

Research Report
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Construction Training for the Current and Next Generation of Technicians

Final Research Report

Construction Training for the Current and Next Generation of Technicians

by

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In cooperation with the Kentucky Transportation Cabinet

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16. Abstract

Technicians are a vital component to the success of any roadway projects. Unfortunately, the Kentucky Transportation Cabinet (KYTC) is experiencing significant shortages of technicians among all aspects of construction and maintenance. Training and developing the adequate numbers of qualified technicians is a substantial endeavor that requires a comprehensive examination of the adequacy of current training program versus the anticipated skill needs of technicians on future projects. Two questionnaires were developed to identify this gap. One is to investigate the skills and trainings that the Cabinet's technicians possesses and received, and the second is to investigate the skills and/or knowledge which section engineers believe are required among their technicians. Through the analysis of the two surveys, this research found current training programs in Kentucky could cover most of the necessary knowledge and skills for transportation technicians, although more wide cooperation and reciprocity with outside training agencies should be built. However, current training programs are not sufficient enough to satisfy the future technician training needs, especially in the area of grading, structure, soil and maintenance and environment. The research also found technician's most favorite training methods are on-the-job and classroom hands-on, but on-the-job training has not become one of the major sources where the Cabinet's technicians received their training. Inability to help promotion and increase salary, schedule conflict and certificate's short validness are the major barriers which prevented technician's training participation.

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EXECUTIVE SUMMARY

Technicians are a vital component to the success of any roadway construction project. Training and developing the adequate numbers of qualified technicians is a substantial endeavor that requires a comprehensive examination of the qualifications of existing technicians versus the anticipated needs of the technicians on future Kentucky Transportation Cabinet's (KYTC) projects.

KYTC awarded a research grant to the University of Kentucky to address how to maintain and expand this key workforce segment of the Cabinet through training. Two questionnaires were developed to help achieve the research mission. One survey investigated the skills and/or knowledge that section engineers believe are required among their technicians, and the other survey investigated the skills and training that the Cabinet's technicians possesses and received.

Through the analysis of the two surveys, this report represents what is envisioned to be the future training needs of the technician workforce for the Cabinet. The analyses presented herein find current training programs in Kentucky cover most of the necessary knowledge and skills for transportation technicians, although more widespread cooperation and reciprocity with outside training agencies should be developed. In addition, current training programs should be expanded to satisfy the future technician workforce demand, especially in the area of grading, structure, soil and maintenance and environment. Based on the study's survey data, a complete list of training areas to be improved, as well as their priority, is shown below (H denotes high priority, M denotes medium priority and L denotes low priority).

- Maintenance and Environment
 - Environmental Awareness (H)
 - Roadway & Shoulder (H)
 - Winter Operations (H)
 - Roadside Maintenance (H)
 - Bridge Maintenance (H)
 - Fleet Management (H)

- Traffic Services & Safety (M)
- Drainage (M)
- Kentucky Erosion Prevention & Sediment Control - Roadway Inspector (L)
- Hazardous Material Awareness (L)
- Pesticide (L)
- Structure
 - Footings (H)
 - Retaining Walls (H)
 - Concrete Girders (H)
 - Steel Girders & Connectors (H)
 - Joints (H)
 - Deck Smoothness (H)
 - Post Tensioning (H)
 - Bridge Coating Inspector (M)
 - Forming & Falsework (M)
 - Reinforcing Steel – Layout (M)
 - Finishing & Curing Concrete (M)
 - Precast Structures (M)
- Grading
 - Controlled blasting (H)
 - Contour Grading (H)
 - Excavation (M)
 - Site Preparation (M)
 - Embankment (M)
 - Borrow (M)
 - Compaction (M)
- Soil
 - Bulk Disturbed Sampling (H)
 - Moisture-Density Relationship for Coarse Soils (M)
 - Geotechnical Exploration, Sampling & In-Situ Testing (M)

- Moisture-Density Relationship for Fine Soils (L)
- Concrete
 - Portland Cement Concrete(PCC) Pavement Field Testing (H)
 - PCC Production & Quality Assurance Labs (H)
 - KRMCA LEVEL II (L)
- Asphalt
 - Superpave Plant Technologist (M)
 - Superpave Mix Design Technologist (M)
 - Hot Mixed Asphalt Pavement Field Inspection (L)
 - Warm-Mixed Asphalt (L)
- Aggregate
 - Documentation (M)

Based on the above number of topics within each area and their priorities, it is apparent that there is strong need to improve the Cabinet's overall training efforts areas related to Maintenance and Environment as well as Structures. As the Cabinet and the Kentucky Transportation Center through its Technology Transfer Program move forward, additional effort to expand their training opportunities for the Cabinet's technician workforce is certainly warranted.

The research also found technician's most preferred training methods are on-the-job and classroom hands-on exercises. Furthermore, on-the-job training has not become one of the major sources where the Cabinet's technicians received their training. Development and expansion of formal mentoring programs would likely help the next generation of construction technicians in these regards. The perceived inability of increased training to help in the promotion and to increase the salaries of the Cabinet's technician workforce, schedule conflict and training certificates' short validness are major barriers which prevented technician's training participation as indicated by those responding to the survey.

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1 INTRODUCTION

Currently, the Kentucky Transportation Cabinet is experiencing significant shortages of technicians among all aspects of construction and maintenance as a result of a significant number of retirements and turnover in recent years. Technicians are a vital member of the Cabinet's project team on any construction and maintenance project. Technicians need to have the understanding of construction practices, record keeping and workmanship in order to adequately inspect and accept the work being installed. This research report addresses a critical issue of how to maintain and expand the skills of this key workforce segment of the Cabinet through training.

Technicians are a vital component to the success of any roadway construction projects. They are often in direct interface with construction operations ensuring that the project is being built in accordance to the quality and design expectations of a project. Unfortunately, the Kentucky Transportation Cabinet is experiencing significant shortages of technicians among all aspects of construction and maintenance as a result of a significant number of retirements and turnover in recent years. Training and developing the adequate numbers of qualified technicians is a substantial endeavor that requires a comprehensive examination of the qualifications of the existing technician workforce (supply) versus the anticipated needs (demand) of the technician on future KYTC projects. While identifying the potential gaps between the supply and demand of technicians does not solve the issue of ensuring that qualified technicians are available when and where they are needed, it does allow the Cabinet to develop the necessary roadmap to meet the desired goal. Once a roadmap is developed, anticipated future research projects will examine how different training delivery methods and technologies can potential accelerate the development of the Cabinet's next generation of construction technicians.

Through extensive literature review and online surveys, the report specifically targets three objectives, which includes:

- A. Identify how other state transportation agencies are addressing the training and development needs of their agency's technician workforce.
- B. Identify the largest gaps in supply and demand for technician skills on the Cabinet's construction projects. This information will develop the roadmap for the construction technician training program.
- C. Identify the barriers that current technicians experience in acquiring training. Understanding training barriers will help identify how future training can be most efficiently delivered.

To meet these objectives, this report first presents research of the transportation technician training effort within Kentucky and nationwide as a background in Chapter 2. Then in Chapter 3, the report introduces the effort to investigate the gap between technician supply and demand, as well as the barriers that technicians experience in acquiring training. Finally, Chapter 4 includes the conclusions and recommendations of this research.

2 TRANSPORTATION TECHNICIAN TRAINING

Before investigating the gap between future technician supply and demands, it is important to have a clear understanding of the current transportation technician training available in Kentucky. Therefore, as a research background, this chapter summarizes the current training programs and courses in Kentucky, as well as nationwide for comparison purpose.

2.1 Transportation Technician Training in Kentucky

The major transportation training source is the Technology Transfer Program by Kentucky Transportation Center at University of Kentucky. This program included trainings in the following areas:

- Road Master Program
- Roads Scholar Program
- KY Erosion Prevention & Sediment Control (KEPSC)
- Asphalt Training & Testing
- Work Zone Qualification Training Program

2.1.1 Kentucky Erosion Prevention & Sediment Control (KEPSC) Program

The Kentucky Erosion Prevention & Sediment Control (KEPSC) Program is designed to offer introductory knowledge as well as assist developers, contractors, and government agencies in complying with the Kentucky Pollutant Discharge Elimination System (KPDES) General Permit for Construction. Courses include the KEPSC Introductory Program, KEPSC Inspector Qualification Training & Testing, and KEPSC Requalification. KEPSC courses are designed to provide governmental roadway maintenance workers the basic knowledge necessary to safely and efficiently maintain Kentucky's highways. These classes are open to local and state governmental employees, private industry, the general public and anyone regardless of job assignment with interest in learning more about maintaining roads and streets. All the four KEPSC courses are one-full-day in-class training.

2.1.1.1 KEPSC Inspector Qualification

This training is invaluable to public works employees, contractors and inspectors throughout the Commonwealth, since Qualified Inspectors are required for a project to receive the Kentucky Pollutant Discharge Elimination System (KPDES) General Permit issued by the Kentucky Division of Water. KPDES permits apply to any construction site in Kentucky with a disturbance of one acre or more. Inspector Qualification is valid three years from successfully completing the exam. This course is given about 4 times per year.

2.1.2.2 KEPSC Inspector Requalification

This course is designed for KEPSC Qualified Inspectors who wish to maintain their qualification, which expires three years after initial testing. In order to become re-qualified, participants must complete the entire workshop and pass the exam. This in-class is given about five times per year.

2.1.2.3 KEPSC Roadway Inspectors

The purpose of KEPSC Roadway Inspectors (KEPSC-RI) is to qualify erosion and sediment control inspectors for roadway projects as required by Standard Specifications for Road and Bridge Construction, published by the Kentucky Transportation Cabinet, Department of Highways. Prior to this course, inspectors were qualified through the KEPSC-Basic Course. This newly developed course specifically addresses linear projects and the specific requirements of the Transportation Cabinet. The course includes detailed discussions of standard specifications and drawings, inspection documentation procedures, and application of Best Management Practices to roadway construction sites. This course is given twice or three times per month.

2.1.2.4 Storm water Pollution Prevention Plan Preparers Course

This newly-developed course is designed to train individuals in the preparation of stormwater pollution prevention plans (SWPPPs) for construction sites. A SWPPP is required for all construction sites that disturb one or more acres of land. This course is intended for individuals with a firm, basic understanding of the KPDES Stormwater Permit requirements for construction sites and familiarity with principles of erosion, sediment and pollutant control. This course is given about twice per year.

2.1.2 The Superpave Asphalt Qualification Program

The Superpave Asphalt Qualification Program operates under principles set forth by Kentucky specifications and federal mandates requiring that knowledgeable, well-trained employees be involved in paving operations. These measures insure cost-effectiveness and quality workmanship. This training program reviews Kentucky procedures, familiarizes experienced technologists with important new practices, and provides an overview of information used on a daily basis in HMA testing. The Superpave Asphalt Qualification Program offers three different qualifications: Asphalt Field Technician (with Asphalt Paving Best Practices as its training course), Superpave Plant Technologist (SPT), Superpave Mix Design Technologist (SMDT).

2.1.2.1 Asphalt Paving Best Practices

The Asphalt Paving Best Practices course (formerly called Asphalt Field Technician, a half-day course) reviews Kentucky procedures, discusses asphalt practices, and provides an overview of information used on a daily basis in asphalt planning, production, placement, and testing. Kentucky specifications and federal mandates require that knowledgeable, well-trained employees be involved in paving operations to insure cost-effectiveness and quality workmanship. Highway contractors wishing to bid on Kentucky projects must have a certified Asphalt Field Technician on staff, and this course along with a test given at the end of the training will qualify those individuals.

2.1.2.2 Superpave Plant Technologist (SPT)

This three-and-a-half day course prepares an individual to be qualified to perform daily inspection, process-control, and acceptance of verification testing as defined in the Kentucky Standard Specifications.

2.1.2.3 Superpave Mix Design Technologist (SMDT)

This is another three-and-a-half day course for the individuals who are successfully qualified as SPTs. Completion of this course indicates qualification as a SMDT. With this designation, an individual is qualified to perform, submit, adjust, or approve mix designs as defined in Kentucky Standard Specifications.

2.1.3 Work Zone Qualification Training Program

In 2007, the Kentucky Transportation Cabinet issued the Policy and Procedures for the Safety and Mobility of Traffic through Work Zones with a primary goal of reducing crashes and injuries in and around highway work zones; as well as providing a safe and efficient environment for workers. The Work Zone Traffic Control Employee Qualification Program has been developed to meet this need. There are four courses included in this program:

- Basic Work Zone And Flagger Qualification

This one-day course teaches basic work zone traffic control procedures and proper flagging methods. The course also fulfills a requirement for the Roads Scholar Program.

- Work Zone Traffic Control Technician Qualification

This course is intended for individuals working for governmental agencies, utilities, and highway contractors who place, monitor, and maintain traffic control devices on public roadways in Kentucky. Technicians must be qualified through training and testing and certified by the Kentucky Transportation Cabinet every five years.

- Work Zone Traffic Control Supervisor Qualification

This one-day course is intended for individuals who supervise traffic control technicians and other field personnel and who are responsible for implementing the

Traffic Control Plan. The course expands on the concepts and techniques taught in the Traffic Control Technician Course, which is a prerequisite for the supervisor training. Supervisors must be qualified through training and testing every five years.

- Basic Work Zone & Flagger Train-The-Trainer

This one-day class was developed to help Kentucky highway contractors, public agencies, and other companies doing work on Kentucky highways to qualify their employees as required by the Transportation Cabinet's Mobility in Work Zones Policy. The curriculum includes discussions of adult learning styles and presentation skills. The approved flagger qualification course is also presented and participants receive copies of materials to facilitate presentation to their own audiences.

2.1.4 Roads Scholar Program

This training series is designed to provide local and state government employees with basic information on maintaining local streets and roads. Completion of this program leads to the designation of Roads Scholar.

The required courses include:

- Basic Work Zone And Flagger Qualification;
- Drainage: The Key to Roads That Last;
- Low-Cost Roadway Safety Improvements;
- Managing People I;
- Risk Management/Tort Liability; and
- Traffic Management through Signals, Signs and Markings.

Besides the required courses, at least three optional courses are required to become a road scholar and include:

- Asphalt Paving Best Practices: RS & Asphalt Field Tech;
- Communications I;
- Construction of Concrete & Cement Stabilization Workshop;
- Customer Service;
- Managing People II;

- Managing People III;
- Managing People IV;
- Managing People V; and
- Managing People VI.

All courses listed above are one-day courses.

2.1.5 Road Master Program

This series is an additional level of training for Roads Scholars that requires seven additional days of training. Completion of the four required courses and at least three optional courses from the lists below leads to the Road Master designation.

The required courses include:

- Communications II;
- Developing Leadership Skills;
- Environmental Awareness; and
- Snow and Ice Removal.

The optional courses include:

- AAA Defensive Driving;
- Basic Plan Reading;
- Computer Familiarization;
- Erosion and Sediment Control;
- Hazardous Materials Awareness;
- Roadside/Vegetation Management; and
- Small Bridges.

2.1.6 Kentucky Qualified Technicians and Laboratories Program

Another transportation technician training source in Kentucky is Kentucky Qualified Technicians and Laboratories provided by the Kentucky Transportation Cabinet's Division of Materials. This program provides in-class training in the areas of

aggregate, asphalt, bridge coating inspection, erosion control, grading, paving marking, structure level I and work zone traffic control.

2.1.6.1 Aggregate

The Kentucky Aggregate Technician Course is sponsored by the Kentucky Aggregate Technician Program. The course is for sampling technicians (those who need to be qualified to perform acceptance sampling of aggregates but who do not need to be qualified to perform testing of aggregate samples), aggregate technicians (those who need to be qualified to perform sampling and testing), and those who plan to sit for their requalification exam. The sampling course is a half-day course, while the aggregate technician course is a two-half-day course.

2.1.6.2 Asphalt

The asphalt training course is provided by the Technology Transfer Program of Kentucky Transportation Center at the University of Kentucky, as mentioned before.

2.1.6.3 Bridge Coating Inspection

This training is provided by the Bridge Coating Inspector (BCI) program from the Society for Protective Coatings (SSPC). The BCI course covers the fundamentals of how to inspect surface preparation and application of protective coatings on bridge steel. These fundamentals are applicable to those who inspect coating work both in the shop and in the field. The course covers unique situations that will affect inspection in the field (e.g. containment, field safety hazards, changing weather conditions), as well as the fundamental inspection skills required to inspect new bridge steel painted in the shop, in the field or maintenance systems applied in the field. The course format is classroom lecture supplemented by quizzes, group exercises, and hands-on workshops. Bridge Coating Inspection has two levels of course. Level I is a 5-day course, and level II is a 6-day course.

2.1.6.4 Erosion Control

This training course is also provided by the Technology Transfer Program of the Kentucky Transportation Center at the University of Kentucky, as mentioned before.

2.1.6.5 Grading

This training course includes Grading Level I and Grading Level I refresher. The Grading Level I course is designed to give participants the skills and knowledge required to become a competent grade and drain inspector. Topics discussed include soil sampling, interpretation of soil profile sheets, moisture and density testing by the nuclear method, developing moisture-density target values by the one-point proctor method, visual identification of soil types, and specifications of grade and drain construction. Each participant performs a one-point proctor and a nuclear density test. The Grading Level I Refresher course is designed to give participants a refresher on the skills and knowledge required to continue as a competent grade and drain inspector. Topics discussed include quality control and assurance, moisture and density testing by the nuclear method, developing moisture-density target values by the one-point proctor method, and changes to the specifications of grade and drain construction.

2.1.6.6 Pavement Markings Inspector Qualification

Candidates who successfully complete this course will be qualified to inspect pavement markings on Kentucky projects. Candidates will be instructed in the appropriate use of the LTL-X Retroreflectometers and retroreflectivity requirements of various pavement marking materials currently used on construction projects. Candidates are also instructed in the use of Excel Spreadsheets to download retroreflectivity data from the LTL-X and calculations for passing percentages of installed markings. Current Specifications and Kentucky Methods governing the evaluation of pavement markings are also reviewed. Candidates will be required to successfully complete both a written and practical exam to be qualified as a Pavement Markings Inspector.

2.1.6.7 Structure Level I

This is a two-day course designed to give participants the skills and knowledge required to become a competent bridge and culvert construction inspector. Topics include Plan Interpretation, Geotechnical Investigation, Bearing Piles, Structural Excavation, Concrete Placement and Testing, Structural Steel, Bridge Decks, Falsework, 3-Sided Structures, Reinforcement, Metal Arch Structures, Retaining Walls, and Specification of Bridge and Culvert Construction.

2.1.6.8 Work Zone Traffic Control

The Transportation Cabinet currently recognizes the three work zone traffic control technician classes below. A passing grade from any of the three courses is accepted, and qualification lasts for 5 years.

- Traffic Control Technician course from American Traffic Safety Services Association
- Traffic Control Technician course from Kentucky Laborers' Joint Apprenticeship & Training Trust Fund
- Work Zone Traffic Control Technician course from University of Kentucky, Kentucky Transportation Center

2.2 Transportation Training Nationwide

2.2.1 National Highway Institute

The National Highway Institute (NHI), a division of the Federal Highway Administration (FHWA), works to improve the performance of the transportation industry through training. To achieve this mission, NHI provides transportation-related training in several formats including both classroom-based and online learning as well as free Web-based seminars and asynchronous training materials.

2.2.1.1 Training Formats

NHI offers a wide variety of transportation-related training courses. These courses are presented in a variety of delivery formats, including Instructor-led training (ILT), Web-conference training (WCT), and Web-based training (WBT).

- Instructor-led Training (ILT)

These courses are held in-person and led by an instructor. In order to open a session, it must be requested to be hosted by a transportation organization. Once the session is opened, other individuals may sign up for that session (based on availability).

- Web-conference Training (WCT)

Like an ILT, a WCT session has an instructor or facilitators and must be requested by a transportation organization. The difference is that a WCT takes place online in a virtual Adobe Connect classroom and can be accessed from any computer with an Internet connection via the My Training page. Although course participants may access a WCT course from almost anywhere in the world, these courses are scheduled to occur at a specific time and consist of live events.

- Web-based Training (WBT)

Like WCT courses, a WBT course is also located online and can be accessed from any computer with an Internet connection via the My Training page. WBTs are self-paced and are not led by an instructor. Instead, they are designed for individual training and reference. You can access a WBT at any time and return to it as many times as you wish, although the final exams can only be completed once.

- Blended

Certain "blended" courses may combine two or three of the above methods (for example, a course may have a Web-based component that must be completed before the instructor-led component).

2.2.1.2 NHI Training Program Areas

NHI offers courses in an extensive variety of Program Areas ranging from Highway Safety to Hydraulics to Financial Management, while in this report, only the courses directly related to transportation technicians' skills are listed below:

- **Construction and Maintenance:** offers courses in value engineering, managing highway contract claims, accelerating innovation implementation, risk management and much more.
- **Design and Traffic Operations:** covers topics such as highway capacity and quality of flow, traffic signal design and operation, and freeway management and operations.
- **Environment:** offers training in NEPA and transportation decision making, environmental justice, and water quality management of highway runoff.
- **Freight and Transportation Logistics:** address topics such as integrating freight in the transportation planning process, linking freight to planning and the environment, principles of effective commercial motor vehicle (CMV) size, and weight enforcement.
- **Geotechnical:** offers training on geosynthetics engineering, drilled shafts, driven pile foundations, soil slope and embankment design, and construction.
- **Highway Safety:** offerings cover roadside safety design, construction zone safety inspection, road safety audits, and low-cost safety improvements.
- **Hydraulics:** addresses river engineering for highway encroachments, urban drainage design, and stream stability and scour at highway bridges.
- **Intelligent Transportation Systems (ITS):** offers training on topic such as how to improve highway safety with intelligent transportation systems and the ITS deployment analysis system.
- **Pavement and Materials:** includes trainings on hot-mix asphalt construction, Asphalt Pavement In-Place Recycling Technologies, and Pavement preservation.
- **Structures:** offers courses on topics such as bridge inspection, fracture critical inspection techniques for steel bridges, highway bridge superstructures, and underwater bridge inspection.

- **Transportation Planning:** includes application of the FHWA Traffic Monitoring Guide, statewide transportation planning, and traffic monitoring and pavement design programs.

2.2.2 Transportation Curriculum Coordination Council

The Transportation Curriculum Coordination Council (TCCC) is a partnership between the Federal Highway Administration (FHWA), State Departments of Transportation (DOTs), and the highway transportation industry. TCCC's missions are to provide leadership at a national level, develop and maintain a national curriculum for various transportation disciplines, identify training and certification requirements, coordinate/facilitate training efforts, and develop training materials.

One of the major contributions of TCCC to transportation training is a complete curriculum matrix. The matrix includes four categories: construction, maintenance, materials and safety & work zone. The structure of the matrix is shown below:

- **Construction**
 - Quality Assurance
 - Environment
 - Construction Surveying & Staking
 - Utility
 - Grading
 - Drainage
 - Aggregate Bases & Subbases Inspection
 - Geotechnical Construction
 - New Structure Construction
 - PCC Pavement Field Inspection
 - HMA Pavement Field Inspection
 - Asphalt Recycling
 - Landscaping

- Maintenance
 - Roadway & Shoulder
 - Drainage
 - Winter Operations
 - Roadside Maintenance
 - Bridge Maintenance
 - Fleet Management
 - Work Zone Traffic Control
 - Traffic Service & Safety

- Materials
 - Soils Testing
 - Aggregates
 - Treated & Untreated Bases
 - HMA Field Testing
 - Recycling: Field In-Place (Hot or Cold)
 - HMA Production & QA Labs (Including Mix Design)
 - Cementitious Material (Low Density Fill, Shotcrete and Other Cementitious Materials)
 - PCC Bridges & Minor Structures
 - PCC Production & QA Labs
 - Miscellaneous
 - Quality Assurance
 - Geotechnical Testing

- Safety and Work Zone
 - Personal Safety

In the course matrix, TCCC also developed competencies by skill level for each course. An example is shown in Figure 2.1. This competency matrix can be a good training guide for both trainers and trainees.

DISCIPLINES	COMPETENCIES BY SKILL LEVELS			
	Level I	Level II	Level III	Level IV
Surface Preparation	Assists in performing surface inspections	Inspects surface for proper preparation in accordance with contract documents	Recommends acceptance or corrective action based on inspection results	Determines contract decisions related to surface preparation acceptance and payment
	Increasing skill level		Documents and follows up on corrective actions	Recommends disciplinary action when corrective measures are not taken in a reasonable time frame
Concrete Delivery	Assists in inspections of delivery vehicles to make sure they are in good working condition	Inspects trucks to assure that all gauges, meters, etc. are in working order	Recommends acceptance or corrective action based on inspection results	Determines contract decisions related to concrete delivery acceptance and payment
		Checks for worn parts that could affect mix quality	Documents and follows up on corrective actions	Recommends disciplinary action when corrective measures are not taken in a reasonable time frame
		Collects load tickets		
	Verifies correct mix was shipped			

Figure 2.1: Sample Competencies by Skill Levels Developed by Transportation Curriculum Coordination Council

In cooperation with states including Iowa, Texas, Maryland, Minnesota, Alabama, North Dakota and South Dakota, TCCC provide the following training courses:

- Aggregate Sampling and Testing;
- Aggregate Specific Gravity;
- Asphalt;
- Asphalt WAQTC;
- Concrete;
- Concrete Inspector;
- Concrete Technician;
- Embankment and Base;

- Grade Training;
- Graduating to Instructor – Beginning;
- HMA Paving Field Inspection;
- Hot Mix Asphalt Paving Inspector;
- Hot Mix Asphalt Plant Technician;
- Hot-mix Asphalt Sampling and Testing;
- In-place Density;
- Level 2 Aggregate;
- Level 2 Bituminous;
- Level 2 Concrete;
- Level 2 Soils;
- Level I and Level II Aggregate;
- Level I Hot-mix Asphalt (HMA);
- Level I Portland Cement Concrete (PCC) Reference M;
- Level I Technician;
- Level II HMA Mix Design;
- Level II Portland Cement Concrete (PCC);
- Low Slump;
- PCC Paving Field Inspection;
- PG Asphalt Binder Laboratory Technician;
- Prestress;
- Profilograph;
- Self-Instructional Plan Reading Course;
- Self-instructional Math;
- Soils and Aggregate Inspector;
- Soils and Aggregate Laboratory Technician;
- Soils Sampling and Testing;
- Structure Field Inspection; and
- Superpave Field Laboratory Technician (SF)

In cooperation with FHWA and NHI, TCCC also developed a series of web-based training course as follows:

- FHWA-NHI-131117: Basic Materials for Highway and Structure Construction and Maintenance;
- FHWA-NHI-131122: Portland Cement Concrete Paving Inspection;
- FHWA-NHI-134069: Ethics Awareness for the Transportation Industry;
- FHWA-NHI-134071: Basic Construction and Maintenance Documentation - Improving the Daily Diary;
- FHWA-NHI-134072: Math Module;
- FHWA-NHI-134075: Hardened Concrete Properties – Durability;
- FHWA-NHI-134078: GPS Technology;
- FHWA-NHI-134081: Plan Reading; and
- FHWA-NHI-134084: Fundamentals of Materials Used for Concrete Pavements.

Obviously, TCCC's training course don't cover all the training areas of its curriculum matrix, and the development of complete training courses is a long and joint effort of not only TCCC but FHWA, NHI and State Departments of Transportation (DOTs), and the highway transportation industry.

2.2.3 Regional training and certification groups

When a State department of transportation (DOT) embarks on a new construction or rehabilitation project, it usually relies not only on its own staff to sample and test the materials used in construction, but also on personnel working for various contractors. In an era of continually changing technologies and advances in knowledge, DOTs are looking for assurance that these technicians, whether they are State employees or contractors, are up to speed on the latest methods and specifications. In response, some states have started regional programs to test workers and to certify those who meet a basic set of standards.

Under most of the existing regional certification programs, technicians who pass written and performance examinations in one state earn the certification ranking, which

allows them to automatically be considered certified in other states that are part of the regional coalition. State DOTs that contract out work benefit from knowing how much training the contractor's technicians have had. Contractors who work in more than one state benefit from not having to spend time and money to get their technicians certified in each state.

Currently, there are five regional training partnerships working through the Transportation Curriculum Coordination Council (TCCC) to help train a qualified workforce to maintain and rehabilitate the nation's aging roads and bridges: The Mid-Atlantic Region Technician Certification Program (MARTCP), The Western Alliance for Quality Transportation Construction (WAQTC), the Southeast Task Force for Technician Training and Qualification (SETFTTQ), The North Central Multi-Regional Training and Certification Program (M-Trac), and the NorthEast Transportation Training and Certification Program (NETTCP). Figure 2.2 shows the geographical distribution of the five regional training partnerships.

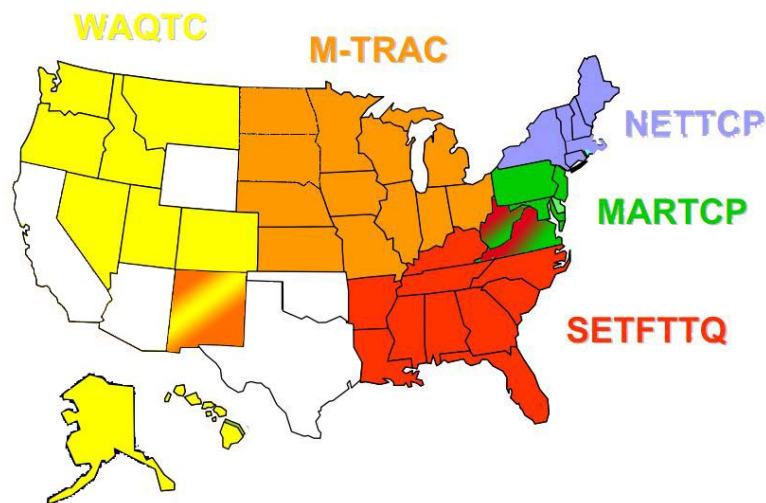


Figure 2.2: Regional Transportation Training Partnerships

Note: New Mexico, Virginia and West Virginia participate in two regional training partnerships

2.2.3.1 The Mid-Atlantic Region Technician Certification Program (MARTCP)

The Mid-Atlantic Region Technician Certification Program is comprised of the State DOT's of New Jersey, Pennsylvania, Delaware, Virginia, West Virginia, Maryland and the District of Columbia and Federal Highway Administration. This organization is dedicated to raising the knowledge level of technicians performing hands-on testing of products and services they provide to the transportation industry.

The Mid-Atlantic Region Technician Certification Program (MARTCP) offers several training programs to its participating states, including soils and aggregate compaction technician, aggregate technician, hot-mix asphalt field construction/paving, and pavement markings technician training. Every participating state also has its specific training program, such as bridge inspector, hot-mix asphalt design and PCC inspector, but a complete reciprocity has not been built in the MARTCP, in other words, not all the training certificates in one participating state are accepted by other participating states.

2.2.3.2 The Western Alliance for Quality Transportation Construction (WAQTC)

The Western Alliance for Quality Transportation Construction (WAQTC), is comprised of representatives of the western states of Alaska, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Texas, Utah, and Washington, and the Western and Central Federal Lands Highway Divisions (WFLHD and CFLHD) of the Federal Highway Administration (FHWA).

To initiate quality improvement, the WAQTC has implemented a Transportation Technician Qualification Program (TTQP) and a Laboratory Qualification Program (LQP). The TTQP currently consists of instruction and qualification, in field materials testing procedures in Aggregate, Asphalt, Concrete, Embankment and Base, and In-Place Density, as well as a course in the Basics of Superpave Mix Design. This program is prescribed to meet, in part, the requirements of The Code of Federal Regulations 637, Subpart B - Quality Assurance Procedures for Construction. The LQP is designed to ensure that all laboratories that perform materials sampling and testing functions required

under an agency's construction contracts comply with qualifications criteria adopted by WAQTC member agencies.

Technicians must successfully complete all requirements of a qualification area to be considered qualified by the TTQP in that area. A person completing these requirements, and holding a valid qualification, will then be considered qualified to perform those specific sampling and testing functions, only, falling under that qualification in any participating agency of the WAQTC. Although the technician is considered qualified in that area by all agencies for the defined test methods, there may be additional agency specific tests and contract administration or quality assurance procedures, not specifically covered in the TTQP qualification, that the technician will be required by that agency to show proficiency in. The technician should be aware that non-WAQTC agencies may or may not accept any of these Qualifications. Therefore, a complete reciprocity is also not achieved within the WAQTC.

2.2.3.3 The Southeast Task Force for Technician Training and Qualification (SETFTTQ)

Twelve Southeastern States (Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, West Virginia) have joined together to form the Southeast Task Force for Technician Training and Qualification (SETFTTQ). The purpose of this task force is to build reciprocity relationships and to develop avenues to share information that will help develop individual state programs. Current priorities include developing a shared training program library, updating existing training programs, and developing new training programs based on the congregate needs of the member States. However, the technician training within SETFTTQ program is still provided by individual states, and the wide reciprocity has not been developed.

The training courses in SETFTTQ are as the following.

Arkansas: Center for Training Transportation Professionals (CTTP), University of Arkansas

- Aggregates
- Hot Mix Asphalt

- PC Concrete
- Soils
- Concrete Strength Testing
- Concrete Pavement Patching
- Roadway Construction Control
- National Pollutant Discharge Elimination System
- Bridge Scour

**Florida: Florida Department of Transportation's Construction Training
Qualification Program (CTQP)**

- Aggregates
 - Aggregate Test Technician
 - Aggregate Base Testing Technician
 - Qualified Sampler Technician
 - LBR Technician Training
- Asphalt
 - Asphalt Paving - Level I
 - Asphalt Paving - Level II
 - Asphalt Plant - Level I
 - Asphalt Plant - Level II
 - Asphalt Mix Designer
- Concrete
 - FDOT Concrete Field Testing Technician Level 1&2
 - ACI Concrete Laboratory Testing Tech - Grade I
 - FDOT Concrete Field Inspector Specification
 - FDOT Concrete Lab Technician Specification
 - Concrete Batch Plant Operator
- Earthwork
 - Earthwork Construction Inspection - Level I
 - Earthwork Construction Inspection - Level II
- Management

- QC Manager
- Final Estimates - Level I
- Final Estimates - Level II
- GeoTech
 - Pile Driving
 - Drilled Shaft

Georgia

- Aggregate Technician Q.C. Sampling and Testing
- Asphalt
 - Quality Control Technician 1
 - Quality Control Technician 2
- Concrete
 - Certified Concrete Batcher (Ready-Mix& Precast-Prestress)
 - Certified Concrete Technician (Ready-Mix & Precast-Prestress)
 - Concrete Tester (Technician I) (Precast & Prestress)
 - Precast (Technician II)
 - Prestress (Technician III)
 - Certified Field Technician

Louisiana: Louisiana Department of Transportation and Development

(DOTD)

Louisiana DOTD offers full certification in the following areas:

- Embankment and Base Course
- Asphaltic Concrete Plant
- Asphaltic Concrete Paving
- PCC Paving
- Structural Concrete
- PCC Technician
- Laboratory Testing

Mississippi

- Level I-Qualification of Soils and Aggregates Technicians
- Asphalt
 - Certified Asphalt Technician Level 1 CAT-I
 - Certified Asphalt Technician Level 2 CAT-II
 - Certified Mix Design Technician Level 3 CMDT
- Concrete
 - ACI Grade I (MDOT Class I)
 - MDOT Class II

North Carolina

- Aggregate and Soil
 - Aggregate QC/QA Sampling & Testing
 - Nuclear Density Certification
 - Conventional Density Certification
- Asphalt
 - Level I Plant
 - Level II Plant
 - Roadway
 - Mix Design
- Concrete Field Technician

South Carolina

- Aggregate and Soil
 - Nuclear Gauge Operator
 - Aggregate Technician - Level I
 - Aggregate Technician - Level II
- Asphalt
 - Level 1 - HMA QC Technician
 - Level 2S - HMA Mix Design Technician
 - Level 3 - HMA Quality Control Manager

- Asphalt Roadway Technician (ART)
- Concrete Technician

Tennessee

- Aggregate and Soil
 - Soils and Aggregate Technician
 - Nuclear Gauge Testing Technician
 - Radiation Safety Officer
- Asphalt
 - Certified Asphalt Lab Technician
 - Certified Asphalt Plant Technician
 - Certified Asphalt Roadway Inspector
- Concrete
 - TDOT Concrete Technician Class 1 Field Testing
 - TDOT Concrete Technician Class 2 Lab Testing
 - TDOT Concrete Technician Class 3 Design

Virginia

- Soils and Aggregate Compaction Technician
- Asphalt
 - Asphalt Field
 - Asphalt Plant Level I
 - Asphalt Plant Level II Mix Design
- Concrete
 - HCC (Hydraulic Concrete Cement) Field
 - HCC Plant

West Virginia

- Aggregate and Soil
 - Aggregate and Soil
 - Aggregate Technician
 - Aggregate Sampling Technician

- Compaction Inspector
- Asphalt
 - HMA Inspector
 - HMA Technician
- Concrete
 - PCC Inspector
 - PCC Technician

2.2.3.4 The North Central Multi-Regional Training and Certification Program (M-TRAC)

M-TRAC offers many training programs to its participating states, most of whom follow reciprocity policies for certifying highway workers. The M-TRAC programs are continually growing and changing. The member states include: Illinois, Indiana, Iowa, Kansas, Louisiana, Michigan, Minnesota, Missouri, Nebraska, New Mexico, North Dakota, Ohio, South Dakota and Wisconsin.

The training courses in M-TRAC are as the following.

- **M-TRAC**
 - MTRAC1. Soils Sampling and Testing
 - MTRAC2. Aggregate Sampling and Testing
 - MTRAC3. Hot Mix Asphalt (HMA) Sampling and Testing
- **Iowa Technical Training and Certification Program**
 - IA1. Level I and II Aggregate
 - IA2. Level I Portland Cement Concrete (PCC) Reference Manual
 - IA3. Level II Portland Cement Concrete (PCC)
 - IA4. Level I Hot Mix Asphalt (HMA)
 - IA5. Level II HMA Mix Design
 - IA6. Profilograph
 - IA7. Prestress
 - IA8. Self Instructional Math

IA9. Self Instructional Plan Reading Course

IA10. Grade Training

IA11. HMA Paving Field Inspection

IA12. PCC Paving Field Inspection

IA13. Structure Field Inspection

- **Minnesota Department of Transportation**

- Aggregate Production
- Concrete Field 1
- Concrete Field 1 with ACI option
- Concrete Field 1 Recertification for ACI option
- Concrete Field 2
- Concrete Field Recertifications
- Concrete Plant 1
- Concrete Plant 1 Recertification
- Concrete Plant 2
- Concrete Plant 2 Recertification
- Bituminous Street (1 & 2 combined)
- Bituminous Street Recertification
- Bituminous Plant 1
- Bituminous Plant 1 Recertification
- Bituminous Plant 2
- Bituminous Plant 2 Recertification
- Grading & Base 1
- Grading & Base 2
- Grading & Base Recertifications
- Bridge Construction 2
- Bridge Construction Recertification

- **Missouri Department of Transportation**

MoDOT1. Level I Technician

MoDOT2. Level 2 Aggregate

- MoDOT3. Level 2 Concrete
- MoDOT4. Level 2 Soils
- MoDOT5. Level 2 Bituminous
- MoDOT6. Aggregate Specific Gravity
- MoDOT7. Profilograph
- MoDOT8. Low Slump

2.2.3.5 NorthEast Transportation Training and Certification Program (NETTCP)

Working together with the Federal Highway Administration (FHWA), Federal Aviation Administration (FAA) and industry throughout New England, a nonprofit organization was established named the New England Transportation Technician Certification Program (NETTCP). The intent of the program is to jointly develop training and certification courses that are supported and commonly specified by each of the New England states. Training and certification programs have been developed in a number of technical areas including hot mix asphalt, soils and aggregate and concrete.

In 2008, New York became a member of NETTCP and the organizational name was officially changed to "NorthEast Transportation Training and Certification Program", maintaining its acronym "NETTCP." Now it includes seven members: Connecticut, Maine, Massachusetts, New Hampshire, New York, Rhode Island and Vermont.

Courses and certification are provided on the following areas:

- Concrete Inspector;
- Concrete Technician;
- HMA (Hot-Mix Asphalt) Paving Inspector;
- HMA Plant Technician;
- Soils & Aggregate Inspector;
- Soils & Aggregate Lab Technician;
- PG Asphalt Binder Technician;
- QA Technologist;
- Drilled Shaft Inspector;
- Driven Pile Inspector; and

- Subsurface Inspector.

Different with another four regional training and certification programs, NCTTCP has built a complete reciprocity, in other words, technicians are actually certified by NETTCP, rather than the six individual states.

2.3 Summary

This chapter introduces the training effort within and outside Kentucky. Through the comparison of training program in Kentucky and nationwide, it can be found that Kentucky's transportation technician training has a good coverage of the knowledge and skills. But this doesn't mean the current training program can satisfy technician's training needs and future workforce demand. This will be analyzed and presented in next chapter. But from this chapter, it can also be found that Kentucky's transportation training efforts highly rely on the Cabinet and the state themselves. In the future, the Cabinet could consider using more outside training resources like NHI and TCCC to help develop more reciprocity with other states.

3 THE GAP BETWEEN TECHNICIAN SUPPLY AND DEMAND IN KENTUCKY

This chapter introduces the development of technician training survey and section engineer survey, which were used to investigate the gap between transportation technician supply and demand, and presents the analysis result of the two surveys.

3.1 Survey Development

To conduct a comprehensive examination of the qualifications of the existing technician workforce (supply) versus the anticipated needs (demand) of technicians on future KYTC projects, two surveys were developed: one for transportation technicians to investigate the available skills in the current technician workforce and for a second survey that targeted section engineers to investigate workforce skills demand. The survey format was an electronic online survey, developed by Qualtrics software. The Kentucky Transportation Cabinet provided the contact information of their technicians and section engineers, and then survey participation invitations with the survey links were sent to them through Qualtrics.

3.1.1 Transportation Technician Training Survey

The complete survey is shown in Appendix A. This Survey includes five sections. The first section investigates respondents' background, such as how many years they have worked for the Kentucky Transportation Cabinet and in what district they are working in Kentucky.

The second section, Training Received and Skill Possessed, is the major part of this survey. This section includes seven common transportation training/skill areas: Aggregate, Asphalt, Concrete, Grading, Structure Construction, Soil, and Maintenance & Environment. The trainings and skills are primarily identified based on the available transportation technician training programs in Kentucky, and training programs in other states especially the training course matrix developed by Transportation Curriculum Coordination Council are referred as supplement. This section was designed to include

all available transportation technician training programs and other important training areas, which may be not available in Kentucky, in transportation. Such a complete training/skill matrix assure the survey would not miss any training received by the Cabinet's technicians, and at the same time, could identify the trainings they need but didn't receive yet. For each of the training programs/technician skills, survey participators are asked to answer four questions:

- 1) Have they received training in this area?
- 2) Do they have a certificate in this area?
- 3) How would they rate the overall quality of the training, using a four-point scale (1-Poor, 2-Fair, 3-Good and 4-Excellent)? and
- 4) How would they rate the overall usefulness of the training, using the same four-point scale?

Besides the training areas/skills included in the survey, respondents also identified and rated the other trainings they received but not included in the survey. This section also aims to investigate the training sources of the Cabinet's technicians. They are asked to rank the frequency of training source including: 1)University of Kentucky (Technology Transfer Center, KTC), 2) Cabinet In-house, District Level, 3) Cabinet In-house, Central Office, 4) Community Technical College and 5) Kentucky Society of Professional Engineers.

The third section investigates the training needs from the aspect of technicians. The first question directly asks if there are any trainings they need but not available in Kentucky. The second question asks what the technicians' favorite training methods are, with options including classroom lecture, classroom hands-on, online, on-the-job and other (open for any input).

The fourth section investigates the training barriers which may prevent technicians' participation in any training program. The common barriers are identified based primarily on previous research Construction Industry Institute RT 231 Construction Industry Craft Training in the United States and Canada, including lack of information, schedule conflicts and lack of financial support etc. Several technician training specific

barriers are also included in this section, such as certificates expiring so quickly and certificates not recognized by other states.

The last section is optional which asks respondents contact information just in case further contact is needed.

3.1.2 Section Engineer Survey

The complete survey is shown in Appendix B. The structure of section engineer survey is similar to the technician training survey, albeit a little simpler. This survey only includes three sections. The first section also investigates the respondents' background. Besides the length of experience with the Cabinet and working district, the section also asks respondents' titles which include Section Engineer, TE (Transportation Engineer), EIT (Engineer in Training), TE Technician Supervisor and Training Coordinator. The second section, Skills Needed for Kentucky Transportation Technicians, investigating the training needs from the view of section engineers, is very similar to the second section of the transportation technician training survey to assure a convenient comparison of analysis result. For each training/skill area, survey participators were asked to answer two questions:

- 1) Do you think this skill is required among your current transportation technician workforce? and
- 2) How would you rate the overall importance of this skill using the four-level scale (1-Not Important, 2-Somewhat Important, 3-Important and 4-Very Important)?

3.2 Respondent Background

In total, 296 technician surveys and 118 engineer surveys were sent out through invitation email. Finally, 125 valid responses to the technician survey and 78 to section engineer survey were received. Only the responses with answering at least one training related question were considered valid. In other words, the responses with only personal background information but without answering training program questions were not included in the analyses.

Tables 3.1 and Table 3.2 summarize the background of the respondents. For the technician training survey, the majority of respondents are technicians (80%), followed by engineering aids (17.6%), and the rest, 2.4 percent of respondents, didn't report their titles. The average years of experience with the Cabinet are 14.4 and 5.3, for technicians and engineering aids respectively. The majority of engineering survey's respondents are section engineers (46.2%), followed by TE (19.2%) and EIT (15.4), with the average years of experience of 12.6, 12.1 and 5.5, respectively.

Table 3.1: Distribution of Technician Survey Respondents' Background

Title	Frequency	Percent (%)	Years of experience with KYTC
Technician	100	80.0	14.4 (41)
Engineering Aide	22	17.6	5.3 (9)
No Response	3	2.4	
Total	125	100	

Notes: the numbers in the parentheses are numbers of responds who answered the experience question

Table 3.2: Distribution of Section Engineer Survey Respondents' Background

Title	Frequency	Percent (%)	Years of experience with KYTC
Section Engineer	36	46.2	12.6 (13)
TE	15	19.2	12.1 (8)
EIT	12	15.4	5.5 (2)
TE Technician Supervisor	8	10.3	30 (1)
Training Coordinator	6	7.7	30 (1)
No Response	1	1.3	
Total	78	100	

Notes: the numbers in the parentheses are numbers of responds who answered the experience question

The geographic distributions of respondents are shown in Figures 3.1 and 3.2. Most of technician survey's respondents are working in Covington (17%) and Louisville

(12%). Most of the section engineer survey's respondents are working in Lexington (13%) and Bowling Green (13%).

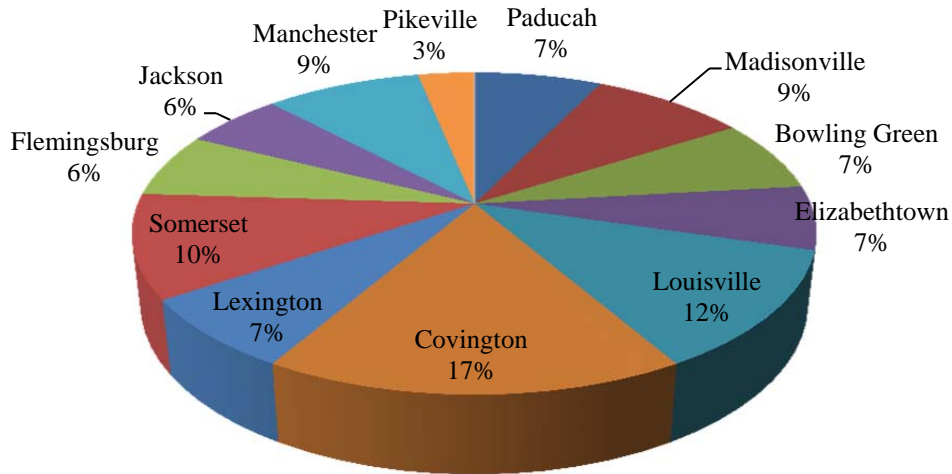


Figure 3.1: Geographic distribution of transportation technician survey respondents

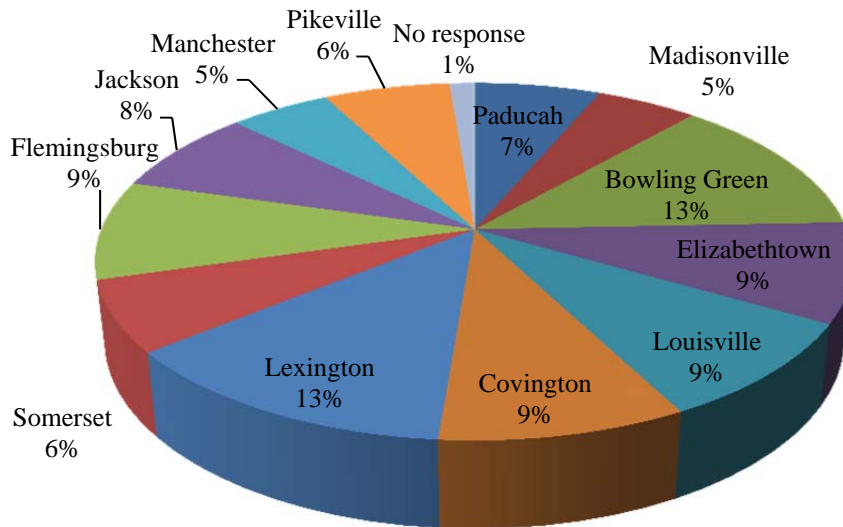


Figure 3.2: Geographic distribution of section engineer survey's respondents

3.3 Training Supply vs. Training Demand

The current training supply is investigated through the transportation technician survey. Each respondent was required to answer if he or she received a training and have a certificate in a certain area (aggregate, asphalt and environment, etc.) as well as the overall quality and usefulness of the training program. The more respondents completed a training program and have a certificate, and the more they were satisfied with the training's quality and usefulness, the more sufficient training is interpreted to be in this area. The training demand is investigated through the section engineer survey, which asked each respondent if a certain skill (corresponding with the training area in the technician survey) is required among their technician workforce as well as the importance of this skill. The more necessary and important a skill, the more training demand is required in this area. The comparison between the responses of technicians and section engineers indicates if a gap between training supply and demand in the Kentucky Transportation Cabinet exists.

3.3.1 Aggregate

The aggregate related training supply and demand are shown in Tables 3.3 and 3.4. For aggregate sampling, 94.3% of technician survey respondents have received this training and 95.1% of them have a certificate. 91.4% of respondents believe the training's quality is good or excellent, and 84.1% believe the usefulness of the training is good or excellent. The average scores for quality and usefulness are 3.06 and 2.96 (both indicating good), respectively (Table 3.3). Correspondingly, 96.2% of section engineer survey respondents think the aggregate sampling is necessary for their technician workforce, and 92.3% believe this skill is important or very important. The above results indicate that in the area of aggregate sampling, although the training need is high, the current training supply is sufficient.

For aggregate testing, 69.0% and 67.6% of technician survey respondents received training and have a certificate, and the average quality and usefulness is a little lower than the sampling training. On the other hand, sections engineers also thought

testing is less necessary than sampling. Therefore, the current aggregate testing training supply is fine or has a small gap compared with the demand. While for documentation skills, 93.6% of respondents thought it necessary, and the average importance score is almost the same as testing, but only about half of technicians have received this training and have a certificate. Therefore, there is a large gap in this area and the Cabinet should strengthen its technicians' documentation skills in the future.

Table 3.3: Technician’s View of Current Aggregate Training

Training Area	Received Training	Have Certificate	Quality					Usefulness				
			1-Poor	2-Fair	3-Good	4-Excellent	Mean	1-Poor	2-Fair	3-Good	4-Excellent	Mean
Sampling	94.3%	95.1%	0.0%	8.5%	76.9%	14.5%	3.06	0.9%	15.0%	70.8%	13.3%	2.96
Testing	69.0%	67.6%	4.5%	11.2%	69.7%	14.6%	2.94	2.3%	22.1%	62.8%	12.8%	2.86
Documentation	57.3%	47.7%	9.3%	18.7%	61.3%	10.7%	2.73	8.2%	23.3%	56.2%	12.3%	2.73

Table 3.4: Section Engineer’s View of Aggregate Training Needs

Training Area	Necessary	Importance				Mean
		1-Not Important	2-Somewhat Important	3-Important	4-Very Important	
Sampling	96.2%	0.0%	7.7%	44.9%	47.4%	3.40
Testing	81.8%	5.3%	16.0%	38.7%	40.0%	3.13
Documentation	93.6%	9.3%	2.6%	36.8%	52.6%	3.39

3.3.2 Asphalt

The asphalt related training supply and demand are shown in Tables 3.5 and 3.6.

Based on the section engineer survey, Asphalt Paving Best Practice and Hot Mixed Asphalt Pavement Field Inspection are the two most demanding trainings. 96.0% and 97.3% of respondents thought the two areas' training are necessary, and the average importance scores are 3.75 and 3.84, which means most respondents believe the trainings are very important (Table 3.6). From Table 5.5, it can be observed that 85.7% and 80.9% of technician survey respondents have received training and have a certificate in the area of Asphalt Paving Best Practice, and the average quality and usefulness scores are 2.95 and 2.99, which indicate good. Therefore, the training supply on Asphalt Paving Best Practice appears acceptable. While for Asphalt Pavement Field Inspection, only 68.1% and 64.6% respondents received training and have a certificate, respectively. The percentage is not very low, but it is not comparable with the percentage of section engineers who thought it necessary (97.3%), so there is a gap between training supply and demand in this area. The same is for the trainings of Superpave Plant Technologist and Superpave Mix Design Technologist. Although the demands are not high, only 66.7% and 52.7% of section engineers believing they are necessary, the supply are extremely low, only 23.3% and 6.1% of technicians having received trainings in these two areas, respectively. Specifically, for Superpave Mix Design Technologist training, the average quality and usefulness scores are 2.32 and 2.37, just a little higher than 2, which means the quality and usefulness are just better than fair.

To summarize, except Asphalt Paving Best Practices, the Cabinet needs to make more effort to develop and improve all other three asphalt related training programs, especially the training of Superpave Mix Design Technologist.

Table 3.5: Technician’s View of Current Asphalt Training

Training Area	Received Training	Have Certificate	Quality					Usefulness				
			1-Poor	2-Fair	3-Good	4-Excellent	Mean	1-Poor	2-Fair	3-Good	4-Excellent	Mean
Asphalt Paving Best Practices	85.7%	80.9%	3.0%	16.2%	63.6%	17.2%	2.95	3.0%	14.9%	62.4%	19.8%	2.99
Superpave Plant Technologist	23.3%	21.3%	10.8%	29.7%	29.7%	29.7%	2.78	10.5%	26.3%	42.1%	21.1%	2.74
Superpave Mix Design Technologist	6.4%	6.1%	32.0%	24.0%	24.0%	20.0%	2.32	29.2%	25.0%	25.0%	20.8%	2.37
Hot Mixed Asphalt Pavement Field Inspection	68.1%	64.6%	4.2%	16.9%	59.2%	19.7%	2.94	4.1%	13.5%	62.2%	20.3%	2.99

Table 3.6: Section Engineer’s View of Asphalt Training Needs

Training Area	Necessary	Importance				Mean
		1-Not Important	2-Somewhat Important	3-Important	4-Very Important	
Asphalt Paving Best Practices	96.0%	1.4%	1.4%	18.9%	78.4%	3.75
Superpave Plant Technologist	66.7%	14.7%	26.5%	29.4%	29.4%	2.74
Superpave Mix Design Technologist	52.7%	28.4%	29.9%	23.9%	17.9%	2.32
Hot Mixed Asphalt Pavement Field Inspection	97.3%	1.4%	1.4%	9.6%	87.7%	3.84

3.3.3 Concrete

The concrete related training supply and demand are shown in Tables 3.7 and 3.8.

The training areas in the technician training survey and section engineer survey are slightly different. In the technician trainings, the first two areas are Kentucky Ready Mixed Concrete Association (KRMCA) LEVEL II and American Concrete Institute (ACI) LEVEL I Field Testing Technician, while in the section engineer survey, only one training area of Field Sampling and Testing on Ready/Freshly Mixed Concrete was used to represent the two training programs in the technician survey. The reason is that a section engineer is more concerned about whether or not his/her technician workforce have received training and have the skill, but is less concerned about what the training program is.

The training content of Kentucky Ready Mixed Concrete Association (KRMCA) LEVEL II and American Concrete Institute (ACI) LEVEL I Field Testing Technician are similar, both of them focusing on Ready/Freshly Mixed Concrete Sampling and Testing. However, the latter is obviously more popular and welcomed among the Cabinet's technicians: much more respondents participated in the latter (95.0% versus 35.5%) and have a certificate (96.5% and 33.0%). The ACI Level I's average quality and usefulness scores are also higher than the KRMCA LEVEL II, 3.15 versus 2.88 and 3.23 versus 2.84, respectively (Table 3.7). In the section engineer survey, most of the respondents thought Ready/Freshly Mixed Concrete Sampling and Testing necessary and very important. Based on the above comparison, the training supply on Ready/Fresh Mixed Concrete Sampling and Testing is sufficient, but some improvement may be needed for KRMCA LEVEL II program to attract more technicians.

As for the other two areas in concrete, Portland Cement Concrete (PCC) Pavement Field Testing and PCC Production & Quality Assurance Labs, there are obvious gaps between the training supply and demand. For PCC Pavement Field Testing, almost all of the section engineers think it is necessary among their workforce and most of them believe it is very important (Table 3.8), but only 30.0% of technician respondents have received this training, and 26.8% have a certificate (Table 3.7). Although relatively fewer section engineers (65.3%) think PCC Production & Quality Assurance Labs

necessary, the percentage of technicians who received this training and have a certificate are extremely low, only 8.8% and 12.3%, respectively.

Table 3.7: Technician’s View of Current Concrete Training

Training Area	Received Training	Have Certificate	Quality					Usefulness				
			1-Poor	2-Fair	3-Good	4-Excellent	Mean	1-Poor	2-Fair	3-Good	4-Excellent	Mean
Kentucky Ready Mixed Concrete Association (KRMCA) LEVEL II	35.5%	33.0%	3.8%	19.2%	61.5%	15.4%	2.88	7.8%	13.7%	64.7%	13.7%	2.84
American Concrete Institute (ACI) LEVEL I Field Testing Technician	95.0%	96.5%	0.9%	9.2%	64.2%	25.7%	3.15	0.0%	6.5%	63.6%	29.9%	3.23
Portland Cement Concrete(PCC) Pavement Field Testing	30.0%	26.8%	5.4%	16.2%	70.3%	8.1%	2.81	5.6%	19.4%	66.7%	8.3%	2.78
PCC Production & Quality Assurance Labs	8.8%	12.3%	12.5%	18.8%	68.8%	0.0%	2.57	12.5%	18.8%	62.5%	6.3%	2.63

Table 3.8: Section Engineer’s View of Concrete Training Needs

Training Area	Necessary	Importance				Mean
		1-Not Important	2-Somewhat Important	3-Important	4-Very Important	
Field Sampling and Testing on Ready/Freshly Mixed Concrete	98.7%	0.0%	0.0%	12.2%	87.8%	3.88
Portland Cement Concrete(PCC) Pavement Field Testing	93.3%	0.0%	6.8%	28.8%	64.4%	3.58
PCC Production & Quality Assurance Labs	65.3%	14.7%	25.0%	27.9%	32.4%	2.78

3.3.4 Grading

The grading related training supply and demand are shown in Tables 3.9 and 3.10.

Kentucky Transportation Cabinet (KYTC) Grading Level I is the major grading related training in Kentucky. 88.7% and 90.7% of respondents reported they have received this training and have a certificate, respectively (Table 3.9). The average quality and usefulness scores of 2.97 and 3.08 indicate this training program is good and useful. In the section engineer survey, 97.3% of respondents think it necessary and the average importance score is 3.81, which means it is very important. The comparison of the two surveys indicates the current Kentucky Transportation Cabinet (KYTC) Grading Level I training is sufficient to the skill requirement of the Cabinet's technicians.

As for other grading related skills, only for controlled blasting, less than 90% of section engineer survey respondents (80.0%) thought it necessary (Table 3.10). However on the other hand, extremely low percentage of technicians received this training (19.4%) and have a certificate. In addition, the average quality and usefulness scores are just 2.25 and 2.52 (Table 3.9). Therefore, the training on Controlled blasting is not sufficient and the training quality and usefulness should be improved in the future. For the other six trainings (Excavation, Contour Grading, Site Preparation, Embankment, Borrow, Compaction), more than 90% of respondents indicated that they are necessary, but the percentage of respondents who have received these trainings and have certificate range from only 38.6% to 59.8% and from 21.8% to 48.8%, respectively. Since the quality and usefulness of these trainings are fine (average score close to 3.0, which means good), the major concerns for the Cabinet is to provide more training programs on these areas to fill the gap between workforce demands and supplies.

Table 3.9: Technician’s View of Current Grading Training

Training Area	Received Training	Have Certificate	Quality					Usefulness				
			1-Poor	2-Fair	3-Good	4-Excellent	Mean	1-Poor	2-Fair	3-Good	4-Excellent	Mean
Kentucky Transportation Cabinet (KYTC) Grading Level I	88.7%	90.7%	4.0%	16.0%	59.0%	21.0%	2.97	2.0%	10.0%	66.0%	22.0%	3.08
KYTC Grading Level I Refresher	60.9%	71.9%	2.9%	19.1%	55.9%	22.1%	2.97	1.4%	12.7%	63.4%	22.5%	3.07
Excavation	51.4%	34.1%	6.0%	22.0%	60.0%	12.0%	2.78	6.0%	18.0%	62.0%	14.0%	2.84
Controlled Blasting	19.4%	9.6%	25.0%	29.2%	41.7%	4.2%	2.25	17.4%	17.4%	60.9%	4.3%	2.52
Contour Grading	38.6%	21.8%	8.6%	22.9%	60.0%	8.6%	2.69	6.3%	18.8%	65.6%	9.4%	2.78
Site Preparation	47.6%	29.1%	7.7%	15.4%	66.7%	10.3%	2.79	5.0%	15.0%	70.0%	10.0%	2.85
Embankment	54.3%	37.0%	8.0%	20.0%	64.0%	8.0%	2.72	4.3%	23.4%	63.8%	8.5%	2.77
Borrow	42.9%	26.3%	10.5%	23.7%	57.9%	7.9%	2.63	7.9%	13.2%	71.1%	7.9%	2.79
Compaction	59.8%	48.8%	3.6%	21.8%	65.5%	9.1%	2.80	1.9%	20.8%	66.0%	11.3%	2.87

Table 3.10: Section Engineer’s View of Grading Training Needs

Training Area	Necessary	Importance				Mean
		1-Not Important	2-Somewhat Important	3-Important	4-Very Important	
Kentucky Transportation Cabinet (KYTC) Grading Level I	97.3%	0.0%	0.0%	18.7%	81.3%	3.81
Excavation	94.6%	0.0%	7.0%	23.9%	69.0%	3.62
Controlled Blasting	80.0%	5.8%	24.6%	33.3%	36.2%	3.00
Contour Grading	92.0%	2.7%	5.5%	38.4%	53.4%	3.42
Site Preparation	96.0%	1.4%	2.7%	27.0%	68.9%	3.64
Embankment	95.9%	1.3%	0.0%	26.7%	72.0%	3.69
Borrow	90.7%	2.9%	8.6%	38.6%	50.0%	3.36
Compaction	97.3%	0.0%	2.7%	13.5%	83.8%	3.81

3.3.5 Structure

The structure related training supply and demand are shown in Tables 3.11 and 3.12.

Kentucky Transportation Cabinet (KYTC) Structures Level I is the major structure related training in Kentucky. 85.6% and 84.6% of respondents reported they have received this training and have a certificate, respectively (Table 3.11). The average quality and usefulness scores of 3.02 and 3.09 indicate this training program is good and useful. In the section engineer's survey, 97.3% of respondents think it necessary and the average importance score is 3.77, which means it is very important. The comparison of the two surveys indicates the current KYTC Structure Level I training is sufficient to the skill requirement among the Cabinet's technicians.

In other training areas, the respondents received training and have certificate on Bridge Coating Inspector (19.8% and 17.1%, respectively) and Post Tensioning (15.8% and 10.4%). In addition, the post tensioning also has the lowest average quality and usefulness scores (2.47 and 2.40, respectively) (Table 3.11). Correspondingly, the necessity and importance of the two training areas are also lower than other trainings (Table 3.12).

After examining and comparing Tables 3.11 and 3.12, it can be found there are significant gaps between the training supply and skill needs in all structure related training areas except the KYTC Structure Level I.

Table 3.11: Technician’s View of Current Structure Training

Training Area	Received Training	Have Certificate	Quality					Usefulness				
			1-Poor	2-Fair	3-Good	4-Excellent	Mean	1-Poor	2-Fair	3-Good	4-Excellent	Mean
Kentucky Transportation Cabinet (KYTC) Structures Level I	85.6%	84.6%	0.0%	19.1%	59.6%	21.3%	3.02	2.2%	11.1%	62.2%	24.4%	3.09
Bridge Coating Inspector	19.8%	17.1%	12.5%	29.2%	33.3%	25.0%	2.71	12.5%	29.2%	33.3%	25.0%	2.71
Footings	40.6%	19.2%	6.1%	30.3%	45.5%	18.2%	2.76	6.5%	35.5%	38.7%	19.4%	2.71
Retaining Walls	40.2%	23.9%	6.9%	24.1%	51.7%	17.2%	2.79	7.1%	25.0%	53.6%	14.3%	2.75
Forming & Falsework	48.5%	26.0%	5.9%	23.5%	52.9%	17.6%	2.82	9.1%	24.2%	51.5%	15.2%	2.73
Concrete Girders	33.0%	20.3%	4.0%	24.0%	48.0%	24.0%	2.92	8.0%	20.0%	52.0%	20.0%	2.84
Steel Girders & Connectors	29.4%	26.1%	0.0%	30.4%	43.5%	26.1%	2.96	0.0%	29.2%	45.8%	25.0%	2.96
Reinforcing Steel – Layout	49.5%	26.1%	6.5%	22.6%	54.8%	16.1%	2.81	6.3%	21.9%	53.1%	18.8%	2.84
Joints	39.4%	22.4%	6.7%	30.0%	46.7%	16.7%	2.73	6.9%	27.6%	51.7%	13.8%	2.72
Finishing & Curing Concrete	54.3%	35.7%	7.5%	20.0%	55.0%	17.5%	2.83	5.1%	17.9%	59.0%	17.9%	2.90
Deck Smoothness	38.2%	20.9%	3.4%	31.0%	44.8%	20.7%	2.83	3.8%	34.6%	50.0%	11.5%	2.69
Precast Structures	49.0%	20.0%	3.1%	31.3%	43.8%	21.9%	2.84	3.3%	26.7%	53.3%	16.7%	2.83
Post Tensioning	15.8%	10.4%	20.0%	26.7%	40.0%	13.3%	2.47	20.0%	33.3%	33.3%	13.3%	2.40

Table 3.12: Section Engineer’s View of Structure Training Needs

Training Area	Necessary	Importance				Mean
		1-Not Important	2-Somewhat Important	3-Important	4-Very Important	
Kentucky Transportation Cabinet (KYTC) Structures Level I	97.3%	0.0%	4.1%	14.9%	81.1%	3.77
Bridge Coating Inspector	63.5%	9.1%	30.3%	28.8%	31.8%	2.83
Footings	94.5%	1.4%	6.8%	23.3%	68.5%	3.59
Retaining Walls	95.9%	0.0%	5.4%	36.5%	58.1%	3.53
Forming & Falsework	95.9%	0.0%	5.4%	37.8%	56.8%	3.51
Concrete Girders	93.0%	0.0%	12.2%	35.1%	52.7%	3.41
Steel Girders & Connectors	90.1%	0.0%	15.3%	29.2%	55.6%	3.41
Reinforcing Steel – Layout	97.2%	0.0%	2.7%	23.0%	74.3%	3.72
Joints	97.1%	1.4%	4.1%	34.2%	60.3%	3.53
Finishing & Curing Concrete	98.6%	0.0%	1.4%	21.9%	76.7%	3.75
Deck Smoothness	88.7%	1.4%	8.5%	39.4%	50.7%	3.39
Precast Structures	98.6%	0.0%	6.8%	32.9%	60.3%	3.54
Post Tensioning	69.0%	7.5%	20.9%	31.3%	40.3%	3.04

3.3.6 Soil

The soil related training supply and demand are shown in Tables 2.13 and 2.14.

Different with other training areas, there is no soil related training program in which more than 80% of section engineers believed it was necessary. In addition, no soil related training's average importance score reached 3.0 on the survey's scale, which means from the view of section engineers, soil related trainings are not as important as other trainings mentioned above (Table 3.14).

From the investigation of current technician training program, there is not a soil-specific training program, in other words, technicians may receive soil-related trainings in other courses or programs, but there is no training program focusing only on soil. The soil related training areas are identified through the course matrix developed by Transportation Curriculum Coordination Counsel. The lack of specific soil related training program may be a result of its relatively low importance as shown in Table 3.14. As a result, the percentage of respondents who received soil related training and have a certificate is very low. As shown in Table 13, only 42.9% and 38.0% of respondents received trainings on Moisture-Density Relationship for Fine Soils and Moisture-Density Relationship for Coarse Soils. For Bulk Disturbed Sampling and Geotechnical Exploration, Sampling & In-Situ Testing, it is much worse and the percentages are only 24.7% and 11.3% respectively. In addition, no soil related training's average quality or usefulness score reaches 3.0, which means good or useful. Specifically, for the training of Geotechnical Exploration, Sampling & In-Situ Testing, the average quality score is just 1.78 which indicates the training quality is even not fair.

Therefore, although the needs of soil related training is relatively low compared with other areas, the current training supply cannot satisfy the demands, and the survey data suggest soil related training needs a significant improvement.

Table 3.13: Technician’s View of Current Soil Related Training

Training Area	Received Training	Have Certificate	Quality					Usefulness				
			1-Poor	2-Fair	3-Good	4-Excellent	Mean	1-Poor	2-Fair	3-Good	4-Excellent	Mean
Bulk Disturbed Sampling	24.7%	22.7%	4.8%	47.6%	33.3%	14.3%	2.57	4.5%	40.9%	36.4%	18.2%	2.68
Moisture-Density Relationship for Fine Soils	42.9%	40.5%	6.1%	27.3%	54.5%	12.1%	2.73	6.5%	29.0%	51.6%	12.9%	2.71
Moisture-Density Relationship for Coarse Soils	38.0%	31.9%	6.7%	33.3%	53.3%	6.7%	2.60	3.4%	34.5%	51.7%	10.3%	2.69
Geotechnical Exploration, Sampling & In-Situ Testing	11.3%	4.7%	33.3%	55.6%	11.1%	0.0%	1.78	30.0%	40.0%	30.0%	0.0%	2.00

Table 3.14: Section Engineer’s View of Structure Training Needs

Training Area	Necessary	Importance				Mean
		1-Not Important	2-Somewhat Important	3-Important	4-Very Important	
Bulk Disturbed Sampling	70.4%	13.2%	33.8%	32.4%	20.6%	2.60
Moisture-Density Relationship for Fine Soils	77.8%	7.2%	26.1%	31.9%	34.8%	2.94
Moisture-Density Relationship for Coarse Soils	79.2%	6.0%	26.9%	31.3%	35.8%	2.97
Geotechnical Exploration, Sampling & In-Situ Testing	49.3%	25.0%	29.7%	26.6%	18.8%	2.39

3.3.7 Maintenance and Environment

The maintenance and environment related training supply and demand are shown in Tables 3.15 and 3.16.

The training program that the most respondents participated and have certificates are Kentucky Erosion Prevention & Sediment Control - Roadway Inspector (KEPSC-RI) and Work Zone Traffic Control. Specifically, 75.8% of respondents received KEPSC-RI training and 75.9% have a certificate. For Work Zone Traffic Control, the percentage is 85.1% and 88% (Table 3.15). Correspondingly, the two areas also have the highest necessity and importance. All section engineer survey respondents (100%) thought the trainings are necessary, and their average importance scores are 3.75 and 3.90, indicating very important (Table 3.16). The comparison shows current training on Work Zone Traffic Control is sufficient, but it is a little insufficient on KEPSC and its quality and usefulness needs some improvement considering the training's high importance.

The training program with the lowest participation rate is Pesticide. Only 7.2% of respondents have received this training and 10.2% respondents claimed to have a certificate (Table 3.15). However, this result is comparable with the training's low necessity and importance: only 32.9% of section engineers think Pesticide necessary among their technician workforce and the average importance score is just 1.95, indicating somewhat important (Table 3.16).

For all other maintenance and environment trainings, no matter how large the percentage of participation and certified respondents, they seem relatively low compared with their necessity and importance from the view of section engineers.

Therefore, the training supply and demand are comparable in the area of Work Zone Traffic Control and Pesticide. A small gap exists in the area of Kentucky Erosion Prevention & Sediment Control - Roadway Inspector (KEPSC-RI), and significant gaps exist in all other training areas.

Table 3.15: Technician’s View of Current Maintenance and Environment Related Trainings

Training Area	Received Training	Have Certificate	Quality					Usefulness				
			1-Poor	2-Fair	3-Good	4-Excellent	Mean	1-Poor	2-Fair	3-Good	4-Excellent	Mean
Kentucky Erosion Prevention & Sediment Control - Roadway Inspector (KEPSC-RI)	75.8%	75.9%	2.9%	17.6%	58.8%	20.6%	2.97	1.5%	16.9%	63.1%	18.5%	2.98
Pesticide	7.2% *	10.2% *	7.7%	38.5%	38.5%	15.4%	2.62	15.4%	38.5%	30.8%	15.4%	2.46
Environmental Awareness	39.4%	32.4%	3.1%	31.3%	53.1%	12.5%	2.75	3.3%	23.3%	60.0%	13.3%	2.83
Hazardous Material Awareness	52.0%	47.2%	2.3%	18.6%	69.8%	9.3%	2.86	0.0%	18.4%	71.1%	10.5%	2.92
Work Zone Traffic Control	85.1%	88.0%	0.0%	6.3%	67.1%	26.6%	3.20	0.0%	6.7%	66.7%	26.7%	3.20
Traffic Services & Safety	56.6%	51.3%	0.0%	21.6%	62.7%	15.7%	2.94	0.0%	22.9%	58.3%	18.8%	2.96
Roadway & Shoulder	39.2%	17.2%	0.0%	32.4%	58.8%	8.8%	2.76	0.0%	31.3%	59.4%	9.4%	2.78
Drainage	47.5%	27.9%	0.0%	24.3%	59.5%	16.2%	2.92	0.0%	25.7%	54.3%	20.0%	2.94
Winter Operations	22.0%	7.6% *	10.0%	25.0%	50.0%	15.0%	2.70	5.3%	26.3%	52.6%	15.8%	2.79
Roadside Maintenance	15.3%	4.5% *	0.0%	37.5%	43.8%	18.8%	2.81	0.0%	30.8%	38.5%	30.8%	3.00
Bridge Maintenance	17.3%	9% *	0.0%	38.9%	33.3%	27.8%	2.89	0.0%	35.3%	35.3%	29.4%	2.94
Fleet Management	12.5%	3.3% *	16.7%	41.7%	41.7%	0.0%	2.25	18.2%	36.4%	45.5%	0.0%	2.27

Note: * denotes responses less than 10.

Table 3.16: Section Engineer’s View of Maintenance and Environment Related Training Needs

Training Area	Necessary	Importance				Mean
		1-Not Important	2-Somewhat Important	3-Important	4-Very Important	
Kentucky Erosion Prevention & Sediment Control - Roadway Inspector (KEPSC-RI)	100.0%	0.0%	0.0%	25.0%	75.0%	3.75
Pesticide	32.9%	42.4%	30.5%	16.9%	10.2%	1.95
Environmental Awareness	94.4%	0.0%	10.4%	35.8%	53.7%	3.43
Hazardous Material Awareness	81.9%	1.5%	31.3%	34.3%	32.8%	2.99
Work Zone Traffic Control	100.0%	0.0%	0.0%	9.9%	90.1%	3.90
Traffic Services & Safety	98.6%	0.0%	0.0%	30.4%	69.6%	3.70
Roadway & Shoulder	95.8%	1.5%	4.4%	39.7%	54.4%	3.47
Drainage	94.4%	1.4%	2.9%	21.7%	73.9%	3.68
Winter Operations	73.6%	13.8%	20.0%	27.7%	38.5%	2.91
Roadside Maintenance	66.7%	10.6%	37.9%	19.7%	31.8%	2.73
Bridge Maintenance	68.1%	7.5%	31.3%	26.9%	34.3%	2.88
Fleet Management	65.3%	18.5%	36.9%	24.6%	20.0%	2.46

3.3.8 Road Scholar and Road Master Program

As introduced in the previous chapter, these two programs are training series which include a set of training courses covering several areas instead of just one specific area. The survey result shows that the participation rates and completion rates are very low. Only 4.0% of respondents participated in the road Scholar Program, and only 2.4% completed this program and were designated as road scholars. For Road Master Program, the participation rate and completion rate are just 3.2% and 1.6%. This indicates the technicians in the Cabinet are more likely to take specific training course according to their personal needs rather than to take these kinds of training series.

3.3.9 Other Skills

Besides the trainings and skills already listed in the surveys, technicians were asked if there are any trainings they need but not available in Kentucky. Similarly, section engineers were also asked if they believe other skills were important and necessary among their technician workforce. These skills are listed below:

- Warm Mixed Asphalt;
- Electrical field (traffic lights & overhead lighting systems);
- Surveying;
- Plan Reading and Interpretation;
- Documentation;
- Computer Skill and Work Related Software Training;
- Communication;
- Drafting and Design;
- Mathematics; and
- Data Collection.

Although some of the above skills and training fields are more likely to be provided by universities and colleges, the Cabinet should be aware of the importance of these basic skills and could provide information on training sources to its technicians when they have training needs in these areas.

3.3.10 Training Source

The technician training survey investigates the training sources of the Cabinet’s technicians. Technicians are asked to rank their training sources regarding the frequency. The training source includes: 1) University of Kentucky (Technology Transfer Center, KTC), 2) Cabinet In-house, District Level, 3) Cabinet In-house, Central Office, 4) Community Technical College and 5) Kentucky Society of Professional Engineers. The ranking is from 1 to 5, and the corresponding ranking score is from 5 to 1, with 1 indicating the most frequent and 5 indicating the least frequent training source. A training source’s total frequency score is calculated through Equation 3.1.

$$\text{Total Frequency Score} = \sum \text{Score of Rank}_i \times \text{Frequency}_i, i \text{ from 1 to 5. (Equation 3.1)}$$

The analysis result is shown in Table 3.17. As an example, the total frequency score for “University of Kentucky (Technology Transfer Center, KTC)” is:

$$5*30+4*20+3*16+2*0+1*1= 279.$$

As shown in Table 3.17, the most respondents (37) rank Cabinet In-house, Central Office as the most frequent (No.1) training source, and its total frequency score is also the highest among the five sources. According to Table 3.17, Cabinet In-house (Central Office), Cabinet In-house (District Level), and University of Kentucky (Technology Transfer Center, KTC) are the top three training sources for the sampled technicians. Very few technicians received trainings from community technical college or Kentucky Society of Professional Engineers.

Table 3.17: The Frequency of Training Source

Training Source	Frequency of Ranking					Total Frequency Score
	1-5 points	2-4 points	3-3 points	4-2 points	5-1 point	
University of Kentucky (Technology Transfer Center, KTC)	30	20	16	0	1	279
Cabinet In-house, District Level	25	29	16	0	1	290
Cabinet In-house, Central Office	37	16	14	0	1	292
Community Technical College	2	0	1	3	1	20
Kentucky Society of Professional Engineers	0	1	1	2	1	12

3.4 Technicians' Favorite Training Method

The technician training survey investigated technicians' favorite training method as a guide of future training program development. This question asked respondents to select their preferred training method among four methods: classroom lecture, classroom hands-on, online, and on-the-job. As shown in Table 3.18, nearly half of respondents (48.8%) selected on-the-job training as their most favorite training method, followed by classroom hands-on training (37.6%). It is obvious that technicians preferred practical training (on-the-job and classroom hands-on) much more than formal lecture based training, whether delivered in a classroom setting or online.

Table 3.18: Technicians' Favorite Training Methods

Training Area	Percentage
Classroom Lecture	16.8%
Classroom Hands-on	37.6%
Online	18.4%
On-the-job	48.8%

While expanding training opportunities through on-line training may seem attractive, it is important to note in Table 3.18 that is the least preferred training method among the surveyed technicians. Instead, the data suggests that training programs that offer more hands-on experience either in the classroom or on-the-job would be preferred. While on-the-job training is the most preferred method, it is acknowledged that this method presents the difficulty of formally documenting the skills that have been received and certified. In the larger construction industry, apprenticeship programs partly rely on on-the-job training to assist an apprentice to progress to journeyman status in their trade. One valuable lesson from the apprentice programs is the need to develop formal mentoring programs and purpose job rotation of the apprenticeship to help ensure that the apprentice experiences the many facets of the skill sets necessary for his or her trade. In the case of the Cabinet, development of a formal mentoring program for new technicians that include development of mentors through train the trainer efforts and formal

documentation of the technicians' rotations through the mentoring program would help the Cabinet improve this training experience for future technicians.

3.5 Technicians' Training Barriers

The technician training survey investigated the common barriers that may prevent technicians' participation in training programs. Technicians were asked to rate the severe level of each common training barrier using a five-level scale from 0-none to 4-very severe. A barrier's total severity score is calculated by Equation 3.2.

$$\text{Total Severity Score} = \sum \text{Severe Level}_i \times \text{Frequency}_i, \text{ } i \text{ from 0 to 4. (Equation 3.2)}$$

In Equation 3.2, the severity level is from 0 to 4, and the frequency of this severe level is the number of respondents who believe that a certain training participation barrier is at this severity level. The analysis result is summarized in Table 3.19. As an example, the total severe score for "The training cannot increase my salary and help me get a promotion" is: $0*33+1*15+2*17+3*11+4*23= 174$.

The higher the total severity score, the more severely a barrier prevented the Cabinet's technician's participation in their overall training effort. According to Table 3.19, the most severe barriers that prevent training participation are:

- Unable to increase salary and help get a promotion;
- Schedule conflict;
- Certificates expire so quickly;
- Not necessary to jobs; and
- Lack of information of available training programs.

The least severe barriers are:

- Language barrier;
- Certificate not recognized by other states; and
- Financial support.

The result seems reasonable. For every employee, salary and promotion are important, so it is natural that a technician would lack motivation to participate in training if they perceive that doing so would not help increase their salary and opportunities for promotion. Naturally, an incentive system for successfully completing training would

help overcome this barrier. Schedule conflict is another realistic problem. When a training program conflicts with a technician's existing work schedule, it is difficult for the person to leave their work and complete their training, even he/she wants to. To overcome this barrier, the Cabinet can simply survey technicians' preferred training times, offer more training programs with different schedule if possible and try the best to coordinate technicians' work. "Certificates expiring so quickly" is the third most severe barrier. Therefore, the Cabinet may want to examine the length of certificates' validity. In addition, the Cabinet may want to consider providing more refresh training programs that require less time and effort to complete. "Training is not necessary to job" may not be a real barrier. It is possible that a training program is useful and necessary, but a technician's major job doesn't require the skill provided by this training program. When the requirement appears, the technician is still willing to participate in training. "Lack of information" is an easily fixed barrier. A simplified version of the second chapter of this report can be a guide of available training programs in Kentucky, and the Cabinet could try to make this accessible to all of its technicians.

Table 3.19: Technicians’ Training Participation Barriers

Training Participation Barrier	Frequency					Total Severity Score
	0-None	1-Slight	2-Moderate	3-Severe	4-Very Severe	
The training cannot increase my salary and help me get a promotion	33	15	17	11	23	174
Training schedule conflicts with work schedule	36	21	30	6	7	127
The certificate expires so quickly	47	19	19	3	11	110
Training is not necessary to my job	61	9	16	7	5	82
Lack of information of available training programs	47	31	17	5	0	80
Dissatisfied with the quality of a training program	50	26	17	3	2	77
Training location is not accessible	55	21	16	3	3	74
Lack of the training programs I need	58	23	11	4	2	65
Training requires too much time to complete	62	25	8	0	3	53
The training program is not sufficient to my job	67	20	10	1	1	47
Lack of general support from my employer (eg. motivation, work coordination, etc)	76	13	3	3	3	40
Lack of financial support from my employer to receive the training I need	78	10	6	3	2	39
The certificate is not recognized by other states	79	9	4	2	2	31
Language barriers	95	1	1	0	0	3

3.6 Summary

By comparing the percentage of technicians who completed a training program as well as the program's quality and importance with the percentage of section engineers who believes the training/skill is necessary as well as the importance of this training/skill, this chapter identified the training areas which the Cabinet should strengthen to satisfy the future training demands of transportation technician workforce as well as their priority as follows:

- Maintenance and Environment
 - Environmental Awareness (H)
 - Roadway & Shoulder (H)
 - Winter Operations (H)
 - Roadside Maintenance (H)
 - Bridge Maintenance (H)
 - Fleet Management (H)
 - Traffic Services & Safety (M)
 - Drainage (M)
 - Kentucky Erosion Prevention & Sediment Control - Roadway Inspector (L)
 - Hazardous Material Awareness (L)
 - Pesticide (L)
- Structure
 - Footings (H)
 - Retaining Walls (H)
 - Concrete Girders (H)
 - Steel Girders & Connectors (H)
 - Joints (H)
 - Deck Smoothness (H)
 - Post Tensioning (H)
 - Bridge Coating Inspector (M)
 - Forming & Falsework (M)
 - Reinforcing Steel – Layout (M)

- Finishing & Curing Concrete (M)
- Precast Structures (M)
- Grading
 - Controlled blasting (H)
 - Contour Grading (H)
 - Excavation (M)
 - Site Preparation (M)
 - Embankment (M)
 - Borrow (M)
 - Compaction (M)
- Soil
 - Bulk Disturbed Sampling (H)
 - Moisture-Density Relationship for Coarse Soils (M)
 - Geotechnical Exploration, Sampling & In-Situ Testing (M)
 - Moisture-Density Relationship for Fine Soils (L)
- Concrete
 - Portland Cement Concrete(PCC) Pavement Field Testing (H)
 - PCC Production & Quality Assurance Labs (H)
 - KRMCA LEVEL II (L)
- Asphalt
 - Superpave Plant Technologist (M)
 - Superpave Mix Design Technologist (M)
 - Hot Mixed Asphalt Pavement Field Inspection (L)
 - Warm-Mixed Asphalt (L)
- Aggregate
 - Documentation (M)

Note: H denotes high priority, M denotes medium priority and L denotes low priority.

Based on the above number of topics within each area and their priorities, it is apparent that there is strong need to improve the Cabinet's overall training efforts areas related to Maintenance and Environment as well as Structures. As the Cabinet and the

Kentucky Transportation Center through its Technology Transfer Program move forward, additional effort to expand their training opportunities for the Cabinet's technician workforce is certainly warranted.

4 CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

Through literature review, this research documented the current status of transportation technician training in Kentucky and nationwide. Then through analysis of two online surveys, this research identified the areas in which the Kentucky Transportation Cabinet should work more to fill the gap between future technician workforce demand and supply. The major findings are as follows:

- Transportation Technician training is a joint effort of DOTs, various agencies, such as TCCC and NHI, and the transportation industry. A trend is to expand reciprocity between different states and partners, for the purpose of time and cost savings on training and recertification.
- The major training providers in Kentucky are the Cabinet and the Technology Transfer Program by Kentucky Transportation Center at University of Kentucky. The training programs they offered could cover most of the necessary knowledge and skills for transportation technicians, although more wide cooperation and reciprocity with other outside training agencies would be a benefit to Kentucky.
- Although Kentucky's current technician training programs cover most of the necessary knowledge and skills, they are not sufficient enough to satisfy the future technician workforce demand, especially in the area of structure and maintenance and environment.
- The technician's most favorite training methods are on-the-job and classroom hands-on training.
- Unable to help with promotion and increase salary, schedule conflicts and the training certificates' short validness are the major barriers which prevented technicians from participating in existing training programs.

4.2 Recommendations

Based on the findings of this research in regards to the current transportation technician training status, it recommends the following for the Cabinet's future training effort:

- More outside training sources from TCCC and other states can be introduced to enrich Kentucky's training programs, and greater reciprocity can be built to attract technicians in other states.
- Based on the gap between the demand and supply of available skills within the Cabinet's technician workforce, additional training opportunities are needed among many areas related to road construction, however **there is a significant need for greater training opportunities related to structures and maintenance and environment.**
- Additional training courses with **more flexible schedule** could be offered to the Cabinet's technicians to satisfy their training needs, especially in the areas mentioned above. Before more courses are developed and offered, increasing technician's accessibility to the information of current training sources can also make training more effective.
- **On-the-job training** is the technicians' most favorite training method, but the major training methods in Kentucky are classroom lecture and classroom hands-on. Therefore, the Cabinet should help technicians to obtain more on-the-job training. Increasing the use of train the trainer programs to ensure that adequate mentors are available to assist the technicians' on-the-job training efforts are important. In additional, developing a formal mentoring program for young technicians could help with expanding on-the-job training experiences.
- The Cabinet should help technicians benefit from their training through **increased opportunities of promotion and salary increases** as a result of completing training program and obtaining the related certification.

In cooperation with colleges and universities, the Cabinet can offer more training on basic knowledge and skills, such as surveying, plan reading, computer and mathematics.

APPENDIX A: TRANSPORTATION TECHNICIAN TRAINING SURVEY

University of Kentucky Kentucky Transportation Cabinet (KYTC) Transportation Technician Training Survey

Technicians are a vital component to the success of any roadway projects. Training and developing the adequate numbers of qualified technicians is a substantial endeavor that requires a comprehensive examination of the qualifications of existing technicians versus the anticipated needs of the technicians on future KYTC projects.

The Kentucky Transportation Academy awarded a research grant to the University of Kentucky to address how to rebuild this key workforce segment of the Cabinet through training while facing the reality of Kentucky's current economic downturn. The first part of this study involved identifying the trainings programs and/or skill sets that we believe are important to transportation technicians based on our research on the current available technician training programs in the US especially in Kentucky as well as the proposed training courses by the Transportation Curriculum Coordination Council. Then we developed this questionnaire to be completed by transportation technicians in Kentucky to investigate the training programs they finished and/or the skills they possess. We want the views of those most closely involved with transportation technician qualification. Identifying the existing technician training program and the skill set will be a significant step towards closing the gap between the technician supply and the future needs.

You have been selected to participate in this questionnaire, and it will take you about 25 minutes to finish. Your participation is purely voluntary. You do not have to participate and nothing will happen to you if you do not. **YOUR RESPONSES IN THIS SURVEY WILL BE KEPT STRICTLY CONFIDENTIAL.**

Kentucky Transportation Cabinet Technician Survey

Part I – Background

The following information is needed to allow comparisons among different groups of transportation technicians in Kentucky. All of your responses are strictly confidential; individual responses will only be seen by the research team. We appreciate your help in providing this important information.

1. How long have you worked for the Kentucky Transportation Cabinet? _____Year(s) (write in the number)

2. What District(s) are you working for in Kentucky?

- | | | | | | |
|--|---|--|--|--|---|
| <input type="checkbox"/> Paducah (1) | <input type="checkbox"/> Madisonville (2) | <input type="checkbox"/> Bowling Green (3) | <input type="checkbox"/> Elizabethtown (4) | <input type="checkbox"/> Louisville (5) | <input type="checkbox"/> Covington (6) |
| <input type="checkbox"/> Lexington (7) | <input type="checkbox"/> Somerset (8) | <input type="checkbox"/> Flemingsburg (9) | <input type="checkbox"/> Jackson (10) | <input type="checkbox"/> Manchester (11) | <input type="checkbox"/> Pikeville (12) |

Part II: Training Received and Skill possessed

Please choose or describe all of the training programs you have completed and the necessary skills you possess. After this, please also select the quality and usefulness of your training program(s) using the 4-point scale.

1. Aggregate Related Trainings

Aggregate (Description in parentheses)	Training: Have you received training in this area? Please answer: Yes or No	Certificate: Do you have a certificate in this area? Please answer: Yes or No	Quality: How would you rate the overall quality of the training that you received? 1-Poor, 2-Fair, 3-Good, 4-Excellent	Usefulness: How would you rate the overall usefulness of the training you received to your work? 1-Poor, 2-Fair, 3-Good, 4-Excellent
Sampling (determining aggregate size, performing proper sampling techniques, conducting visual inspections and making recommendations for corrective action)				
Testing (performing testing, interpreting test methods, test results and data)				
Documentation (completing sample forms and test reports, interpreting completed documentation, conducting trends analyses of all test results on a program basis)				
Other Aggregate related trainings or skills (Please describe)				

2. Asphalt Related Trainings

<p style="text-align: center;">Asphalt (Description in parentheses)</p>	<p>Training: Have you received training in this area? Please answer: Yes or No</p>	<p>Certificate: Do you have a certificate in this area? Please answer: Yes or No</p>	<p>Quality: How would you rate the overall quality of the training that you received? 1-Poor, 2-Fair, 3-Good, 4-Excellent</p>	<p>Usefulness: How would you rate the overall usefulness of the training you received to your work? 1-Poor, 2-Fair, 3-Good, 4-Excellent</p>
<p>Asphalt Paving Best Practices (formerly called Asphalt Field Technician, reviews Kentucky procedures, discusses asphalt practices, and provides an overview of information used on a daily basis in asphalt planning, production, placement, and testing)</p>				
<p>Superpave (Superior PERforming Asphalt PAVements) Plant Technologist (prepares an individual to be qualified to perform daily inspection, process-control, and acceptance of verification testing)</p>				
<p>Superpave (Superior performing asphalt pavements) Mix Design Technologist</p>				
<p>Hot Mixed Asphalt Pavement Field Inspection (surface preparation, hauling, laydown, compaction, smoothness and documentation, etc)</p>				
<p>Other Aggregate related trainings or skills (Please specify)</p>				

3. Concrete Related Trainings

<p style="text-align: center;">Concrete (Description in parentheses)</p>	<p>Training: Have you received training in this area? Please answer: Yes or No</p>	<p>Certificate: Do you have a certificate in this area? Please answer: Yes or No</p>	<p>Quality: How would you rate the overall quality of the training that you received? 1-Poor, 2-Fair, 3-Good, 4-Excellent</p>	<p>Usefulness: How would you rate the overall usefulness of the training you received to your work? 1-Poor, 2-Fair, 3-Good, 4-Excellent</p>
<p>Kentucky Ready Mixed Concrete Association (KRMCA) LEVEL II (field sampling and testing on ready mixed concrete)</p>				
<p>American Concrete Institute (ACI) LEVEL I Field Testing Technician (performing and recording the results of basic field tests on freshly mixed concrete)</p>				
<p>Portland Cement Concrete(PCC) Pavement Field Testing (checking concrete delivery, sampling and testing, checking smoothness and documentation)</p>				
<p>PCC Production & Quality Assurance Labs (sampling, performing QA/QC testing in laboratory, mix design and verification, documentation)</p>				
<p>PCC Pavement Field Inspection (inspection of surface preparation, concrete delivery, paving machine, laydown/consolidation, steel placement, smoothness, dowels/joints and documentation)</p>				
<p>Other concrete related trainings or skills (Please specify)</p>				

4. Grading Related Trainings

<p style="text-align: center;">Grading (Description in parentheses)</p>	<p>Training: Have you received training in this area?</p> <p>Please answer: Yes or No</p>	<p>Certificate: Do you have a certificate in this area?</p> <p>Please answer: Yes or No</p>	<p>Quality: How would you rate the overall quality of the training that you received?</p> <p>1-Poor, 2-Fair, 3-Good, 4-Excellent</p>	<p>Usefulness: How would you rate the overall usefulness of the training you received to your work?</p> <p>1-Poor, 2-Fair, 3-Good, 4-Excellent</p>
<p>Kentucky Transportation Cabinet (KYTC) Grading Level I (soil sampling, interpretation of soil profile sheets, moisture and density, developing moisture-density target, visual identification of soil types, and specifications of grade and drain construction)</p>				
<p>KYTC Grading Level I Refresher (quality control and assurance, moisture and density testing, developing moisture-density target values, and changes to the specifications of grade and drain construction)</p>				
<p>Excavation (recognizing implication of improper application, interprets haul diagram and identifies changes in the field, examining shore plan, distinguishing between materials that can be excavated by conventional equipment, evaluating subgrades to identify wet or unsuitable subgrade materials and recognizes solution alternatives)</p>				
<p>Controlled Blasting (recognizing implication of improper application, examining contractor's controlled blasting plan, verifying vibration monitoring requirements and results)</p>				
<p>Contour Grading (interpreting staking, recognizing implication of improper application, examining contract decisions)</p>				

Grading Related Trainings (continue)

<p style="text-align: center;">Grading (Description in parentheses)</p>	<p>Training: Have you received training in this area?</p> <p>Please answer: Yes or No</p>	<p>Certificate: Do you have a certificate in this area?</p> <p>Please answer: Yes or No</p>	<p>Quality: How would you rate the overall quality of the training that you received?</p> <p>1-Poor, 2-Fair, 3-Good, 4-Excellent</p>	<p>Usefulness: How would you rate the overall usefulness of the training you received to your work?</p> <p>1-Poor, 2-Fair, 3-Good, 4-Excellent</p>
<p>Site Preparation (recommendation of acceptance or rejection of limits of clearing and grubbing for payment, evaluation of foundation to identify wet or unsuitable foundation materials and recognizing of solution alternatives, identifying limits of wet or unsuitable material and making recommendations for shallow repair)</p>				
<p>Embankment (recognizing implication of improper construction of embankment, interpreting results of density tests for acceptance or rejection of compacted materials, verifying requirements and results for ground improvement methods used for embankment construction)</p>				
<p>Borrow (identifying limits of borrow site and representative samples for laboratory testing, interpreting material test result for suitability of material, recommending acceptance or rejection of borrow site reclamation plan and borrow source)</p>				
<p>Compaction (interpreting material test result for acceptance or rejection of compactive effort and/or soil moisture, reviewing results of compaction tests, moisture contents, and field proctor tests as required, recognizing problems associated with density tests and notification of supervisor when necessary)</p>				
<p>Other Grading related trainings or skills (Please specify)</p>				

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5. Structure Construction Related Trainings

Structure (Description in parentheses)	Training: Have you received training in this area? Please answer: Yes or No	Certificate: Do you have a certificate in this area? Please answer: Yes or No	Quality: How would you rate the overall quality of the training that you received? 1-Poor, 2-Fair, 3-Good, 4-Excellent	Usefulness: How would you rate the overall usefulness of the training you received to your work? 1-Poor, 2-Fair, 3-Good, 4-Excellent
Kentucky Transportation Cabinet (KYTC) Structures Level I (for bridge and culvert construction inspector)				
Bridge Coating Inspector (inspecting surface preparation and application of protective coatings on bridge steel)				
Footings (determining specification and geotechnical requirements compliance or corrective action required, verifying footing bearing elevation and location, verifying concrete and steel reinforcement requirements & placement)				
Retaining Walls (recognizing improper wall construction and conditions effecting wall performance and stability, verifying foundation and wall bearing subgrade conditions, verifying structural and drainage detail requirements, structural connection requirements, and delivered materials, material requirements, material testing results)				
Forming & Falsework (comparing field layout to forming and falsework drawings, determining specification compliance or corrective action required when necessary)				
Concrete Girders (checking for proper deflection, Observing placement, handling and storage of concrete girders)				
Steel Girders & Connectors (verification of proper bolted connections and sandblasting of steel, inspecting painting, handling and storage of girder)				

Structure Construction Related Trainings (continue)

<p style="text-align: center;">Structure (Description in parentheses)</p>	<p>Training: Have you received training in this area?</p> <p>Please answer: Yes or No</p>	<p>Certificate: Do you have a certificate in this area?</p> <p>Please answer: Yes or No</p>	<p>Quality: How would you rate the overall quality of the training that you received?</p> <p>1-Poor, 2-Fair, 3-Good, 4-Excellent</p>	<p>Usefulness: How would you rate the overall usefulness of the training you received to your work?</p> <p>1-Poor, 2-Fair, 3-Good, 4-Excellent</p>
<p>Reinforcing Steel – Layout (identifying proper spacing, tying and support of steel, observing handling and storage of reinforcing steel, inspecting reinforcing steel for damage, compares field layout to contract plans)</p>				
<p>Joints (comparing layout of joints to plans and determining if proper material is used to construct joint)</p>				
<p>Finishing & Curing Concrete (observing setup of deck finishing machine and checks for proper deck thickness, inspecting the application of curing compound and checks to make sure the curing system is maintained)</p>				
<p>Deck Smoothness (determining specification compliance or corrective action required, checking smoothness)</p>				
<p>Precast Structures (recognizing proper precast structure installation procedures, identifying product defects prior to installation)</p>				
<p>Post Tensioning (checking strand condition, certification of post-tensioning equipment, inspecting pre-tensioning preparations, verifying post tensioning layout, inspecting grouting operations)</p>				
<p>Other structure related trainings or skills (Please specify)</p>				

6. Soil Related Trainings

<p style="text-align: center;">Soil (Description in parentheses)</p>	<p>Training: Have you received training in this area?</p> <p>Please answer: Yes or No</p>	<p>Certificate: Do you have a certificate in this area?</p> <p>Please answer: Yes or No</p>	<p>Quality: How would you rate the overall quality of the training that you received?</p> <p>1-Poor, 2-Fair, 3-Good, 4-Excellent</p>	<p>Usefulness: How would you rate the overall usefulness of the training you received to your work?</p> <p>1-Poor, 2-Fair, 3-Good, 4-Excellent</p>
<p>Bulk Disturbed Sampling (performing sampling techniques in accordance with American Association of State Highway and Transportation Officials (AASHTO) and American Society for Testing And Materials (ASTM) standards)</p>				
<p>Moisture-Density Relationship for Fine Soils (performing testing in accordance with AASHTO/ASTM test methods, conducting QC or QA testing, making recommendations to adjust jobsite processes based on varying moisture conditions)</p>				
<p>Moisture-Density Relationship for Coarse Soils (performing testing in accordance with AASHTO/ASTM test methods, conducting QC or QA testing, making recommendations to adjust jobsite processes based on varying moisture conditions)</p>				
<p>Geotechnical Exploration, Sampling & In-Situ Testing (determining water levels in borings, operating drilling equipment, performing standard subsurface exploration boring, coring, sampling, visual description and logging crew operations, installing instrumentation)</p>				
<p>Other soil related trainings or skills (Please specify)</p>				

7. Maintenance and Environment Related Trainings

Maintenance and Environment (Description in parentheses)	Training: Have you received training in this area? Please answer: Yes or No	Certificate: Do you have a certificate on this area? Please answer: Yes or No	Quality: How would you rate the overall quality of the training that you received? 1-Poor, 2-Fair, 3-Good, 4-Excellent	Usefulness: How would you rate the overall usefulness of the training you received to your work? 1-Poor, 2-Fair, 3-Good, 4-Excellent
Kentucky Erosion Prevention & Sediment Control - Roadway Inspector (KEPSC-RI)				
Pesticide (ornamental and lawn care, aquatic pest control, right-of-way pest control, turf or ornamental care)				
Environmental Awareness (highway maintenance in and around streams, general permits, working in streambeds, waste management, surface water management, and ground water protection)				
Hazardous Material Awareness (based on OSHA and NFPA recommendations and standards, identifying hazardous substances and, generally, what to do in the first few minutes of an incident)				
Work Zone Traffic Control (installation of traffic control components, erect and maintain and establish traffic control setups, flagging)				
Traffic Services & Safety (pavement marking, signs, guiderail and median barrier, incidental service)				
Roadway & Shoulder (shaping, stabilization, distress analysis, patching, crack sealing, joint sealing, widening, surface treatment, base/subbase repair)				
Drainage (drainage system, pipe/culvert replacement, grade control, environmental protection, hydraulics, drainage inspection, drainage intercept systems, subsurface drainage)				
Winter Operations (pre-season and pre-storm event preparations, equipment calibration and application of anti-icing and deicing materials)				

7. Maintenance and Environment Related Trainings (continue)

Maintenance and Environment (Description in parentheses)	Training: Have you received training in this area? Please answer: Yes or No	Certificate: Do you have a certificate in this area? Please answer: Yes or No	Quality: How would you rate the overall quality of the training that you received? 1-Poor, 2-Fair, 3-Good, 4-Excellent	Usefulness: How would you rate the overall usefulness of the training you received to your work? 1-Poor, 2-Fair, 3-Good, 4-Excellent
Roadside Maintenance (safe tree trimming, brush cutting, roadside mowing practices, roadside maintenance management programs)				
Bridge Maintenance (bridge drainage systems cleaning and flushing, bridge inspection techniques and effective maintenance management techniques)				
Fleet Management (motorized equipment operation, inspection, fleet optimization and life cycle management)				
Other maintenance or environment related trainings or skills (Please specify)				

8. Other Trainings or Skills

Other transportation trainings or skills you finish or possess but were not listed above (Please specify)	Training: Have you received training in this area? Please answer: Yes or No	Certificate: Do you have a certificate in this area? Please answer Yes or No	Quality: How would you rate the overall quality of the training that you received? 1-Poor, 2-Fair, 3-Good, 4-Excellent	Usefulness: How would you rate the overall usefulness of the training you received to your work? 1-Poor, 2-Fair, 3-Good, 4-Excellent

9. Have you participated in the Road Scholar Program provided by Technology Transfer Center of Kentucky Transportation Center at University of Kentucky? Yes No

If yes, are you designated as a Road Scholar? Yes No

10. Have you participated in the Road Master Program provided by Technology Transfer Center of Kentucky Transportation Center at University of Kentucky? Yes No

If yes, are you designated as a Road Master? Yes No

11. Please rank the following training sources according to their frequency in your training experience.

_____ University of Kentucky (Technology Transfer Center, KTC)

_____ Cabinet In-house, District Level

_____ Cabinet In-house, Central Office

_____ Community Technical College

_____ Kentucky Society of Professional Engineers

_____ Other (Please describe: _____)

Part III. Training Needs

1. Is there any training you need but not available in Kentucky?

Please describe: _____

2. What's your favorite training method?

Classroom Lecture Classroom Hands-on Online
 On-the-job Other (please describe) _____

Part IV. Training Barriers

Below are common barriers which may prevent you participating in a training program. Please indicate the barrier's level of impact if it has prevented your participation in any training.

	N/A	None	Slight	Moderate	Severe	Very Severe
Training is not necessary to my job		1	2	3	4	5
Lack of information of available training programs		1	2	3	4	5
Lack of the training programs I need		1	2	3	4	5
The training program is not sufficient to my job		1	2	3	4	5
Lack of financial support from my employer to receive the training I need		1	2	3	4	5
Lack of general support from my employer (eg. motivation, work coordination, etc)		1	2	3	4	5
Training schedule conflicts with work schedule		1	2	3	4	5
Dissatisfied with the quality of a training program		1	2	3	4	5
Training location is not accessible		1	2	3	4	5
Training requires too much time to complete		1	2	3	4	5
The training cannot increase my salary and help me get a promotion		1	2	3	4	5
The certificate expires so quickly		1	2	3	4	5
The certificate is not recognized by other states		1	2	3	4	5
Language barriers		1	2	3	4	5
Other (please describe) _____		1	2	3	4	5

Part V – Contact Information

May we contact you for additional information?

Yes

No

If you answered yes to the above questions, please provide the following contact information.

Name:

Company:

Email:

Fax:

Phone Number:

APPENDIX B: SECTION ENGINEER SURVEY

University of Kentucky Kentucky Transportation Cabinet (KYTC) Section Engineer Survey

Technicians are a vital component to the success of any roadway projects. Training and developing the adequate numbers of qualified technicians is a substantial endeavor that requires a comprehensive examination of the qualifications of existing technicians versus the anticipated needs of the technicians on future KYTC projects.

The Kentucky Transportation Academy awarded a research grant to the University of Kentucky to address how to rebuild this key workforce segment of the Cabinet through training while facing the reality of Kentucky's current economic downturn. The first part of this study involved identifying the skill sets that we believe are important to transportation technicians based on our research on the current available technician training programs in the US especially in Kentucky as well as the proposed courses by the Transportation Curriculum Coordination Council. Then we developed this questionnaire to be completed by transportation engineers in Kentucky to investigate the skills and/or knowledge which they believe are required among their technicians. Besides surveying the existing technician training program and the skill set, identifying skill needs among the cabinet's current technician workforce will be another significant step towards closing the gap between the technician supply and the future needs.

You have been selected to participate in this questionnaire, and it will take you about 20 minutes to complete. Your participation is purely voluntary. You do not have to participate and nothing will happen to you if you do not. **YOUR RESPONSES IN THIS SURVEY WILL BE KEPT STRICTLY CONFIDENTIAL.**

Kentucky Transportation Cabinet Section Engineer Survey

Part I – Background

The following information is needed to allow comparisons among different groups of transportation engineers in Kentucky. All of your responses are strictly confidential; individual responses will only be seen by the research team. We appreciate your help in providing this important information.

1. How long have you worked for the Kentucky Transportation Cabinet? _____Years (write in the number)

2. What's your title?

Section Engineer TE EIT TE Technician Supervisor Training Coordinator

3. What District(s) are you working for in Kentucky?

Paducah (1) Madisonville (2) Bowling Green (3) Elizabethtown (4) Louisville (5) Covington (6)
 Lexington (7) Somerset (8) Flemingsburg (9) Jackson (10) Manchester (11) Pikeville (12)

Part II: Skills Needed for Kentucky Transportation Technicians

Please choose or describe all of the skills and/or knowledge which are required by your current transportation technician workforce. If you believe the skill is required, please also select its importance using the 4-point scale.

1. Aggregate Related Skills

Aggregate (Description in parentheses)	Do you think this skill is required among your current transportation technician workforce? Please answer: Yes or No	Importance: How would you rate the overall importance of this skill? 1- Not Important, 2-Somewhat Important, 3- Important, 4-Very Important
Sampling (determining aggregate size, performing proper sampling techniques, conducting visual inspections and making recommendations for corrective action)		
Testing (performing testing, interpreting test methods, test results and data)		
Documentation (completing sample forms and test reports, interpreting completed documentation, conducting trends analyses of all test results on a program basis)		
Other aggregate related skills (Please describe)		

2. Asphalt Related Skills

<p style="text-align: center;">Asphalt (Description in parentheses)</p>	<p>Do you think this skill is required among your current transportation technician workforce? Please answer: Yes or No</p>	<p>Importance: How would you rate the overall importance of this skill? 1- Not Important, 2-Somewhat Important, 3- Important, 4-Very Important</p>
<p>Asphalt Paving Best Practices (Kentucky procedures, asphalt practices, and an overview of information used on a daily basis in asphalt planning, production, placement, and testing)</p>		
<p>Superpave (Superior Performing Asphalt Pavements) Plant Skill (daily inspection, process-control, and acceptance of verification testing)</p>		
<p>Superpave (Superior performing asphalt pavements) Mix Design</p>		
<p>Hot Mixed Asphalt Pavement Field Inspection (surface preparation, hauling, laydown, compaction, smoothness and documentation, etc)</p>		
<p>Other aggregate related skills (Please specify)</p>		

3. Concrete Related Skills

Concrete (Description in parentheses)	Do you think this skill is required among your current transportation technician workforce? Please answer: Yes or No	Importance: How would you rate the overall importance of this skill? 1- Not Important, 2-Somewhat Important, 3- Important, 4-Very Important
Field Sampling and Testing on Ready/Freshly Mixed Concrete		
Portland Cement Concrete(PCC) Pavement Field Testing (checking concrete delivery, sampling and testing, checking smoothness and documentation)		
PCC Production & Quality Assurance Labs (sampling, performing QA/QC testing in laboratory, mix design and verification, documentation)		
PCC Pavement Field Inspection (inspection of surface preparation, concrete delivery, paving machine, laydown/consolidation, steel placement, smoothness, dowels/joints and documentation)		
Other concrete related skills(Please specify)		

4. Grading Related Skills

<p style="text-align: center;">Grading (Description in parentheses)</p>	<p>Do you think this skill is required among your current transportation technician workforce? Please answer: Yes or No</p>	<p>Importance: How would you rate the overall importance of this skill? 1- Not Important, 2-Somewhat Important, 3- Important, 4-Very Important</p>
<p>Kentucky Transportation Cabinet (KYTC) Grading Level I Skill set (soil sampling, interpretation of soil profile sheets, moisture and density, developing moisture-density target, visual identification of soil types, and specifications of grade and drain construction)</p>		
<p>Excavation (recognizing implication of improper application, interprets haul diagram and identifies changes in the field, examining shore plan, distinguishing between materials that can be excavated by conventional equipment, evaluating subgrades to identify wet or unsuitable subgrade materials and recognizes solution alternatives)</p>		
<p>Controlled Blasting (recognizing implication of improper application, examining contractor's controlled blasting plan, verifying vibration monitoring requirements and results)</p>		
<p>Contour Grading (interpreting staking, recognizing implication of improper application, examining contract decisions)</p>		
<p>Site Preparation (recommendation of acceptance or rejection of limits of clearing and grubbing for payment, evaluation of foundation to identify wet or unsuitable foundation materials and recognizing solution alternatives, identifying limits of wet or unsuitable material and making recommendations for shallow repair)</p>		

Grading Related Skills (continue)

<p style="text-align: center;">Grading (Description in parentheses)</p>	<p>Do you think this skill is required among your current transportation technician workforce? Please answer: Yes or No</p>	<p>Importance: How would you rate the overall importance of this skill? 1- Not Important, 2-Somewhat Important, 3- Important, 4-Very Important</p>
<p>Embankment (recognizing implication of improper construction of embankment, interpreting results of density tests for acceptance or rejection of compacted materials, verifying requirements and results for ground improvement methods used for embankment construction)</p>		
<p>Borrow (identifying limits of borrow site and representative samples for laboratory testing, interpreting material test result for suitability of material, recommending acceptance or rejection of borrow site reclamation plan and borrow source)</p>		
<p>Compaction (interpreting material test result for acceptance or rejection of compactive effort and/or soil moisture, reviewing results of compaction tests, moisture contents, and field proctor tests as required, recognizing problems associated with density tests and notification of supervisor when necessary)</p>		
<p>Other grading related skills (Please specify)</p>		

5. Structure Construction Related Skills

<p style="text-align: center;">Structure (Description in parentheses)</p>	<p>Do you think this skill is required among your current transportation technician workforce?</p> <p>Please answer: Yes or No</p>	<p>Importance: How would you rate the overall importance of this skill?</p> <p>1- Not Important, 2-Somewhat Important, 3- Important, 4-Very Important</p>
<p>Kentucky Transportation Cabinet (KYTC) Structures Level I skill set (for bridge and culvert construction inspector)</p>		
<p>Bridge Coating Inspecting (inspecting surface preparation and application of protective coatings on bridge steel)</p>		
<p>Footings (determining specification and geotechnical requirements compliance or corrective action required, verifying footing bearing elevation and location, Verifying concrete and steel reinforcement requirements & placement)</p>		
<p>Retaining Walls (recognizing improper wall construction and conditions effecting wall performance and stability, verifying foundation and wall bearing subgrade conditions, verifying structural and drainage detail requirements, structural connection requirements, and delivered materials, material requirements, material testing results)</p>		
<p>Forming & Falsework (comparing field layout to forming and falsework drawings, determining specification compliance or corrective action required when necessary)</p>		
<p>Concrete Girders (checking for proper deflection, Observing placement, handling and storage of concrete girders)</p>		
<p>Steel Girders & Connectors (verification of proper bolted connections and sandblasting of steel, inspecting painting, handling and storage of girder)</p>		

Structure Construction Related Skills (continue)

<p style="text-align: center;">Structure (Description in parentheses)</p>	<p>Do you think this skill is required among your current transportation technician workforce? Please answer: Yes or No</p>	<p>Importance: How would you rate the overall importance of this skill? 1- Not Important, 2-Somewhat Important, 3- Important, 4-Very Important</p>
<p>Reinforcing Steel – Layout (identifying proper spacing, tying and support of steel, observing handling and storage of reinforcing steel, inspecting reinforcing steel for damage, compares field layout to contract plans)</p>		
<p>Joints(comparing layout of joints to plans and determining if proper material is used to construct joint)</p>		
<p>Finishing & Curing Concrete (observing setup of deck finishing machine and checks for proper deck thickness, inspecting the application of curing compound and checks to make sure the curing system is maintained)</p>		
<p>Deck Smoothness (determining specification compliance or corrective action required, checking smoothness)</p>		
<p>Precast Structures (recognizing proper precast structure installation procedures, identifying product defects prior to installation)</p>		
<p>Post Tensioning (checking strand condition, certification of post-tensioning equipment, inspecting pre-tensioning preparations, verifying post tensioning layout, inspecting grouting operations)</p>		
<p>Other structure related skills (Please specify)</p>		

6. Soil Related Skills

<p style="text-align: center;">Soil (Description in parentheses)</p>	<p>Do you think this skill is required among your current transportation technician workforce?</p> <p>Please answer: Yes or No</p>	<p>Importance: How would you rate the overall importance of this skill?</p> <p>1- Not Important, 2-Somewhat Important, 3- Important, 4-Very Important</p>
<p>Bulk Disturbed Sampling (Performing sampling techniques in accordance with American Association of State Highway and Transportation Officials (AASHTO) and American Society for Testing And Materials (ASTM) standards)</p>		
<p>Moisture-Density Relationship for Fine Soils (Performing testing in accordance with AASHTO/ASTM test methods, conducting QC or QA testing, making recommendations to adjust jobsite processes based on varying moisture conditions)</p>		
<p>Moisture-Density Relationship for Coarse Soils (performing testing in accordance with AASHTO/ASTM test methods, conducting QC or QA testing, making recommendations to adjust jobsite processes based on varying moisture conditions)</p>		
<p>Geotechnical Exploration, Sampling & In-Situ Testing (determining water levels in borings, operating drilling equipment, performing standard subsurface exploration boring, coring, sampling, visual description and logging crew operations, installing instrumentation)</p>		
<p>Other soil related Skills or skills (Please specify)</p>		

7. Maintenance and Environment Related Skills

<p>Maintenance and Environment (Description in parentheses)</p>	<p>Do you think this skill is required among your current transportation technician workforce? Please answer: Yes or No</p>	<p>Importance: How would you rate the overall importance of this skill? 1- Not Important, 2-Somewhat Important, 3- Important, 4-Very Important</p>
<p>Kentucky Erosion Prevention & Sediment Control - Roadway Inspector (KEPSC-RI)</p>		
<p>Pesticide (ornamental and lawn care, aquatic pest control, right-of-way pest control, turf or ornamental care)</p>		
<p>Environmental Awareness (highway maintenance in and around streams, general permits, working in streambeds, waste management, surface water management, and ground water protection)</p>		
<p>Hazardous Material Awareness (based on OSHA and NFPA recommendations and standards, identifying hazardous substances and, generally, what to do in the first few minutes of an incident)</p>		
<p>Work Zone Traffic Control (installation of traffic control components, erect and maintain and establish traffic control setups, flagging)</p>		
<p>Traffic Services & Safety (pavement marking, signs, guiderail and median barrier, incidental service)</p>		
<p>Roadway & Shoulder (shaping, stabilization, distress analysis, patching, crack sealing, joint sealing, widening, surface treatment, base/subbase repair)</p>		
<p>Drainage (drainage system, pipe/culvert replacement, grade control, environmental protection, hydraulics, drainage inspection, drainage intercept systems, subsurface drainage)</p>		
<p>Winter Operations (pre-season and pre-storm event preparations, equipment calibration and application of anti-icing and deicing materials)</p>		
<p>Roadside Maintenance (safe tree trimming, brush cutting, roadside mowing practices, roadside maintenance management programs)</p>		

Maintenance and Environment Related Skills (continue)

Maintenance and Environment (Description in parentheses)	Do you think this skill is required among your current transportation technician workforce? Please answer: Yes or No	Importance: How would you rate the overall importance of this skill? 1- Not Important, 2-Somewhat Important, 3- Important, 4-Very Important
Bridge Maintenance (bridge drainage systems cleaning and flushing, bridge inspection techniques and effective maintenance management techniques)		
Fleet Management (motorized equipment operation, inspection, fleet optimization and life cycle management)		
Other maintenance or environment related trainings or skills (Please specify)		

8. Other Required Skills

Other transportation technician skills which you think are required not listed above (Please specify)	Importance: How would you rate the overall importance of this skill? 1- Not Important, 2-Somewhat Important, 3- Important, 4-Very Important

Part III – Contact Information

May we contact you for additional information?

Yes

No

If you answered yes to the above questions, please provide the following contact information.

Name:

Company:

Email:

Fax:

Phone Number: