# **Developing Knowledge Management** Strategies

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## **Research Report** KTC-18-07/SPR16-516-1F

## **Developing Knowledge Management Strategies**

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#### 16. Abstract

Retirements and other staff changes have led to a loss of institutional knowledge across public agencies. These changing workforce dynamics have highlighted the study of knowledge management, and how organizations can best retain their core knowledge bases. Key to understanding knowledge management is how organizations have approached the issue and the most effective methods and processes they have used to retain, store, and disseminate knowledge. Part of the knowledge management discussion includes core competencies, or what basic knowledge and skills are essential to an organization's mission. Also, considering the impacts of outsourcing on public employment, is another key to understanding the importance of knowledge management. Personnel turnover, through outsourcing, retirements, and other changes, can lead to a loss of institutional familiarity. Knowledge management is capturing the value of know-how from seasoned employees so that all may benefit and improve efficiency. Previous research has placed great importance on an organization's capacity to access the multitude of abilities possessed by agency staff to improve the delivery of services. Several state departments of transportation (DOTs) and their knowledge management efforts were profiled including: Alaska, Virginia, California, Pennsylvania, Texas, Wisconsin, and Missouri. Additionally, current efforts at the Kentucky Transportation Cabinet (KYTC) were profiled and a survey was conducted to ascertain where employees are finding pertinent information. This report serves as both a primer on knowledge management as well as a guide to current and potential future efforts in this area.

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#### **Executive Summary**

Retirements and other staff changes have led to a loss of institutional knowledge across public agencies. These changing workforce dynamics have highlighted the issue of knowledge management, and how organizations can best retain their core knowledge bases. Gaining insight into knowledge management and developing organizational knowledge management processes and program first requires an understanding of the various approaches. Additionally, experiences from organizations that have developed knowledge management programs can inform potential efforts. The purpose of this study was to explore knowledge management strategies and identify the most effective methods and processes organizations can use to in retain, store, and disseminate knowledge.

Part of the knowledge management discussion includes core competencies, or what basic knowledge and skills are essential to an organization's mission. Also, considering the impacts of outsourcing on public employment, is another key to understanding the importance of knowledge management. Personnel turnover, through outsourcing, retirements, and other changes, can lead to a loss of institutional familiarity. Knowledge management generally is capturing the value of know-how from seasoned employees so that all may benefit and improve efficiency. Knowledge can be broken in tacit and explicit knowledge, where tacit is the more difficult to capture as it is not clearly defined, rather it results from the experiences of individuals. Knowledge management has been shown to have value for organizations and many public agencies have developed programs to facilitate the capture and transfer of knowledge. Previous research has placed great importance on an organization's capacity to access the multitude of abilities possessed by agency staff to improve the delivery of services. Several state departments of transportation (DOTs) and their knowledge management efforts were profiled including: Alaska, Virginia, California, Pennsylvania, Texas, Wisconsin, and Missouri. These case studies as well as the literature reviewed and a survey administrated to Kentucky Transportation Cabinet (KYTC) employees provided a number of different approaches that could potentially be implemented at KYTC. These knowledge management strategies selected are included in the table below (Table 5, p. 42 in this report).

Workforce Tools	Workforce Planning	Informal Collaborations	Formal Collaborations			
Develop a Yellow Pages	Link Management Strategies with Succession Planning	Communities of Practice	Implement Formal Lessons Learned Meetings			
Knowledge Mapping	Forecast Workforce Supply	Increase collaboration opportunities	Conduct after action Reviews			
Update Guidance Manuals	Develop a Workforce Plan	Implement sharing opportunities for "war stories" and lessons learned	Leadership training workshops			
Create a central repository with searchable features		Job Rotation/Shadowing	Conduct a last lecture and exit interviews for retiring employees			

#### **Chapter One: Introduction**

## 1.1 Study Overview

The Kentucky Transportation Cabinet (KYTC) is responsible for "providing a transportation infrastructure and transportation services for the 21<sup>st</sup> century that deliver new economic opportunities for all Kentuckians." KYTC "manages more than 27,000 miles of highways, including roughly 20,500 miles of secondary roads, 3,600 miles of primary roads, and more than 1,400 interstate and parkway miles. The Cabinet also provides direction for 230 licensed airports and heliports and oversees all motor vehicle and driver's licensure for more than three million drivers in the Commonwealth."<sup>1</sup> KYTC's mission is "to provide a safe, efficient, environmentally sound and fiscally responsible transportation system that delivers economic opportunity and enhances the quality of life in Kentucky" speaks to the broad nature of its work. These core organizational statements capture the breadth of KYTC's work and the myriad skill sets needed in order to perform all the functions that fall under KYTC's responsibility.

In recent years, many public agencies — including KYTC — have lost significant institutional knowledge due to retirements, staff turnover, and other organizational changes. Over past 30 years, in-house employment at KYTC has declined while outsourcing has increased. These changing workforce dynamics have sparked conversations around knowledge management and how organizations can best retain their core knowledge bases in the face of employment instability.

Personnel turnover can lead to a loss of institutional familiarity across government agencies. Devising knowledge management preservation strategies and mapping the organizational know-how of an agency are effective methods to promote knowledge retention. Organizing information and retaining core resources is a critical practice for any governmental agency — it enables an agency to provide consistently high levels of service to its constituents. Research on knowledge management has grappled with the importance of retaining core competencies or functions within agencies to maintain organizational functionality and continuity. Researchers place great importance on an organization's capacity to access the multitude of abilities that their staff possess to improve the delivery of services. By preserving and disseminating an organization's informational resources, employees are empowered to use organizational knowledge, potentially increasing efficiency.

Insight into knowledge management and developing organizational knowledge management processes and program first requires an understanding of the various methods. Experiences from organizations that have developed knowledge management programs can also inform potential efforts. Once a context-specific evaluation of knowledge management has been completed, an organization can identify steps to develop, implement, and monitor a knowledge management program.

## **1.2 Research Objectives**

The purpose of this study is to explore knowledge management strategies and identify the most effective methods and processes organizations can use to in retain, store, and disseminate knowledge. Based on this exploration and assessment of current methods, KYTC will be able to determine if a knowledge management program warrants development, which would represent a second phase of this project. This study also identifies opportunities to implement knowledge management.

This study has three objectives that relate to and combine elements of core competencies, outsourcing, and knowledge management. First, we review literature on core competencies and their importance to knowledge management. Secondly, we synthesize literature on outsourcing and its impact on knowledge levels across organizations. Insights from these organizations will be useful because they may parallel similar changes taking place in public agencies such as KYTC. Third, we conduct a high-level review of

<sup>&</sup>lt;sup>1</sup> <u>http://transportation.ky.gov/Pages/AboutUsInfo.aspx</u>

knowledge management strategies that have been put into place. Our specific focus is on the experiences state agencies have had during their attempts to implement knowledge management. These case studies describe strategies and tools KYTC could potentially use to implement a robust knowledge management program. Finally, we offer some recommendations on implementing of knowledge management systems. Knowledge management systems are integral for tapping into and archiving the collective intelligence and skills of an agency's employees. Tapping into these skills enlarges an organization's knowledge base, which is critical if it is to remain competitive and effective (Bollinger and Smith 2001). If KYTC is to deliver on its organizational mission, having a reliable knowledge management plan will be critical.

#### **1.3 Structure of the Report**

Chapter 2 focuses on knowledge management and includes selected state case studies where knowledge management programs have been implemented. Additionally, Chapter 2 reviews current programs at KYTC that relate to knowledge management. These include training and professional development offerings as well as databases and other sources of information. Chapter 3 discusses a survey that was administered to KYTC employees and the results. Chapter 4 offers concluding remarks and recommendations for knowledge management efforts in the future.

#### **Chapter Two: Knowledge Management**

#### **2.1 Literature Review**

Knowledge management is a critical for ensuring that a government agency's can efficiently provide a high level of service to its constituents. Knowledge management is defined as an organizational organizing practice that deals specially with the process of creating value from an agency's intangible assets (Rubenstein-Montano 2001). The literature on knowledge management discusses two types of knowledge - tacit knowledge and explicit, or codified, knowledge. Explicit knowledge is clearly defined, expressed in a straightforward manner, and may be codified (Bollinger and Smith 2001). Tacit knowledge resides in human consciousness, however, it is difficult to articulate, formulate, or code. Tacit knowledge is recognized as a key component of the learning economy and a critical to innovation and value creation (Gertler 2003). As Chinowsky and Carrillo (2007) noted, individuals who possess tacit knowledge have to interact with one another in order to share it. Further, they have to identify a way to transform tacit knowledge into explicit knowledge, so that it can be used by the entire organization. NCHRP Report 813 (Spy Pond Partners 2015) classified knowledge as descriptive, causal, procedural, and social (i.e., the what, why, how, and who). Quinn, Anderson, and Finkelstein (1996) listed four stages in the evolution of knowledge management and the cultural shifts that occur in an organization. The stages include: (1) knowing what, (2) knowing how, (3) knowing why, and (4) caring why. NCHRP Report 813 broadly defines knowledge management is as "a variety of techniques for building, leveraging and sustaining the know-how and experience of an organization's employees" (Spy Pond Partners 2015, p.1). The value derived from knowledge management for state DOTs resides in the know-how of seasoned employees. From a business perspective, DOTs realize the following benefits from knowledge management (p. 12):

- Improve organizational efficiency
- Improve organizational effectiveness
- Strengthen organizational resilience
- Bolster workforce capabilities
- Leverage external expertise
- Foster an environment for learning and innovation
- Reduce impact of employee transitions

The knowledge worker stands at the center of knowledge management. Knowledge workers "have high degrees of expertise, education or experience and the primary purpose of their jobs is the creation, distribution, or application of knowledge" (Davenport 2005). Although this applied to workers in the private sector, Novak and Hammer (2009) argued that government employees also fit well into this definition. The shift to knowledge workers over the last 25 years has brought new challenges to DOTs, creating an even greater urgency to practice integrated and accessible knowledge management practices and implement knowledge transfer systems.

Over the past two decades, knowledge management research has grappled with the importance of managing knowledge in organizations and among workers. It is critical for organizations to access workers' tacit knowledge bases to preserve and expand core competencies. Doing so will also help to establish systems that will empower employees trying to do more with fewer resources (Bollinger and Smith 2001), which is necessary given the impacts of outsourcing. The greatest concern pertains to the loss of tacit knowledge management into practice requires that an organization's leadership be aware of the value and impact of knowledge networks and culture change among employees (Novak and Hammer 2009). As a result, adoption is often slow (Anumba and Pulsifer 2010). Initial forays attempts at knowledge management are often restricted to specific departments or initiatives. Only later, after they have succeeded on a small scale, will they diffuse throughout the organization.

Arora and Associates (2014) scanned transportation agencies to gain insight into knowledge management practices. Seven states, including Alaska, Georgia, Kansas, Missouri, Virginia, Washington, and Wisconsin, as well as several federal agencies and private entities, participated in the scan. Initial definitions of knowledge management revealed that many agencies confuse knowledge management and information management. The scan differentiated between the two as follows:

Information refers to data or facts that have been organized and presented with the context necessary for use or application. In contrast, knowledge typically is characterized as something that exists within a human brain, built over time from learning and experience and used as the basis for judgment, prediction, and decision-making.

Agencies cited the loss of key staff, transitions across their organizations, a desire to improve efficiency and promote innovation, and a need to manage workforce changes (e.g., communication) as the primary reasons for expanding their knowledge management programs.

Implementation often began on a small scale and grew over time. Early knowledge management initiatives typically focused on workforce planning, knowledge sharing opportunities, and access to knowledge bases. Often, sustaining programs proved difficult because many arose in response to a crisis and were not built for longevity.

Kivrak et al. (2008) noted the difficulty of capturing construction-based knowledge as it is grounded in experience. Companies surveyed in Turkey had not established knowledge management program. The authors developed a framework (Figure 1) to capture knowledge management in construction projects (Kivrak et al. 2008, Fig.4, p. 91).



Figure 1: Framework for Knowledge Capture in Construction Projects

Kivrak et al. (2008) created an online Knowledge Platform for Contractors (KPfC) to facilitate the capture and use of knowledge through an interactive tool. It can reduce reworks, improve sharing and retention of tacit knowledge, foster innovation, facilitate continuous improvement, and bolster client satisfaction. However, in order for a tool like KPfC to succeed, participation and sharing across the organization is imperative.

Knowledge management tools designed to capture and disseminate knowledge can include the use of formal information technologies and training sessions, informal mentoring across project teams, or a combination of both formal and informal techniques. Knowledge management tools may include (Bollinger and Smith 2001; Chang-Albitres and Krugler 2005):

- 1. Software programs or software as a service—"on demand" software
- 2. Hardware technologies
- 3. Collaboration tools
- 4. Intelligent tools

Anumba and Pulsifer (2010) divided approaches to knowledge management into two categories — technology and techniques. *Techniques* include approaches that do not rely on technology, such as mentoring and forming communities of practice. Anumba and Pulsifer also reviewed several knowledge management systems, which could be used if an outside solution is desired (p. 692-693).<sup>2</sup> Continued development of knowledge systems will yield improvements in a *next generation* approach to knowledge management (Anumba 2009). Such systems will have clearly identified benefits, intelligent components to act on behalf of the owner-operator, use more artificial intelligence techniques, deliver more content and context-specific information, be able to support communities of practice, develop knowledge chains for the facilitation of knowledge flow, and support those whose roles are focused on knowledge management.

<sup>&</sup>lt;sup>2</sup> See also Krugler, Chang-Albires, and Robideau (2006) p. 24-32.

For knowledge management to be valuable, an agency must do more than simply implement one of the tools described above. The success or failure of a knowledge management initiative is dictated by the people who implement it and the organizational culture in which they operate (Rubenstein-Montano, 2001). It also involves knowledge transfer, where there is an intentional transmission of knowledge between a source and a recipient (Crichton-Sumners et. al., 2013). A case study of the Pennsylvania Department of Transportation (PennDOT) pointed toward several lessons learned during the implementation of its knowledge management system. A number of these lessons related to the role managerial support and informal communities of practice played in helping PennDOT establish a knowledge management system (Chang-Albitres and Krugler 2005).

Cronin et al. (2013) identified five knowledge management strategies for DOTs. Each strategy hinges on direct interaction with colleagues, not merely the adoption of information technology tools. The five management strategies are:

- 1. Create a people-focused knowledge management system
- 2. Implement communities of practice
- 3. Use job rotation
- 4. Engage employees in knowledge transfer
- 5. Link knowledge management strategies to succession planning efforts

Ward listed a number of knowledge management practices and activities described in research literature, including (p. 3):

- Content management
- Knowledge taxonomies
- Groupware
- Online communities of practice
- Enterprise portals
- Social network analysis and design
- E-learning
- Storytelling and narratives
- Wireless tools for knowledge mobilization
- Innovation and idea management systems

Ward also documented basic ideas, which are included in Appendix A. Key ideas include mentoring, succession planning, employee retention, job shadowing, engaging retired workers, and holding knowledge transfer workshops.

An *agency-wide approach* to knowledge management consists of four parts (SpyPond Partners 2015, p. 16):

- 1. Leadership and direction
- 2. Collaboration and communities
- 3. Knowledge codification and dissemination
- 4. Succession and talent management

Leadership and direction are critical because it is important that management demonstrate support for knowledge management and articulate what this kind of program should accomplish.

Important to this function is having a lead person to help keep the initiative focused and moving forward. Collaboration and communities among organization employees emerge through online and personal

interactions. They help employees locate knowledge throughout an organization. Identifying, codifying, and disseminating knowledge through the documentation and transfer of relevant material creates a knowledge base that employees can turn to. The last step is succession planning and personnel management to fill knowledge gaps and augment organizational know-how.

To implement knowledge management across an agency through the approach defined above, a four step process is proposed. Each part described above plays a role in each step.

- 1. Assess risks and opportunities
- 2. Develop a strategy
- 3. Create an implementation plan
- 4. Monitor results

There many ways to assess the current situation, risks, and opportunities. Some examples include litmus tests (see Appendix B), senior leadership workshops to identify important knowledge areas, knowledge surveys for employees that inquire about current practices for gathering and sharing knowledge, and risk assessments (p. 20). The latter measures attrition (i.e., projected retirements or departures) and position risk (i.e., level of knowledge and skill in the positon).

Strategies should align with an agency's mission and priorities and mitigate potential risks. A knowledge management strategy consists of a written document outlining the program's goals. People, culture, and processes can all be incorporated into knowledge management strategy, and it can draw on business plans, organizational goals, and/or values. Strategies can be categorized according to the four elements of an agency-wide approach noted above. For example, knowledge assessment falls under leadership and direction, and cuts across people, processes, and information management and technology. Communities of practice contribute to social learning and; as such, they fall into all three categories as well. Under knowledge codification and dissemination, a database cataloguing lessons learned fits into process and information management and technology. Within succession and talent management, phased retirement is a strategy that fits people and process.<sup>3</sup>

Spy Pond Partners (2015, Figure 5, p. 27) outlined a modest knowledge management strategy for DOTs, which is reproduced below.

- 1. Business Case
  - a. Within the next few years, several district administrators are expected to retire and the next level management has less than five years' experience.
  - b. There is a need to strengthen the support system for new staff so that they can learn from more experienced staff.
  - c. There is a need for consistency in work processes.
- 2. Goals
  - a. Increase collaboration opportunities
  - b. Capture knowledge before staff retire
- 3. Strategies
  - a. Establish communities of practice for district personnel
  - b. Map processes and use as part of new hire orientation
  - c. Conduct interviews with senior personnel to document lessons and experience
- 4. Implementation
  - a. Designate a lead at 50 percent of his/her time
  - b. Train two employees in process mapping

<sup>&</sup>lt;sup>3</sup> For more examples see Spy Pond Partners (2015) Table 1, p. 25

- c. Brief managers on knowledge management strategy
- d. Establish quarterly progress reporting

When preparing for implementation, an organization's leadership should evaluate whether the knowledge management plan is sustainable and identify what role different personnel will play in executing the plan. In some cases, an agency may want to develop an implementation plan. This would usually identify strategies to put the plan into action, determine what metrics will be collected to assess whether knowledge management is succeeding, communicate an overarching strategy, put forward budgets, and establish a protocol for conducting follow-up reviews.

Implementing knowledge management systems is particularly critical for organizations that outsource services — agencies are rarely able to leverage the intellectual capital generated through the outsourced initiative (Willcocks et al. 2004). This is not to imply that outsourcing cannot generate tacit knowledge (which the outsourcing agency uses). Instead, there must be a more deliberate approach to outsourcing, where organizations and their private contractors recognize the importance of knowledge exchange, rather than focusing purely on contract monitoring and management. Implementing knowledge exchange systems between agencies and suppliers will guard against government officials becoming mere contract specialists, rather than public service providers. However, there are often barriers to implementing knowledge management, at least as a business process, as noted in *The European Guide to Good Practice in Knowledge Management, Part 2: Organizational Culture*. Some of these obstacles include time, apathy, organizational culture differences, virtual workers, emphasis on technological solutions, and management indifference among others.

A number of strategies can be used to implement and facilitate the expansion of a knowledge management program. These implementation strategies relate to leadership, human resource management, recognition of collaboration and knowledge sharing, foster networking and communities of practice, capturing and applying knowledge, and managing and disseminating information (Arora and Associates 2014). A number of examples were presented for how to operationalize these strategies. For example, leadership buy-in is an important step in implementing knowledge management. If leadership provides direction and is engaged in the process, it can accelerate adoption by other employees. Human resource management focuses on the day-to-day activities of employees by developing briefings that describe the organization and its key members. It also tracks employee training to maximize talent usage and integrate knowledge management measures into performance evaluation. Next, recognizing efforts that improve knowledge management can be as simple as rewarding employees engaged in the practice and updating job descriptions to emphasize the importance of sharing information. Fostering networking and communities of practice can be simple. It may entail instituting low impact measures, such as generating an expertise database, and rewarding employees who participate in communities of practice. Capturing and applying knowledge approaches could entail recording and archiving institutional knowledge and the stories and experiences of experts in the organization. Peer and action reviews during projects can ensure that knowledge is being applied where it is germane. Finally, information management and dissemination measures are general guidelines rather than specifics. For example, ensuring that employees can locate information in a timely fashion and reviewing procedures to reduce duplication.

Two useful strategies to grow a knowledge management program are increasing the understanding of the value of knowledge across the organization and developing tools to support the program. Conference presentation, webinars, and video recordings are convenient media to sustain knowledge management

Ward (2007) listed several reasons why promoting the preservation, dissemination, and transfer of knowledge in transportation agencies is important (p. 9). These include:

- Facilitating training and succession management in light of the unprecedented numbers of longterm department of transportation employees who are retiring or otherwise departing
- Needing to build on past understandings and improving efficiency when providing the information and knowledge that allow managers, professionals, and technicians to deliver agency programs effectively, on time, and within budget
- Budget-wise, doing more with less
- Responding to requests from legal staff for information to support agency positions in litigation
- Integrating historical perspectives and lessons learned into current transportation agency activities and decision making
- Striving to respond efficiently and accurately to requests for information from elected officials, media, historians, researchers, and the general public

Metrics can be identified to monitor performance and assess outcomes<sup>4</sup>, test the alignment of a knowledge management program with an organization's mission, and make adjustments as needed. Metrics generally focus on costs, exposure or usage, and impacts (or outcomes). Costs generally refer to time spent by employees on knowledge management. Outputs encompass the end product of a management process (such as written documents that archive employee knowledge). Exposure is measured in terms of the number of employees who participate in a program or take advantage of resources such as online information and knowledge databases. Measuring outcomes poses greater challenges. However, surveys to determine employees' satisfaction with a knowledge management can be informative. For example, to measure communities of practices, an organization could evaluate the number of communities (output), the number of posts and participants (exposure), and employee satisfaction (impact). To determine the effectiveness of mentoring and/or job shadowing, an agency could measure the number of training sessions or shadowing opportunities (output), the percentage of employees participating (exposure), and the reported benefits from the experiences (impacts).

If an agency realizes savings from outputs or other business components, these can be used to benchmark a knowledge management program's performance. Factors associated with success have been documented by a number of researchers, such as the rate at which knowledge is entered into a database and the adoption of learning processes structured to incorporate new knowledge (Cross and Baird 2000); measures of organizational culture (Davenport and Glaser 2002); the amount of financial savings, knowledge accessibility, and rate of knowledge growth (Davenport et al. 1998); the application of knowledge, whether knowledge gaps are identified and addressed, investments in learning, and whether a mission is knowledge-focused (Zack 2003); the identification and dismantling of barriers, whether storytelling is encouraged, and what IT tools are used to capture knowledge (European Guide to Good Practice in Knowledge Management, Part 2: Organizational Culture 2004).

Knowledge management are transferable between government agencies and private businesses. Private and public organizations may attempt to derive similar benefits from knowledge management, such as reducing project time and cost and enhancing project quality (Shelbourn et al. 2006). More comprehensive efforts at a national and regional level have been proposed, but lack any actionable steps to date. NCHRP Report 643 (Spy Pond Partners, University of Minnesota Center for Transportation Studies, and Tucker 2009) detailed a comprehensive approach to implementing knowledge networks, with a particular focus on national and regional coordination. If these efforts were broadly adopted, DOTs could perform nationwide searches for knowledge and resources. Additionally, this framework also contained a description of an information portal, which could potentially be applied at the state level. The portal would let users query information,

<sup>&</sup>lt;sup>4</sup> Examples of knowledge management metrics can be found in Spy Pond Partners (2015) Table 4, p. 38.

ask a question, access an event calendar, locate a person, read organizational news, research transportation topical areas, submit a resource, issue notes about ongoing research, and identify communities of practice.

## 2.2 State Experiences

Ward (2007) synthesized practices used to preserve knowledge in by surveying transportation agencies in the U.S. and Canada. Thirty-eight agencies responded, including 34 state DOTs. Only seven DOTs had robust knowledge management processes for managing personnel changes. Many reported that they attempted to capture knowledge from retiring employees through methods such as exit interviews (most common), rehires on a temporary basis, succession plans, documentation of expertise, and knowledge capture assignments for management staff. Training and mentoring programs were also used to facilitate knowledge capture. However, most lacked programs focused on knowledge capture and transfer. At DOTs without knowledge management plans, there was no central repository or point of contact to aid knowledge transfer. Generally, DOTs did not allocate specific resources to knowledge management tasks. Most efforts were undertaken by individual departments or working groups rather than across entire agencies.

Table 1 summarizes knowledge management initiatives at a number of DOTs (Spy Pond Partners 2015, Table 6, p. 43).

Organization	Description
Alaska DOT	Strategic Workforce planning; information management in support of
	knowledge management, Communities of Practice, Succession Management.
Caltrans	Knowledge transfer activities under the agency's risk management function,
	in support of workforce and succession planning
Georgia DOT	Communities of Practice; Succession Management
Kansas DOT	Field Inspector Mentor Program
Missouri DOT	Practical Design, Innovations Challenge, consolidated wiki-based policy and procedures manual, accelerated Leadership Development Program
Virginia DOT	KM Office, Communities of Practice, Lessons Learned, Business Process Analysis
Washington DOT	Knowledge mapping, knowledge interviews, knowledge capture guidance
Wisconsin DOT	Guidance on low-cost KM techniques, AARs, process documentation

 Table 1: State DOT Knowledge Management Initiatives

Arora and Associates (2014) also reported where DOTs housed the knowledge management functions within their organization. Table 2 reviews these findings. The following paragraphs comment in detail on initiatives at the state level.

Virginia	Knowledge Management Office
Washington	Office of Research and Library Services (Strategic Planning Division)
Georgia	Multiple offices
Wisconsin	Multiple offices
Kansas	Informal program
Alaska	Administrative Services Division
Missouri	Multiple offices

**Table 2: Location of Knowledge Management Functions** 

## <u>Alaska</u>

As part of its Workforce Excellence Program, the Alaska Department of Transportation and Public Facilities (ADOT&PF) identified future workforce trends (Holland 2013). Recruitment, retirements, and retention were among the trends cited. These issues are critical for knowledge management. ADOT&PF viewed knowledge management as an emergent trend as well, and the agency has introduced efforts to use facilitate knowledge capture and transfer through document imaging and technology. The agency also started a mentoring program is has sought to identify best practices for transportation knowledge management. New strategies to disseminate knowledge to staff and conduct workforce training have also been identified. ADOT&PF archives online training programs for easy access. The number of virtual conferences has increased, which is important in a state the size of Alaska with low population density. The program also has protocols for identifying critical needs, gathering data, reevaluating programs, communicating with employees, and management training. The workforce program has faced a number of challenges with stagnation, unreliable communication, procuring honest reviews of culture, funding, and the aging workforce.

Perkins and Bennett (2012) examined knowledge transfer in ADOT&PF. They conducted a survey of ADOT&PF employees to assess effectiveness of knowledge transfer. These surveys revealed a number of trends, which were elaborated through staff interviews, and agency and data review. Based on their findings, Perkins and Bennett advanced seven recommendations related to knowledge management:

- 1. Support formal and information meetings within and across specialty groups.
- 2. Recognize the limitations of manuals, including standard operating procedure manuals.
- 3. Make job shadowing a priority.
- 4. Recognize the need for informal knowledge transfer between specialty groups.
- 5. Recognize the value of formal lessons learned meetings.
- 6. Develop a "yellow pages" and communities of practice. Dedicate resources to update the system.
- 7. Capture more of the knowledge of departing experts with semi-formal debriefings to rising professionals and managers.

Perkins and Bennett reviewed data programs and training programs, and determined that the programs in place were valuable sources for knowledge management — but not effective for transferring knowledge.

## <u>Virginia</u>

Cronin et al. (2013) discussed the Virginia Department of Transportation's (VDOT) knowledge management program. Researchers started with the premise that due to the expected loss of staff, knowledge management needed should be rethought and the transfer of knowledge encouraged. Anticipated staff losses were calculated based on an analysis of VDOT's human capital, which demonstrated that 28 percent of VDOT employees would retire over the ensuing five years and that those employees held valuable undocumented knowledge important to the organization.

To encourage VDOT employees to meet with the Division of Knowledge Management, staff attempted to foster a sense of solidarity among employees and encourage a high level of sociability. VDOT would be able to evaluate the successful transfer of knowledge within the organization when there was evidence of a change in performance.

Figure 2 (Arora and Associates 2014) summarizes measures and outcomes for knowledge management.



Figure 2: Virginia Measurements and Outcomes for Knowledge Management

Communities of practice are an important element in Virginia's knowledge management program, with over 40 communities (Perkins and Bennett 2012). Initial knowledge management efforts prioritized the formation of online communities of practice for large projects. However, these were unsuccessful. Subsequent efforts focused on face-to-face meetings, and communities now meet on a quarterly basis. A knowledge management officer collects ideas from these communities, analyzes them, and determines whether they could be integrated across the agency.

Active communities meet at varying intervals. In between meetings, the agency's intranet supports additional collaboration. A Lessons Learned Initiative was also launched to capture and share information across the agency. Lessons are peer reviewed to ensure their accuracy and applicability prior to publication. The knowledge management office is also responsible for knowledge mapping. It uses methods such as video interviews to preserve and transfer knowledge.

Spy Pond Partners (2015, Table 5, p.40) chronicled additional knowledge management programs VDOT has introduced, each of which warrants further exploration. Knowledge management outcomes in Virginia are measured via return on investment, effectiveness, efficiency, avoiding duplication, and risk management. A lessons learned database that compiled knowledge of construction practices has proven useful for managers and inspectors. An after-action review of winter maintenance led to the implementation of a statewide anti-icing program. The techniques used as part of the anti-icing program were developed by staff, who also updated them and delivered training programs. Development of standard operating procedures for emergency responses (through a task force) helped VDOT staff define and understand methods of response for different types of emergency incidents. These procedures improved the cooperation and coordination among agency stakeholders during incident management, which has reduced the average time required to clear incidents. An organizational network analysis of construction projects showed that building communication networks among project team members improved their efficiency and effectiveness, resulting in lessons for future projects. Process mapping of the environmental review process led to annual savings of \$300,000 due to process streamlining. This mapping improved comprehension of how different groups interact one another during the process. Finally, a community of practice specific to

construction enhanced the vertical and horizontal integration of construction knowledge in VDOT's strategic plan.

Krugler et al. (2006) also explored Virginia's knowledge management experiences. VDOT is focused on a community of practice for project managers as well as knowledge mapping for a district office. Knowledge mapping is focused on identifying what knowledge each segment of the workforce possesses and individuals they interact with on a daily basis to perform their job functions. Knowledge mapping is also used to help VDOT identify areas in which succession planning and network building is necessary (Cronin et. al. 2013). Identifying experts within communities of practice will assist in their development and highlighting potential benefits. Leadership that encourages participation in communities of practice, focuses on critical issues, and identifies groups with similar levels of responsibility will increase sharing and learning. Retirees who are willing to contribute should be integrated into communities. VDOT has staff dedicated to knowledge management, which helps communities to function and provides a go-to source for any problems that may arise.

## <u>California</u>

The California Department of Transportation (Caltrans) has an aging workforce and retirements could drain significant knowledge from the agency. *The Mile Marker*, an agency performance report, highlighted this issue and the steps being taken to address it in its second-quarter issue of 2015. Workforce planning, which includes succession planning is focused on:

- Providing strategies and methods to analyze current workforce
- Encourage proactive planning to address future workforce needs
- Highlighting the need for knowledge transfer
- Encouraging development for existing and new staff
- Efficient use of resources for recruitment
- Policies to help with employee retention<sup>5</sup>

As noted in the Mile Marker, an audit by the State Auditor of workforce planning identified four areas in need of change.

- 1. Developing a single workforce plan that is updated annually
- 2. Developing measures to track performance in meeting goals and needs
- 3. Creating methods to evaluate workforce planning processes
- 4. Designating a single point to monitor workforce planning and apply solutions as needed

The Caltrans Knowledge Transfer Guidebook<sup>6</sup> details many of the approaches the agency has taken to knowledge management and workforce planning. As of 2014, over half of the workforce and nearly two-thirds of management were either at or within three years of retirement age. The guidebook focuses on the transfer of tacit knowledge. It begins with a workforce planning model that helps to identify workforce gaps and determine how to fill those gaps. The seven steps are:

- 1. Review strategic plan
- 2. Identify workforce functions
- 3. Identify staffing demand
- 4. Forecast workforce supply
- 5. Analyze any gaps
- 6. Develop priorities and implement identified solutions

<sup>&</sup>lt;sup>5</sup> <u>http://www.dot.ca.gov/MileMarker/2015-2/index.html</u>

<sup>&</sup>lt;sup>6</sup> <u>http://www.dot.ca.gov/docs/ct\_knowledge\_transfer\_guidebook.pdf</u>

7. Evaluate the plan

To capture and transfer knowledge, thereby bridging gaps and succession issues, four strategies are promoted as part of the Caltrans program. The four strategies are face-to-face group, face-to-face individual, multimedia, and rotational programs. Figure 3 illustrates the strategies and components, which includes a bottom-up approach, starting with staff commitment and formal training and references before moving to knowledge management. Face-to-face groups provide a setting in which an experienced staff member or trainer transfers knowledge to a larger group. Face-to-face individuals are personal connections between two individuals with one person offering knowledge to the other (e.g., mentoring). Multimedia approaches use technology, such Wiki pages, to catalogue and disseminate knowledge. Rotational programs send employees to various areas within the organization to learn the ins and outs of each area. Within each strategy there are various methods to consider. Short definitions of each method shown in Figure 3 are listed in Table 3.

#### Figure 3: Caltrans Knowledge Management Approach



COMMITMENT & TEAMWORK ~ buy in and staff 'championing' STEWARDSHIP & SERVICE ~ knowledge management as a priority MISSION & VISION ~ starts with exemplary leadership

<b>Table 3: Definitions</b>	of Caltrans	Strategies
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Face to Face Groups	
Bootcamp	Specific topic covered by an expert or multiple training sessions over several topics
Best Practices Meetings/Studies	Identifying processes/systems that have had success and are transferable
Communities of Practice	Groups of employees sharing responsibilities; not necessarily in same work area
Critical Incident	Document and discuss critical incidents and lessons to focus on
Reviews/Lessons Learned	improvements and capture
Expert Storytelling/Expert Interviews	Sessions with experts who share their knowledge with groups
Knowledge Fairs	Event to showcase knowledge and information about subject matter
Face to Face Individuals	1
Cross-Training	Training one employee to do another's work
Job Shadowing	Newer employees are paired with more experienced employees to learn and transfer knowledge
Mentoring Programs	Similar to shadowing, although over a longer period; coaching approach to foster employee growth and retention
Structured on the Job Training	Hands-on instruction at the job site
Transitional Training	Newer employees paired with more experienced employees in the same job for a short period of time
Multimedia	
Expert Storytelling/Expert Interviews	Capturing these events (defined above) for storing and disseminating knowledge
Knowledge Maps	Attempts to discover knowledge through its ownership, value, and use
Wiki	Web tool to capture knowledge and build a sharing platform
<b>Rotational Programs</b>	
Job Rotation	Formal programs where employees experience a variety of job
	functions across an organization

## <u>Pennsylvania</u>

Krugler et al. (2006) documented the Pennsylvania Department of Transportation's experience with knowledge management systems. The program used the DOT intranet and Lotus Notes with templates. Communities of practice started with equipment managers, who were already engage in such activities before the official launch. The focus is on the communities of practice as a means to share and apply knowledge to various issues and documenting best practices. Projects have focused on storytelling by project foreman, agile collaboration between operations, and fleet ideas exchange to encourage communication between equipment managers and technicians. Reviewing the program yielded several insights. For example, when implementing a knowledge management system, it is best to start where there is an already established community of practice or like-minded group. Along the same lines, having a responsible individual to act as a group moderator is important; similarly, using word of mouth and/or rewards to generate awareness of the program is encouraged. If used, software limitations can slow implementation. As such, choosing the right tool for recording and disseminating knowledge is vital. Progress reports and meetings should be held on a regular basis to monitor progress. Support from agency administration is needed to successfully build and implement and program.

## Texas

Krugler et al. (2006) summarized the Texas Department of Transportation's efforts to develop a knowledge management system that would document knowledge on right pavement forensics. They gathered tacit knowledge by interviewing current and retired employees. The information was stored in the agency's learning content management system, i-Way, where it could be retrieved. Glossaries of terms were used to categorize information with. An indexing system was built so that keywords could be used to search i-Way. A number of barriers forestalled the implementation of this system, including a lack of understanding by employees, unrealistic expectations, and the fact that sharing expertise results in a loss of prestige.

Figure 4, which is drawn from Krugler et al. (2006, p.15; see also Tiwana 2000), shows a knowledge management roadmap that was developed as part of their study.



#### Figure 4: Knowledge Management Roadmap

#### Wisconsin

The Wisconsin Department of Transportation has adopted a tiered approach to knowledge management, with different tools classified according to the resources they require. Some of the less resource-intensive methods include writing and videoing processes, formalizing processes, and double filling positions to encourage new employees to learn about the organization's practices (Arora and Associates 2014). Tools that required a medium level of resources were automating processes, cross-training, communities of practice, exit and expert interviews, and last lectures. Resource-intensive tools included expert decision systems, storytelling, and rotation and leadership programs. The Wisconsin DOT also had its Office of Research and Library Services interview retiring employees, but these efforts demanded significant time and labor, and were therefore of marginal value. Still, the insights gained were useful for remaining staff.

Wittwer and Adams (2011) focused the Wisconsin DOT's low cost, low staff workload impact techniques for knowledge management. They considered a number of strategies for knowledge management, with most focused on explicit rather than tacit knowledge (Wittwer and Adams, 2011, p. 7-9).

- 1. **Videotaping** is a tool that could be used in concert with other strategies. As it is listed here, the intent is to simply videotape someone doing the job. The tape would thus provide a reference to someone in the future.
- 2. **Annotated templates** could be used as guides for the preparation of contracts or agreements. The template would simply be a standard document. The annotations would help the employee to understand the meaning of clauses or the type of information that is to be entered at given points.
- 3. **Process documentation** involves developing flow diagrams of a process that illustrates who does what in the overall process as well as the specific actions, participants and products at each step in the process.
- 4. **Job rotation** involves moving people around in the organization to broaden their understanding of the organization and to ensure that more than a single person knows how to perform a given job.
- 5. **Communities of practice** are groups of people with similar jobs or interests. Knowledge can be transferred with a community of practice, if one exists or can be defined.
- 6. **Double filling positions** requires early notification of a departure. It allows the exiting person to train the incoming person.
- 7. **Retiree job banks** allow the use of retirees on a retainer basis to help the new person learn the job.
- 8. **Phased retirement** can allow experienced people to stay on the job, perhaps in a diminished role and at less than full time.
- 9. **Cross training** is rather like job rotation except that the person who is being cross-trained also retains his or her regular job. The objective is to get several people capable of doing several jobs, increasing flexibility and broadening knowledge.
- 10. **Information repositories** are simply places in which explicit information is stored, organized and made available. The title tends to suggest a major database or library, but it could also be a manual or a section bookshelf.
- 11. **Mentoring/coaching** is simply a process of an experienced employee providing guidance to a less experienced employee. It may be structured or informal.
- 12. Social network analysis is somewhat like process analysis, but the emphasis is more heavily on the people with whom the interactions take place and on the specific knowledge, skills and abilities (KSAs) brought to the interaction by those people.
- 13. **Business process mapping** is also somewhat similar to process analysis, but it tends to be broader in its approach and application to include data sharing and interaction of business processes across organizational units.
- 14. **Expert interviews** is an attempt to capture tacit knowledge. This approach requires someone skilled as an interviewer asking questions of employees to make tacit knowledge explicit.
- 15. After action reviews are an approach to learning that involves gathering people who have been a part of an action—perhaps a program development process—to dissect that action to determine what went right or wrong and how improvement could be made. In our context, documenting such a review could be used as a reference and a learning tool for new employees.
- 16. **Internet conferencing** is a tool that could be used with other strategies, such as community of practice, to share knowledge with people who are geographically dispersed.
- 17. **On-the-job training** is often seen as training provided by doing work or shadowing more experienced employees. It could also be a structured process of learning in which a new person takes a defined set of short courses, attends a series of conferences or reads specified articles or books.
- 18. **Encourage mingling** is an approach to making the coffee pot conversation productive. It allows people to learn what happens on the other side of the partition or at the other end of the office. It is very informal, but it can produce results.

- 19. Last lecture is an approach that encourages retiring employees to share their experiences with others by giving a last presentation. It could be at a staff meeting or in a brown bag setting. It could also be face-to-face or over a videolink.
- 20. **Storytelling** is like a last lecture only you do not have to wait until someone is leaving to do it. Experienced employees share their knowledge and experience in some venue, a staff meeting or brown bag.
- 21. Exit interviews are typically a fairly formal process in which a departing employee is asked his or her impressions of the organization, why they are leaving, etc.
- 22. Leadership programs can be formal training programs, job shadowing or mentoring efforts to develop the leadership skills of less experienced people.
- 23. **Share fairs** are structured events in which experienced people share knowledge. They could be internal conferences or simply brown bag events.
- 24. **War stories** are really not a standalone tool. Rather it is listed as a reminder to embellish any of the above with real events that make the stories and the knowledge more real.

Defined knowledge types were noted for each strategy. Figure 5 is reproduced from Wittwer and Adams (2011, p. 11); shaded columns indicate knowledge that is more tacit in nature.

	Task	Process	Technical	Analytic	Standards	Program	People	Organization	Leadership	Supervisory/Mgt.
Videotaping	X									<u> </u>
Annotated Templates	X	X								ļ
Process Documentation	X	X								
Job Rotation	X	X	X	X	X	X	X	X		
Communities of Practice	X	X	X	X	X	X				ļ
Double Filling Positions	X	Х	X	X	X	X	Х	X		
Retiree Job Banks	X	Х	Х	X	Х	X	X	X	X	X
Phased Retirement	X	Х	X	X	X	X	Х	Х	X	X
Cross Training	X	Х	Х	X	X	Х	Х	Х		
Information Repository	X	X	Х		х	X				
Mentoring/Coaching	X	X		X	х	X				
Social Network Analysis		X					X			
<b>Business Process Mapping</b>		Х								
Expert Interviews		Х				X		X		
After-Action Reviews		X				X	Х			
Internet Conferencing			Х			X	Х	Х	X	
On-the-Job Training			х	X	х	X		Х	Х	X
Encourage Mingling				X		X	X	X		
Last Lecture						X		X		
Story Telling						X	X	X	X	
Exit Interviews								Х		
Leadership Programs									X	
Share Fairs						Х		Х		
War Stories						Х	Х	X		

#### Figure 5: Knowledge Management Approaches and Knowledge Types

To pilot knowledge management strategies, the Wisconsin DOT adapted an eight step process from the Alaska DOT. This consisted of identifying critical positions, verifying position descriptions, organizational review, senior management agreement, modifying position descriptions as needed, defining critical knowledge for each position, selecting the strategies or tools, and implementing them. The agency developed critical evaluation forms for each position. These forms noted the importance, difficulty, and priority of the position responsibilities. The approach was piloted in a section that had already documented many processes and procedures, but had not recorded historical experience. Thus, one of the focuses was on storytelling, which occurred at brown bag lunches. These stories were also video recorded. Stories were limited to around 30 minutes and included a mixture of generalized knowledge and anecdotes. On-the-job training was critical (e.g., class and field work). Information repositories and annotated documents were tools that could be accessed and used by employees irrespective of their experience. The agency also used retirees as de facto trainers and communities of practice to facilitate knowledge transfer.

## <u>Missouri</u>

Missouri developed a new Engineering Policy Guide in 2005 to replace paper manuals that existed across multiple divisions. The efforts were coordinated by a single group, but experts helped write the policies. The new guide, which is available online in a wiki format,<sup>7</sup> can be updated and searched and enables discussion. Figure 6 is a screenshot of the website.

<sup>&</sup>lt;sup>7</sup> <u>http://epg.modot.org/index.php?title=Main\_Page</u>

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## 2.3 Current Knowledge Management Programs at KYTC

There are several opportunities that the Cabinet provides its employees to enhance knowledge and build new capacities. These include scholarships, training opportunities, and several tools that KYTC employees can utilize. While the offerings listed in this section are likely not exhaustive, they indicate that KYTC is engaging in knowledge management, although not necessarily by name, by ensuring employees are equipped with knowledge and opportunities for growth.

#### General

The Supervisor Training and Resources (STAR) Program is KYTC's supervisor training series. STAR "offers an in-depth orientation to the responsibilities and expectations of those who oversee and evaluate the job performances of others." The STAR Program focuses on improving supervisory skills as well as overall comprehension of KYTC policies and procedures. Some of the course topics cover merit law, the disciplinary process, workplace conduct, and performance matters, among others. Employees are required to take this training within 12 months of an appointment to a management role.

The Roadmap Program is "a series of courses designed to help entry- to mid-level Transportation Cabinet employees develop and expand their administrative skills and maximize their potential as governmental administrators." The Roadmap Program contains a total of 12 half-day courses and is open to all KYTC employees with supervisor approval.

The *General Administration and Personnel Manual* covers professional licenses and certifications and fees associated with professional organizations. If professional licenses or certifications are needed based on an employee's class position, then they will be reimbursed. Professional organization fees or costs associated with attendance at meetings of such organizations are the responsibility of the employee. Professional Development Branch courses are also available to employees.

The American Association of State Highway Transportation Officials (AASHTO) offers a program that develops and provides training for transportation professionals across subject areas. The Transportation Curriculum Coordination Council (TC3) offers courses in construction, maintenance, traffic and safety, pavement preservation, and employee development. This is a technical service program that develops trainings in various areas such as construction, maintenance, and employee development. Over 120 courses are available to state transportation employees.<sup>8</sup>

The Kentucky Enterprise Learning Management System (KELMS) "is an enterprise-wide software application for the administration, documentation, tracking, reporting and delivery of employee development opportunities."<sup>9</sup> KELMS has been in use since 2015. It is a web-based system that helps track training progress of employees and offers training alternatives such as online courses and other activities outside of classroom training.

Finally, the Guiding Potential Supervisors Program (GPS) is a set of courses for employees who desire to become supervisors. "The program offers insight into the skills and traits necessary to be an effective manager and leader of personnel." The GPS Program is a set of six half-day courses and two videos covering subjects such as effective communication, employee engagement, and forward thinking.

#### **Advanced Leadership Academy**

The Advanced Leadership Academy (ALA) is a two-year training program that focuses on developing leadership and management skills in Cabinet employees. Employees must meet certain requirements such as having a 2-year or 4-year degree or a professional license, worked for KYTC for the prior two years, and hold a position at Grade 15 or higher in order to apply for the academy. The ALA offers participants training

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<sup>&</sup>lt;sup>8</sup> <u>https://training.transportation.org/browse\_bookstore.aspx</u>

<sup>&</sup>lt;sup>9</sup> <u>https://personnel.ky.gov/Pages/TrainingKELMS.aspx</u>

through course work, mentoring with top Cabinet officials, and a final project that focuses on Cabinet issues and possible improvements to current processes or the development of new processes. Some of the topics focused on include managing work relationships, measuring personal leadership qualities, Cabinet organizational structure, media relations, finance and forecasting, and time management.

## Scholarship Programs

In order to attract new talent to KYTC, there is a scholarship programs in place that serve as a recruiting tool for new engineers and technicians. The program has two types of scholarships, the Civil Engineering Scholarship Program, and the newer Civil Engineering Technology Scholarship Program. These scholarship initiatives allow KYTC to identify future employees, support their education, and cultivate their knowledge of the transportation system and KYTC's mission in exchange for several years of service.

According to KYTC, the Civil Engineering Scholarship Program "began in 1948, and the Cabinet has awarded nearly 1,700 scholarships, amounting to more than \$12 million in scholarships since its beginning."<sup>10</sup> Each year 10-20 new scholarships are awarded to students attending Kentucky universities including the University of Kentucky, Western Kentucky University, or the University of Louisville.<sup>11</sup> The total number of scholarships outstanding generally totals around 80. In addition to education funding, scholarship recipients often spend their summers working at KYTC gaining valuable experience. Criteria for continued summer employment include satisfactory academic progress coupled with prior summer work performance, if applicable. This competitive program allows KYTC to identify potential new employees and to fill areas of need. The program is designed to require a year of service for each year of scholarship funding.

The Civil Engineering Technology Scholarship Program was launched in 2009, and provides "5-10 new scholarships each year to qualifying students interested in attending Bluegrass Community & Technical College in Lexington, Kentucky, or Big Sandy Community & Technical College in Prestonsburg, Kentucky, to complete an Associate's Degree in Civil Engineering Technology."<sup>12</sup> KYTC has partnered with the Kentucky Community and Technical College System to develop a program to prepare students to meet the demands of working for KYTC. Summer internships and job placement with KYTC upon graduation is also an integral part of this program.

#### Lessons Learned Database

There are some formal procedures and programs in place at the Cabinet that assist in the capture of knowledge and building of databases, which can inform and improve future work. The Quality Assurance Branch maintains a Lessons Learned Database. This database takes feedback from project stakeholders and compiles it along with utilizing a GIS map feature of Kentucky. The database contains information from four datasets: Value Engineering, Constructability Review, Value Engineering Change Proposals, and Post Construction Reviews. The Lessons Learned Database compiles information from value engineering studies, constructability reviews, value engineering change proposals, and post construction reviews. This database can provide Cabinet employees with solutions to common issues that have been previously encountered.

## **Project Manager's Toolbox**

The Project Manager's Toolbox is a source of information for projects including expenditures, scope of work, and anticipated completion. The toolbox has financial information for all active Six-Year Plan projects and less detailed information for non-plan projects. It functions as a project management system

<sup>&</sup>lt;sup>10</sup> <u>http://transportation.ky.gov/education/pages/scholarships.aspx</u>

<sup>&</sup>lt;sup>11</sup> Students have the option of taking pre-engineering courses at Kentucky State University, the Kentucky Community and Technical College System, or other Kentucky colleges and then completing their degree at one of the aforementioned universities.

<sup>&</sup>lt;sup>12</sup> <u>http://transportation.ky.gov/education/pages/scholarships.aspx</u>

designed to facilitate ease of information gathering. The Transportation Enterprise Database (TED) integrated many different sources of information and aggregated data from multiple data sources in the Cabinet. This database provides project management capabilities and a complete timeline of highway projects and Cabinet assets. Essentially, it has been described as a "backbone" application that quickly and easily shares data across divisions. A User's Manual is available to assist employees using the toolbox.

## **Project Manager's Boot Camp**

Project Manager's Boot Camp is an eight-day training course that has been offered to KYTC project managers over the past two years. The purpose of Project Manager's Boot Camp is to improve project delivery by focusing on all aspects of project management. As noted previously, KYTC's mission — which underwrites all of its activities — is to provide a safe, efficient, environmentally sound, and fiscally responsible transportation system that gives Kentucky's citizens access to economic opportunity while enhancing their quality of life. The Cabinet's Department of Highways helps fulfill this mission by persistently working to maintain and improve the Commonwealth's roads and bridges. To maintain and improve roads and bridges, the Department has two legislatively enacted programs — the Highway Plan, which is a construction program, and a maintenance program. These biennial budget process is responsible for authorizing and enacting these programs. The purpose of Project Manager's Boot Camp is to improve the Department's success rate in delivering the Highway Plan. A successful project is one that meets the defined scope with quality solutions and deliverables on schedule and within the budget specified in the Highway Plan. Improving the success rate of project delivery helps the Cabinet fulfill its mission and enrich the lives of all Kentuckians. This training includes defining roles and responsibilities of personnel, improve understanding of process areas that can influence the critical path schedule, focus on early team assembly during project development, and knowledge regarding needed resources and strategies for project delivery. The Department has created the Project Manager's Boot Camp training to meet its current needs, and help the Cabinet fulfill its mission.

## <u>Structures Level I, Grade and Drain I, Grade and Drain II, and Field Engineer's Guardrail</u> <u>Workshops</u>

Structures Level I is a course designed to develop bridge and culvert construction inspectors. It is available for both KYTC and contractor employees who will be performing inspections. Course topics covered 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.

Grade and Drain I is also for those who will be inspectors. The course provides enrollees with the informational and tools needed to be a grade and drain inspector. Course topics 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.

Grade and Drain II is a continuation of Grade and Drain I and builds on the initial foundation of that course. It includes additional training for inspectors and covers topics such as: construction and design of cut slopes in rock, geotextiles, karst topography (sinkholes), subgrade stabilization, structural backfill and pipe installation. Those who are Grade I inspectors and will be working with the topical areas are candidates for this course.

Finally, Field Engineer's Guardrail Workshops are offered to KYTC employees that work with guardrails. The course covers design and installation of NCHRP 350 approved devices.

## Kentucky Qualified Testers and Laboratories

KYTC also provides links to various related offerings for those who work in Materials. These courses are conducted both internally as well as externally by organizations such as the Kentucky Crushed Stone

Association and the Kentucky Transportation Center Technology Transfer Program. Those various areas include: aggregate, asphalt, bridge coatings inspection, concrete, erosion control, grading, pavement markings, and work zone traffic control.

#### **Construction Management Academy**

The Construction Management Academy (CMA) is focused on helping project engineers grasp all the responsibilities of a construction crew supervisor in a district and as the project engineer on a construction project. The goal of CMA is: "To provide a Project Engineer with the skill needed to administer a construction project and manage a crew of inspectors thus providing a statewide consistency while minimizing claims and change orders." The training covers six days with instructors from both the districts and central office as well as outside partners such as the Federal Highways Administration (FHWA).

## **Minority Internship Program**

The Minority Internship Program at KYTC "provides career opportunities, formal mentoring, and handson experiences to traditionally under-represented groups."<sup>13</sup> The program is offered twice a year in a fourmonth session with each session accommodating up to 15 interns. Interns are offered the opportunity to work across KYTC in various offices including administrative and engineering. The program includes mentoring, networking, and a chance to learn about transportation careers. The Minority Internship Program is designed for undergraduate or graduate students enrolled in Kentucky colleges and universities.

## **Transportation Mechanic Apprenticeship Program**

The Transportation Mechanic Apprenticeship Program (TMAP) is a hands-on program that is for first-year students who are enrolled in an Automotive or Diesel Technology Program through the Kentucky Community and Technical College System. The program covers two years including a combined 2,000 hours of school and paid work experience. Upon completion, students will earn a credential as an "Automotive Technician Specialist Apprentice" as well as a college degree.

#### **Other**

Additionally, the Cabinet has several informal programs and procedures designed to capture and retain knowledge as staff retire or certain functions are outsourced. Maintaining guidance manuals are two common methods used to capture and impart specific functions, although not all divisions currently practice this method of knowledge management. Although these manuals were cited as being informal, they can provide new employees with procedures and steps to follow in their specific job function. Some noted that informal mentoring programs often took place in the Cabinet and that these were the best way to train and impart knowledge to new employees. However, the mentoring culture has not been as prevalent in recent years as it has been in previous decades. Annual meetings between section engineers are designed to allow the exchange of ideas and the annual American Council of Engineering Companies of Kentucky/Federal Highways Administration/KYTC Partnering Conference is another opportunity to learn and exchange knowledge and experiences. It was also mentioned that the Cabinet meets once a year with contractors to discuss potential ideas, but without any formalized structure or methods in place to ensure knowledge dissemination the value of these exercises decreases.

<sup>&</sup>lt;sup>13</sup> <u>https://transportation.ky.gov/Education/Pages/default.aspx</u>

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## **Chapter Three: Survey**

To better understand current employee learning habits, their knowledge of various programs, and ways to improve knowledge management activities in the future, a survey was developed in consultation with the Study Advisory Committee (SAC). It was set up using Qualtrics Survey Software and distributed to KYTC staff via email. Survey respondents received assurances that all responses would be anonymous. The survey's goal was to determine where KYTC personnel find knowledge and information that is vital to fulfilling the Cabinet's mission. The survey was open from February 23, 2018, to April 2, 2018. The following text was sent in the email explaining the purpose of the survey:

KYTC and the Kentucky Transportation Center (KTC) have partnered to study how KYTC employees find the knowledge and information they need, what educational and training initiatives employees are aware of or have participated in, and to rank several potential opportunities to improve knowledge transfer and dissemination. To better answer these questions and gauge employee opinions, a short 7-question survey was developed. We would appreciate your participation in this survey. All responses are anonymous. Thank you!

The survey questions and potential responses are listed below.

- 1. How long have you worked at KYTC?
  - <5 years
  - 5-10 years
  - 10-20 years
  - >20 years
- 2. Where do you currently work?

Central Office

- Aviation
- Budget and Fiscal Management
- Audits
- Support Services
- OHRM
- Legal Services
- Public Affairs
- Civil Rights and Small Business Development
- OIG
- OIT
- Vehicle Regulation
- Transportation Delivery
- Rural and Municipal Aid
- Office of the Secretary
- SHE Office
- Highway Safety
- Planning
- Structural Design
- Highway Design
- Environmental Analysis
- Right of Way and Utilities
- Professional Services
- Incident Management

- Highway Safety Programs
- Construction
- Materials
- Construction Procurement
- Equipment
- Traffic Operations
- Maintenance
- Program Management
- Management/Administration (District)
- Project Development (District)
- Project Delivery and Preservation (District)
- Engineering Support (District)
- Other
- 3. How long have you worked in your current position?
  - a. <2 years
  - b. 2-5 years
  - c. 5-10 years
  - d. >10 years
- 4. Which of the following KYTC initiatives are you aware of, or have you participated in (yes/no answer for aware of and participated in)?
  - Advanced Leadership Academy
  - Civil Engineering/Technology Scholarship Program
  - Project Manager's Bootcamp
  - Partnering Conference
  - Construction Management Academy
  - Supervisor Training and Resources (STAR) Program
  - Guiding Potential Supervisors Program (GPS)
  - The Roadmap Program
  - Section Engineer's Meetings
  - Workshops including: Structures Level I, Grade and Drain I, Grade and Drain II, and Field Engineer's Guardrail
  - Kentucky Qualified Testers and Laboratories Training (includes Aggregate, Asphalt, Bridge Coatings Inspection, Concrete, Erosion Control, Grading, Pavement Markings, and Work Zone Traffic Control)
  - Transportation Curriculum Coordination Council (TC3) Online Training Courses
  - Kentucky Enterprise Learning Management System (KELMS)
  - Transportation Mechanic Apprenticeship Program
  - Minority Internship Program
  - Professional Development Branch Courses
  - Other
- 5. When you need to find information or knowledge about a problem or issue, where do you most often go to find that information? (Check the top 2)
  - Guidance manuals
  - Supervisor
  - Coworkers
  - Internet (non-KYTC web resources)
  - External partners (such as consultants, contractors, university professionals, etc.)

- Other
- 6. What methods or approaches would you prefer to find information or knowledge? (please rank these options from 1-7, with 1 being your most preferred)
  - Updated guidance manuals
  - Communities of practice (meetings with certain groups of employees)
  - Training offerings
  - Job rotation/shadowing
  - Mentoring
  - Supervisor/coworkers
  - Wikipedia-style policy guide
- 7. If you have any other ideas related to finding information or knowledge feel free to share those here.

The original note was sent to 2,387 email addresses, and the survey garnered 319 responses, for a response rate of 11.2 percent. The responses for each question are detailed in Figures 7-11 and Table 4 below, with a more detailed breakdown by count and percentage as well as responses to "other" answers included in Appendix C.



Figure 7: 1. How long have you worked at KYTC?



Figure 8: 2. Where do you currently work?

Other answers generally fell within one of the previously identified areas, but included: Highway District, Project Development and Preservation Section Office, Facilities Maintenance, Department of Highways, Building Maintenance, District Office, Structures (Bridge Inspection), Right of Way and Utilities, Transportation, Motor Carriers Permits and Credentials, Office of Transportation Delivery, and Highway Safety Improvement Program.



Figure 9: 3. How long have you worked in your current position?

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# Figure 12: 5. When you need to find information or knowledge about a work-related issue, where do you most often go to find that information? (top two)





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## Table 4: 7. Other ideas related to finding information or knowledge.

Need to hire more merit positions, where the employee has a career not just a job.

Cabinet online library supported by TRB, AASHTO, Research, webinars, etc.

Step by step manuals throughout the contract process for SiteManager and where to locate in the spec book.

Need to offer more Windows Office Classes. Haven't had one in a long time.

Training Coordinator

A KYTC app that has the ability to search for resolutions, gives appropriate policy guidance, and provides the forms for the work in question to provide a single point of reference.

More trainings or current trainings be offered more often through KELMS.

The standard of hiring a person into a position with limited, or in many cases no relevant training, and just expecting them to wing it isn't a good way to keep employees. Expecting people to know and understand a process that they have never seen or done before without any relevant training is one reason why Kentucky, throughout every department I have been in, can't keep good employees.

We are wasting a lot of money testing the employees every 3 years. I can understand 7-10 years because things change. But for the pay and every time you go by the book Frankfort or engineers change it.

Not computers

Ground zero training for new, hybrid employees. current classes are geared toward recertification.

There are many databases available with a remarkable amount of data that can be effectively used by others besides the intended users. But when one requests access from OIT the first response is "you're a security risk and you can't have access." It would seem to be a much more effective use of data if one could request access for such and such reason, have it signed by whatever level of authority is needed, and submitted for review. We don't even know what's available to see if it could be useful because we're a security risk?

Online guidance manuals online more user friendly. Better way to search for things .

Outside seminars such as SkillPath, and those type of entities

Webinars are good for some trainings.

Wikipedia not always accurate.

Online One Stop Shop for all employee information; forms, payroll, GAP...etc.

Social Media/Face Book etc.

Past experience

Initial orientation and training should include job training, not just a "you'll catch on" attitude. Get an experienced trainer involved.

Organizational links to updated documented successful solutions & approaches

Google

All of our Policies that we use in PD&P are all separate and in different places. It would be much easier to have all of them in one big manual with different chapters so you could search them all at once.

People are the best resource a lot of trainings are useless or not very effective, but coworkers are the best source of knowledge

KYTC website needs more info and info that is on there needs to be easier to find

I know several employees throughout the cabinet who lack basic computer skills (maneuver windows, create folders or save documents to a particular directory). Additional, they lack Microsoft Office Word, Excel and Outlook skills (how to format a simple document or manage their email account).

Offering some form of incentive for employees who wish to receive continuation of education credits for attending night, or online college courses

Outside training providers have been nearly useless. Challenge of constant conflict of written policy/procedures & the practical "How To" application.

You Tube is a great asset

Put more things on the internet

Software/Vendor forums, webinars, YouTube tutorials

Rework KYTC Web site. The recent changes have made it unworkable.

Cross train employees and when an employee asks for a specific thing that will help them with their job it should be given freely. I recently moved to a new branch and the former admin spec had transferred to another district. I have requested to see if that admin could come train me and was told "Can't you do that by phone?" That is crazy when i would take this employee one or two days train me.

Bring on your Highway TECHS somebody will have to answer to all the problems that comes with them

You Tube videos

I have taken several Webinars. they seem to help and provide a resource to watch again when needing a refresher

Make it easier to find out what training is available for each specific position. Something might sound interesting when sent out by Postmaster, but might be something that your job title isn't set to do.

The survey results indicated that employees have heard of many KYTC initiatives and that opinions vary on how improve knowledge management practices. Respondents encompassed staff with a wide range of experience across numerous offices, departments, and divisions. Cabinet initiatives that employees were more aware of included the Advanced Leadership Academy, Kentucky Enterprise Learning Management System, Civil Engineering/Technology Scholarship Program, and Guiding Potential Supervisors (91, 84, 82, and 83 percent of respondents respectively). Conversely, staff had the least awareness of the Transportation Curriculum Coordination Council (22 percent), Construction Management Academy (25 percent). Minority Internship Program (24 percent), and Transportation Mechanic Apprenticeship Program (16 percent). In terms of participation in the identified initiatives, the Partnering Conference and Kentucky Enterprise Learning Management System scored highest. Most employees reported that when they need to find information or knowledge about a work-related issue they approach their supervisor, followed by coworkers and guidance manuals. When ranking preferred methods for finding knowledge or information updated guidance manuals were the highest ranked choice followed by supervisors/coworkers, and a Wikipedia-style policy guide. Several respondents also left comments regarding the website, training, and other ideas (Table 5). Overall, the survey revealed several initiatives and resources that could be more widely used across KYTC as well as where employees currently find or want to find information and knowledge. Insights generated by this survey are useful for understanding what knowledge management programs might be most useful to KYTC employees.

#### **Chapter Four: Conclusion and Recommendations**

Many government agencies are suffering from knowledge drain due to outsourcing and retirements shrinking in-house staff, often to critical levels. Maintaining a sufficient level of knowledge, which at a minimum, allows project managers to adequately oversee outsourced projects, demands that agencies to implement knowledge capture and management strategies before knowledge is permanently lost. New policies and procedures are needed to retain this knowledge. The preceding chapters discuss some initial steps in the process of identifying core competencies as well as capturing and disseminating valuable knowledge. These practices will grow in relevance as transportation departments come to realize the value of preserving in-house knowledge. As transportation departments continue to rely less personnel, these protocols will be essential for maintaining a knowledge base to aid in the variety of agency functions.

A review of knowledge management literature and state agency experiences provided a number of insights that could be harnessed at KYTC. For example, Virginia's Department of Transportation has established a knowledge management division designed to collect and share institutional knowledge. Creating such a division may unnecessary for KYTC, however replicating the practices used in Virginia could benefit the Cabinet's knowledge management strategies, particularly the establishment of communities of practice. Writing formal guidance manuals for specific job functions would be especially useful for complex jobs and those that require on-the-job training. By providing new employees processes step-by-step instructions, they will make fewer mistakes and increase their efficiency. In addition to outlining basic procedures, initial employee training could communicate past experiences from other employees. Programs that connect employees impart knowledge to newer employees outside of manuals and other formal, written methods of knowledge capture.

Certainly, such programs may not be feasible for all positions, and they should be evaluated for the expected benefit of each division and job function. Currently, KYTC has an annual meeting for its section engineers as noted in Chapter 3, but this type of meeting and information exchange could be more widely utilized. Kentucky has a large footprint, and sharing experiences and information will expand the knowledge and competency across the 12 districts. Due to the variety of functions that the Cabinet performs in these districts, many lessons and ideas can be shared to increase the knowledge base of KYTC and its jurisdictions. To that end, we recommend that KYTC departments hold annual meetings to facilitate the transfer of knowledge. These could establish communities of practice. Finally, KYTC should examine whether to conduct in-depth exit interviews with and surveys of departing employees. The criteria for these should be developed by each department, and be grounded in the functions they perform. A universal questionnaire used Cabinet-wide would fail to capture some of the relevant knowledge base. KYTC may want to explore recording critical portions of an exit interview. This would enable the Cabinet to preserve all of the knowledge a person has accumulated during their career and then disseminate relevant parts to the wider organization.

Conversations with the SAC revealed several areas for improvements. Based on the case studies presented in this document, the SAC committee suggested several options that could potentially be implemented at KYTC. These options are grouped into four categories:

- 1. Workforce Tools,
- 2. Workforce Planning,
- 3. Informal Collaborations, and
- 4. Formal Collaborations.

Specific action items have been identified for each category in Table 5 and are discussed in more detail based on how the items are defined in the literature and in their use by other states.

Workforce Tools	Workforce Planning	Informal Collaborations	Formal Collaborations
Develop a Yellow Pages	Link Management Strategies with Succession Planning	Communities of Practice	Implement Formal Lessons Learned Meetings
Knowledge Mapping	Forecast Workforce Supply	Increase collaboration opportunities	Conduct after action Reviews
Update Guidance Manuals	Develop a Workforce Plan	Implement sharing opportunities for "war stories" and lessons learned	Leadership training workshops
Create a central repository with searchable features		Job Rotation/Shadowing	Conduct a last lecture and exit interviews for retiring employees

Table 5: Knowledge Management Tools and Strategies

## 4.1 Workforce Tools

The action items proposed under Workforce Tools are:

- Developing a yellow pages
- Knowledge mapping
- Updating guidance manuals
- Creating a central repository for information with a searchable features

These action items are briefly summarized below, and a brief description of how KYTC could apply each is included.

<u>Yellow Pages</u>: To generate a yellow pages, KYTC employees would provide a written description of their expertise and contact information. This information would be combined into one database. KYTC would need to emphasize the importance of updating information, as this is critical for making the yellow pages a useful tool. The yellow pages should be accessible to all employees.

Knowledge Mapping: Knowledge mapping identifies what each level of the workforce knows and their daily interactions to characterize their job functions. For KYTC employees, this would require the employee to record who they interact with in a typical workday and why they interact with that person. Additionally, each employee should list two or three additional people within KYTC they contact when a problem or issue arises.

<u>Update Guidance Manual</u>: Updating guidance manuals ensures that policy is up-to-date and consistent with practice, publicizes current resources internally, consolidates and eliminates overlaps in technical policy manuals, and ensures that training is effective and that processes are being followed. KYTC could use training or other methods to familiarize employees with policy manuals, institute training on the use of policy manuals, integrate practices across divisions so that standards are well-known, and link division-specific manuals across KYTC for ease of use.

<u>Create a Central Repository Tool</u>: A Central Repository Tool of information has clearly identified benefits: intelligent components to act on behalf of the user, use of more artificial intelligence techniques, delivery of more content and context specific information, foster communities of practice, develops knowledge chains to facilitate knowledge flow, and support employees whose roles are focused on knowledge management.

## 4.2 Workforce Planning

The action items proposed under Workforce Planning are:

- Linking management strategies with succession planning
- Forecasting workforce supply
- Developing a workforce plan

These action items are briefly summarized below, and a brief description of how KYTC could apply each is included.

<u>Link Management Strategies with Succession Planning</u>: By linking succession planning and preparing for workforce changes with a knowledge mapping strategy, KYTC will be in a more informed position to fill positions vacated by retirements or attrition. This strategy also works in tandem with workplace supply forecasts.

<u>Forecast Workforce Supply</u>: Understanding what percentage of the current workforce will be eligible for retirement in the next five years can assist KYTC's management team smooth these transitions. The effects of losing significant knowledge due to retirement windows can be minimized if they are identified and transition plans put into place. KYTC can also forecast the number of expected entry level candidates given its Engineering Scholarship Program and partnerships with the various Universities throughout the state.

<u>Develop a Workforce Plan</u>: Developing a workforce plan for KYTC would facilitate planning for critical needs, gathering employee data, evaluating programs, communicating with employees, and management training. Workforce plan development would rely on data collected during succession planning and the workforce supply forecast.

## **4.3 Informal Collaborations**

The action items proposed under Informal Collaborations are:

- Include communities of practice
- Increased collaboration opportunities
- Implementing sharing opportunities of war stories and lessons learned
- Job shadowing/rotation

These action items are briefly summarized below, and a brief description of how KYTC could apply each is included.

<u>Communities of Practice</u>: Communities of practice involve face-to-face meetings between certain groups of employees; for example, those on a large project team, a group of division directors, or district employees. Fostering an environment conducive to the emergence of communities of practice is challenging. KYTC leadership will need to lend their support and encouragement in order for these communities to evolve and flourish A community of practice is a means of sharing and applying knowledge to KYTC issues and capturing the best practices that emerge.

<u>Increased Collaboration Opportunities</u>: Increasing collaborative opportunities among KYTC employees provides an environment to foster organic conversations among colleagues. For example, in the fall of 2015, KYTC held a Project Managers Boot Camp over a two-month period. During this training, participants had the opportunity to interact through group activities and informal breaks. Multiple participants commented that having the ability to interact and share with their colleagues from around the state was an extremely valuable part of the course. Given that some KYTC employees already participate in training events, the Cabinet should examine refocusing or reorganizing portions of these events to enable collaborative opportunities.

<u>Implement sharing opportunities for "war stories" and lessons learned</u>: One of the most popular events at the fall 2015 Project Managers Boot Camp training was a session devoted to advice and lessons learned from four esteemed transportation veterans. The war stories and lessons learned that members of the panel shared resonated with participants. Although these types of panels are useful for all levels of personnel at KYTC, they will likely be most valuable for younger/newer employees.

<u>Job Rotation/ Shadowing</u>: Implementing job rotation/shadowing among employees is an excellent way to help ensure continuity of specific key functions at KYTC. Although resources are limited, job rotation/shadowing can smooth the transition as employees retire, are promoted, or leave the employment of KYTC. While job shadowing/rotation may not be feasible in every case, it should be pursued as time and resources permit.

## **4.4 Formal Collaborations**

The action items proposed under Formal Collaborations are:

- Implementation of formal lessons-learned meetings
- Conducting after-action reviews
- Leadership training workshops
- Conducting exit interviews with retiring employees

These action items are briefly summarized below, and a brief description of how KYTC could apply each is included.

<u>Implementing Formal Lessons-Learned Meetings</u>: Implementing formal meetings and/or presentations dedicated to lessons learned is one method of distributing information to targeted groups at KYTC. By allowing employees to formally present what lessons were learned during a project, for example, KYTC leadership can demonstrate that they value the knowledge that their employees have gained on the jobs and the importance of communicating it to other employees.

<u>Conducting After-Action Reviews</u>: After-action reviews involve bringing together people who have been a part of an action—perhaps a program development process—to scrutinize that action to identify went right and wrong, and how to make improvements in the future. By documenting the review process, KYTC could use these documents as a reference and a learning tool for new employees.

<u>Leadership Training Workshops</u>: KYTC already offers several workshops that are similar to a leadership training workshop. This training focus would remain on younger staff and emerging leaders (as identified by KYTC leadership), but should also focus on interactions between less experienced and seasoned employees.

<u>Conducting a Last Lecture and Exit Interviews</u>: Giving retiring employees the opportunity to conduct a last lecture encourages them to share experiences with a final presentation. The presentation could take place at a

staff meeting, a brown bag setting, face-to-face, or over a video link. Currently, exit interviews are typically a formal process conducted by KYTC. A departing employee may be asked questions about their impressions of the organization, why they are leaving, and what they would change if they could.

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## Appendix A

#### List of Possible Knowledge Management Ideas (Ward 2007, p. 20-21)

- 1. Establish mentoring programs.
- 2. Establish ongoing process to determine which employees have the most critical knowledge.
- 3. Institute succession and career development planning.
- 4. Build repositories of knowledge that professionals need as they move through the organization.
- 5. Master practices of knowledge transfer, such as face-to-face skill training programs.
- 6. Use technology to supplement person-to-person knowledge transfer.
- 7. Explore phased retirement.
- 8. Look for new ways to retain key workers.
- 9. Use retirees' expertise by implementing formal programs to reemploy recent retirees, especially on contract or part-time basis (i.e., an intentional, focused program, as opposed to ad hoc, on-the-fly hiring in time of crisis or in unplanned manner).
- 10. Build a knowledge-retention culture and make knowledge retention part of the organization's mission.
- 11. Understand that voluntary reductions, because the most marketable and knowledge individuals leave first, can harm social networks and undermine trust.
- 12. Spread pay cuts rather than layoffs to maintain underlying social networks.
- 13. Systematically record knowledge of employees on verge of retirement by using video, interviews, and documentation.
- 14. Pay bonuses to departing employees willing to share their working knowledge with their replacements.
- 15. Encourage workers to mingle across department boundaries, etc., to facilitate knowledge transfer.
- 16. Use social network analysis to map patterns of interaction and identify key individuals.
- 17. Use knowledge mapping techniques.
- 18. Investigate in a purposeful manner why individuals leave the organization.
- 19. Pay close attention to worker demographics and staff positions requiring extensive experience so as to allow junior employees to grow in experience.
- 20. Allow succession practices in selected critical specialized positions.
- 21. Shape the organization to meet future demands by understanding whether the organization itself (or department) is in a growth or stewardship cycle.
- 22. Encourage employees to transfer between disciplines to increase skill sets.
- 23. Ensure that attention is paid to less glamorous but critical positions.
- 24. Include social scientists, cultural anthropologists, transportation historians, and other social scientists on consulting teams.
- 25. Use sophisticated software to analyze make-or-break losses in key competencies.
- 26. Develop extended "supply chains" of people by creating pools of individuals to train and develop so they are ready to move into positions in about three years.
- 27. Reduce importance of positions and skills of retiring workers by revamping job or outsourcing.
- 28. Redesign existing processes to focus on knowledge retention needs.
- 29. Calculate the cost of lost critical knowledge in terms of how much productivity will be lost.
- 30. Leverage what is already in place, such as by making exit interviews more knowledge oriented or improving existing communities of practice or focus groups.
- 31. Hire people with strong knowledge-sharing skills and behaviors.
- 32. Allow employees to "shadow" senior staff and reward senior staff for that.
- 33. Give employees just-in-time access to retirees as they need them for current work.
- 34. Understand it is necessary to gather knowledge from the high performers only, regardless of their level in the organization or job slot.

- 35. Identify core processes in organization that need protection and identify top performers in those processes.
- 36. Use specialized interviews called a "naïve new person" interview, led by a coach, and then polishing that knowledge gleaned into a best practice stored in an electronic library.
- 37. Update knowledge, especially that which is stored in explicit form, regularly through continuous use and feedback.
- 38. Seek not to retain workers but to constantly "re-recruit" them by engaging and valuing them.
- 39. Make sure employees do not have to choose between loyalty to their careers and loyalty to their organization.
- 40. Engage retired workers on a project-consulting basis.
- 41. Create a retiree job bank.
- 42. Hold one-day wisdom transfer workshops.

## Appendix B

## Knowledge Management Litmus Test (Spy Pond Partners 2015, p. 18)

Over 20 percent of senior managers will be retirement eligible in the next five years	
Many mid-career employees are likely to leave to pursue other opportunities	
We have not identified specific areas or skills that are important	
There is no count of employees with critical skills or experience	
We do not keep up to date documentation maintained of core procedures and processes	
The organization lacks standard debriefing methods to capture lessons learned and other	
knowledge	
We do not have any formal mentoring programs or ways to share knowledge	
Training and development budgets are limited and/or declining	
A part of the organization may not know what the other is doing even if there is a similar task	
It is difficult for us to find information to improve efficiency	
Employees don't feel like they have time to with other employees informally	
Peer agencies are ahead of us in knowledge management	

Instructions: Check the boxes that apply; if 7-12 are marked then there could be significant benefits to the organization from a knowledge management program. If 4-6 are checked then there could organizational enhancements from knowledge management and if 1-3 are checked then current practices are likely sufficient and can be fine-tuned as needed.

## Appendix C

# 1. How long have you worked at KYTC?

Answer	%	Count
<5 years	17.87%	57
5-10 years	22.57%	72
10-20 years	37.93%	121
<20 years	21.63%	69
Total	100%	319

## 2. Where do you currently work?

Answer	0/0	Count
	/0	Count
Aviation	1.88%	6
Budget and Fiscal Management	2.51%	8
Audits	1.88%	6
Support Services	1.25%	4
OHRM	2.51%	8
Legal Services	2.51%	8
Public Affairs	0.63%	2
Civil Rights and Small Business Development	0.31%	1
OIG	0.31%	1
OIT	0.63%	2
Vehicle Regulation	5.02%	16
Transportation Delivery	2.19%	7
Rural and Municipal Aid	1.25%	4
Office of the Secretary	0.00%	0
Highway Safety	0.94%	3
Maintenance	11.29%	36
Materials	2.19%	7

Planning	4.70%	15
Professional Services	0.00%	0
Program Management	1.57%	5
Right of Way and Utilities	6.90%	22
SHE Office	0.31%	1
Structural Design	1.88%	6
Construction Procurement	1.57%	5
Traffic Operations	3.45%	11
Equipment	3.45%	11
Environmental Analysis	0.94%	3
Highway Design	5.64%	18
Construction	8.46%	27
Engineering Support (District)	4.39%	14
Management/Administration (District)	3.76%	12
Project Delivery and Preservation (District)	6.90%	22
Project Development (District)	5.02%	16
Other:	3.76%	12
Total	100%	319

Other:

Highway District

PD & P Section Office

facilities maintenanace

Department of Highways

**Building Maintenance** 

District Office

Structures (Bridge Inspection)

Right of Way & Utilities

Transportation

Motor Carriers Permits and Credentials

Highway Safety Improvement Program

# 3. How long have you worked in your current position?

Answer	%	Count
<2 years	15.99%	51
2-5 years	26.33%	84
5-10 years	27.59%	88
>10 years	30.09%	96
Total	100%	319

# 4. Which of the following KYTC initiatives and resources are you aware of, or have you participated in?

## Aware of

Question	Yes		No		Total
Advanced Leadership Academy	90.77%	246	9.23%	25	271
Civil Engineering/Technology Scholarship Program	82.05%	224	17.95%	49	273
Project Manager's Bootcamp	52.01%	142	47.99%	131	273
Partnering Conference	75.00%	204	25.00%	68	272
Construction Management Academy	25.18%	70	74.82%	208	278
Supervisory Training and Resources (STAR) Program	74.64%	209	25.36%	71	280
Guiding Potential Supervisors (GPS)	82.78%	226	17.22%	47	273
The Roadmap Program	79.93%	223	20.07%	56	279
Section Engineer's Meetings	60.43%	168	39.57%	110	278
Workshops including: Structures Level I, Grade and Drain I, Grade and Drain II, and Field Engineer's Guardrail	50.94%	135	49.06%	130	265
Kentucky Qualified Testers and Laboratories Training (includes Aggregate, Asphalt, Bridge Coatings Inspection, Concrete, Erosion Control, Grading, Pavement Markings, and Work Zone Traffic Control)	52.06%	139	47.94%	128	267
Transportation Curriculum Coordination Council (TC3) Online Training Courses	21.98%	60	78.02%	213	273
Kentucky Enterprise Learning Management System (KELMS)	83.64%	225	16.36%	44	269
Transportation Mechanic Apprenticeship Program	15.58%	43	84.42%	233	276
Minority Internship Program	24.19%	67	75.81%	210	277
Professional Development Branch Courses	54.85%	147	45.15%	121	268
Other	50.00%	12	50.00%	12	24

## Participated in

Question	Yes		No		Total
Advanced Leadership Academy	23.98%	59	76.02%	187	246
Civil Engineering/Technology Scholarship Program	22.32%	52	77.68%	181	233
Project Manager's Bootcamp	18.38%	43	81.62%	191	234
Partnering Conference	42.91%	106	57.09%	141	247
Construction Management Academy	7.11%	16	92.89%	209	225
Supervisory Training and Resources (STAR) Program	27.97%	66	72.03%	170	236
Guiding Potential Supervisors (GPS)	26.86%	65	73.14%	177	242
The Roadmap Program	28.34%	70	71.66%	177	247
Section Engineer's Meetings	30.33%	74	69.67%	170	244
Workshops including: Structures Level I, Grade and Drain I, Grade and Drain II, and Field Engineer's Guardrail	30.65%	76	69.35%	172	248
Kentucky Qualified Testers and Laboratories Training (includes Aggregate, Asphalt, Bridge Coatings Inspection, Concrete, Erosion Control, Grading, Pavement Markings, and Work Zone Traffic Control)	34.39%	87	65.61%	166	253
Transportation Curriculum Coordination Council (TC3) Online Training Courses	14.53%	34	85.47%	200	234
Kentucky Enterprise Learning Management System (KELMS)	76.72%	201	23.28%	61	262
Transportation Mechanic Apprenticeship Program	1.73%	4	98.27%	227	231
Minority Internship Program	0.44%	1	99.56%	224	225
Professional Development Branch Courses	39.83%	96	60.17%	145	241
Other	35.71%	10	64.29%	18	28

Other:

6 Days of Internal Consultant Training by Center of Quality Management in 2000

**GIS** Training

IRWA

Several Federal HWY mandated courses for bridge inspecction, given by the FED HWY personnel or contracted personnel

GSC Certified Management Fundamentals

CPM & CFM

eMars classes

RoW training courses

Road scholar & master classes

Road masters and roads scholar

CPM

Highway Design annual Conference

Interpreter Program

ACEC Technical Seminars and Classes

I am aware of the Highway Tech positions but will not ever take part in this due to not ever being promoted always reclassed. This is disrespectful to all of us TECH that have endured how we have been passed over for years and watch the maintenance side be giving major raises and now giving even more raises with this new position that has been created.

CSE

5. When you need to find information or knowledge about a work-related issue, where do you most often go to find that information? (check the top 2)

Answer	%	Count
Guidance manuals	23.55%	166
Supervisor	28.09%	198
Coworkers	25.39%	179
Internet (non-KYTC web resources)	15.18%	107
External partners (such as consultants, contractors, university professionals, etc.)	4.11%	29
Other	3.69%	26
Total	100%	705

Other:

suppliers/vendors

intranet

Use the information source most suitable to the issue that gets the answer the quickest.

Training Coordinator

Google!

Personnel Office

Experience & common sense

When I first came on board in this position, there was no information available and no one would train. I dug it out for myself and asked questions until I annoyed people. Eventually, I had the information needed to write procedures and even the program template with instructions. We now have instructions but I consider myself a big part of us having this because no one had ever compiled instructions and not even the supervisor would train. They just said "do it". I found this ridiculous but now we are able to train new employees. Incidentally, all of the employees that were here when I came on board have moved on because they did not want to be accountable. Only the original supervisor remains and she is now the manager and glad that I train new employees.

Westlaw, brainstorm for likely information source

HEC, FHWA, AASHTO, NCHRP

KYTC Web Site

Web search

Postmaster

Intranet

EMARS reporting
district office
Upper Management
Intranet
old documents
TT
KYTC Intranet
Director
Nobody really knows anything when it comes to surveying on the construction side of things.
Specifications
KYTC Web resources

Training Coordinator CO

6. What methods or approaches would you prefer to find information or knowledge? (please rank these options from 1-7, with 1 being your most preferred)

Question	1		7		3		4		5		9		7		Total
l guidance manuals	28.84%	92	17.55%	56	10.03%	32	12.54%	40	11.29%	36	10.97%	35	8.78%	28	319
munities of practice gular meetings with oups of employees)	11.60%	37	13.48%	43	17.87%	57	14.73%	47	14.42%	46	15.05%	48	12.85%	41	319
Training offerings	12.85%	41	19.44%	62	22.26%	71	18.50%	59	12.54%	40	7.52%	24	6.90%	22	319
rotation/shadowing	7.21%	23	5.96%	19	12.23%	39	18.18%	58	17.55%	56	18.50%	59	20.38%	65	319
Mentoring	6.27%	20	11.29%	36	13.79%	44	10.97%	35	23.82%	76	21.63%	69	12.23%	39	319
Ipervisor/coworkers	17.87%	57	20.38%	65	14.42%	46	16.30%	52	10.97%	35	11.91%	38	8.15%	26	319
a-style policy guide	15.36%	49	11.91%	38	9.40%	30	8.78%	28	9.40%	30	14.42%	46	30.72%	98	319