

VIRGINIA DEPARTMENT OF TRANSPORTATION

# LOCATION AND DESIGN DIVISION

## INSTRUCTIONAL AND INFORMATIONAL MEMORANDUM

GENERAL SUBJECT: Practical Design Flexibility in the Project Development Process	NUMBER: IIM-LD-255.1
SPECIFIC SUBJECT:  Performance Based Practical Design	DATE: November 17, 2020
	SUPERSEDES: IIM-LD-255
APPROVAL:	Susan H. Keen, P.E. November 17, 2020 State Location and Design Engineer

Due to the number of Changes shading has been omitted.

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### CURRENT REVISION

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- Revised to reflect 2018 AASHTO Green Book adoption.
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### EFFECTIVE DATE

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- This memorandum is effective upon receipt.
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### INTRODUCTION

This memorandum rebrands as Performance Based Practical Design (PBPD) a key aspect of VDOT's Project Development Process formerly called Common Sense Engineering (CSE). The following information offers the foundation for overall thought and general policy to achieve more focused transportation improvements at lower costs. The goal of PBPD is to appropriately allocate limited resources to optimize system wide transportation improvements. This type of approach allows VDOT to focus on maximizing transportation system improvements statewide, rather than maximizing improvements in a select few locations.

The long term objective of PBPD is to build good projects everywhere and not perfect projects somewhere. By taking a more systematic approach, this objective can be more readily achieved.

PBPD is a “*design approach in which key design decisions are made with consideration of their anticipated effects on aspects of future performance that are relevant to the project purpose and need.*” -AASHTO Green Book 2018. PBPD does not dismiss engineering policies and/or standards. Rather, it aims to increase flexibility for the Project Sponsor and Project Team to produce more efficient, effective, and appropriate designs to meet the project purpose and need (scope). The most critical milestone in PBPD is the development of the project purpose and need (scope). It is this stage where the fundamental engineering decisions are made that will substantively influence the development of a project.

### **Performance Based Practical Design Philosophy**

Every proposed transportation improvement must look to achieve the most return for the least cost. However, VDOT will not overemphasize short-term cost savings without a clear understanding how such decisions could impact other objectives such as operational performance and life-cycle costs. It is the responsibility of the Project Team in conjunction with the Project Sponsor to provide the most efficient engineering solution (both cost and function) to achieve the purpose and need (scope) of the project. This will require multi-disciplinary project development especially where innovations are included.

VDOT made the transition in June 2015 to a new paradigm where the benefits of a project will be measured relative to its cost as required by the Commonwealth Transportation Board’s (CTB) Policy and Guidelines for Implementation of a [Project Prioritization Process \(§33.2-214.1\)](#). This process is commonly known as Smart Scale.

Transportation projects are scored based on an objective, outcome-based process that is transparent to the public and allows decision-makers to be held accountable to taxpayers. Once projects are scored and prioritized, the Commonwealth Transportation Board (CTB) has the best information possible to select the right projects for funding. Funding decisions are made based on the results of project scoring and prioritization.

The CTB’s policy requires a project to be rescored if the scope or estimate changes significantly such that the calculation of benefit relative to cost would be impacted. The use of PBPD is expected to result in more cost effective design solutions providing a better benefit to cost ratio for projects and a greater return on investment. PBPD is expected to result in more stable cost estimating, minimizing the need for rescoring.

Federal Highway Administration’s Performance-Based Practical Design initiatives and the May 23, 2016 [NCHRP Report 785](#), Performance-Based Analysis of Geometric Design of Highways and Streets both provide guidance on implementation of approach into the scoping and design of a project.

## **Performance Based Practical Design Objectives**

The results achieved by PBPD must be tangible to the traveling public to gain their support. The traveling public does not understand simply meeting an engineering or performance standard. Tangible results include improvements to safety, accessibility, congestion, asset condition, modal choice, quality of life, economic growth, land use, and environment. Therefore all projects must be consistent with the following principles:

- **Safety**
  - ❖ Projects will either make the facility safer or maintain the existing safety level.
  - ❖ No project will degrade the overall system safety.
- **Optimization**
  - ❖ VDOT will continue to use an asset management approach to all multimodal transportation systems managing pavements, bridges and roadway operations and safety features to provide maximum flexibility while maintaining or exceeding safety.
  - ❖ Ensure engineered solutions do not produce a legacy of maintenance problems.
- **Public Support**
  - ❖ It is VDOT's responsibility to provide clarity regarding the project purpose and need (scope) and to ensure that we accurately convey and provide the benefits to the traveling public.
  - ❖ PBPD will help ensure localities bring their leadership (elected officials) into the design process earlier to ensure all stakeholders have a clear view on project expectation, costs and challenges.
- **Maximization of Project Budgets**
  - ❖ Setting the purpose and need (scope) is critical in the plan development process so that funding can target the specific need.
  - ❖ VDOT's purpose and need should clearly outline the scope of the project with the fiscally constrained obtainable solutions. VDOT's goal is to get the best value for the least cost.

## **Intended Consequences of Performance Based Practical Design**

- Identify intended outcomes –This step defines the purpose and need for the project as early as possible in the plan development process and should be the driving force behind project decisions that are made throughout the life of the project. Focus is on defining a very specific purpose and need (scope) and then addressing those identified specific aspects of roadway performance within the confines of the project's purpose and need (scope) and conserving project resources to be utilized for additional improvement projects later or elsewhere on the system network. Life Cycle costs should be evaluated when developing the purpose and need (scope). Stakeholders' desires/wants must be within the purpose and need (scope) of the project. This is

accomplished by having the stakeholders involved in development of the purpose and need.

- Establish preliminary geometric design criteria – The development of preliminary design criteria and the use of design exceptions or waivers that satisfy the identified intended outcome is necessary to evaluate performance in subsequent steps. Risk identification and management is an important part of this step. (For guidance on Risk, please refer to [PMO-15.0](#).) Design flexibility may, in some cases, involve leaving some geometric design elements unchanged, if there are no proven safety or operational issues, even if they do not meet the current design criteria. The design starts with the existing conditions and then builds upward to meet the objective of the purpose and need (scope). Consideration of design exceptions and waivers to achieve a balance of project needs and community values will be evaluated on a case-by-case basis.
- Evaluate performance outcomes - At this point, the project team must gather some additional information and perform various analyses to determine the effectiveness of the geometric design.
- Refine alternatives – Based on the performance outcomes, the project team may need to re-assess the alternatives to confirm that they still align with the targeted project purpose and need. The alternatives may need to be modified in order to meet the expected level of performance. The project team must have a clear understanding of how certain design criteria can affect the performance outcome and ultimately meet the project’s targeted purpose and need.
- Select alternatives – By following this process, the design team should ultimately identify the most cost effective approach alternative for the project.

## **Roles and Responsibilities**

- The success of PBPD is dependent upon the communication generated between the two principal working groups responsible for project development: the Project Sponsor and the Project Team. Below is a brief description of these two group’s duties and responsibilities in implementing PBPD.
  - ❖ **Project Sponsor**
    - Assist in the development of the project’s purpose and need (scope).
    - Provide a clear understanding of each project’s overall impact to VDOT’s program objectives.
    - Provide budgetary expectations based upon the purpose and need/scoping of the project.
    - Support project team when alternative solutions are provided to meet project objectives.

### ❖ **Project Team**

- Provide engineering improvements that meet the purpose and need (scope) of the project and eliminate any proposed improvements that do not meet the purpose and need (scope) of the project.
- Evaluate all plausible project improvements in a corridor context while exercising every effort to stay within the purpose and need (scope) of the project.
- Engineer based on a “build up” philosophy from a project’s existing conditions to meet the project’s purpose and need (scope).
- Development of a sound and realistic budget based upon all available project information during the scoping phase. Coordinate PBPD solutions with other stakeholders (both internally and externally) such as Residencies, Districts, other VDOT Divisions, Regions, Metropolitan Planning Organizations, Planning Districts, Localities, Businesses, the Public, and Emergency Service Providers, etc.

### **Summary**

The overall objective of VDOT is to appropriately allocate limited resources to optimize system wide transportation improvements. VDOT must ensure that every project, every engineering decision, every dollar on every project budget is focused on improving VDOT’s overall transportation system. There must be an overall systematic synergy created between all facets of program development (planning, engineering, right-of-way acquisition, construction, operations and maintenance) which has a sole focus of improving VDOT’s transportation system. Implementation of PBPD will also necessitate cultural and systematic change. VDOT will adopt and adapt to a new way of thinking and the inclusion of alternative design strategies for delivering its transportation improvement program. This process will require full and complete integration of PBPD methodology along with Context Sensitive Solutions ([IIM-LD-235](#)) throughout the agency to unify and enhance project planning, scoping, design, construction, and maintenance operations. The end result will improve and ensure VDOT’s ability to deliver the best valued projects while enhancing safety, mobility and economic growth throughout the state.

By following this Performance Based approach the project team is able to develop viable solutions that meet the targeted project purpose and need. Project team members are encouraged to obtain the NCHRP Report 785 for more detailed guidance and examples of Performance Based Design.

SYIP

District PE Manager

Residency has the option to do Tier I work or can pass along to District

Tier I

Tier II

Project Selection Criteria

- ❖ No Plan (Small Projects)
- ❖ State Forces/Hired Equipment
- ❖ Pipe Jacking projects
- ❖ Involves replacement in kind/routine maintenance to existing dimensions, lines and grades
  - ❖ Pipes on existing line and grade
  - ❖ sidewalks, curb and gutter, drop inlets, medians
  - ❖ Non-bridge classifications/culverts less than 36 sq. ft.
    - For larger structures, consult with the District Bridge Engineer
- ❖ Standards and Specifications work
- ❖ See IIM-LD-249

- ❖ All Federal Oversight (FO) Construction, Routine Maintenance and Operations Projects
- ❖ All NFO Construction Projects > \$10 M Construction Cost, and;
- ❖ All Projects procured as Design Build
- ❖ See IIM-LD-249

NO

District PE Manager evaluates project in consultation with responsible charge engineer in residency for residency design consideration. Could be situation where residency/district do project together

YES

YES

NO

Residency

District/  
CO Design