RESEARCH & DEVELOPMENT

Product Evaluation Tracking Tools and Product Categories

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EXECUTIVE SUMMARY

State transportation agencies (STAs) implement countless transportation products, identified, evaluated, and accepted through a Product Evaluation Program (PEP). Through an effective PEP, STAs can ensure the continuous availability of high performance products to be used on various construction and maintenance projects. STAs are encouraged to constantly monitor and update an Approved or Qualified Product List (APL or QPL, respectively).

The purpose of this study was to assess the current state of practice of PEPs throughout transportations departments in the United States. The researchers analyzed flowcharts, product application forms, and standard operating procedures, and conducted an extensive academic literature related to the subject. A survey was then developed and distributed to all 50 DOTs (56% response rate). Follow-up interviews were conducted with about half of the respondents. Data was collected on PEP staffing levels, satisfaction, size of approved product lists, annual budgets, and more.

The study found that, in general, PEPs lack priority, consistency, and coordination. Statistical analyses revealed that agencies dedicating equal time toward both phases of evaluation (initial product application review and technical product review) have achieved the highest satisfaction levels for PEP communication and performance. An optimal PEP management model is proposed, and includes a modified product application form, past performance survey (where applicable), and revised product evaluation form / process.

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1 INTRODUCTION

The systematic process of evaluation has long-served as the cornerstone of accomplishment, both in definition and in application. Whether an evaluation process is initiated as a means of measuring productivity, demonstrating efficiency, or determining impacts, it is an inevitable task for any project or program manager. Apart from aiding individuals with making well-informed decisions on behalf of their organization, proper evaluation practices can serve as a protective barrier between success and failure, which is often drawn on a very fine line. Despite the use of evaluation as a basic requirement for most decision-based scenarios, there is evidence that the lack of a consistent evaluation process diminishes the value of entire processes, as well as the subjects of such evaluation. Many evaluation processes are substantially neglected both at the operational and the executive levels. This study was conducted to address these concerns and provide recommendations for improvement.

2 LITERATURE REVIEW

The purpose of this literature review was to identify the fundamental attributes of effective evaluation, which will assist in the creation of optimized PEP management by transportation program managers. Evaluations are generally conducted to examine and judge the effectiveness of a program; however, most evaluations are a result of existing dissatisfaction or poor performance, and a desire to implement positive change *(24)*. Therefore, this literature review is not limited to understanding the different fundamentals of evaluation, but also reviews other significant factors involved in effective evaluation processes, including decision-making and organizational change. These elements are an extension of evaluation and are necessary for the successful implementation of evaluation findings and results, as initially aimed.

According to Lancaster *(15)*, the main role of any evaluation is to carry out an assessment and gather information, which can then be used by decision makers to solve underlying issues, as well as to prevent problems going forward. Thus, in addition to the "why, what, when, and where" of evaluation, special attention has been given to literature related to decision-making, helping to inform the discussion through a more wholesome understanding about the most productive methods, and criteria needed, to ensure that an evaluation is both adequate, and easily implementable. The final section of this literature review concludes with a description of organizational change and its impact on enhanced program implementation, which is intended to guide decision makers through the evaluation process, and to ensure that planned objectives can be successfully implemented.

In some form or another, people have been using evaluation techniques and processes for thousands of years. As Scriven *(30)* said, "the evaluation is a very young discipline - although it is a very old practice." Within the last few decades, evaluation practices have evolved and expanded as a more distinct, and somewhat refined, organizational process. As a result, the term "evaluation" has also evolved to include multiple meanings and is often defined by the type and content in which it is being employed. Some of the more broadly accepted, yet distinct definitions include:

- "An evaluation is performed, not as an intellectual exercise, but to gather data useful in problem solving and decision making" *(15)*.
- "Evaluation refers to the process of determining the merit, worth, or value of something, or the product of that process. Terms used to refer to this process or part of it include: appraise, analyze, assess, critique, examine, grade, inspect, judge, rate, rank, review, study, test" *(29)*.
- "Evaluation is any activity that throughout the planning and delivery of innovative programs enables those involved to learn and make judgements about the starting assumptions, implementation processes and outcomes of the innovation concerned" *(33)*.

To illustrate the general evaluation process, Figure 1 shows the flow of an evaluation, and identifies the activities carried out at each step. The first step of the evaluation process is called the evaluation assessment or framework. This step can be referred to the planning stage, which primarily sets the foundation or the framework for the upcoming steps. At the planning stage, an investigation is conducted, starting with identification of major concerns, uncertainties, and the key issues, followed by the preparation of a detailed plan, comprised of various techniques and methods to address those problems. The second step deals with carrying out the actual evaluation

of a product, process, or the program to assess its performance. The data is collected by performing tests or checking standards and specification. Once there is sufficient data, the analysis of results will include recommended alternatives, and provide guidance on required steps for improvement. Finally, the decision makers assess the alternatives and the recommended steps to select the best suited option based on the goals and objectives established at the outset (i.e. the planning stage) *(32)*.

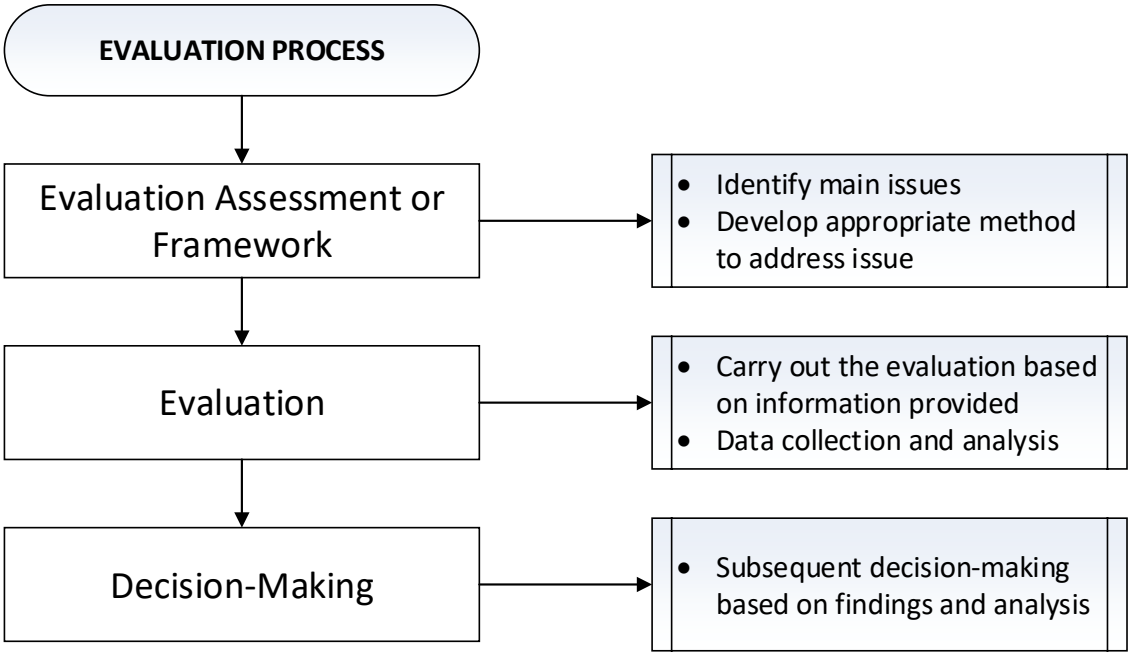


Figure 1: Flowchart of evaluation process, Adapted from (32).

An orderly framework that clearly portrays each essential step helps to define the respective program, which lends toward better understanding. When the process is more clearly defined, it allows for improved performance, as seen by the successful completion of tasks, which ultimately helps to achieve the desired results. According to a report by the Center for Disease Control *(7)* regarding an evaluation framework for the Public Health Department, the necessary activities in an effective evaluation framework are illustrated in Figure 2. The research shows that visualization tools are productive in illustrating the more conceptual aspects of an evaluation framework. Accordingly, Figure 2 shows six different steps or stages involved in an evaluation process with the help of an evaluation framework *(20)*.

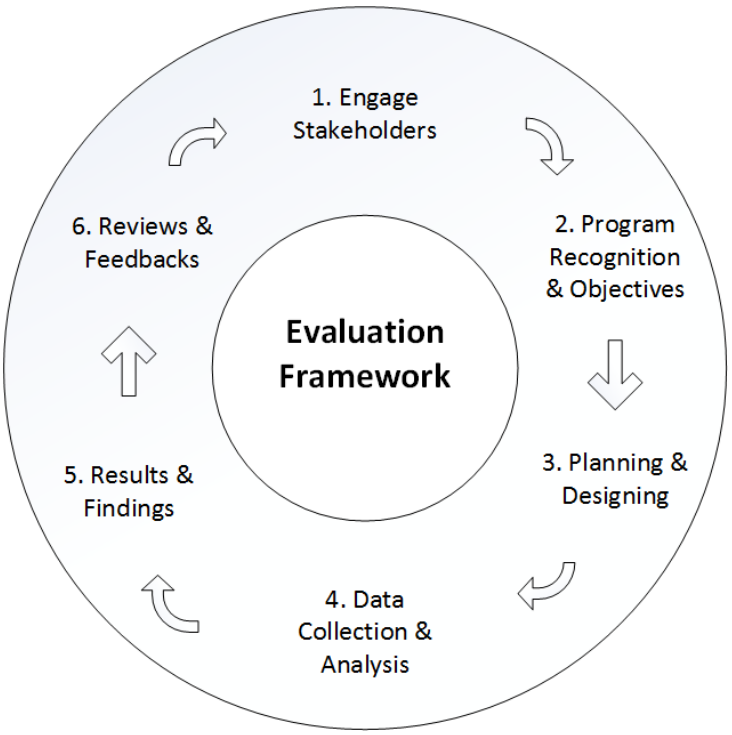


Figure 2: Framework to execute evaluation, Adapted from (20).

A 1999 survey found that decision-making process was one of the most critical elements behind the successful implementation of a project *(23)*. Similarly, it has been determined that decision making plays a significant role with respect to evaluation, selection, and implementation processes, *(31)*. Improved decision-making mitigates the risk of failure by ensuring interests are aligned against mutually desired results and assists to maintain control over the accuracy of evaluation outcomes. In business, companies are often observed making erroneous decisions, either by pursuing the evaluation of a potentially unsuccessful product and wasting resources, or by skipping the evaluation of a potentially successful product *(22)*. However, the research shows that such erroneous decisions are avoidable, or can at least be mitigated. Through the integration of performance management, better decisions can be made that correctly redirect resources, and help to modify operations by setting achievable goals and priorities, monitoring outcomes closely, and ultimately improving performance *(35)*.

To promote a deliberate and effective approach, this research adopted the decision-making process proposed by UMass, Dartmouth *(34)*, which include seven steps to ensure an informed decision making. The decision-making model is based on the identification of the best available alternatives followed by, the thorough assessment of all the choices to select the most suitable option. The seven steps include: (1) identification of the appropriate decision, (2) Collection of the relevant information, (3) identification of alternatives, (4) evaluate the alternatives, (5) selection of the best suited alternative, (6) implementation of the decided alternative, and (7) review the effects of the decision made.

A comprehensive review of relevant literature has helped the research team to determine whether organizational change is a necessary consideration for improving evaluation programs. At the outset, information was gathered from earlier works that identified some of the problems typically encountered during program implementation. As suggested by Kotter *(14)*, the most important aspect to bringing about change is to express a vision, communicate a sense of urgency, and then establish the motivation and cooperation needed to pursue it. Kotter further stated that "if you can't communicate the vision to someone in five minutes or less and get a reaction that signifies both understanding and interest, you are not done." Moreover, it is important to understand the need of change in the first place. As mentioned in a study by Armenakis and Bedeian *(1)*, the stresses resulting from dissatisfactions and inertia (commitment to current strategy) signal a need for change. Therefore, to improve the performance of work, the organization needs to understand the shortcomings and plan to implement change in a strategic manner that matches well with the targeted objectives of its internal and external requirements *(27)*.

The literature review confirmed that many organizations understand the importance of change and the need for large initiatives to successfully implement it. However, per Kotter's study, well over 50% of companies fail within the first phase of implementing change, often due to a lack of motivation and sense of urgency among the employees. To help address this failure, factors like receptivity, resistance, commitment, and other personal reactions should be considered whenever implementing change *(1)*. Other important factors, like addressing the inherent stress employees experience, whether due to lack of skill for new role, cynicism toward change, in general, or the result of inadequacies in the organization's sharing of information, should also be considered. Likewise, Judson *(13)* suggested five phases that must be followed whenever implementing change within an organization, including a (1) planning phase, (2) communications phase, (3) acceptance phase, (4) turnover phase (i.e. moving from the status quo), and finally, (5) institutionalizing the new order. Ultimately, the research supports the notion that proper communication is key to resolving and avoiding many of the problems arising from any transformative process and should be used as a tool throughout the entire process *(14)*.

3 DATA COLLECTION

The researchers conducted a robust study to prepare a survey questionnaire with questions from a variety of associated backgrounds to understand the best practices, organizational culture, employee satisfaction, communication tools and methods, and overall performance of the PEP. The survey was prepared using the Qualtrics web-based service due to its highly interactive interface and ease of use. The survey was distributed to all 50 DOTs in the United States.

The survey questionnaire included a total of 40 questions, which could be further classified into different categories based on the scope of the study, derivation, and source. The survey preparation began in January 2018, and took approximately six to eight weeks to complete, after pursuing several rounds of feedback from members of the research committee, as well as DOT staff members associated with the work. The survey required approximately 15 minutes to complete. The questions were prepared using the help of relevant research work, PEP annual reports by various state DOTs (Nevada, Arizona, and others), PEP annual conference of NCDOT, and recommendations from NCDOT staff members. The final database was prepared from a total of 28 (56%) respondents recorded from different state transportation agencies.

4 DATA ANALYSIS

This chapter summarizes the data collected. Table 1 shows the number of dedicated staff members employed by the state agencies to oversee and manage the PEP in 2002 *(6)* with the current study in 2018. The results showed a decline in the number of dedicated staff members for all 10 state agencies in the past 16 years. The table also shows the number of approved and rejected products by the respondents.

Table 1: Summary of Products Approvals / Rejections and Staffing Levels

State	# of Approved Products	# of Rejected Products	# of Staff Members (2018)	# of Staff Members (2002 – see Carr)
Alaska	106	10	1	--
California	8	3	2	> 10
Delaware	4250	750	1	--
Georgia	28	6	4	5 to 10
Hawaii	45	5	1	--
Idaho	16	4	1	--
Indiana	5	13	2	5 to 10
Kentucky	180	20	7	> 10
Louisiana	2	1	10	--
Maine	10	5	2	--
Mississippi	99	12	0	1 or 2
Missouri	111	13	0	3 or 4
Montana	35	5	1	--
New Hampshire	13	13	2	--
New Mexico	100	113	2	--
New York	50	10	5	> 10
North Carolina	49	23	2	--
Oklahoma	5	3	4	--
Oregon	150	100	1	> 10
South Dakota	25	7	1	--
Tennessee	50	50	3	--
Texas	20	1	1	5 to 10
Washington	261	2	0	5 to 10
Wisconsin	107	133	1	--

Table 2 provides a statistical summary for (1) the number of days taken to finish the initial product review and (2) the number of days taken to finish the technical product review. A clear distinction can be observed among the two phases, as most of the DOTs take considerably less time in the initial review phase. The number of days taken to finish the initial product reviews conducted in 2017 had a mean value of approximately 30 days, median of 18 days, and a standard deviation of about 44 days. On the other hand, the technical review duration had a mean value of approximately 228 days, median of 143 days, and the standard deviation of about 224 days (Table 2).

Table 2: Statistical summary initial product review and the technical product review

	Initial Review Duration (Days)	**Technical Review Duration (Days)**
Sample Size	18	18
Mean	32.00	228.10
Std. Error of Mean	-	52.704
Median	18.00	142.50
Mode	1.00a	15.00
Std. Deviation	44.34	223.60
Variance	1966.40	49999.16
Skewness	2.512	1.802
Std. Error of Skewness	.536	.536
Range	179.00	885.00

Figure 3 shows the relationship between the average performance and communication satisfaction of the employees from 17 state agencies and the percentage of time dedicated for initial review. The attribute on y-axis denotes the employee satisfaction level with “100%” being “Extremely Satisfied” and “0%” being “Extremely Dissatisfied”. The x-axis denotes the percentage of time dedicated for the initial review phase with the duration for entire product evaluation process being “100%” (i.e., initial review time and technical review time). As per the results, the highest level of satisfaction (over 90%) for the performance as well as the communication was observed when the duration for the initial and the technical review process were equally divided (i.e., between 40% and 60%). The lowest level of satisfaction (below 45%) was observed when the over 60% of time was dedicated during the initial review phase.

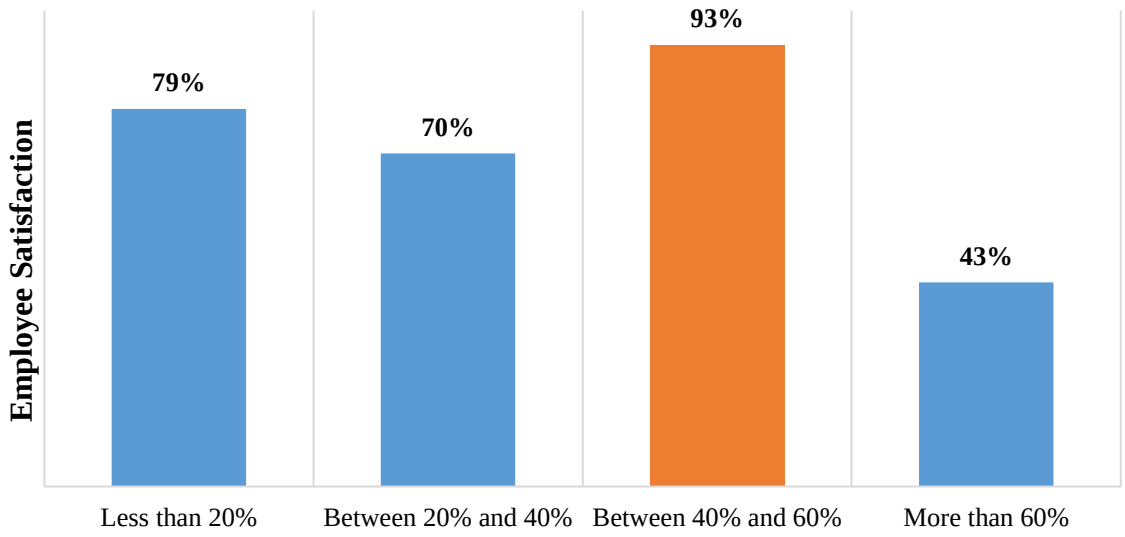
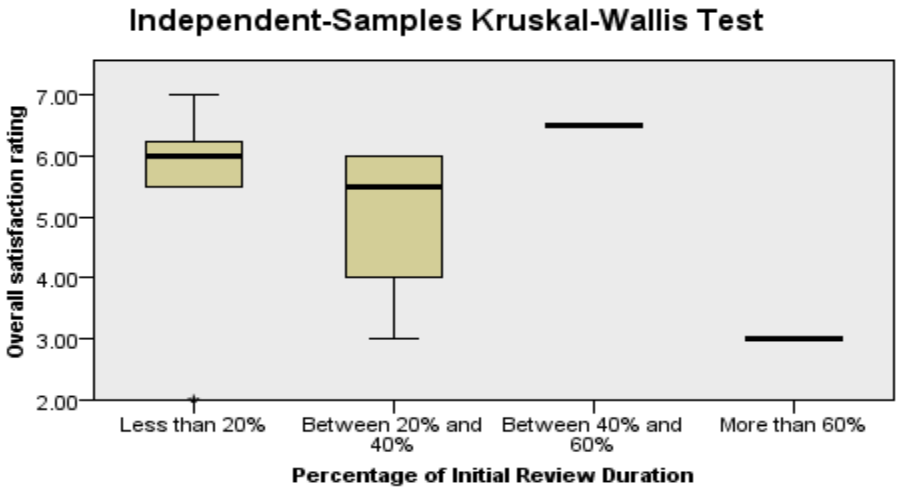


Figure 3: Employee satisfaction level and initial review process review duration

The results of this descriptive analysis were further corroborated using the Kruskal-Wallis H test (a.k.a. one-way ANOVA on ranks) to determine if there existed any statistically significant difference between different distributions of the initial product review duration. Figure 4 shows the distribution of percentage of time dedicated for the initial product review across different state agencies and the corresponding satisfaction level for each group. Figure 4 also provides the results for Kruskal-Wallis H test with the p-value (sig.) of 0.08, which is within the acceptable limit i.e. p-value less than 0.1. The results show that there exists statistically significant difference between the distributions developed based on the time dedicated for the initial product review and the corresponding satisfaction level achieved.

Therefore, the results of Kruskal-Wallis H test support the findings from descriptive analysis (Figure 4), hence, the state agencies with equal distribution of time for the initial and the technical review process can lead to higher level of employee satisfaction with respect to the performance of PEP and the communication within the different involved parties.



Total N	17
Test Statistic	6.762
Degrees of Freedom	3
Asymptotic Sig. (2-sided test)	.080

Figure 4: Test summary for the Kruskal-Wallis H Test (output from IBM SPSS)

The DOTs have defined criteria to conduct the initial product review for potential applicability. Figure 18 shows the most frequently used criteria across the nationwide DOTs. As observed, the lab and field test results along with DOTs established standards and specifications were the two most widely used criteria with 15 responses. The other frequently used criteria were AASHTO's specification, DOT's internal needs, and safety and hazard test results.

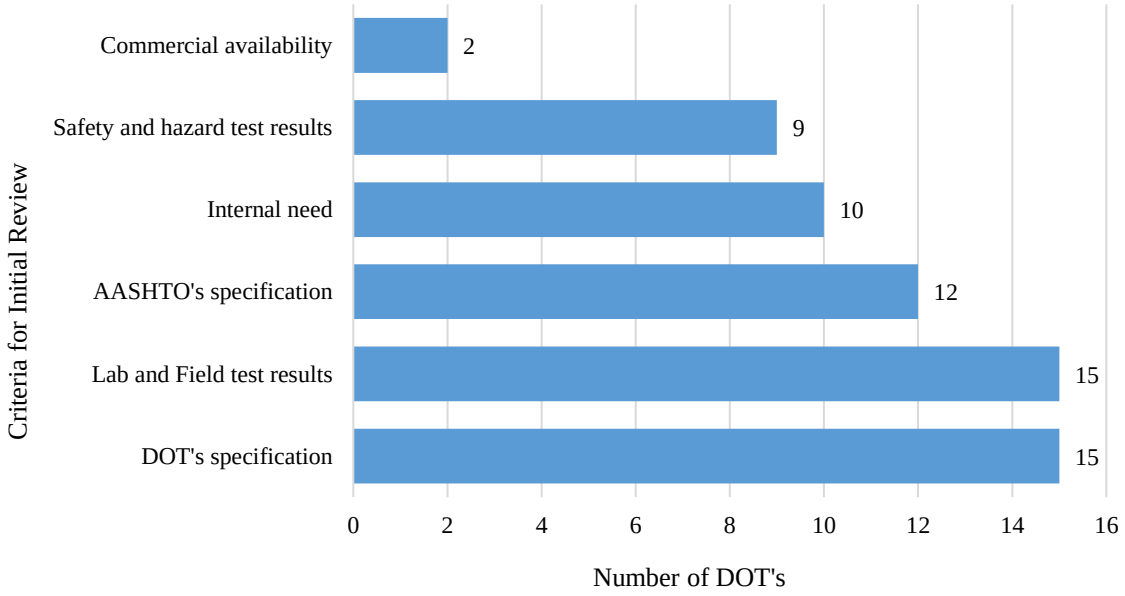


Figure 5: Criteria considered during the initial review process for 15 DOTs

As shown in Figure 21, out of 23 responses recorded for the use of data management software to maintain, update, and control product database, 70% of the DOTs use software either created within their agency or adopted industrial software like Oracle, MS Excel, MS Access, and others. The remaining 30% of the DOTs do not use any specialized software to manage their product lists.

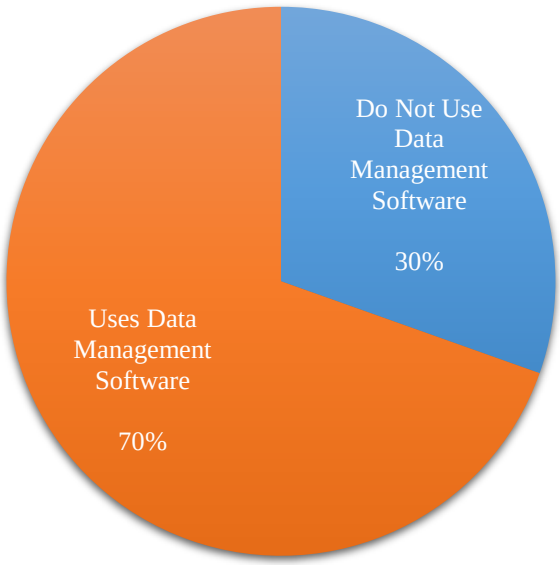


Figure 6: Usage of database management software by Agencies

5 FINDINGS AND RECOMMENDATIONS

The results of this analysis further revealed that there is significant variation amongst State Transportation Agencies and the time taken to complete the initial review process, ranging from 1 day to 180 days, with substantial spread between the respective agencies. Conversely, the technical review requires the technical committee to follow pre-defined tests and procedures, leaving little room for any modification to the second phase of the product evaluation process. Accordingly, since the norms for an initial product review can be tailored according to the needs, goals, and objectives of an agency's evaluation program, the research team developed a model with three components to ensure the optimum allocation of available resources and use of recognized guidelines for the initial review phase.

The modified product evaluation model was inspired by Garces' theory, which states that all product review models should aim to increase the probability of the product's acceptance, and minimize the risk of a new product's rejection, pursuant to a rigorous evaluation program *(8)*. This model should assist NCDOT in delivering a systematic, structured, and extensive procedure for product evaluation, at least at the initial review phase, that minimizes the chances of a product being rejected, and maximizes the overall output of the evaluation program, including the performance of its approved products. To ensure the successful implementation of improved practices, three components were developed as a part of the initial review process, to capture the product's initial performance:

1) Modified Product Evaluation Application: The content included in the modified product evaluation application is the result of a thorough analysis of previously submitted product applications, and accompanying files, from more than twenty departments of transportation (DOTs). Based on this review, the research team was able to identify the best means available for retrieving the information necessary to achieve a more productive and expeditious initial and technical review process, which was drafted into a modified product application form (Appendix 1). In addition to the basic demands of the evaluation process, DOTs encounter an average of 25% products that require additional information, sometimes later in the review phase, causing a significant delay in the overall evaluation process. The modified product application helps to minimize the likelihood of a product being approved for further evaluation without first ensuring complete and sufficient product information exists at the outset (i.e. upon receipt).

2) Past Performance Survey: A questionnaire is a necessary component of any application used for evaluation to ensure easier and faster product review *(8)*. The researchers developed and added a questionnaire as a part of the product submittal. The survey is an integral part of the application and must be submitted by the vendor, as an attachment, along with a maximum of three references. The use of the survey is only applicable to those products that were previously used on projects and does not apply to products that are new to the market. The questionnaire has seven criteria to provide the feedback on the product's performance, based on a Likert scale of 1 to 10, with 10 being excellent (Appendix 2).

3) Product Evaluation Form: The evaluation checklist is a major component of the final model and has a significant impact on the initial product review phase. As a result, it has been adopted into the modified product evaluation model because of its broad and proven applicability, as seen by those state agencies identified as having the most improved PEP. The evaluation checklist provides a standard, yet easily customizable platform, to review

the products by using the established criteria, as well as the support of committee members, to ensure higher transparency and uniformity in the evaluation process. Likewise, to reduce the confusion inherent when attempting to consume too much information, the checklist also assists the investigator by ensuring the application captures only necessary information, and that each input can be checked against the established criteria. It not only supports the ease and speed of initial reviews, but it helps to weed out those product applications that do not fully satisfy the requisite information. Thus, a technical evaluation will only be initiated by a full and complete product application, enabling more efficient use of time and resources, while also reducing the likelihood of its rejection. The criteria are assigned weights to account for the agency's priorities, needs, and requirements while computing the overall score of the product application (Appendix 3).

The aim of the final model is to enhance the evaluation process by ***improving the initial product review***, which will have a corresponding impact on the technical product review process. During the investigation of the state agencies nationwide, the research team recorded a few important characteristics that could be implemented along with the modified practices of the final model to enhance the performance of the initial review process. The following recommendations can be implemented in conjunction with the final model (see Appendix 6 for a flow chart showing the modified evaluation process):

- Allocate more time and staff to review the information retrieved from product submittal and necessary to complete the technical evaluation.
- Use the product evaluation form to rate the products and arrange them in the QPL based on their overall scores to ensure effective and expeditious selection by the project managers.
- Establish a priority list of highly-demanded products with the support of technical team, maintenance team, and project managers that are needed urgently on the current or future projects but not available on the QPL/APL.
- Require an application fee for the product evaluation to eliminate the spam applications, with a possible cost-incentive for innovative and proven products.
- Allow the vendors or manufactures to provide the feedback/review on their experience with the product evaluation process and the suggested changes for the program.
- Create a centralized database by sharing the evaluation results with the other state agencies and existing bodies with evaluation program like APEL, ASTM, and others.
- Implement a formal training program to educate the employees before joining the PEP.
- Include higher management officials and technical experts from different background in the PEP committee.

6 CONCLUSION

It is important to identify the need for improvement before implementing any change or modification, therefore, the evaluation process should be correctly implemented to provide with the evidence necessary to make informed decisions *(36)*. The state product evaluation program is one such effort to improve the national transportation infrastructure by ensuring the use of highly qualified products and superior technology for the construction projects.

In this study, the researchers examined the PEPs across DOTs and identified the best practices, unique features, advanced technologies, and other impressive evaluation techniques. The database prepared using the survey and the follow-up interviews with nationwide DOTs was analyzed to successfully implement the findings and recommended changes. The team prepared a final model that comprised of the modified tools and practices to enhance the product evaluation process. The final model aimed to improve the initial review phase with the help of modified tools developed to acquire comprehensive and accurate product information and conduct an extensive and systematic initial review with the help of advanced scoring system for the recognized criteria.

The model was inspired from the Ozer's study, where it was suggested that firms often make two erroneous decisions: a) pursue the evaluation of a potentially unsuccessful product leading to wastage of time, workload, and other valuable resource and b) fail to evaluate a highly potential product *(22)*. The modified evaluation process facilitates a systematic, expeditious, and transparent approach to ensure the higher probability of product approval after the qualification of initial review phase and reduced workload on the technical committee due to the availability of exhaustive and accurate product information. However, the biggest challenge for the research team was imposed due to a smaller sample size to conduct the statistical analysis even with 56% (28 out of 50) response rate.

The model developed for the initial review encourages state agencies to allocate resources (e.g. time, money, and labor) more effectively, to finish the initial product review process quickly and efficiently. The modified product application form ensures the collection of comprehensive and reliable information from the vendor. The past performance survey is a part of the product submittal that allows the evaluator to capture the product's performance based on its use in previous projects. The product evaluation form allows a formal and structured initial review of the product application. It helps to grade the product application using recognized criteria, owing to the availability of the required product information, and ensure an expeditious review process.

7 FUTURE RESEARCH

The review of numerous DOT agencies across the U.S. reveals that many struggle with providing timely end-user feedback to the product evaluation group. While this research report provides recommendations to NCDOT on immediate changes to the PEP, the UNC Charlotte research team can assist in developing and implementing a formal feedback program. Similar to Kentucky's model, the proposed tool would augment NCDOT's current structure and deliver an efficient method to assess product performance outcomes. The tool would provide NCDOT with:

- Performance / satisfaction summary of products.
- "Tiers" of approved product risk levels. Many DOT agencies reported that they while certain products were approved, they needed to be closely monitored. Likewise, other approved products were not flagged and required less frequent review. This tiered structure will allow NCDOT PEP to optimize management resources based on each product's overall risk level.
- A performance dashboard with the ability to generate preset reports as well as the ability to create custom reports.
- Provide industry partners with a synthesis of evaluation results. Research has identified that this is an important component to continuous improvement.
- An integrated product reports database (initial review results, technical review, and on-going customer feedback).

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APPENDIX 1 – MODIFIED PRODUCT EVALUATION FORM

VENDOR INFORMATION

Manufacturer:	Click here to enter text.
Contact Name:	Click here to enter text.
Email:	Click here to enter text.
Title:	Click here to enter text.
Address:	Click here to enter text.
Telephone No:	Click here to enter text.
E-mail Address:	Click here to enter text.
Website Link:	Click here to enter text.
Company's Background:	Click here to enter text.

PRODUCT INFORMATION

Product Name:	Click here to enter text.
Product Description:	
Product Primary Use:	
Product Secondary Use:	
Product Outstanding Benefits (30 words):	
Product Limitations (30 words):	
Model Number:	Click here to enter text.
NCID Username:	Click here to enter text.
APL Category:	Click here to enter text.
APL Sub-Category (If Applicable):	Click here to enter text.
Product Website Link:	Click here to enter text.
Material Composition:	Click here to enter text.
Product Previously Submitted for Evaluation:	☐**Yes** ☐**No**
If Yes, Tracking Id:	NP_____-_____

Product Cost:	Click here to enter text.
Unit of Measurement:	Click here to enter text.
Installation Cost:	Click here to enter text.
Special Equipment Required for Installation:	Click here to enter text.
Material Composition:	Click here to enter text.
Country of Manufacturing:	Click here to enter text.
Availability (*Seasonal/Non-Seasonal*):	Click here to enter text.
Product Shelf Life:	Click here to enter text.
Alternate for What Existing Products On APL:	Click here to enter text.
Recycled Materials (%):	Click here to enter text.
State Recycled Materials Used:	Click here to enter text.
Hazardous Materials (%):	Click here to enter text.
State Hazardous Materials Used:	Click here to enter text.
Educational Courses or Videos Available Link	Click here to enter text.

PRODUCT HISTORY

Agenda	Applicable?	Details/Results
Previously Applied for Evaluation at Other Governmental Agency/DOT	☐	Click here to enter text.
Product Warranty	☐	Click here to enter text.
Product Is Biodegradable	☐	Click here to enter text.
Product Is Permeable	☐	Click here to enter text.
Product Demonstration Provided by The Vendor	☐	Click here to enter text.
Product Delivery at Site	☐	Click here to enter text.
Patented in U.S.	☐	Click here to enter text.

Specification Information

Agency	Applicable?	Details
DOT Standard Specifications	☐	Click here to enter text.
DOT Special Provisions	☐	Click here to enter text.
AASHTO	☐	Click here to enter text.
ASTM	☐	Click here to enter text.
MUTCD	☐	Click here to enter text.
Other DOT approvals (List)	☐	Click here to enter text.
Other Agency Approvals (List)	☐	Click here to enter text.

Testing Information

Agency	Applicable?	Test Data / Results
AASHTO	☐	Click here to enter text.
ASTM	☐	Click here to enter text.
Other Nationally Recognized Agency	☐	Click here to enter text.

Attachments

Attached File	Applicable?	Details
Technical Data Sheet	☐	Click here to enter text.
Installation Details	☐	Click here to enter text.
Safety Data Sheet	☐	Click here to enter text.
Test Data	☐	Click here to enter text.
Design Sheets	☐	Click here to enter text.
Laboratory Reports	☐	Click here to enter text.
Certificate of Compliance	☐	Click here to enter text.
Life Cycle Cost Analysis	☐	Click here to enter text.
Quality Control Plan	☐	Click here to enter text.

APPENDIX 2 – PAST PERFORMANCE SURVEY

PROPOSING COMPANY NAME is performing Past Performance Questionnaires for PRODUCT'S NAME used in one of their projects. This survey is provided to evaluate our performance for the product identified in Part A.

PART A – CLIENT REFERENCE & PROJECT INFORMATION

Client:	Insert	Project Name:	Insert
Reference:	Insert individual person's	Product Name:	Insert
Job Title:	Insert individual person's role	Product Unit Cost ($):	Insert
Email:	Insert e-mail address.	Phone:	Insert

PART B – COMPANY & PERSONNEL BEING EVALUATED.

Name of the Past Project/Installation: Insert Project Name

Name of the Consultant: Insert Proposing Company's Name

PART C – PERFORMANCE EVALUATION

Please rate your level of satisfaction with the product's performance on a scale of 1 to 10 (with 10 representing that you were very satisfied and 1 representing that you were very unsatisfied).

- Ratings will be applied for (a) our company overall, and (b) the listed product in Part A above.

No.	CRITERIA	UNIT	RATING
1	Risk associated with safety and health	(1-10)	
2	Availability of the product	(1-10)	
3	Quality of the product	(1-10)	
4	Installation of the product	(1-10)	
5	Product compliance with standards & specifications	(1-10)	
6	Overall professionalism and responsiveness to requests	(1-10)	
7	Overall client satisfaction with the product	(1-10)	

Please provide any recommendations or lessons learned from your project experience:

Click here to enter text.

Printed Name of Client Reference | Job Title | Signature

Thank you for your time and effort in assisting us in this important endeavor!

Please return the completed survey to: <<Insert proposing company's contact info>>

APPENDIX 3 – PRODUCT EVALUATION FORM

Evaluation checklist filled out by the **product evaluation program manager**:

Criteria	Applicable?	Weight	Score (1-10)
Product Fits the Established Priorities	☐		
Product Within the Established Cap	☐		
Product Availability	☐		
Established Need and Benefits of The Product	☐		
Safety and Health Review	☐		
Environmental Impacts	☐		
Availability of Resources to Carry Out Technical Review	☐		
Warranted Background Information and Research Test Data	☐		
Product Supported by Other Technical Committee Members	☐		
Past Performance Survey	☐		
Product Warranty	☐		
Program Evaluator Score:			

Evaluation checklist filled out by the assigned **technical committee member**:

Criteria	Applicable?	Weight	Score (1-10)
Safety and Health Review	☐		
Environmental Impacts	☐		
Life Cycle Cost Analysis	☐		
Quality Control Plan	☐		
Overall Product Performance	☐		
Technical Evaluation Score:			
TOTAL SCORE: *(Program Evaluator + Technical Evaluation)*			

APPENDIX 4 – PRODUCT ALIGNMENT MATRIX

The product alignment matrix provides a summary of the proposed product evaluation model based on an analysis of the best practices identified from 28 states DOTs and compares them with NCDOT's current PEP structure. The applicable benefits of implementing the feature/recommendation of the final model are denoted using the identification numbers (ID) ranging from 1-8 as listed in Table A4-1

Table A4-1: List of benefits with identification number used in the matrix.

Identification Number	Benefit(s)
1	Save Time
2	Save Money
3	Improved Communication
4	Employee Satisfaction
5	Reduced Workload
6	High Performance
7	Comprehensive Database
8	Uniformity and Transparency

Table A4-2: Product alignment matrix proposed model and NCDOT

Category	Sub-Category	Features of the PEP at NCDOT	Features of the Final Research Model (FM)	ID(s)*
Product Evaluation Application Form	**Questions related to Product Performance**	Was product previously submitted for evaluation within the agency?	Provide the result/status of the product submitted for evaluation at the local or other state agency?	1,2,5
		Approval from other agencies/DOTs?	Alternate/Replacement for what existing products on APL/QPL?	1,2,5
		Submission of material/product safety data-sheet and independent lab tests reports?	Submission of past performance survey from the clients who previously used the product (Maximum 3)	4,6,7,8
			Pre-defined list of required documents to ensure the submission of all required document with the product application as an attachment	1,5,7,8
		State product's advantages & limitations	State product's outstanding benefits and limitations within 30 words for each section	1,5,7
	Product Installation Details		Requires submitting the educational video or tutorial for the installation of the product	3,5,7
			Provide the shelf life and seasonal availability of the product	7
			Ask for the requirement of any special equipment to install the product in the field	1,5
	Application Fee	Do not have an application fee to submit the product application	An application fee of $50 is imposed for the submission of product application to avoid spam	1,2,5
Initial Product Review Phase	**Review Procedure**	PEP manager checks product specification against the established guidelines	Products are reviewed using the evaluation form, the product is scored against the pre-defined criteria developed with the help of technical committee	1,4,5,6,8
		Assigned two staff members dedicated to conduct and manage the review process	The pre-defined criteria are assigned weights to accommodate agency's priorities and goals	1,4,5,6,8
			Initial review qualification depends on the documents submitted, information provided, and the overall score achieved by the product	5,6,7
	Duration	Initial product review takes up to two weeks	Initial review takes from six to eight weeks of time	4,5,6

Miscellaneous Features & Recommends	**Technical Review Duration**	Technical product review takes approximately four months of time	Technical product review takes from six to eight weeks of time	1,6
	IT Services	Use HiCAMS to manage and update the APL database.	Outsource the IT services to experts or use industrial software like AASHTOWare to manage the database of the QPL/APL	1,3,4,5,6,7
			Use IT services to obtain the feedback from the staff members on the product performance and vendors on the evaluation experience	1,3,4,7
	Database Management	Maintain the database of approved products, approved for the provisional use, and products under field trial	Maintain the database of approved, rejected, under field trial, and provisional use products	6,7
	PEP Flowchart	Use single flowchart to explain the entire evaluation process using 36 steps	Use separate flowchart to illustrate initial review process and overall evaluation process using eight and sixteen steps, respectively	3
	Additional Features		Arrange the products on the QPL based on the overall score achieved for easier selection	1,4,5,6
			Enforce a formal training program for the new employees assigned to the PEP	3,4,6
			Establish priority list with the support of committee members to expedite the evaluation of urgently needed products	1,4,5,6
			Track the product performance after the placement in the field using the overall scores or risk rating on the evaluation form	1,2,5,6

APPENDIX 5 – SUMMARY OF DOT PEP SUCCESSES AND CHALLENGES

State DOT	• Specialties / Unique Points
California	**Successes:** • Revamped the program and specifications to create more transparency • Uses a centralized program to minimize the wastage of resources from evaluation of redundant products (Carr, 2002) **Challenges:** • Lack of response from some technical committees on the product review • Do not include personnel from top management in the evaluation program committee
Connecticut	**Successes:** • Use Oracle software to manage the approved product list database • Dedicates significant time for employee training • Plans to create a miscellaneous category for products with unique features and specifications. • Extra care and documentation for potentially hazardous products • Receives an annual funding of approximately $200,000 for the management of evaluation processes **Challenges:** • Require a product champion to review, test, and create specification for the product • Difficult to accommodate and manage large number of products in a single category within a QPL. • Hard to find the right fit or category for few unique products
Delaware	**Successes:** • All products must be tested and approved each time before usage • Conduct follow-up inspections to track the product's performance • Modify/update specifications based on the analysis of products with poor track records **Challenges:** • Do not maintain an Approved Product List (APL) • Additional work load due to the repeated evaluations of same product

Maine	**Successes:** • Aims to enforce a system that boots non-active and obsolete products from the approved product list • Maintain extra documentation for products with fly ash • Uses a program called what's new to update the content on the web server **Challenges:** • Does not track the performance of the products on the approved list • Weak communication among the people in the field and in the office
Minnesota	**Success:** • Tracks the installation of various products on the approved list **Challenge:** • The changes in the evaluation program are poorly communicated
Utah	**Successes:** • Allows vendors/manufacturers to provide input • Test results from the independent labs must be within one year of the submittal date • The APL database is used throughout the Utah DOT **Challenges:** • The Regional Engineer can choose a product that is not on APL • It is difficult to ensure the validity of the information provided by the vendor

APPENDIX 6 – MODIFIED PRODUCT EVALUATION PROGRAM FLOWCHART