 100 to 250 inspectors are certified annually; of those, 20 to 30% are CDOT employees.

10. Are inspectors trained at the DOT or at an off-site location?

    Testing is done on-site for core tests. The specialty certifications (i.e., CAPA Asphalt Inspection, WAQTC, and Major Structures) are only required when an inspector is working on a project where that kind of work is performed.

11. How many hours of time are involved (preparing material, teaching, certifying, post-activity)?

    Material preparation time takes about one to two hours. Testing time is 90 minutes each; the tests are graded during testing time. It takes about two hours to send out pass/fail letters and certificates and post certifications. Testing is available once a month for all three core tests (i.e., math, plan reading, and surveying.)

12. What is the operating budget for this program?

    For the Transportation Engineering Training Program (TETP) program, CDOT hires consulting firms to help us develop and deliver training. This is about $860,000 annually. CDOT's staff time and training time is paid by staff salaries and is not included in the TETP budget. Staff time is estimated to be approximately 40 hours per year; this time includes the employee's preparation and instruction time. TETP has approximately 50 trainers. The cost is approximately $200,000 per year.

13. Are any fees collected (does your agency charge consultants a fee for receiving the training/certification)?

    CDOT charges $25 per test.

14. How does your agency identify and develop internal instructors and coaches?

    For the Inspector Certification Program, instructors are identified by the Inspector Program Steering Committee, which includes engineers from construction, materials, and bridges; these instructors also proxy the core tests. For the TETP courses, CDOT builds the instructor base by working with SMEs. These experts must be certified as trainers by taking the train-the-trainer course and are given the course's facilitator guide to prepare them for instructing the course.

15. How is training developed? Please describe the development process.

We develop training through our TETP. To develop or update a course, CDOT identifies a need, develops a scope, and works with SMEs and the TETP's consultant team, which includes an instructional designer. Once this process is complete, the SMEs review the course and the course is delivered. If the course is new, CDOT often pilots the course with specific attendees who will help ensure that the course meets its objectives.

16. How is new information communicated (microlearning, standups with talking points, text blasts, social media)?

We announce new courses by notifying staff on the CDOT website, public announcements, which is sent out as a blast e-mail, and through the region training coordinators.

17. How does your agency assess knowledge transfer for updated information?

Each student is asked to submit a course review; the results are combined and reviewed annually. A survey is sent to engineering staff at the end of the fiscal year to determine the overall feel for course needs.

18. Has your agency made any adjustments for younger audiences and their learning styles? If so, please explain.

CDOT has not made any adjustments for different audiences.

19. Does your agency have requirements for in-service training? How often? How long?

CDOT does not have an in-service training requirement.

20. How does your agency collect feedback from participants, supervisors, management, contractors, or consultants (surveys, word of mouth)?

A survey is conducted at the end of each course on the course materials and instructor ability, and then the TETP combines and analyzes the results. CDOT also conducts an annual survey of engineering staff to determine the engineering training needed for the next year.

21. How is feedback that is collected used?

A survey is conducted at the end of each course on the course materials and instructor ability, and then the TETP combines and analyzes the results. CDOT also conducts an annual survey of engineering staff to determine the engineering training needed for the next year. If the survey results determine a need to add or revise a course, that is noted and done at the next opportunity.

Qualifications and Certifications

22. What qualifications/certifications does your agency require or use for field inspection technicians?

The Inspector Qualification Board of Directors has developed the following policies regarding prerequisites, certification requirements and program implementation.

Required Prerequisite Classes

- Technical Series (EPS Assistant I through EPS Technician III)

  - Basic Highway Math

  - Basic Highway Surveying

  - Basic Highway Plan Reading

  - Erosion Control Supervisor

- Professional Series (EIT I through EIT III)

  - Basic Highway Surveying

  - Basic Highway Plan Reading

  - Erosion Control Supervisor

The specialty certifications, such as CAPA Asphalt Inspection, WAQTC, and Major Structures, will only be required when an inspector is working on a project where those items of work are performed. For example, a person working on an asphalt overlay would need the prerequisites plus the CAPA Asphalt Inspection; a person working on an embankment would need the prerequisites plus the WAQTC soils. The specialty training requirements apply to the full range of both the technical and professional series listed above.

23. What regional (NETTCP, WAQTC, SETFTTQ, M-TRAC, etc.), national (NICET), or other state qualification/certification programs for field inspection does your agency accept or use as an equivalent, if any?

    CDOT accepts the WAQTC.

24. Does your agency require or encourage private firm (CEI) field inspection technician personnel to be qualified/certified?

    CDOT does encourage everyone supporting a CDOT construction project to be certified.

25. Do you offer pay incentives or compensation for certification?

    CDOT does not offer incentives or compensation for certification.

26. What procedures has your agency introduced along the guidelines enumerated under Section 3, paragraph d of the 23 CFR 637 Quality Assurance (QA) Program for sampling and testing?

    CDOT does not take a PE license or EIT certification as qualification.

Career Path Management (Employee Cross-Training)

27. How do you develop the cross-training activities (e.g., contractor/consultant, OJT, informal, formal, manuals, etc.)?

TETP training classes (instructor-led training and eLearning) are available to our outside partners to learn the CDOT processes.

28. What activities are included in your cross-training program (e.g., OJT, job shadow, mentoring, coaching, online training, external training, internal training, job rotation, etc.)?

Mentoring, online training, external training, and OJT

Expand New Innovations and Technologies

29. How is technology used in the development of curriculum?

Storyline[39], Google Docs[40] and ProjectWise[41] are used to store, develop, and share course material.

30. How is technology used in the delivery of training?

eLearning courses are in our LMS.

31. How is your agency keeping up-to-date and assessing current materials?

We review evaluations and course materials with instructors and SMEs after every class.

32. Is there a set of guidelines on the cadence of when materials are updated?

They are updated as needed for every class.

Innovative Contracting

33. Does your agency utilize a "risk-based audit" approach to construction inspection? If so, please explain.

CDOT does a risk-based audit on design build projects. Our contract technical requirements are put into a database that we query to develop audit reports. This allows us to develop data on technical requirements and track and trend those requirements. Any requirements that are found to be consistently or chronically in nonconformance will be flagged and CDOT can adjust its resource loading and increase its observation and audit of that work breakdown structure element. Risk is also considered with each WBS element. Each element is assigned a level of risk and the higher the risk the more critical the construction of that element becomes.

34. Does your agency provide special guidance on construction inspection considerations for projects that are on an accelerated schedule? For example, projects that are being constructed during the night or on weekends as well as projects that consist of more than one work shift. If so, please describe.

Accelerated-schedule projects are taken on a case-by-case basis. If the work can be inspected at the end of the shift during normal working hours, then that is when the inspection happens. If the work must be observed during nights or weekends, then we have testers and inspectors on site during these shifts.

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39 Storyline 360, Articulate Global, Inc., https://articulate.com/360/storyline

40 Google Docs, Google, https://www.google.com/docs/about/

41 ProjectWise, Bentley Systems Incorporated, https://www.bentley.com/en/products/brands/projectwise

35. Does your agency provide pay differential for work being performed during the night or on weekends?

CDOT inspectors and testers receive a pay differential when working outside of their normal working time.

36. To what extent does your agency utilize consultant engineering inspection services?

At CDOT, the mix is typically split 50/50 between CDOT and consultant staff. Consultant staff are mainly used for construction inspection and testing services.

37. Does your agency have a process for confirming that certified construction inspectors are performing their construction inspection duties as required? If so, please describe this process.

Yes, project staff are required to meet the minimum requirements set by CDOT for inspection and testing.

38. What certification makes sure the contractor has the skills needed?

CDOT keeps record of the people who are certified through its program. Teams submitting proposals for the project must meet minimum qualifications based on the request for qualification.

39. How does your agency pretest to make sure the contractor can deliver?

CDOT does not pretest.

Organizational Hiring (Recruiting) and Retention Practices

40. If your agency hires or promotes from within, how do you identify candidate employees?

We announce individual positions as departmental promotional (i.e., open only to CDOT employees) or open competitive (i.e., open to the public as well as our own employees) based on hiring manager/region/division preference. Each announcement lists minimum requirements that the hiring manager and human resource specialist identify that an individual must meet to apply for the position. Positions are posted on the CDOT website and the State of Colorado Job Opportunities website.

41. Does your agency recruit field inspection technicians? If so, what skills or competencies does your agency look for in a potential recruit?

CDOT hires CIs in our Engineering Physical Sciences Assistant (I, II, III levels) and Technician (I, II, III levels) classifications. Each level has required minimum qualifications (related education and/or experience) that correspond. An applicant cannot be considered for the position unless they meet those qualifications. From there, candidates are assessed based on their job-related knowledge and skills. Here are some typical primary competencies, which were taken from a job announcement:

- Highest work/personal ethics and integrity

- Knowledge and experience with highway transportation design, construction, inspection, and materials testing

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- Knowledge of the CDOT Field Materials Manual and the CDOT Construction Manual

- Knowledge and experience in reading and interpreting engineering project plans

- Knowledge and experience with the Manual on Uniform Traffic Control Devices

- Strong mathematical skills

- Strong interpersonal and relationship building skills

- Excellent oral and written communication skills

- Strong attention to technical detail and accuracy

- Ability to work effectively in both independent and team situations

- Proven ability to manage multiple assignments, priorities, and projects in a demanding environment

- Ability to work under tight deadlines and be adaptable to changing assignments

- Strong time and project management skills, including prioritization and multitasking ability

- Strong time management skills

- Ability to take initiative to solve problems in an innovative manner

- Ability to work with diverse stakeholders

- Excellent reasoning, investigative, analytical, and problem solving ability

- Passion for safety

- Ability to organize, analyze, and interpret numerical data

- Excellent MS Office Suite (Word, Excel), Gmail, and SAP skills, and the ability to quickly learn new software

42. What is the ramp-up time for new hires?

This varies, depending on the employee and position. It expected that employees will start their duties immediately. The hiring manager would gear assignments to fit the need and each individual's ability. On a side note, it does take approximately one to two weeks to get a new employee set up with computer access.

43. Succession Planning—Does your agency use 9-box grid or other methods to identify and develop internal candidates?

The department currently does not have a targeted succession planning program.

44. Does your agency have a field training opportunity program? What qualifications does someone need to be a coach?

The department currently does not have a targeted field training opportunity program.

Florida Department of Transportation

Organizational Knowledge Transfer/Knowledge Management Initiatives

Communities of Practice

1. Does your agency use any knowledge management or knowledge transfer techniques such as communities of practice to train field inspection technicians? If so, please describe.

   1. No.

2. Does your agency hold or convene annual or other scheduled meetings or workshops with construction inspectors to discuss areas of concern or interest? If so, please describe.

   No.

Mentoring Programs

3. Does your agency use mentoring to develop construction inspectors? If so, please describe.

   We have experience requirements for several of our qualifications. Consultant inspection staff provide construction inspection and rely on consultant engineering firms to train the inspectors.

Best Practice Sharing Within the Agency

4. How do you convey your decision-making processes/practices (methods, considerations, levels of authority, communications, etc.)?

   Our process is conveyed through contracts, procedures, specifications, and manuals.

Procedure Manuals

5. How current are your agency's manuals and guidance documents?

   Most manuals in our construction office have a two-year review cycle.

6. How does your agency develop and maintain its manuals and guidance documents?

   Positions are assigned responsibility for a manual or for manual chapters; these positions oversee the review and updates to manuals.

7. How is this information shared with staff?

   Manuals are posted on our website. E-mail notifications are distributed to interested parties.

Resources

8. Is your agency willing to provide links to online manuals or hard copies of the procedure manuals upon request?

   Yes.

Training Programs

1. Which of the following methods of delivery are used for the development of construction inspector knowledge and skills? To the extent possible, include the percentage of time spent for each method of delivery: a) hands-on training, b) online training, c) JIT training, d) video training, e) instructor-led training.

   Consultant staff are utilized as our inspection staff. The consultant engineering firms contracted to provide inspection to projects determine the methods used.

2. What types of initial construction inspection training does your agency provide?

   FDOT requires qualification inspectors must have the necessary qualifications to perform the work. We manage the program that issues these qualifications. The CEI firm that employs the inspector would provide any initial training.

3. What types of continued construction inspection training does your agency provide?

   The training qualification program requires requalification to maintain the qualification.

4. Has your agency developed any online construction inspection training courses and testing? If so, please list/describe.

   - CBTs: Drilled Shaft, Pile Driving; many CBT pending development

   - Exam: Pending development or purchase of acceptable platform to house exams

5. Does your agency use proficiency testing? If so, please describe.

   Yes, several of our qualifications utilize proficiency exams in addition to written exams. These proficiency exams require that the trainee successfully complete field and lab testing methods.

6. How many inspectors does your agency train or certify on an annual basis? How many are DOT? How many are consultants?

   - 7,400 inspectors hold active qualification.

   - Each qualification held must be requalified every five years.

   - An inspector may hold only one qualification or several.

   - All inspectors are consultants.

7. Are inspectors trained at the DOT or at an off-site location?

   Most CTQP training is held at off-site locations. If a district works with a provider to schedule a course, that course may be held at an FDOT location.

8. How many hours of time are involved (preparing material, teaching, certifying, post-activity)?

9. This is unknown since these activities (certifying, posting, etc.) are contracted to an administrator. The teaching of the material is a free-market activity conducted by approved

providers. The specialty area's technical review team prepares the materials or that work is contracted out.

10. What is the operating budget for this program?

The CTQP is self-supporting through fees. FDOT has a $300,000 budget allotment to maintain FDOT personnel qualifications.

11. Are any fees collected (does your agency charge consultants a fee for receiving the training/certification)?

The CTQP is an open-market program where approved providers charge for training sessions and exams for all trainees, FDOT and consultant.

12. How does your agency identify and develop internal instructors and coaches?

Our technical review teams are tasked with review and recommendation of approval for all approved instructors in our program.

13. How is training developed? Please describe the development process.

Training is developed as needed via contract with a consulting engineering firm. Most of the program's training was developed at the program's inception and has only needed updating to the materials.

14. Has your agency made any adjustments for younger audiences and their learning styles? If so, please explain.

No, not yet.

15. Does your agency have requirements for in-service training? How often? How long?

Qualification is good for five years; after that time, the inspector must requalify to continue inspecting.

16. How does your agency collect feedback from participants, supervisors, management, contractors, or consultants (surveys, word of mouth)?

Yes, there is a survey for trainees. We also follow up on any feedback we receive from other sources (e.g., word of mouth).

17. How is feedback that is collected used?

We follow up on issues found from surveys/feedback through the technical review teams and make corrections/adjustments in our courses and exams.

18. What do you believe are the key elements that make your program successful?

All participants in the program working together as a team

Qualifications and Certifications

19. What qualifications/certifications does your agency require or use for field inspection technicians?

    We require CTQP qualification in specialty areas for our field and lab inspectors and technicians.

20. What regional (NETTCP, WAQTC, SETFTTQ, M-TRAC, etc.), national (NICET), or other state qualification/certification programs for field inspection does your agency accept or use as an equivalent, if any?

    None.

21. Does your agency require or encourage private firm (CEI) field inspection technician personnel to be qualified/certified?

    We require qualifications.

22. What procedures has your agency introduced along the guidelines enumerated under Section 3, paragraph d of the 23 CFR 637 Quality Assurance (QA) Program for sampling and testing?

    We created the Construction Training Qualification Program and developed the Construction Training Qualification Manual.

Expand New Innovations and Technologies

23. How is your agency keeping up-to-date and assessing current materials?

    Material is under constant review by area-specific technical review teams.

24. Is there a set of guidelines on the cadence of when materials are updated?

    No.

Innovative Contracting

25. Does your agency utilize a "risk-based audit" approach to construction inspection? If so, please explain.

    Specialty area offices conduct audits under the mandate of that office.

26. To what extent does your agency utilize consultant engineering inspection services?

    100%

27. Does your agency have a process for confirming that certified construction inspectors are performing their construction inspection duties as required? If so, please describe this process.

    Specialty area engineering staff and construction project staff conduct audits and reviews.

28. What certification makes sure the contractor has the skills needed?

    That is unknown to this office. We ensure inspector qualification not contractor certification.

29. How does your agency pretest to make sure the contractor can deliver?

    That is unknown to this office.

Organizational Hiring (Recruiting) and Retention Practices

30. If your agency hires or promotes from within, how do you identify candidate employees?

    Employment is based on the application process.

Georgia Department of Transportation

Organizational Knowledge Transfer/Knowledge Management Initiatives

Communities of Practice

1. Does your agency use any knowledge management or knowledge transfer techniques such as communities of practice to train field inspection technicians? If so, please describe.

   Yes, GDOT utilizes a variety of methods to share knowledge within the construction inspection area. GDOT holds an annual Project Engineer's Academy, bringing together similarly titled individuals to disseminate training and foster an open dialogue between project managers from different parts of the state. Lower level inspectors and technicians are provided training opportunities and the ability to attend multiple annual workshops and seminars related to their job functions. Several communities of practice have been engaged with success in terms of idea sharing and practical learning. Two of GDOT's strongest communities include our Practical Design Training, Roundabout Alternative Intersection Design and our Traffic Incident Management Enhancement groups.

2. Does your agency hold or convene annual or other scheduled meetings or workshops with construction inspectors to discuss areas of concern or interest? If so, please describe.

   Annual training workshops and seminars for construction personnel include Bituminous Asphalt Construction, Bridge Construction, Traffic Control, and Erosion Control, as well as training and certification/recertification for topics such as field concrete testing.

   In 2015, GDOT revived the Georgia Transportation Partnership for Construction, an annual and ongoing workshop/conference to bring together GDOT construction and industry to share and disseminate ideas, knowledge, and concerns.

Mentoring Programs

3. Does your agency use mentoring to develop construction inspectors? If so, please describe.

   District Construction utilizes an informal mentoring process within the individual offices. This consists of placing new or less experienced personnel with more experienced project inspectors and managers to foster knowledge transfer.

Preretirement Knowledge Management Activities

4. Which techniques does your agency use to capture tacit knowledge or "tribal knowledge" before someone retires (standard work instructions, job shadowing, etc.)? Please explain.

   At one point, we conducted extensive preretirement KM interviews; however, the data has not been utilized much. One challenge is that the jobs and structure of the department change so fast, in some respects the way things "were done in the old days" are hardly "relevant" any more.

Best Practice Sharing Within the Agency

5. Has your agency conducted "after action reviews" or documented lessons learned or case studies? If so, please describe.

   GDOT conducts post-construction evaluations of selected projects to discuss lessons learned in areas of constructability, change orders, quantity estimation, contract time, future maintenance issues, etc.

6. What methods or avenues does your agency use to keep inspectors informed of inspection techniques or requirements?

   GDOT maintains the following resources for construction inspection personnel:

   ■ Continual updates to Construction Manual as necessary

   ■ E-mail dissemination of changes to policies and practices

   ■ Annual workshops and seminars

   ■ Engineering skills development courses for lower and entry-level inspectors

7. GDOT also holds Project Engineer's Academy for senior inspectors and project managers. This off-site, two-week training brings together construction personnel and SMEs from various offices.

Procedure Manuals

8. How current are your agency's manuals and guidance documents?

   ■ **Specifications Manual** – 2013, with supplemental specifications issued as they are developed; special provisions to the specifications are developed for specific projects

   ■ **Construction Manual** – continually updated as necessary

   ■ **Construction Standards & Details** – revised and updated as necessary and approved

   Online training materials are currently being developed in coordination with Georgia Tech Research Institute for Construction Inspection based on GDOT Specifications and Construction Manuals.

9. How does your agency develop and maintain its manuals and guidance documents?

   The State Construction Office, in coordination with SMEs, develops the specifications and the Construction Manual. The Office of Design Policy & Support, in coordination with SMEs, develops the Construction Standards & Details.

10. How is this information shared with staff?

Manuals and guidance are maintained electronically (i.e., online on the GDOT website). Printed versions are available and are distributed to construction employees.

Training Programs

1. Which of the following methods of delivery are used for the development of construction inspector knowledge and skills? To the extent possible, include the percentage of time spent for each method of delivery: a) hands-on training, b) online training, c) JIT training, d) video training, e) instructor-led training.

   The Division of Constructions has several categories of training: contract administration, inspection, safety, and SWPPP. The following is based on the courses in the inspection category.

   - Hands on training (70%) – GDOT places new or less experienced inspectors with seasoned inspectors and project managers in the field to develop construction inspection competence. Complexity of work also dictates the extent of the hands-on training.

   - Online training (5%) – GDOT offers various online training to CIs and is in the process of developing an online, self-paced construction inspection course. External online training (NHI, AASHTO, etc.) is also promoted for CIs.

   - JIT training (5%) – GDOT provides project-specific JIT training as needed for new construction practices, such as Drilled Shafts and a High-Friction Surface Course.

   - Video training – Video training is seldom used but some construction inspection training is available.

   - Instructor-led training (20%) – GDOT offers many instructor-led training courses, including Traffic and Erosion Control, Bridge Construction, Asphalt Construction, Concrete Testing, etc. GDOT also has what we call our Engineering Skills Development Series of self-paced learning texts, which provides that basic core of materials critical for on-the-job knowledge as well as standards for promotion. The program has been around since the mid 1990s, when it was called Programmed Instructional Texts.

2. What types of initial construction inspection training does your agency provide?

   Formal initial construction inspection training includes GDOT's Engineering Skills Development programmed texts, covering these topics:

   - Plan Reading

   - Construction Surveying

   - Highway Math

   - Asphalt Paving

   - Base Course Inspection

   - Excavation & Embankments

- Bridge & Structures Inspection

- Portland Concrete Inspection

GDOT also offers certifications for new inspectors in the areas of Worksite Erosion Control, Georgia Soil & Water Conservation Commission Level 1-A, Field Concrete Testing, as well as the annual workshops and seminars listed above. Informal training is primarily hands-on training in the field.

3. What types of continued construction inspection training does your agency provide?

    We offer continuing recertification for Worksite Erosion Control, Georgia Soil & Water Conservation Commission Level 1-A, field concrete testing and annual workshops and seminars for bridge and asphalt construction and traffic and erosion control.

4. Has your agency developed any online construction inspection training courses and testing? If so, please list/describe.

    GDOT is in the process of developing an online training series of courses for construction inspection with Georgia Tech. SMEs developed the topics and points covered and it has been submitted to GDOT for approval but has not been adopted and implemented yet.

5. Has your agency modified its training to accommodate millennials? If so, please explain.

    Yes, GDOT's Construction Manual and Field Construction Memoranda used to be hard copies that were distributed and updated manually. Now both are maintained on web-based applications. This also includes The Source[42], a one-stop repository of information that includes specifications, Construction Office guidance, standards and details, and sampling and testing requirements and information.

6. Does your agency develop specialists or generalists? How long does it take to see results?

    As GDOT has lost vast amounts of knowledge through attrition and force reductions over the years, the need for knowledge retention in specialized areas has become paramount. At the agency level, this topic is being discussed and emphasis is being placed on creating the framework to regain what was once common. In my district, we began an Enhanced Bridge Training Program, where we identified individuals with the aptitude and attitude to take on this responsibility and placed them with a retired GDOT bridge liaison over the course of a year. During this time, these individuals gain more specific knowledge through enhanced training and site visits to bridge projects of varying complexity across the region. Most of our inspection staff, however, are generalists.

7. Does your agency use proficiency testing? If so, please describe.

    Our Engineering Skills Development courses have a proctored testing requirement.

8. Does your agency use/have employee development plans for your construction inspector job series?t

    Yes. Each employee may have an individual development plan associated with his or

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42 The Source, Georgia Department of Transportation, http://www.dot.ga.gov/PS/Business/Source

her performance evaluations; this plan is generated by the manager. Often, construction inspection employees' development plans are related to developing their skill sets in construction inspection.

9. How many inspectors does your agency train or certify on an annual basis? How many are DOT? How many are consultants?

   GDOT currently has 216 construction inspection staff, who all are trained annually. Some certifications are annual, most are valid for three years so there is a rolling certification process to keep all employees current.

10. Are inspectors trained at the DOT or at an off-site location?

    They are trained at GDOT, except for Project Engineer's Academy, which is off-site.

11. Are any fees collected (does your agency charge consultants a fee for receiving the training/ certification)?

    Most training is internal and therefore is no-cost. GDOT currently contracts out its Worksite Erosion Control Training to a consultant.

Qualifications and Certifications

12. What qualifications/certifications does your agency require or use for field inspection technicians?

    GDOT Worksite Erosion Control Supervisor, Georgia Soil & Water Conservation Commission Level 1 A, GDOT Field Concrete Testing

13. What regional (NETTCP, WAQTC, SETFTTQ, M-TRAC, etc.), national (NICET), or other state qualification/certification programs for field inspection does your agency accept or use as an equivalent, if any?

    GDOT does not require regional or national certifications for construction inspection.

14. Does your agency require or encourage private firm (CEI) field inspection technician personnel to be qualified/certified?

    Yes, CEIs are required to possess the same qualifications/certifications GDOT inspectors possess.

15. Do you offer pay incentives or compensation for certification?

    No.

Career Path Management (Employee Cross-Training)

16. How do you develop the cross-training activities (e.g., contractor/consultant, OJT, informal, formal, manuals, etc.)?

    Cross-training is encouraged if it does not violate existing GDOT HR policy or give unfair advantage to individual employees and is done as workload allows.

17. What activities are included in your cross-training program (e.g., OJT, job shadow, mentoring, coaching, online training, external training, internal training, job rotation, etc.)?

Job shadowing is encouraged if it does not violate existing GDOT HR policy or give unfair advantage to individual employees and is done as workload allows to a lesser extent than cross-training. This past year we have partnered with a local university to conduct a job shadowing pilot program. The concept was tested in several districts with solid success. We are in the process of developing a larger, more organized program now. One challenge is how to manage the program on a large-scale versus the organic practices we have experienced in the past.

18. What are the key competencies, skills, and milestones that someone climbing the ladder has to acquire before they are placed in a position of responsibility?

19. Each successive construction title has specific job duties and required skills. As employees gain experience and knowledge and demonstrate the ability to perform these functions, consideration for promotion increases. Promotion within GDOT for field construction inspection is based on the agency's and/or the individual offices' need for certain titles.

Expand New Innovations and Technologies

20. How is technology used in the development of curriculum?

As GDOT transitions to e-Construction[43], the use of technology is becoming integral to its function. Inspectors will soon utilize tablets in the field for construction inspection, measurement and payment, and plans and standards. As the industry changes and incorporates more technology, our specifications and training are changing to keep up with the times. The adoption of GPS and wireless technologies dictates that our inspection staff be familiar and competent in their use.

Innovative Contracting

21. Does your agency provide special guidance on construction inspection considerations for projects that are on an accelerated schedule? For example, projects that are being constructed during the night or on weekends as well as projects that consist of more than one work shift. If so, please describe.

Traffic considerations generate project-specific restrictions of work (i.e., hours/shifts when work can interfere with normal traffic). Beyond that, GDOT leaves the means and methods to the respective contractors. GDOT inspection adapts to the contractor's plans and schedules. Most projects in our metro regions are night work; therefore, inspectors work nights/weekends. Rural projects have fewer restrictions. Weekly tailgate/office safety meetings generally tend to focus on aspects of applicable working conditions.

22. Does your agency provide pay differential for work being performed during the night or on weekends?

Yes, a pay differential is available to those individuals working nights. There is no pay differential for weekend work.

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43 e-Construction, Federal Highway Administration, U.S. Department of Transportation, https://www.fhwa.dot.gov/construction/econstruction/

23. To what extent does your agency utilize consultant engineering inspection services?

    Currently, GDOT maintains an approximate 50% to 50% ratio of GDOT to CEI construction inspection personnel; however, as our work program increases, the use of CEI is expected to increase. Ultimately, a 30% to 70% ratio of GDOT to CEI is forecasted.

24. Does your agency have a process for confirming that certified construction inspectors are performing their construction inspection duties as required? If so, please describe this process.

    GDOT utilizes various levels of QA/QC in its materials testing, contract auditing, and field inspection. Oversight by first-line supervisors and managers occurs in the field routinely. Performance metrics are being developed to quantify and measure our performance, even in construction inspection. Areas of focus currently include Asphalt Smoothness, Bridge Deck Steel Cover, Project Closeout, and Project Delivery from an on-time and on-budget standpoint.

Organizational Hiring (Recruiting) and Retention Practices

25. If your agency hires or promotes from within, how do you identify candidate employees?

    The interview and selection process allows for hiring managers to review resumes and applications prior to face-to-face interviews with potential candidates. GDOT's entry-level positions include Engineering Technician and Civil Engineering 2 positions. Promotions are based on identified critical skills gaps, where a specific need for certain titles and abilities is identified and those titles are advertised. Career ladder promotions are no longer allowed under current legislative and budgetary policies.

26. Does your agency recruit field inspection technicians? If so, what skills or competencies does your agency look for in a potential recruit?

    Occasionally, recruiters visit technical schools to reach out to potential candidates. Many entry-level field inspection technicians are made aware of vacancies through word-of-mouth and advertisements in local media.

27. What is the ramp-up time for new hires?

    Entry-level technicians are expected to have a basic grasp of and ability to interpret construction drawings, basic math skills, and the ability to understand construction practices. GDOT policies, systems, and practices should be grasped in an increasing manner with experience.

Nebraska Department of Roads

Organizational Knowledge Transfer/Knowledge Management Initiatives

Communities of Practice

1. Does your agency use any knowledge management or knowledge transfer techniques such as communities of practice to train field inspection technicians? If so, please describe.

   - NDOR has utilized small communities of practice, such as project manager groups, that may include information regarding field inspection.

- Engineer Pool Program

- OJT or job shadowing

- PM Best Practice Manual

- Construction Inspector Certification Program (CICP)

- Materials Sampling/Testing Certification Process with annual IA updates

- Leadership Development Program

- Speech Crafters (a Toastmasters International club for Central Complex employees)

- Internal engineer website

2. Does your agency hold or convene annual or other scheduled meetings or workshops with construction inspectors to discuss areas of concern or interest? If so, please describe.

- NDOR hosts an Annual Project Managers Conference that includes construction project managers and higher level construction technicians. Throughout the year, field inspectors and construction personnel attend additional conferences, such as the Annual Concrete Conference and the Asphalt Conference.

- Annual IA Rodeos provide updated information on testing changes or other specification changes that affect materials.

- Materials and Research/Construction district visits have been held to give updates on items that concern the district field staff. They are held about once every 3 years.

- During the Annual Environmental Road Show, Environmental discusses with all the districts the changes to environmental specifications and regulations; the event lasts three hours.

- Occasional district visits are made by other divisions (Bridge, Roadway).

Mentoring Programs

3. Does your agency use mentoring to develop construction inspectors? If so, please describe.

NDOR has an informal mentoring program relating to developing leaders throughout the agency. Participants are asked to identify an individual to serve as a mentor based on any skill or knowledge they hope to learn from the mentor. Mentor relationships are not tracked or monitored; the mentee reports goals and then goal achievement. This opportunity is available to all employees. Mentoring is included in each level of the leadership development program

Inspectors are trained using CICP courses and OJT. If practical, inexperienced CTs are paired with experienced CTs to transfer knowledge of each type of inspection.

Preretirement Knowledge Management Activities

4. Which techniques does your agency use to capture tacit knowledge or "tribal knowledge" before someone retires (standard work instructions, job shadowing, etc.)? Please explain.

The Project Management Best Practices Manual was developed from a scan of input from many project managers. The manual update also has combined the knowledge of various members.

Construction Manual (although it is outdated)

Typically, there are no techniques for this for inspectors. For project managers we have double-filled the position for a short period to transfer knowledge. If we have a good project manager candidate, we have assigned project manager duties to CTs.

Best Practice Sharing Within the Agency

5. Has your agency conducted "after action reviews" or documented lessons learned or case studies? If so, please describe.

   The only example I can think of is retrospectives that BTSD does has part of its software development and project management. I have heard of design meetings with the districts to review a project that has had quite a few change orders. I am not sure if this happens any longer or not. Post-construction meetings have been discussed but it is up to the district to pursue this.

6. What methods or avenues does your agency use to keep inspectors informed of inspection techniques or requirements?

   - Project Management/Asphalt/Concrete Conferences

   - Agency-wide communication from Materials and Research and Construction Divisions

   - Material Sampling Guide

   - Project Management Best Practices Manual

   - Construction Manual (someday, hopefully)

   - Division/district visits

7. How do you convey your decision-making processes/practices (methods, considerations, levels of authority, communications, etc.)?

   By the following forms of communication:

   - Project Management Best Practices Manual

   - Construction directives/memos

   - Site Manager Help file and Materials Standard Operating Procedures (quick reference guides)

   - Materials Sampling Guide, Sections 27 and 29

   Each district has different processes and can come from the Construction office, DE, DCE, or PM. Conveyance also depends on the topic for which level the decision would come from.

Procedure Manuals

8. How current are your agency's manuals and guidance documents?

   - Final Review Manual, 2010

   - Spec Book, 2007

   - Construction Manual, 2001?

   - Materials Sampling Guide, updated every six months

   - PM Best Practice Manual, trying for updates every year

   - CICP Manual, updated as needed

9. How does your agency develop and maintain its manuals and guidance documents?

   It varies. Construction or M&R personnel maintain some and others are maintained by task forces, as needed. The Final Review Manual is updated by the Construction Office final review supervisor working with the district final reviewers. The Specifications Book is reviewed with every division, district, and FHWA for input and updates. No major updates have been made to the Construction Manual since 2001; we are talking about a rewrite soon. The Materials Sampling Guide is updated with input from the assistant materials engineers and lab managers every six months. The PM Best Practice Manual is updated by a rotating team of Construction, M&R, and district volunteers. The task force responsible for the CICP program updates that manual.

10. How is this information shared with staff?

   - The information relating to the Construction Inspection Program is available on the agency's Learning Management System (EDC). In addition, progress and completion are also tracked in this system.

   - CICP: Most manuals and guidance are available electronically on our website or file servers. Certain information is distributed in hard-copy form and is also available electronically.

   - Public website or agency file servers

Resources

11. Is your agency willing to provide links to online manuals or hard copies of the procedure manuals upon request?

   Yes.

Training Programs

1. Which of the following methods of delivery are used for the development of construction inspector knowledge and skills? To the extent possible, include the percentage of time spent for each method of delivery: a) hands-on training, b) online training, c) JIT training, d) video training, e) instructor-led training.

   They are rapidly learning within the first six months as new inspectors. I estimate training

would be 80% of their time spent at work. Hands-on training would be the primary way working knowledge is transferred. I rate them as follows a) 60%, b) 10, c) 5%, d) 5%, e) 20%.

2. What types of initial construction inspection training does your agency provide?

    ■ Contact NDOR for current version of CICP Training Matrix.

    ■ Aside from hands-on training, we require formal plan reading and math coursework.

    ■ Job shadowing

    ■ Site manager training, depending on the district

    ■ Materials sampling/testing and provisions certifications if there are timing issues.

3. What types of continued construction inspection training does your agency provide?

    I think most districts encourage everyone to attend any training if it pertains to their duties and as schedules allow; CEUs are earned through the CICP; and leadership development.

4. Has your agency developed any online construction inspection training courses and testing? If so, please list/describe.

    Currently the online courses we utilize as part of the CICP program are provided by the TC3. Also included: sediment/erosion control inspector, and ATSSA technician, and supervisor refresher training courses.

5. Has your agency modified its training to accommodate millennials? If so, please explain.

    The agency continues to offer classroom and online courses to serve the various needs of the participants.

6. Does your agency develop specialists or generalists? How long does it take to see results?

    Generalists with some exceptions: dedicated survey crews and dedicated PCC/Asphalt Plant technicians It can take a while (i.e., one to two years) to develop these people.

7. Does your agency use proficiency testing? If so, please describe.

    Some classes have testing requirements if the participant would like PDHs; generally, no testing is required. Technically, via CFR, materials sampling/testing is supposed to be reinforced via proficiency testing with a passing grade of 70%. I am not sure how this is practiced. Circumstantial evidence seems to indicate that it is not strictly enforced.

8. Does your agency use/have employee development plans for your construction inspector job series?

    Contact NDOR for current information regarding CICP Training Matrix and Leadership Development programs.

9. How many inspectors does your agency train or certify on an annual basis? How many are DOT? How many are consultants?

    ■ • Approximately 450 Construction Inspection staff in house, 200 consultants

- ■ Annual Total 425
  - ● Level 1 = 62
  - ● level II = 122
  - ● Level III = 147
  - ● Level IV = 94

- ■ Approximate DOT numbers include:
  - ● Construction Tech I = 15
  - ● Construction Tech II = 90
  - ● Construction Tech III = 110
  - ● Construction Tech IV = 15
  - ● Project Managers = 60

- ■ Those identified complete some type of training annually, whether it is certification requirements or annual certification maintenance requirements. This does not include nonemployees who may receive training in similar fields. Materials sampling/testing certifications are on a five-year rotation for the most part.

10. Are inspectors trained at the DOT or at an off-site location?

    Training is done onsite, in a classroom within the agency, and outside of the agency at such locations as the LTAP, AGC, etc. Third-party training is done off site.

11. How many hours of time are involved (preparing material, teaching, certifying, post-activity)?

    This cannot be estimated due to the organization of our trainers.

12. What is the operating budget for this program?
    - ■ $650,000 (total rounded)
      - ● $300,000 for employee development (state money)
      - ● $300,000 for federally funded workforce development
      - ● $10,000 estimate for district training

13. Are any fees collected (does your agency charge consultants a fee for receiving the training/certification)?

    If the agency provides the courses and consultants/contractors are invited to attend, a registration fee is often charged to cover the instructor's expenses for the training; the agency makes no profit. If NDOR provides materials certifications, then there is no charge; however, if a third party is used (e.g., ACI), then the consultant pays for it. NDOR pays for internal personnel training if a third party provides it.

14. How does your agency identify and develop internal instructors and coaches?

   Internal instructors are identified by SMEs or direct reports, and by their ability to transfer knowledge.

15. How is training developed? Please describe the development process.

   District, division, industry, and FHWA

   - Identify a need and audience

   - Determine the training objectives

   - Determine the best method of instruction (i.e., online versus classroom)

   - Research/develop content with SMEs; review with SMEs when possible

   - Conduct pilot training course

   - Make necessary changes based on feedback

16. How is new information communicated (microlearning, standups with talking points, text blasts, social media)?

   EDC (LMS) training videos, division visits, mass e-mails, DCE communication from meetings/directives; Central Complex: divisional coordination meetings

17. How does your agency assess knowledge transfer for updated information?

   We assess it from district feedback, observation of skills, application of knowledge, and performance measures. This information is gathered through the LMS survey for the class, then aggregated into a performance measure for the training program. The performance measures are updated every six months, then combined and reported annually.

18. Has your agency made any adjustments for younger audiences and their learning styles? If so, please explain.

   Newer technology has enabled quicker completion of the training and allows us to meet our training needs more efficiently. This has not happened because of the audience members' ages necessarily.

19. Does your agency have requirements for in-service training? How often? How long?

   Our agency's annual maintenance requirements may be considered similar to the in-service training mentioned here. Each year, employees within the Construction Inspection program are asked to complete a specific number of training hours in a construction-related topic(s), which might include attending relevant conferences.

20. How does your agency collect feedback from participants, supervisors, management, contractors, or consultants (surveys, word of mouth)?

   Feedback is collected based on course surveys and word of mouth.

21. How is feedback that is collected used?

We review the feedback and make updates to courses and content as necessary.

22. What do you believe are the key elements that make your program successful?

We require all employees within a specific classification to complete the training required of all individuals in that classification, which creates a basis of knowledge for everyone. As employees progress through their career, they can build on that base knowledge by adding additional training. Refresher training and annual maintenance requirements allow employees to revisit topics to ensure that the knowledge has been renewed regularly. A wide variety of training courses are available and management offers a lot of support.

Qualifications and Certifications

23. What qualifications/certifications does your agency require or use for field inspection technicians?

The higher levels (e.g., CT IV and PM) do require some certification to meet the minimum qualifications of the classification. CICP

24. What regional (NETTCP, WAQTC, SETFTTQ, M-TRAC, etc.), national (NICET), or other state qualification/certification programs for field inspection does your agency accept or use as an equivalent, if any?

NDOR analyzes reciprocity on a case-by-case basis; none is accepted across the board.

25. Does your agency require or encourage private firm (CEI) field inspection technician personnel to be qualified/certified?

Consultants must have the same certifications as NDOR inspectors, with exception of the CICP, and are required to have the appropriate sampling/testing certification to perform work on NDOR projects. The only exception is that CEI staff are not required to have an annual IA unless they are on a project that is on the NHS.

26. Do you offer pay incentives or compensation for certification?

NDOR's Construction Inspection Certification is a requirement of the job, and therefore is not compensated in any way. Applicants are made aware of the training requirements at the time of hire. Training is covered at the agency's expense and the employee incurs no costs for certification.

Career Path Management (Employee Cross-Training)

27. How do you develop the cross-training activities (e.g., contractor/consultant, OJT, informal, formal, manuals, etc.)?

This is up to each district, and more so the project manager. Typically, we use job shadowing. The only example I can think of would be higher-level CTs being cross-trained as project managers so that they could fill in for the managers in their absence or prepping them to be the project managers on their own job. All aspects are informal. An employee could train ahead in the CICP to gather more cross-training skills for levels above their own.

28. What activities are included in your cross-training program (e.g., OJT, job shadow, mentoring, coaching, online training, external training, internal training, job rotation, etc.)?

Cross-training is done with all methods listed. There is no consistent practice; it varies based on the employee learning the skills, the resources available, and district preferences.

29. What are the key competencies, skills, and milestones that someone climbing the ladder has to acquire before they are placed in a position of responsibility?

We want people with the experience and ability to manage/run a project on their own with only general guidance. This requires that they have worked for NDOR long enough and had the opportunity to be involved with all types of NDOR projects. They also need to have been involved with most inspection-duty types. This is outlined in the CICP. Taking classes beyond their current skill level would show initiative; however, they do not need to be completed prior to the advancement.

Expand New Innovations and Technologies

30. How is technology used in the development of curriculum?

The agency works to stay current on development methods, including content, software, and trainer skills through development and research; web-based classes developed by AASHTO TC3 use online conferencing tools for collaboration of a distributed team. Online training development software has been utilized to replace or supplement classroom instruction; it helps with travel and cost as well as time away from the job site. An example is new employee orientation, which is a 45-minute online guided training that makes new employees generally aware of what the department offers and how it is structured.

31. How is technology used in the delivery of training?

The EDC is online and provides training via the web for web-based classes we have selected.

32. How is your agency keeping up-to-date and assessing current materials?

Materials are updated on a case-by-case basis. Other than material manuals, usually a task force is utilized to review and edit manuals. These folks usually have other duties so the manual update takes second priority. We subscribe to TC3 updates and state sharing allows us to load updated materials into the EDC when they are available.

33. Is there a set of guidelines on the cadence of when materials are updated?

Materials are updated as needed. CICP materials will be updated based on an established schedule. Materials manuals are kept current based on need. Materials/sampling testing training is updated every year.

Innovative Contracting

34. Does your agency utilize a "risk-based audit" approach to construction inspection? If so, please explain.

35. Not officially, but I would say to some degree yes. Items that have the most risk of audit, failure, etc., get more inspection scrutiny.

36. Does your agency provide special guidance on construction inspection considerations for projects that are on an accelerated schedule? For example, projects that are being constructed during the night or on weekends as well as projects that consist of more than one work shift. If so, please describe.

    I do not know for sure, but I do not think the inspection requirements change; however, the methods and safety involved may change depending on work conditions

37. Does your agency provide pay differential for work being performed during the night or on weekends?

    Yes, we do provide shift differential. It is part of the labor contract to pay $0.60/hour additional for the hours of 6:00 p.m. to 6:00 a.m.

38. To what extent does your agency utilize consultant engineering inspection services?

    For local projects, we had been utilizing them extensively; however, with programmatic changes those will likely fall back to NDOR forces. We have our first consultant-inspected state project in District 5 on the interstate. This also depends on the inspection load on the state staff.

39. Does your agency have a process for confirming that certified construction inspectors are performing their construction inspection duties as required? If so, please describe this process.

    For LPA projects, the NDOR representative had checklists to verify certifications.

40. What certification makes sure the contractor has the skills needed?

    This is handled through bonding and the Construction Division handles prequalification. Contractor certifications only apply to asphalt QA/QC and PCC batch plant testing currently.

41. How does your agency pretest to make sure the contractor can deliver?

    Bonding and prequalification

Organizational Hiring (Recruiting) and Retention Practices

42. If your agency hires or promotes from within, how do you identify candidate employees?

    Our agency has a competitive applicant process. Positions are posted, available for all permanent employees (and) nonemployees. Applicants are reviewed and scored based on standard screening criteria. Interviews are conducted based on standard, consistent questions and the interviewees are evaluated on consistent criteria. The top selection is made based on the results of the interview or the position is reclassified due to the workload and due to the importance of the work that is assigned.

43. Does your agency recruit field inspection technicians? If so, what skills or competencies does your agency look for in a potential recruit?

   Career fairs, construction career days at the high school level, job shadowing (only a few hours)

44. What is the ramp-up time for new hires?

   From job requisition to first day on the job typically can be six weeks or more. From there it is usually one construction season before new hires are ready to inspect a task on their own. (CT1 or CT2 brand new off the street). Per the CICP, new hires are given six months to complete necessary training.

45. Succession Planning—Does your agency use 9-box grid or other methods to identify and develop internal candidates?

   For training purposes, the agency currently does not have a standard method for determining selection/succession planning. Promotion is based on a competitive applicant process. A leadership development program helps to establish a foundation for developing leadership skills. Continuity of operations identifies the next in charge if something were to happen to the existing leaders (administration), such as sickness, death, or unexpected leaves of absence.

46. Does your agency have a field training opportunity program? What qualifications does someone need to be a coach?

   The CICP Program and the Engineering Pool Program are two. Work study is mostly utilized in the Central Complex area. The primary coach is assigned as a supervisor of the employee being developed.

47. What turnover issues, if any, has your agency identified related to construction inspector positions?

   Turnover is most frequently based on pay/benefits, and typical competitors include local city/county government, contractors, and consultants within the state of Nebraska. Turnover is most likely to happen with employees within the first five years of employment. The retention rate once employees have reached five years is much greater. People occasionally will move laterally due to the nature of the work or the people they work with.

48. How does the average retention rate compare to other categories?

   Turnover in the construction field is significantly less that than in the agency's maintenance field, which is up to 25% annually.

49. How do you provide new staff the range of impacts/outcomes affecting or affected by decisions (impact to quality, costs, future projects, claims, etc.)?

   Informal conversation, typically, when issues are identified as the tasks are performed and mistakes are made.

50.

Oregon Department of Transportation

Organizational Knowledge Transfer/Knowledge Management Initiatives

Communities of Practice

1. Does your agency use any knowledge management or knowledge transfer techniques such as communities of practice to train field inspection technicians? If so, please describe.

   ODOT has an inspector certification program to train state inspectors, consultant inspectors, and local agency inspectors. This certification is required on all construction projects funded through ODOT.

2. Does your agency hold or convene annual or other scheduled meetings or workshops with construction inspectors to discuss areas of concern or interest? If so, please describe.

   - **Inspector Symposium** – Presentations by ODOT technical experts to address construction issues from recent construction seasons; used as an information-sharing workshop

   - **Pavement Forum** – Annual feedback to ODOT personnel about pavement-related issues over the past construction season and what issues might be for the coming construction season

   - **Quality Control Compliance Specialist Workshop** – Annual feedback to ODOT, consultant, and local agency personnel about what issues related to materials testing have been in the past construction season and what issues might be for the coming construction season

   - **Annual Project Manager's Meeting** – Share statewide perspective on current construction project management issues and vision for the future

Mentoring Programs

3. Does your agency use mentoring to develop construction inspectors? If so, please describe.

   ODOT project manager's offices have project coordinators and senior inspectors that are responsible for guiding the work and development of the CIs that work on their crews.

Best Practice Sharing Within the Agency

4. Has your agency conducted "after action reviews" or documented lessons learned or case studies? If so, please describe.

   ODOT developed a process called "Project Manager Narratives" that are required on all projects to help identify issues that occur on projects and discuss improvements that may need to be implemented to prevent further occurrences.

5. What methods or avenues does your agency use to keep inspectors informed of inspection techniques or requirements?

6. The Annual Project Manager's Meeting, Pavement Forum, Inspector Symposium, and Quality Control Compliance Specialist Workshop are all used to keep inspectors informed of inspection techniques and requirements. In addition to this, ODOT uses "Spec Notes,"

two-page online documents on specific issues that have come up to help inform inspectors and contractors about specific construction issues. ODOT has also used a few online YouTube videos to provide guidance on other issues on which we need to provide more visual information.

Procedure Manuals

7. How current are your agency's manuals and guidance documents?

   - ODOT Construction Manual – Chapters updated on an as-needed basis (August 2016)

   - Inspectors Manual – Updated on an as-needed basis (May 2014)

   - Manual of Field Test Procedures – Updated every year (December 2015)

   - Laboratory Manual of Test Procedures – Updated every year (May 2016)

   - ODOT Qualified Products List – Updated every 6 months (July 2016)

   - Non-Field Tested Materials Acceptance Guide – Updated on an as-needed basis (June 2016)

8. How does your agency develop and maintain its manuals and guidance documents?

   See answer to previous question.

9. How is this information shared with staff?

   All information is provided online. The General Construction Inspector certification class teaches the use of the Construction Manual, the Manual of Field Test Procedures, the Qualified Products List, and the Non-Field Tested Materials Acceptance Guide.

Resources

10. Is your agency willing to provide links to online manuals or hard copies of the procedure manuals upon request?

    - [ODOT Construction Manual](#)

    - [Inspector's Manual](#)

    - [Manual of Field Test Procedures](#)

    - [Laboratory Manual of Test Procedures](#)

    - [ODOT Qualified Products List](#)

    - [Non-Field-Tested Materials Acceptance Guide](#)

Training Programs

1. Which of the following methods of delivery are used for the development of construction inspector knowledge and skills? To the extent possible, include the percentage of time spent for each method of delivery: a) hands-on training, b) online training, c) JIT training, d) video training, e) instructor-led training.

   - Hands on training – Done at the project manager's office level as needed

- Online training – All instructor-led training is available online for review (PowerPoint presentations)

- JIT training (10%) – This is becoming more useful on specific issues and is done in the project manager's office (concrete paving, intelligent compaction, MSE retaining walls)

- Video training (5%) – Exploring use of this on specific items (direct tension indicator)

- Instructor-led training (85%) – All the inspector certification training is done with instructor-led training.

2. What types of initial construction inspection training does your agency provide?

   General Construction Inspector training is required for all inspectors.

3. What types of continued construction inspection training does your agency provide?

   - Bridge Construction Inspector

   - Asphalt Concrete Pavement Inspector

   - Drilled Shaft Inspector

   - Environmental Construction Inspector

   - Traffic Signal Inspector

   These certifications are required of inspectors when the items are included on a construction project:

   - Survey Verification (not a certification course)

   - Structure Coatings Inspection (not a certification course)

   - Chip Seal Workshop (not a certification course)

4. Has your agency developed any online construction inspection training courses and testing? If so, please list/describe.

   We developed an online training for Introduction to ODOT Project Plans and Specifications. The intention behind this course was that it could be used as an introduction before taking the General Construction Inspector certification.

5. Has your agency modified its training to accommodate millennials? If so, please explain.

   We have not modified training specifically for millennials.

6. Does your agency develop specialists or generalists? How long does it take to see results?

   General Construction Inspector is a general certification for all inspectors. Bridge, Asphalt, Drilled Shaft, Environmental, and Traffic Signal are considered specialists; however, we encourage all inspectors to be certified

7. Does your agency use proficiency testing? If so, please describe.

   Proficiency testing is used for Materials Testing Technicians in ODOT but there is no proficiency testing for inspectors.

8. Does your agency use/have employee development plans for your construction inspector job series?

   Project managers' offices are encouraged to have employee development plans for their inspectors. ODOT has developed a document outlining recommended training required for different positions in the project manager's office.

9. How many inspectors does your agency train or certify on an annual basis? How many are DOT? How many are consultants?

   - 511 people went through training classes in the 2015-2016 training season

     - 252 were ODOT inspectors

     - 103 were consultant inspectors

     - 156 were local agency inspectors

     - 148 other people challenged the exam without going through the training

   - ODOT has 2,454 different inspector certifications that are currently active.

10. Are inspectors trained at the DOT or at an off-site location?

    We use several off-site locations throughout the state for training. Most training is held in the Salem area.

11. How many hours of time are involved (preparing material, teaching, certifying, post-activity)?

    This information is not tracked. A rough estimate is about 10,000 hours of time (two full-time staff involved with full program, three staff involved half-time with administration, over 20 SMEs involved developing training material).

12. What is the operating budget for this program?

    Expenses for the training season are roughly $500,000:

    - $43,000 for facilities and materials

    - $242,000 for two full-time staff

    - $116,000 for three half-time staff

    - $100,000 for SME time/training

    A lot of this is not charged directly to the program but is paid for through crew budgets.

13. Are any fees collected (does your agency charge consultants a fee for receiving the training/certification)?

    Yes. All certification classes have a cost for everyone who takes the training based on the historical costs associated with providing the facility and the training materials.

14. How does your agency identify and develop internal instructors and coaches?

    Over the past 10 years, ODOT has worked with agency SMEs to develop and deliver training classes. Two positions are full-time positions dedicated to the program.

15. How is training developed? Please describe the development process.

    Training has been developed over the past 10 years through the SMEs. Full-time staff review the material. Staff attends the training and provides comments on improvements. Students fill out surveys for the class that identify changes that should be considered. Material is updated as needed each year.

16. How is new information communicated (microlearning, standups with talking points, text blasts, social media)?

    ODOT has developed Spec Notes that are developed on topics for which we want to provide specific information. Spec Notes are developed as needed and posted online. They are two-page documents (front/back) so that they can also be handed out and be used as references in the field.

17. How does your agency assess knowledge transfer for updated information?

    We do not track knowledge transfer on updated information.

18. Has your agency made any adjustments for younger audiences and their learning styles? If so, please explain.

    We have not modified training specifically for younger audiences.

19. Does your agency have requirements for in-service training? How often? How long?

    We do not have requirements for in-service training but the certification is for a five-year period. After certification expires, inspectors have the option of taking the class and exam again or they can challenge the exam without taking the class.

20. How does your agency collect feedback from participants, supervisors, management, contractors, or consultants (surveys, word of mouth)?

    Class training has a survey that is done at the end of the class. We have used Survey Monkey for the information but have found that our best response comes from an actual handout in the class. It is better to get feedback from them before they know their test results. We are going to try using a survey this fall to assess the needs that the project managers have for their inspectors.

21. How is feedback that is collected used?

    Feedback is used to update class material as needed during the training season. We also use the feedback to redevelop the material for the next training season.

22. What do you believe are the key elements that make your program successful?

    ODOT worked for buy-in from our project managers' offices early on to make sure that there would be good participation. We rely on instructors who have good field experience and credibility. We work with inspectors who fail the certification exam to help them understand the material so that they can come back and successfully take the exam again.

Qualifications and Certifications

23. What qualifications/certifications does your agency require or use for field inspection technicians?

    - General Construction Inspector

    - Bridge Construction Inspector

    - Asphalt Concrete Pavement Inspector

    - Drilled Shaft Inspector

    - Environmental Construction Inspector

    - Traffic Signal Inspector

24. What regional (NETTCP, WAQTC, SETFTTQ, M-TRAC, etc.), national (NICET), or other state qualification/certification programs for field inspection does your agency accept or use as an equivalent, if any?

    ODOT does not use other certification programs for inspector certification. We do work with WAQTC for Material Technician certification but WAQTC does not have an inspection certification piece.

25. Does your agency require or encourage private firm (CEI) field inspection technician personnel to be qualified/certified?

    ODOT requires all consultants working on ODOT contracts to have certified inspectors. They need to have identified the certified inspectors from their staff before they can bid for the work.

26. Do you offer pay incentives or compensation for certification?

    No pay incentive or compensation is made for inspector certifications.

27. What procedures has your agency introduced along the guidelines enumerated under Section 3, paragraph d of the 23 CFR 637 Quality Assurance (QA) Program for sampling and testing?

ODOT has a materials technician certification program that is operated separately from the inspector certification program. ODOT works with the Asphalt Pavement Association of Oregon and the Oregon Concrete and Aggregate Producers Association to provide training on materials testing. The training and testing is provided working with the material developed by WAQTC. The training involves a hands-on training and performing actual material testing procedures that the students are tested on to pass the certification. No OJT is required for certification. Technicians need to be recertified after five years. The IA program is not used as recertification.

ODOT has a Certification Advisory Committee that reviews information on technicians suspected of improper testing procedures and has the ability to suspend technicians who are not following the program and test procedures. Technician certification is not grandfathered for technicians; professional engineer or engineer in training certification does not satisfy the certification requirement. ODOT does have a reciprocity agreement with technicians who have been certified in one of the other WAQTC states.

Career Path Management (Employee Cross-Training)

28. How do you develop the cross-training activities (e.g., contractor/consultant, OJT, informal, formal, manuals, etc.)?

The project manager's staff identifies cross-training opportunities and incorporates them into the inspector's work as allowed by their position description. Most inspectors need to apply for other positions to work in other disciplines.

29. What activities are included in your cross-training program (e.g., OJT, job shadow, mentoring, coaching, online training, external training, internal training, job rotation, etc.)?

Mentoring and coaching are encouraged for staff development and may be formally identified for individual inspectors.

Expand New Innovations and Technologies

30. How is technology used in the delivery of training?

The main format for training is PowerPoint presentations; the material is available online for access. One strategy that is used in several classes is an audience response component to the training where the instructor has prepared questions with multiple-choice answers from which to choose. Getting feedback from the answers allows instructors to gauge how well the class understands the material and allows them to adjust how they deliver the material as needed. The responses are anonymous so it allows students to answer without the stigma of having wrong answers.

31. How is your agency keeping up-to-date and assessing current materials?

Training material is evaluated each year in advance of the training season and updated as needed. Survey responses from past classes are also used to help identify issues that may need to be updated.

32. Is there a set of guidelines on the cadence of when materials are updated?

We have no set guidance on when materials are updated; they are updated on an as-needed basis. Feedback from class surveys is used to look into material that needs to be updated. Answers on the exams that are consistently answered wrong may also be used to identify parts of the class that are not being understood. Another item that is frequently used to update training materials is when the ODOT specifications manual is updated. At that point we make sure that we still have appropriate training material and try to incorporate a new example project into training that uses the updated specifications.

Innovative Contracting

33. Does your agency utilize a "risk-based audit" approach to construction inspection? If so, please explain.

ODOT does not use a risk-based approach to construction inspection.

34. Does your agency provide special guidance on construction inspection considerations for projects that are on an accelerated schedule? For example, projects that are being constructed during the night or on weekends as well as projects that consist of more than one work shift. If so, please describe.

ODOT does not provide any special guidance for consideration of projects that are on an accelerated schedule.

35. Does your agency provide pay differential for work being performed during the night or on weekends?

ODOT's employee association has a contract requirement that employees are paid a shift differential for any work that is done between 9:00 p.m. and 6:00 a.m.

36. To what extent does your agency utilize consultant engineering inspection services?

ODOT has established a goal that 30% of project work is done with CEI to manage the workload requirements on our projects.

37. Does your agency have a process for confirming that certified construction inspectors are performing their construction inspection duties as required? If so, please describe this process.

ODOT does not have a program to assess the performance of CIs.

38. What certification makes sure the contractor has the skills needed?

Our Construction section does not have a certification requirement for contractors. However, ODOT's Procurement Office has a process by which contractors are prequalified to do certain types of work and the contractor must show its ability to perform a certain percentage of the work on the project to qualify to bid the project.

Organizational Hiring (Recruiting) and Retention Practices

39. If your agency hires or promotes from within, how do you identify candidate employees?

    ODOT advertises available positions and HR reviews the applications to identify candidates who are qualified for a position based on an evaluation of the position's minimum requirements.

40. Does your agency recruit field inspection technicians? If so, what skills or competencies does your agency look for in a potential recruit?

    ODOT recruitment is based on job classifications that have developed work history requirements to qualify on their applications to interview for positions. HR handles the process. The job descriptions can be used for multiple different positions and offices throughout ODOT. Typically, requirements are based only on education background and years of work experience since the appropriate skills and competencies of the positions can vary. HR does not allow managers to have any say in the selection of who passes the criteria because HR wants to be sure that the decisions are unbiased. This is a big problem in our recruitment of new employees because it is completely out of the manager's hands. Many times we find that candidates who we expect to apply do not make the cut from HR.

41. Succession Planning—Does your agency use 9-box grid or other methods to identify and develop internal candidates?

    ODOT does not use any methods to identify or develop internal candidates.

42. Does your agency have a field training opportunity program? What qualifications does someone need to be a coach?

43. ODOT does not use a field training program.

44. What turnover issues, if any, has your agency identified related to construction inspector positions?

    The main issue identified at ODOT is the number of people who are eligible for retirement. There is the sense that we are losing a lot of institutional knowledge. The inspector certification program was developed in part to help address this issue through training.

Virginia Department of Transportation

Organizational Knowledge Transfer/Knowledge Management Initiatives

Communities of Practice

1. Does your agency use any knowledge management or knowledge transfer techniques such as communities of practice to train field inspection technicians? If so, please describe.

    We have used communities of practice over the past several years for district construction engineers and area construction engineers. I am not aware of communities of practice for CIs.

2. Does your agency hold or convene annual or other scheduled meetings or workshops with construction inspectors to discuss areas of concern or interest? If so, please describe.

3. Annual Construction Inspector's Conference

Mentoring Programs

4. Does your agency use mentoring to develop construction inspectors? If so, please describe.

   We are in the process of recruiting retired construction managers/senior inspectors as mentors.

Preretirement Knowledge Management Activities

5. Which techniques does your agency use to capture tacit knowledge or "tribal knowledge" before someone retires (standard work instructions, job shadowing, etc.)? Please explain.

   We are not doing this now.

Best Practice Sharing Within the Agency

6. Has your agency conducted "after action reviews" or documented lessons learned or case studies? If so, please describe.

   We are not doing this now.

Procedure Manuals

7. How current are your agency's manuals and guidance documents?

   They are reasonably current.

8. How does your agency develop and maintain its manuals and guidance documents?

   They are regularly updated with instructional memoranda.

9. How is this information shared with staff?

   It is published on the Construction Division's website.

Resources

10. Is your agency willing to provide links to online manuals or hard copies of the procedure manuals upon request?

11. Yes.

Training Programs

1. Which of the following methods of delivery are used for the development of construction inspector knowledge and skills? To the extent possible, include the percentage of time spent for each method of delivery: a) hands-on training, b) online training, c) JIT training, d) video training, e) instructor-led training.

   The predominant method VDOT uses is instructor-led training. We also use OJT and a minor amount of online training.

2. What types of initial construction inspection training does your agency provide?

   We are developing a community college associate degree program in partnership with the industry.

3. What types of continued construction inspection training does your agency provide?

   We are developing a community college associate degree program in partnership with the industry.

4. Does your agency use proficiency testing? If so, please describe.

   Materials certification

5. Are inspectors trained at the DOT or at an off-site location?

   They are generally trained at VDOT.

6. Are any fees collected (does your agency charge consultants a fee for receiving the training/ certification)?

   No.

7. Does your agency have requirements for in-service training? How often? How long?

   No.

Qualifications and Certifications

8. What qualifications/certifications does your agency require or use for field inspection technicians?

9. Materials, Safety, and Work Zone Safety

10. Does your agency require or encourage private firm (CEI) field inspection technician personnel to be qualified/certified?

    Yes.

11. Do you offer pay incentives or compensation for certification?

    No.

Appendix H:
Responses to Amplifying Questions—Texas Department of Transportation

Texas Department of Transportation

Texas
Department
of Transportation

Domestic Scan 15-01

Developing and Maintaining
Construction Inspection Competence

Organizational Knowledge Transfer / Knowledge Management Initiatives

Communities of Practice

1. Does your agency use any knowledge management or knowledge transfer techniques such as communities of practice to train field inspection technicians?

The Inspector Development Program (IDP) is managed by construction division, and is comprised of formal and on-the-job training (OJT). The goal of the IDP is to improve the overall quality of construction on department contracts by advancing the knowledge and experience of construction inspection staff, sharing knowledge among inspection staff, by providing additional guidance to lesser experienced inspectors, and providing a resource for updating and refreshing knowledge of more experienced inspectors.

Success of the program is dependent upon the maintenance of a consistent learning curve for less experienced construction inspectors, who are referred to as inspectors. The timeliness of attendance at formal training, on-the-job training (OJT), or mentoring, and availability of experienced support is important to the successful development of the Inspector.

2. Does your agency hold or convene annual or other scheduled meetings or workshops with construction inspectors to discuss areas of concern or interest?

On a monthly and quarterly basis, local districts hold meetings between Directors of Constructions, Area Engineers, Section Supervisors, Inspectors and Mentees to report on the progress of projects and the development of OJT within the IDP. Areas of concern may vary

depending on the nature of the district, i.e. whether or not the district has been established as an Urban, Rural or Metro.

Mentoring Programs

3. Does your agency use mentoring to develop construction inspectors? If so, please describe.

Inexperienced inspectors are routinely trained in the field by more experienced senior inspectors. While formal training is an important component of inspector development, the most effective training tool is field experience. The mentoring part of the IDP provides an emphasis of OJT development by identifying experienced mentors to provide informal OJT to less experienced inspection staff. Mentors are asked to look for opportunities to develop more inexperienced staff.

In order for the IDP network to achieve maximum success, qualified mentors need to be identified and organized into a group that will work together to achieve the goal of increasing department inspector knowledge. Desirably, a mentor and an inspector will work in the same area office. This situation provides close proximity, and familiarity, between the mentor and inspector, and two employees with the same supervisor. However, there will be instances when a mentor with knowledge in a specific module is not available in the Area Office.

A critical aspect of the program is the ability of mentors to assist outside their normal geographical work area. The ability for this to be successful is already limited by the time available for outside assistance. That can get further complicated by differing personalities and territorial concerns about someone from the "outside" coming in to give instruction to "our" inspectors. In some cases, a mentor or other division or district staff will be asked to assist in developing an inspector or inspector work group. Districts, area offices, and area engineers can assist in making these efforts successful by addressing these issues with their staff in advance and by providing support to the mentor assigned to assist. To be most effective, the mentor needs to talk with the Area Engineer, and possibly the Director of Construction, be comfortable and have a sense of support.

Further, the mentor must recognize territorially concerns, and grasp sensitivity issues of employees with regard to someone from outside of the area coming in to assist. A mentor must have respect for the possibility that inspection practices and procedures may be different in another Area Office. To further support outside mentors, Area Engineer's should take positive steps to support external assistance.

Area Engineers should discuss their needs with mentors prior to initiating the program, especially for those mentors that are coming from outside the Area office. Mentors must work through the Area Engineer to develop inspectors. The mentors should meet with the Area Engineers to determine inspector development needs, assignments, Area Office inspection practices, and other specifics for individual inspectors.

Over a period of time, the mentor will oversee and counsel the Inspector until the mentor observes that the Inspector is able to make independent inspections, and contract inspection decisions in accordance with, and as allowed by, department specifications and policy.

Pre-Retirement KM Activities

4. Which techniques does your Agency use to capture tacit knowledge or "tribal knowledge" before someone retires (Standard work instructions, Job Shadowing, etc.)? Please explain.

TxDOT uses the mentorship program within the IDP to cultivate and retain tacit knowledge. Given the process is designed to happen over a period of 18-36 months, it is easy to see how the relationship grows between the mentor and inspector. Our agency contains 25 districts and 32 divisions, maintaining 80,423 centerline miles (miles traveled in a one-way direction regardless of the number of lanes in a roadway).

In order to maintain the inspector labor and expertise required for the roadway, TxDOT is continually exploring options to alternatively fill the team member gap with an additional 800 employees over the next 3 years.

Best Practice Sharing within the Agency

5. Has your agency conducted "after action reviews", or documented lessons learned or case studies? If so, please describe.

After action reviews immediately occur following the inspector's mentorship, and usually happen with Area Engineers in con-junction with the Mentor. Either the Area Engineer or the Mentor may sign-off on the Inspector's performance and completion of any of the modules, completion and graduation of the IDP program. TxDOT uses a series of program modules within the IDP, which contain checklists that follow the training series within each topic as outlined.

Area Engineer and District Director of Construction Duties

Area Engineers use the module check list to determine the development needs of inspectors, as a tool for evaluations, and for determining resources for inspection. Area Engineers, or other district staff supervisors, sign the statement at the end of a module after they determine that the inspector has satisfactorily completed the module. Input from the mentor is needed for this determination.

Modules and References

The references shown on each module is a starting point for an inspectors' use in locating a specification, and in some cases standard sheets. In some instances, specific Specification Articles and pages are referenced; however significant resources are not always referenced include the following:

- Plans

- Department Standard Specifications bid items and reference items

- Proposal with special provisions and special specifications

- Department test procedures (TEX-XXX)

- Department Material Specifications

- American Association of State Highway Transportation Officials (AASHTO) and American Society for Testing and Materials (ASTM), etc. Standards, Test Procedures, and Material Specifications

- Pertinent Manuals such as the Construction Contract Administration Manual (CCAM).

6. What methods or avenues does your agency use to keep inspectors informed of inspection techniques or requirements?

Area Engineer and District Director of Construction Duties

Area Engineers should use these module check lists to determine the development needs of inspectors, as a tool for evaluations, and for determining resources for inspection. Area Engineers, or other district staff supervisors, sign the statement at the end of a module after they determine that the inspector has satisfactorily completed the module. Input from the mentor is needed for this determination.

Procedure Manuals

7. How current are your agency's manuals and guidance documents?

All reference material for this document is current within the last 5 years and is currently undergoing revision to industry standard.

8. How does your agency develop and maintain its manuals and guidance documents?

Construction Division's Construction Section as well as the Materials and Pavements Section are responsible for making changes to manuals and policy with approval by Engineering Operations leadership with final approval of the Chief Engineer.

9. How is this information shared with staff?

Procedural and manual updates are circulated in a variety of manners, i.e. quarterly or monthly district and divisional meetings, TxDOT Crossroads webpage, interdepartmental meetings as well as the TxDOT Training Program via HRD-WFD.

Training Programs

1. Which of the following methods of delivery are used for the development of construction inspector knowledge and skills? To the extent possible, include the percentage of time spent for each method of delivery:

a). Hands on training 60%, b) On line training 10%, c) Just in time training 5%, d) Video training <1%, e) Instructor led training 25%.

2. What types of initial construction inspection training does your agency provide?

Formal Inspector training is offered though the Human Resources Division-Workforce Development Section (HRD-WFD). A list of the courses available may be viewed on the department's website at http://www.txdot.gov/business/events-training/training-and-development.html

Additional courses may also be available from outside entities, such as the National Highway Institute (NHI), Texas Hot Mix Association, etc. District training coordinators should be contacted for additional information regarding available training.

3. What types of continued construction inspection training does your agency provide?

Formal training may not always be readily available or feasible; however, any training accomplished by the Inspector should coincide with the training strategy for the respective IDP module. The list includes a suggested time frame in an Inspector's career when the Inspector should be considered for formal training. Each module also contains specific training related to that particular module

*See below for Instructor Led Courses:

Table: Instructor Led Courses

Instructor Led Courses	Course Name	Classroom	Recommended Time Frame
CON105	Introduction to Construction/Maintenance Inspection	24	First 6 months
CON118	Construction Contract Administration	24	First 6 months
CON500	SiteManager Inspector Field Reporting	12	First 6 months
CON501	SiteManager Contract Administration	12	First 6 months
CON503	SiteManager Materials Management	12	First 6 months
MNT412	Revegetation Training	8	First 6 months
TRF520	Work Zone Traffic Control	16	First 6 months
SFH110	Confined Space Safety	12	First 6 months
SFH610	Excavation and Shoring Safety	8	First 6 months
BRG100	Bridge Construction Inspection	24	First 6 – 18 months
CON205	Fundamentals of Concrete 101	8	First 6 – 18 months
CON411	Inspection of Flex Base & Embank	16	First 6 – 18 months
ENV103	Storm Water Pollution Prevent Plan	8	First 6 – 18 months
MNT702	Seal Coat Inspection & Applications	8	First 6 – 18 months
TRF510	Installation & Maintenance of Pavement Markings	4	First 6 – 18 months
TRF515	Installation & Maintenance of Signs	12	First 6 – 18 months
CON116	Critical Path Scheduling-Construction	20	18 + months
CON120	Fundamentals of Concrete 201	4	18 + months
CON206	Concrete Paving	8	18 + months
CON209	Dispute Resolution (Contract Administration)- Construction	16	18 + months
GEO203	Drilled Shaft Foundation Inspection	20	18 + months
GEO201	Drill Shaft	24	18 + months
CON303	Bridge Deck Workshop	6	18 + months
CON806	Hot-Mix Level IB-Recertification (out-of-agency)	4	18 + months
ENV300	Stormwater Erosion & Sediment Day 1	8	18 + months
TRF450	TxDOT Roadway Illumination & Electrical Installation	24	18 + months
TRF453	TxDOT Electrical Requirements Installation & Traffic	24	18 + months
TRF 525	Work Zone Traffic Control Refresh	8	18 + months

4. Has your agency developed any online construction inspection training courses and testing?

TxDOT readily offers training via our learning management system, PeopleSoft. We offer locally hosted versions of AASHTO's T3C computer based courses.

Table: Online Training Courses

On-Line Training Course Code	Course Name	Approx Time	Recommended Time Frame
CON 702	Nuclear Gauge Transportation Overview	1 hour	Mandatory before transporting gauge.
CON703	Basic Nuclear Safety	4 hours	Mandatory before using gauge.
TCC101	Daily Diary Documentation Training	1 hour	First 6 Months
TCC102	Construction Inspection & Emerging Technology - GPS Technology in Construction	1 hour	First 6 Months
TCC100	Math Module	6 hours	First 6 Months
TCC111	Plan Reading: Erosion and Sediment Control Plans	1 hour	First 6 Months
TCC131	Introduction to Portland Cement Concrete Paving Inspection	20 hours	First 6-18 Months
TCC108	Plan Reading: Highway Plan Reading Basics	1 hour	First 6-18 Months
TCC109	Plan Reading: Grading Plans	1.5 hours	First 6-18 Months
TCC160	Fresh Concrete Properties	1 hour	First 6-18 Months
TCC106	Basic Construction Surveying	3 hours	First 6-18 Months
TCC168	Maintenance of Traffic for Technicians	5 hours	First 6-18 Months
TCC011	Portland Cement Concrete Pavement Inspection	5 hour s	First 6–18 Months
TCC104	Hot Mix Asphalt (HMA) Paving Field Inspection	4.5 hours	First 6–18 Months
TCC131	Introduction of Portland Cement Concrete (PCC) Paving Inspection	10 hours	First 6–18 Months
TCC175	Bolted Connections	4 hours	First 6–18 Months
TCC169	Maintenance of Traffic for Supervisors	5 hours	First 6–18 Months
TCC107	Basic Materials for Highway and Structure Construction	4 hour	18 + Months
TCC154	Concrete Series: Hardened Concrete Properties: Durability	1 hour	18+ Months
TCC159	Concrete Series: Basics of Cement Hydration	1 hour	18+ Months
TCC161	Concrete Series: Construction for Concrete Pavements	1 hour	18+ Months

5. Has your agency modified its training to accommodate millennials?

Yes, Generational Diversity (DEV234) course allows participants to gain an understanding of diversity, characteristics of the different generations in the workplace, and helps participants apply effective strategies to work with diverse groups and generations in the workplace. This is also address in Practical Supervision (DEV115) as well as TxDOT – AASHTO Leadership Training (DEV127).

6. Does your agency develop specialists or generalists? How long does it take to see results?

TxDOT develops generalist via the Inspector Development Program. As an agency we rely on the legacy knowledge via the mentorship aspect of the IDP.

7. Does your agency use proficiency testing?

The training courses within the modules have proficiency expectations of pass/fail and 80% pass rates.

Content mastery within each module of the IDP is proven via mentor signature, approval date and the new inspector validating they have the skills listed in the assessment sheet on the following topics:

Contract Administration, General Requirements, Scheduling, Plan Reading, Surveying, Basic Construction Surveying, Storm Water Pollution Prevention Plan (SWP3) & Environmental, Traffic & Safety, Traffic Control, Traffic Signals and Illumination, High Mast Illumination, Permanent Signing and Supports, Striping, Prefab Pavement Markings & Raised Pavement Markers, Concrete Traffic Barrier, Metal Beam Guard Fence & Guardrail End Treatments, Crash Cushion Attenuators, Earthwork and Base Courses, Embankment, Flexible Base, Lime, Fly Ash & Lime-Fly Ash Treated Subgrade & Base, Cement Treated Subgrade & Base, Cement Treated Subgrade & Base, Asphalt Treatment – Plant Mixed, Landscaping, Landscaping Planting & Establishment, Topsoil, Compost, Sodding, Seeding, Soil Retention Blanket, Surface Treatments & Pavements, Surface Treatments, Hot Mix Asphalt Pavements, Permeable Friction Courses, Concrete Pavement, Cleaning & Sealing Joints & Cracks, Drainage, Misc. Concrete & Structures, Basic Reinforced Concrete, Drainage Systems, Pipe Culverts, Precast Box Culverts, Precast Manholes & Inlets, Precast Headwalls & Wingwalls & Precast Safety End Treatments, Earthwork for Structures, Miscellaneous Concrete Structures (Curb & Gutter, Driveways Sidewalk, Medians & Islands, etc.), MSE Retaining Walls, Soil Nail Anchors, Foundations (Drilled Shafts, Pile Driving), Substructures (Columns, Caps, Footings, Culverts), Superstructures (Decks, Setting and Grading Girders and Rails [to include related surveying responsibilities]), Structural Bolting and Double-Nut Anchor Bolts, and Concrete Batch Plant Inspection,

8. Does your agency use/have employee development plans for your construction inspector job series?

Within TxDOT's Human Resource Performance Management, employee management plans are developed to involve defining criteria at the beginning of the calendar year with mid-year checkpoints and an end-of-year evaluation. The annual evaluation and final rating is delivered the following February and would naturally include the Inspector's participation in the IDP.

9. How many inspectors does your agency train or certify on an annual basis? How many are DOT? How many are consultants?

TxDOT has approximately 1000 internal inspectors and utilizes the services of external inspectors on an as needed basis.

10. Are inspectors trained at the DOT or at an off-site location?

TxDOT's inspectors are trained within our Agency, with the exception of asphalt certification,

which takes place at the industry association's headquarters in Buda, TX.

11. How many hours of time are involved (preparing material, teaching, certifying, post activity)?

Total time to prepare a fully certified inspector is 6 months of on-the-job training coupled with continual mentorship and 3 years of ongoing training within the TxDOT system.

12. What is the operating budget for this program?

The TxDOT operating budget for the IDP is considered a divisional expense of the construction; Within the fiscal boundaries of FY17-18 there is opportunity to develop $7.7M in forecasted training assets statewide.

13. Are any fees collected (does your agency charge consultants a fee for receiving the training / certification)?

No, TxDOT does not train outside consultants within the IDP at this time.

14. How does your agency identify and develop internal instructors and coaches?

The TxDOT Instructor Certification Program is a unique assessment-based series that covers the entire process of delivering training, assessment and evaluation, preparation, creating a positive learning environment, as well as designing and developing engaging curriculum. Grounded in theory and focused on practice and application, this program will help develop your professional development in these areas of expertise. This program is available to all trainers regardless of their training discipline.

Three Instructor Levels

Instructor

Successfully completed DEV 119 and is currently delivering training or has a listed job duty to deliver training or administer a training project or program.

Senior Instructor

> Successfully completed DEV 119 and is currently delivering training or has a listed job duty to deliver training or administer a training project or program

- has been delivering training or administering a training project or program for at least 1 year

- has received formal WFD-approved classroom and evaluations of training has assisted in implementation of DEV 119 and has successfully completed DEV 120

Master Instructor

Successfully completed DEV 119 and is currently delivering training or has a listed job duty to deliver training or administer a training project or program

- has been delivering training or administering a training project or program for at least 3 years and has received formal WFD-approved classroom evaluations of training

- has assisted in implementation of DEV 119 has successfully completed DEV 120 and DEV 121

- has designed and developed new training that meets WFD guidelines for Instructional System Design that is also recorded in PeopleSoft as being implemented and has been implemented or otherwise delivered as well as assisted in the implementation of DEV120

Course Descriptions

DEV119 – Training Basics for Trainers: This course explores the fundamental skills of a trainer. Participants will learn elements of class preparation, adult learning principles, learning styles, classroom management techniques, working with group activities, and training evaluation. The course also uses practical tips and techniques to reinforce various training skills. Participants will benefit from individual feedback to improve their specific challenges and build upon their strengths as trainers.

DEV120 – Training Curriculum Design: This hands-on, activity-based course includes the design of instructional materials. As a requirement for completion, participants will design a Participant Guide through the storyboard stage. Topics include: curriculum development process flow, developing learning objectives, working with a Curriculum Development Plan, types of instructional methods, and completing a Form 1951.

DEV121 – Training Curriculum Development: Designed as an individual project-based course for curriculum developers who have completed the Training Curriculum Design course and want to improve their development skills. Participants attend at least two sessions of these four Topics: Enhancing Writing Skills, Using PowerPoint to Develop Training Guides, Finalizing Course Materials, or Developing Technical /Performance-based Manuals. Optional workshops follow classes.

Equivalencies: Certain degrees, certifications, or training count as equivalencies.

- Education degrees focused on Adult Learning and/or Curriculum Development may be substituted for any of the three certifications with evidence of equivalent qualifications and position job duties consistent with above requirements.

- Current ATD CPLP for Instructor level

- Current IRWA (International Right of Way Association) Level 1, 2, and 3 instructor certifications for Instructor (IRWA level 1) and Senior Instructor (IRWA levels 2 and 3)

- Specific external training may be substituted for DEV 119 and DEV 120 with provision of curriculum and subsequent WFD approval

- Other equivalencies can be substituted with documentation.

15. How is training developed? Please describe the development process.

Workforce Development uses a Project Management framework with the A.D.D.I.E. model and the

Kirkpatrick evaluation strategy. Once training is identified as needed, curriculum is sourced and developed by a team of Instructional System Designers with HRD-WFD and calibrated by Subject Matter Experts (SME's) within the specified division of origin. In this case, the Construction is the Division of origin with the SME's who will read for content specifics; HRD-WFD will compile and write the content within the A.D.D.I.E. model of instructional design.

16. How is new information communicated? (Microlearning, Standups-with talking points, text blasts, social media?)

New information regarding course updates, training calendars and course pilots is communicated via weekly calendar notifications state & district wide.

17. How does your agency assess knowledge transfer for updated information?

Typically, knowledge transfer is established in monthly one-to-one meetings with supervisors, staff meetings, the mentorship quality of the IDP as well as the succession planning mapping of the mid-year through end-of-year evaluation process.

18. Has your agency made any adjustments for younger audiences and their learning styles? If so, please explain.

Yes, we offer on-demand training as well as computer-based training, instructor led, out-of-agency, and learning profile/learning style offerings for today's labor force. Professional development and Supervisory packages are tailored to every divisions need on an ongoing basis.

19. Does your agency have requirements for in-service training? How often? How long?

Not specifically, we require our internal TxDOT and vended TxDOT instructors be professionally vetted and undergo professional certification program in order to understand what goes into training and training adult learners.

20. How does your agency collect feedback from participants, supervisors, management, contractors, or consultants? (Surveys, word of mouth)

TxDOT Training collects Level-1 surveys from participants as well as open-door feedback from TxDOT divisions and divisions, contractors and consultants. Most certification related courses conclude with Level-2 evaluations.

21. How is feedback that is collected used?

TxDOT uses feedback in a variety of ways:

- Vendor and Contractor Management
- Ongoing Project Management
- Annual Program Planning

Qualifications and Certifications

22. What qualifications/certifications does your agency require or use for field inspection

technicians?

TxDOT requires field inspection technicians to have the following certifications:

- Hot mix IA IB certification ACI Testing Center

- ACIA certifications, as well as proficiency in concrete, and to be certified for a year. This is strongly encouraged to participate in the IDP for TxDOT.

23. What regional (NETTCP, WAQTC, SETFTTQ, M-TRAC, etc.), National (NICET), or other state qualification/certification programs for field inspection does your agency accept or use as an equivalent, if any?

TxDOT does not currently accept equivalencies at this time.

24. Does your agency require or encourage private firm (CEI) field inspection technician personnel to be qualified/certified?

Current IDP Mentors are undergoing training through TxDOT Instructor Certification Program, partnered by Human Resources Division and Construction Division.

25. Do you offer pay incentives or compensation for certification?

The overall training program provides educational and professional development opportunities for employees to enhance their current work and prepare them for future roles with the Department. The program(s) supports both internal and external models; the internal program is designed and implemented by internal staff, while the external program provides financial assistance to employees for educational opportunities outside the Department. Decisions regarding training opportunities will be made without regard to the employee's race, color, religion, sex, national origin, genetic information, citizenship or immigration status, disability, military status, or age.

Via TxDOT Training Programs, District Engineers/Division Directors/Office Directors (DE/DD/ODs), their designees, supervisors, and managers focus on program activities that add value to the Department business and enable it to meet its strategic objectives, ensuring all employees receive appropriate work-related training, education, licensing, and certification to meet job demands.

*26. What procedures has your agency introduced along the guidelines enumerated under Section 3, **paragraph d of the 23 CFR 637 Quality Assurance (QA) Program** for sampling and testing:*

Formal training of personnel including all sampling and testing procedures with instructions on the importance of proper procedures and the significance of test results:

1. *Formal training of personnel including all sampling and testing procedures with instructions on the importance of proper procedures and the significance of test results:* **Lab and Field Training, Observations**

2. *Hands-on training to demonstrate proficiency of all sampling and testing to be performed:* **Lab and Field Training including Sampling**

3. *A period of on-the-job training with a qualified individual to assure familiarity with State DOT procedures:* **Progressively over a course 18- 24 months**

4. *A written examination and demonstrated proficiency of the various sampling and testing methods:* **Performance Observations and Proficiency Testing with Passing of 80%**

5. *Requalification at 3- to 5-year intervals (data from the IA program can be used as one element of requalification):* **Qualifications at 3 years and re-qualifications at 5 years (recognized by ACI)**

6. *6A documented process for retraining or removing personnel that perform the sampling and testing procedures incorrectly:* **Proficiency testing is used where a notice to respond is given; root-cause analysis begins at this juncture.**

7. *The following are not appropriate criteria for achieving or maintaining qualification status:* **Specification dictates qualification, i.e. must have a level IA, level II & level B certification. Certification established for life & is applicable only to level IA with participation annually.**

Career Path Management (employee cross-training)

27. How do you develop the cross-training activities?

Within the IDP, TxDOT flexes the Mentor/mentee relationship across the agency and throughout the modularized capacity of the program, the contractor/consultant, OJT in the form of project management and task completion with the districts, IDP manual and ongoing training.

28. What activities are included in your cross-training program?

TxDOT uses the mentoring outline within the IDP manual to continual develop Inspectors via job shadowing, mentoring and coaching.

29. What are the key competencies, skills, and milestones that someone climbing the ladder has to acquire before they are placed in a position of responsibility?

IDP outline provides an accurate and timely assessment of job preparedness of an inspector's job readiness as well as ongoing performance evaluation.

Expand new innovations & technologies

30. How is technology used in the development of curriculum?

TxDOT utilizes the Learning Management System PeopleSoft that interfaces with a variety of software applications to develop on-going training and newly enhance curriculum to ensure up-to date training standards are adhered to.

31. How is technology used in the delivery of training?

TxDOT training staff uses enhanced delivery methods of Computer-based training, YouTube, WebEx, VTC, online hosting and hosted delivery sites to ensure all adult learners are accommodated in an environment that best suits the adult learner

32. How is your agency keeping up-to-date and assessing current materials?

TxDOT Training stays intimately involved with the business needs and field operations of its Divisions and Districts, ensuring content is up to date with industry standards, a general rule of thumb is calibrating curriculum at an 18 month review rhythm Agency wide

33. Is there a set of guidelines on the cadence of when materials are updated?

A general rule of thumb is calibrating curriculum at an three year review- rhythm Agency wide.

Innovative Contracting

34. Does your agency utilize a "Risk Based Audit" approach to construction inspection? If so, please explain.

While not mandated, almost all engineering projects employ some form of risk based strategy. It is to the discretion of the District Engineer of where to apply the daily focus of the Construction inspection team or individual. Typically, projects that draw the risk based audit focus are those that carry the following overarching characteristics such as high value and great impact to public safety. An example of this would be the hot mix process.

35. Does your agency provide special guidance on construction inspection considerations for projects that are on an accelerated schedule? For example, projects that are being constructed during the night or on weekends as well as projects that consist of more than one work shift. If so, please describe.

During an accelerated contract, more inspectors are required to develop the project. TxDOT taps into the consultant pool to augment current staffing levels. Currently, TxDOT employs 1,000 inspectors, and could potentially supplement with up to 800 additional outside resources as a combo of TxDOT and consultative resources.

36. Does your agency provide pay differential for work being performed during the night or on weekends?

Yes, as outlined by Texas Government Code §§659.015(f) and 659.016(b), regular overtime (compensatory time) may be earned by non-exempt and exempt employees. Regular compensatory time is the total number of hours worked (40 hours or less) plus any paid leave or paid holidays taken that exceeds 40 hours in one workweek. All regular compensatory time worked is earned at a rate of one hour for every hour worked. Non-exempt employees who earn regular compensatory time may be paid if:

- It is earned for public safety activities, including highway construction, maintenance, ferry boat operations, or an emergency response activity,
- The DE/DD determines that taking the time off would disrupt critical functions.

37. To what extent does your agency utilize consultant engineering inspection services?

TxDOT uses consultants to the extent that project based construction deems necessary.

38. Does your agency have a process for confirming that certified construction inspectors are performing their construction inspection duties as required? If so, please describe this process.

TxDOT utilized performance documentation mid- and end-of-year as well as the validation of completion of the IDP for current Inspectors.

39. What certification makes sure the contractor has the skills needed?

For the TxDOT Inspector the IDP checklist plus the mentorship graduation will confirm the skillset necessary for inspections. For the private contractor, courses must be completed for TxDOT curriculum via the hosted website at the University of Texas at Arlington Public Works Institute

40. How does your agency pre-test to make sure the contractor can deliver?

A passing grade must be achieved in all courses; The TxDOT training department receives all training rosters, Wallet Cards, and validation of enrolments of contractor completions.

Organizational Hiring (Recruiting) and Retention Practices

41. If your agency hires or promotes from within, how do you identify candidate employees?

TxDOT utilizes succession planning; 30-40% of hires are internal. Construction inspectors often come from maintenance inspectors. The Department's performance management philosophy is to ensure alignment between the work performed by employees and the objectives of TxDOT. The intent of the program is to provide employees with an assessment and feedback of their job performance on an annual basis from both the employee and supervisor, including touch points throughout the year.

TxDOT hiring process

As outlined by Texas Government Code §656.024, external job vacancies for regular, full-time or part-time positions are published with the Texas Workforce Commission (TWC) for at least ten (10) business days unless the Department notifies the TWC that the vacancy has been filled. All internal vacancies are posted on the Department's internal web site for at least five (5) business days. Positions may be filled on an "interim basis" as needed prior to filling a position through the selection process. An interim temporary assignment cannot be longer than six months. As outlined by Texas Transportation Code §201.403, all positions at or above salary group B17 must be open to applicants from inside and outside the Department.

42. Does your agency recruit field inspection technicians?

TxDOT Construction Inspectors must have an aptitude for construction, mathematical ability, willingness to extended hours, and mechanically inclined.

43. What is the ramp up time for new hires?

For less demanding tasks, new inspector's progress through the first series of modules in roughly four months while they remain under the mentorship of a senior inspector; In an ideal world, the entire IDP is completed in 2 years. Onboarding a new employee whose responsibility is to complete the IDP with job shadowing a senior inspector, the program is completed in twelve (12) weeks. Some districts have a much longer time horizon and believe good inspectors take 5-8 years to develop.

Included in the Inspector's Mandatory Training is also agency wide New Employee Mandatory training, as follows:

New Employee Mandatory Training

Course Code	Course Title	Completion Time	Delivery Method
ETH101	TxDOT Ethics Policy	30 days of hire	Online
DEV205	Equal Employment Opportunity (EEO)	30 days of hire	Online
EL2016	HR Policy Manual Release	30 days of hire	Online
EL2017	Records Retention and Litigation Hold	30 days of hire	Online
SFH902	Defensive Driving	30 days of hire	Online
DEV282	Violence Prevention	30 days of hire	Online
SFH420	Hazardous Communication	90 days of hire	Online
EL8474	Securing the Human	90 days of hire	Online

Current Employee Mandatory Training

Course Code	Course Title	Completion Time	Delivery Method
ETH101	TxDOT Ethics Policy	Annually	Online
EL2017	Records Retention and Litigation Hold	Annually	Online
EL8474	Securing the Human	Annually	(1) Has your agency developed
DEV205	Equal Employment Opportunity (EEO)	Every 2 years	Online
SFH902	Defensive Driving	Every 3 years	Online
SFH421	Hazardous Communication-Refresher	Every 5 years	Online

43. Succession Planning — Does your Agency use 9-box grid or other methods to identify and develop internal candidates?

TxDOT's Succession Management Program will ensure a comprehensive talent pool is available to meet the Department's needs. The Department's candidates will be better positioned to compete with external candidates for available positions. An effective program will ensure the Department faces minimum disruptions when vacancies occur.

TxDOT's program includes the entire leadership pipelines, from the senior level positions to deep within the organization and across functions. TxDOT is committed to preparing our employees to assume critical positions of leadership at all levels. We will develop staff based on business need and knowledge transfer will occur using a variety of learning opportunities.
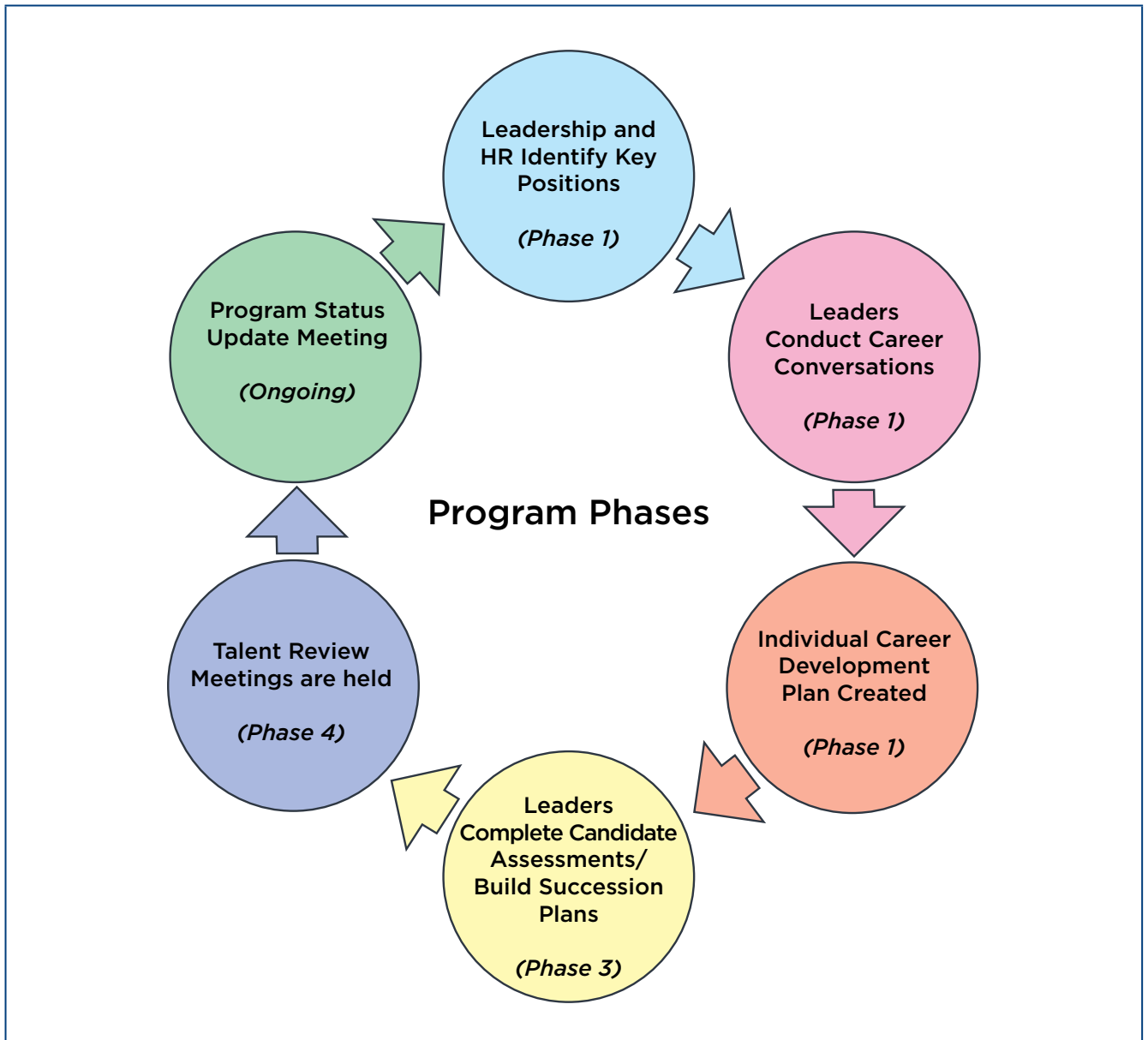
Program Mission and Goals

The Succession Management Program mission is simple: "To develop a talent benchstrength to contribute to the achievement of TxDOT's mission and goals while maintaining TxDOT's values." Basically, this program hopes to have a strong bench of talent (employees) who can compete for future positions and play a role in how TxDOT will achieve its overall mission and goals.

Three Main Goals:

1. Identify and ensure critical positions have adequate sources of qualified candidates to compete for the position.

2. Identify and develop strategies to transfer knowledge and skills to educate on TxDOT's initiatives, services, and resources from senior leadership.

3. Commit to building an inclusive environment where employees from all backgrounds can thrive within the Department.

Program Phases

The diagram below illustrates the key phases in the program. It is important to note that there is no start or end to this process, but a continual progression in developing a strong bench of talent for TxDOT. Additionally, one phase does not have to end in order for the next phase to begin. With the continual cycle of the program, the phases will overlap. Timelines for each phase will be determined as the program matures.

Program Phases

- Leadership and HR Identify Key Positions *(Phase 1)*
- Leaders Conduct Career Conversations *(Phase 1)*
- Individual Career Development Plan Created *(Phase 1)*
- Leaders Complete Candidate Assessments/ Build Succession Plans *(Phase 3)*
- Talent Review Meetings are held *(Phase 4)*
- Program Status Update Meeting *(Ongoing)*

44. Does your Agency have a field training opportunity program?

The IDP is reserved solely for Construction Division; For TxDOT all, there is the Leadership One Program, designed specifically to develop leadership skills at all levels of the organization. Participants will gain the skills, competencies and values necessary to lead employees effectively, achieve personal mastery and promote a meaningful culture within TxDOT.

References:

Texas Department of Transportation. (September, 2016). Human Resources Policy. Retrieved from: http://gsd-ultraseek/txdotmanuals/hrp/index.htm

Texas Department of Transportation. (May, 2011). Inspector Development Manual. Austin, Texas: Author.

Texas Department of Transportation. (May, 2012). Material Inspection Guide. Retrieved from: http://ftp.dot.state.tx.us/pub/txdot-info/cst/mig.pdf

Texas Department of Transportation. (May, 2014). Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges. Retrieved from: ftp://ftp.dot.state.tx.us/pub/txdot-info/des/spec-book-1114.pdf

Texas Department of Transportation. (May, 2011). TxDOT Design-Build Quality Assurance Program Implementation Guide. Retrieved from: https://ftp.dot.state.tx.us/pub/txdot-info/cst/db_qap_guide.pdf

U.S. Department of Transportation, Federal Highway Administration. Formerly Federal-aid Policy Guide Non-Regulatory Supplement NS 23 CFR, Part 637B,

July 19, 2006, Transmittal 36. Retrieved from: http://www.fhwa.dot.gov/pavement/0637bsup.cfm

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