pennsylvania
DEPARTMENT OF TRANSPORTATION

482-13-13

DATE: May 30, 2013

SUBJECT: Design Manual, Part 1, Chapter 2
Design Manual, Part 1C, Chapter 2
Design Manual, Part 1X, Chapter 1
Design Manual, Part 1X, Appendix AC
Planning and Project Development Guidance for Roundabouts
Design Manual, Part 1X, Appendix AD
Study Process to Evaluate Bridge Closure and Removal

TO: District Executives

FROM: George W. McAuley, Jr., P.E. /s/ R. Wayne Willey, P.E.
Acting Director
Bureau of Project Delivery

This Strike-off Letter (SOL) is time and cost neutral. It is to issue Appendix AC, "Planning and Project Development Guidance for Roundabouts" and Appendix AD, "Study Process to Evaluate Bridge Closure and Removal" to the September 2010 Edition of Design Manual, Part 1X (Publication 10X). Although these topics are unrelated, they affect the same areas of the DM-1 Series of manuals. Therefore, they are being issued under one SOL.

This SOL also includes revised pages to Design Manual, Part 1 (Publication 10), Chapter 2 and Design Manual, Part 1C (Publication 10C), Chapter 2 for cross reference to the new Appendicies. An updated introduction for DM-1X is also provided.

Appendix AC is being issued to ensure that roundabouts are being considered during the Planning Phase of project development. The appendix will also assist the Districts in determining the feasibility and prudency of roundabouts at specific locations, as well as provide guidance on various planning and project development activities of projects for which a roundabout may be a viable option.

Appendix AD is being issued to describe the study process to evaluate bridge closure and removal. As part of bridge asset management, the inventory of bridges should be optimized by removing state- and locally-owned bridges that are operationally redundant. This evaluation process can be used to evaluate bridges at a regional, county, or corridor level, or be used to evaluate single or multiple bridge locations for a specific project. MPOs and RPOs will be the lead for the study and should work with PennDOT Districts and local municipalities to conduct the study.

The updates made by this SOL will be incorporated into the next change or reissuance of Design Manuals, Part 1, Part 1C, and Part 1X.

If there are any questions regarding Appendix AC, please contact Mr. David J. Azzato, P.E., Chief, Highway Design and Technology Section, Bureau of Project Delivery at 717-787-3732. If there are any questions regarding Appendix AD, pleased contact Mr. Thomas P. Macioce, P.E., Chief, Bridge Design and Technology Division, Bureau of Project Delivery at 717-346-9904.

Attachments

4822/JDB/ses/soldm1x052913

cc: FHWA
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- Alignment - change the roadway by either reducing or eliminating horizontal and vertical curves, or changing the roadway's superelevation.
- Structures - replace or rehabilitate structures of any length.
- Other roadway work items - replace and/or repair existing guide rail, signs, traffic signals, pipes, culverts, drainage systems, etc.
- Various minor safety improvements.

The maintenance and restoration of Pennsylvania's existing highway and bridge system is a priority. During LRTP and TIP development, it is vital that asset management needs be considered and funded first (Asset Management – see Appendix B, Glossary, in Publication 10X, Design Manual Part 1X, *Appendices to Design Manuals 1, 1A, 1B, and 1C*) to ensure the viability of the Commonwealth's highway network. The PennDOT Districts and their Planning Partners develop prioritized lists of highway restoration needs. The Program Center considers available funding and aggregates the regional TIPs into PennDOT's recommended State Transportation Improvement Program (STIP). The recommended program is submitted to the State Transportation Committee (STC) for review and adoption.

The highway restoration program focuses on the restoration of Interstate highways, expressways, other state highways, and local roads. Not only is the existing network systematically improved and restored, but improved mobility and safety is considered for all travelers, including pedestrians and bicyclists.

Specific highway restoration programs and definitions of each include:

- Preventive Maintenance (PM). These projects involve tasks such as pothole repair, crack and joint sealing, pipe cleaning, milling and resurfacing, etc. The purpose of preventive maintenance is to maintain the integrity of the transportation network. For information regarding pavement preservation, see Publication 242, *Pavement Policy Manual*, Appendix G and Publication 15M, Design Manual 4, Chapter 5, *Bridge Preservation*.
- Roadway and Bridge Rehabilitation (3R) - Resurfacing, Restoration and Rehabilitation. These projects selectively upgrade existing highway safety, highway features, and roadway features without the cost of full reconstruction. Publication 13M, Design Manual Part 2 provides specific design criteria for 3R projects. Refer also to the Transportation Research Board's Special Report 214, *Designing Safer Roads, Practices for Resurfacing, Restoration, and Rehabilitation*, and related publications for guidance.

Highway restoration projects differ from capital projects since the project is primarily within the existing right-of-way (not on new location). These projects involve minimal reconstruction of the roadway and often use state funds from the county's annual Appropriation 582 maintenance budget. Most Interstate and expressway restoration projects are considered capital projects (see Section D below on the Interstate Restoration Program), with federal funds being matched with Appropriation 581 funding, which are state funds for capital projects. The identification of highway restoration projects for programming is based upon a variety of factors, including:

- Deficiencies identified in Systematic Techniques to Analyze and Manage Pennsylvania Pavements (STAMPP).
- Continuation of the priority corridor approach to restoring state routes.
- Project coordination with other highway or bridge projects.
- Inclusion of minor safety improvements in the restoration project.
- Replacement or rehabilitation of bridges.
- Coordination of projects with the District's Business Plan, pavement cycles, and the surface treatment program.
- Public Input.

Roadway restoration projects can require an extended design phase to complete all environmental clearance, utility relocation, design review and right-of-way acquisition requirements. To insure that projects are let in the year they are programmed for construction, costs associated with these activities are usually programmed at least one year before construction.

B. Bridge Program. PennDOT typically considers a bridge as any elevated structure, carrying a roadway or railroad, that is 2.4 meters (m) [8 feet (ft)] or greater in length. By this definition, there are approximately 55,000 bridges in Pennsylvania, including all highway and railroad bridges that overpass highways. Federal regulations limit the use of Federal critical bridge funds to the replacement or rehabilitation of structures 6 m (20 ft) or greater in length that satisfy specific condition criteria. The Bridge Program uses a combination of federal, state (Act 26, see Section 5.4), and local funds and, generally, gives priority to projects that address closed and weight restricted bridges. State funding is provided from the bridge-restricted account for state bridges (Appropriation 185) and local bridges (Appropriation 183). State law limits the level of state participation for local projects to 80% of the non-Federal share.

The Districts, in coordination with MPOs, RPOs and local officials, develop prioritized lists of bridge project candidates. As with the highway restoration program, the Program Center considers available funding and aggregates the regional TIPs into PennDOT's recommended STIP. The recommended program is submitted to the State Transportation Commission for its review and adoption.

For more information on PennDOT's local bridge program, including program management, eligible projects, right-of-way, utility and construction approvals, and funding issues, see Publication 541, *Local Bridge Program Delivery Manual*.

For information regarding bridge preservation, see Publication 15M, Design Manual Part 4, Chapter 5.

For information regarding the Study Process to Evaluate Bridge Closure and Removal, see Publication 10, Part 1X (DM-1X), Appendix AD.

C. Safety and Mobility Programs. Safety and mobility programs provide an expanded and comprehensive approach to highway safety improvements. The success of a safety and mobility program depends on the cooperation of the Planning Partners, PennDOT and other agencies. The range of typical safety and mobility project improvements include:

- Intersections
- Interchanges

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depending on the project scope, CE/ED Level 2). Pre-TIP purpose and need information/documentation should be verified and serve as the basis for development of the project during the Post-TIP Preliminary Engineering and NEPA Project Delivery Phases.

Detailed discussion on Purpose and Need follows in Chapter 3, Section 3.3.B.1 of this manual. Also, see PennDOT Publication 319, *Needs Study Handbook* for information on preparing and documenting Project Purpose and Need, and the American Association of State Highway and Transportation Officials (AASHTO) Practitioner's Handbook #07, *Defining Purpose and Need and Determining the Range of Alternatives for Transportation Projects*.

B. Pre-TIP Conceptual Alternatives Analysis. During the Pre-TIP phases a conceptual alternative analysis should be completed by the MPO/RPO with assistance from PennDOT, particularly for higher Class of NEPA Action projects (EIS, EA, EER, and possibly, depending on the project scope, CE/ED Level 2. This conceptual alternatives analysis should focus on identifying potential solutions and assessing whether or not they will meet project needs. Both traditional (turning lanes, new travel lanes, new alignment options, etc.) and non-traditional (traffic calming, transit options, transportation system management options, etc.) solutions should be considered, as should use of alternative modes of transportation to meet project needs. Low-cost options should be considered first, with higher cost options only being considered if low-cost options that meet project needs cannot be identified. For more information, refer to the AASHTO Practitioner's Handbook #07, *Defining Purpose and Need and Determining the Range of Alternatives for Transportation Projects*. Additionally, due to the significant safety and operational benefits of roundabouts, they are to be considered for all significant intersection and corridor improvement projects. Supplemental roundabout guidance pertaining to planning, cost/benefit methodology and public involvement is provided in Design Manual Part 1X, Appendix AC, Planning and Project Development Guidance for Roundabouts.

Due to asset management considerations, as part of the project development process, an evaluation of the benefits of eliminating a bridge versus upgrading the existing bridge is to be considered. The process to evaluate the elimination of a bridge is contained in Publication 10, Part 1X (DM-1X), Appendix AD.

A high level of engineering is not required at this stage; however, input from PennDOT engineers should be sought to help identify and conceptually analyze potential solutions. As stated in Section 3.3A of this manual, potential solutions should not only attempt to meet project needs, but fit the scale of the project and the area's context. PennDOT's Publication 10B, *Design Manual Part 1B* contains more information on factors to consider when analyzing solutions (potential alternatives).

Documentation of the Conceptual Alternatives Analysis is very important during the Pre-TIP phases. For the analysis to be useful during the Post-TIP NEPA phases, the documentation must clearly layout:

- What alternatives were evaluated, including the process for selecting alternatives to analyze?
- How the analysis was conducted (methodology).
- The results of the analysis, including:

- How alternatives meet the needs
- Preliminary construction cost estimates for each alternative
- Preliminary environmental impacts for each alternative (based on readily available, existing data from resource agencies and other sources).
- What alternatives were deferred from consideration and why.
- What alternatives should be moved forward to the Post-TIP phases and why.

C. Pre-TIP Cost Estimate. During the Pre-TIP phases, a preliminary, but justifiable, estimate of project costs should be developed for alternatives recommended to the TIP. This preliminary design and construction cost estimate will become the basis for the project costs funded on the TIP. It will also be the baseline for comparison of future updated construction cost estimates. The Pre-TIP preliminary project cost estimate should include careful consideration of inflation factors. Refer to the latest TIP/STIP Financial Guidance (PennDOT, Office of Planning, Center for Program Development) for more information. Costs should be inflated to the anticipated year of use; in other words preliminary construction costs should be inflated to the estimated construction let date (Year of Expenditure). The importance of this Pre-TIP project cost estimate cannot be overstated. This estimate provides the amount that will be programmed for funding and should accurately reflect the project scope and scale to avoid cost overruns to all extents possible.

Estimating and containing project costs is a key project management responsibility that begins at screening and continues throughout project development and delivery. One of the primary functions of screening is to develop an accurate preliminary project (design and construction) cost estimate of proposal costs, use it as the programmed cost for the TIP, and compare it to the future updated cost estimate. This preliminary project cost should be held as the baseline for the project and revisited throughout project development as the project becomes increasingly well defined.

An effective way of containing project costs is to control project scope at the screening field view, if held during Step 4 and at the Scoping Field View held in Step 6 and throughout project development. It is important that the Scope of Work developed at the Scoping Field View be achievable within the budget that will be approved by the Program Management Committee (PMC). For projects to be constructible, they must be fundable.

The project cost estimate should be based on realistic estimates for the time of expenditure of the following costs:

- Preliminary Engineering (including the need for consultant services)
- Final Design
- Right-of-Way
- Utilities
- Railroad coordination
- Mitigation Commitments
- Construction
  - Construction Inspection

- Construction Consultation (Refer to Publication 352, *Estimating Manual*, *Figure 4.2* for more information).

PMC action will be required if at any time estimated costs exceed the programmed costs as shown on the TIP by $1 million or more. The Project Manager is to submit this information, including historical cost information, to the District Planning & Programming Manager for presentation to the MPO or RPO, PennDOT, and FHWA/FTA. Justification for cost increases will focus on project cost and scope, and any cost containment measures that have already been taken. Estimated costs exceeding programmed costs by less than $1 million, but more than $500,000, require action by the Center for Program Development and Management. Estimated costs exceeding programmed costs by less than $500,000 require approval from the District Executive. More information on construction cost estimating for PennDOT projects can be found in Publication 352, *Estimating Manual*.

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CHAPTER 1: INTRODUCTION

1.0 PURPOSE AND OBJECTIVES

The purpose of Design Manual Part 1X is to provide the appendix items supporting Design Manuals 1, 1A, 1B, and 1C for Pennsylvania Department of Transportation's (PennDOT's) Transportation Program Development and Project Delivery Process. PennDOT developed these manuals to serve as a guide for planners, environmental staff, engineers, administrators, and others, both within and external to PennDOT, who are responsible for project delivery. The Transportation Program Development and Project Delivery Process (Process) and its procedures, discussed in this and the other Design Manuals, were developed by PennDOT with input from the MPOs/RPOs, counties, municipalities, resource agencies, District representatives, Office of Chief Counsel, and the Federal Highway Administration (FHWA). The information is PennDOT guidance for project delivery and implementation but not a federal or state regulation. Following this guidance will assist in assuring compliance with relevant state and federal requirements.

1.1 ORGANIZATION

A. Design Manual Family of Documents. This manual is Part 1X of a nine-volume series of documents that encompass PennDOT's Design Manual. The Design Manual series of documents includes:

Publication 10	Part 1	*Transportation Program Development & Project Delivery Process*	Design Manual Part 1	(DM-1)
Publication 10A	Part 1A	*Pre-TIP and TIP Program Development Procedures*	Design Manual Part 1A	(DM-1A)
Publication 10B	Part 1B	*Post-TIP NEPA Procedures*	Design Manual Part 1B	(DM-1B)
Publication 10C	Part 1C	*Transportation Engineering Procedures*	Design Manual Part 1C	(DM-1C)
Publication 10X	Part 1X	*Appendices to Design Manuals 1, 1A, 1B, and 1C*	Design Manual Part 1X	(DM-1X)
Publication 13M	Part 2	*Highway Design*	Design Manual Part 2	(DM-2)
Publication 14M	Part 3	*Highway Plans Presentation*	Design Manual Part 3	(DM-3)
Publication 15M	Part 4	*Structures*	Design Manual Part 4	(DM-4)
Publication 16M	Part 5	*Utilities*	Design Manual Part 5	(DM-5)

B. Contents of Design Manual Part 1X. Design Manual Part 1X, *Appendices to Design Manuals 1, 1A, 1B, and 1C*, contains 27 appendices. This section provides a list of the appendices.

APPENDIX A, *LIST OF ACRONYMS*

APPENDIX B, *GLOSSARY*

APPENDIX C, *FHWA/PENNDOT STEWARDSHIP & OVERSIGHT AGREEMENT*

APPENDIX D, *QUALITY MANAGEMENT MANUAL FOR PROJECT DEVELOPMENT*

APPENDIX E, *AGENCY COORDINATION MEETING OPERATING PROCEDURES*

APPENDIX F, *GUIDANCE FOR COMPILING TECHNICAL SUPPORT DATA*

APPENDIX G, *SAMPLE FHWA PURPOSE AND NEED CONCURRENCE LETTER*

APPENDIX H, *EA AND EIS DISTRIBUTION LISTS*

APPENDIX I, *SAMPLE FONSI AND FONSI RELATED CORRESPONDENCE*

APPENDIX J, *SAMPLE PROJECT INITIATION LETTER*

APPENDIX K, *SAMPLE PARTICIPATING AGENCY INVITATION LETTERS*

APPENDIX L, *SAMPLE COORDINATION PLAN AND SCHEDULE*

APPENDIX M, *SAMPLE STATUTE OF LIMITATIONS NOTICE*

APPENDIX N, *CONSTRUCTIBILITY REVIEW PROCEDURES FOR HIGHWAY AND BRIDGE PROJECTS*

APPENDIX O, *SAFETY REVIEW PROCEDURES*

APPENDIX P, *DESIGN EXCEPTIONS*

APPENDIX Q, *POINTS OF ACCESS*

APPENDIX R, *DESIGN VALUE ENGINEERING REVIEW PROCEDURES*

APPENDIX S, *BICYCLE AND PEDESTRIAN CHECKLIST*

APPENDIX T, *ENVIRONMENTAL COMMITMENTS AND MITIGATION TRACKING SYSTEM (ECMTS) PROCESS*

APPENDIX U, *PS&E SUBMITTAL REVIEW CERTIFICATION LIST*

APPENDIX V, *BRIDGE AND ROADWAY PROGRAMMATIC AGREEMENT*

APPENDIX W, REAL PROPERTIES PROGRAMMATIC AGREEMENT

APPENDIX X, LEVELS 1 – 3 SCREENING FORMS

APPENDIX Y, SECTION 106 PROGRAMMATIC AGREEMENT

APPENDIX Z, REPAYMENT OF PRELIMINARY ENGINEERING COSTS

APPENDIX AA, EA REEVALUATION TRANSMITTAL FORM

APPENDIX AB, MINOR PROJECTS DESIGN PROCEDURES FOR CONSULTANT DESIGNED PROJECTS

APPENDIX AC, PLANNING AND PROJECT DEVELOPMENT GUIDANCE FOR ROUNDABOUTS

APPENDIX AD, STUDY PROCESS TO EVALUATE BRIDGE CLOSURE AND REMOVAL

1.2 PROCEDURES FOR MODIFICATIONS OR ADDITIONS TO THIS DOCUMENT

This Design Manual is published in digital form to facilitate future changes and additions. PennDOT recognizes that the regulations and policies affecting its procedures are continuously changing and that this manual must be a dynamic document to remain current. Whenever

modifications or additions are required to improve the present procedures, the following procedure shall be followed:

1. Bureau Directors and District Executives should submit suggestions in the form of revised pages in digital form to the Central Office Bureau of Project Delivery for evaluation and processing. The Bureau of Project Delivery is to evaluate and process the submittals, and coordinate with other Central Office Deputates and Bureaus as necessary concerning any changes and/or additions. The suggestions should include:

   - The title and page number of the existing procedures if applicable.
   - The recommended revised page(s) and the Appendix into which it (they) should be incorporated.
   - The reasons for recommending modifications or additional procedures.

2. The Director, Bureau of Project Delivery, will review the recommended changes or additional procedures and transmit copies to the various affected Bureau Directors for their comments.

3. The affected Bureau Directors shall provide their comments to the Director, Bureau of Project Delivery, who will take appropriate action.

4. The Director, Bureau of Project Delivery, will submit the final version of all changes to FHWA for approval prior to issuing the revised manual.

5. When modifications or additions are made to pages in this manual, a revision date will be indicated in the upper right-hand or upper left-hand corner, and the revision will be distributed by the Bureau of Project Delivery by Transmittal Letter.

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APPENDIX AC

PLANNING AND PROJECT DEVELOPMENT GUIDANCE FOR ROUNDABOUTS

AC.0. INTRODUCTION

Modern roundabouts, which first appeared in the United States in the early 1990s, are becoming an increasingly popular form of intersection. Roundabouts offer a number of benefits compared to signalized and stop-controlled intersections. *NCHRP Report 672, "Roundabouts an Informational Guide, Second Edition"* identifies a 35% reduction in total crashes and 76% reduction in injury crashes when an existing intersection is converted to a roundabout. Other studies have identified reductions in pedestrian and bicycle crashes and more than a 90% reduction in fatal crashes. Roundabouts often operate with less delay and lower volume to capacity ratios than similarly-sized signalized intersections, as drivers may proceed when no conflicting vehicles are present. Roundabouts also eliminate the need for traffic signal maintenance and electrical supply when they are used in lieu of a signal. Also, roundabouts often eliminate the need for lanes, such as left-turn lanes, at an intersection.

The FHWA promotes the consideration and implementation of roundabouts as one of nine proven safety countermeasures and indicate that they should be considered in the following situations:

- As an alternative for intersections on federally funded highway projects that involve new construction or reconstruction.
- When rehabilitating existing intersections that have been identified as needing major safety or operational improvements.
- At freeway interchange ramp terminals and at rural high-speed intersections.

Refer to http://safety.fhwa.dot.gov/provencountermeasures for additional FHWA guidance on safety countermeasures.

PennDOT's current policy statement regarding roundabouts is as follows: *"When planning intersection improvements, a variety of improvement alternatives should be evaluated, including roundabouts, to determine the most appropriate alternative."*

Therefore, a roundabout option shall be considered for all moderately complex and major intersection, interchange and corridor projects. They are also to be considered for any intersection project that would otherwise require the addition of left turn lanes.

The following guidance is being provided to enhance existing planning and project development guidance. It focuses on Planning, Cost/Benefit Methodology, and Public Involvement to assist in determining locations where a roundabout may be a viable option. For roundabout design guidance refer to *Design Manual, Part 2, Highway Design (DM-2), Chapter 3, Intersections.*

AC.1. PLANNING

The District should work in cooperation with their Local Municipal officials, County Planners, and the Metropolitan and Rural Planning Organizations (MPO/RPO) for their region during planning to determine potential candidate sites for roundabouts.

Potential roundabout candidate sites should be evaluated during the Linking Planning and NEPA process. Recommendations for roundabout consideration should be documented in the LPN Screening Form.

The District may choose to conduct a screening of a county or multiple counties using the Expedited Screening Guidelines for Single Lane Roundabouts provided below. This may be accomplished with assistance of a consultant by developing a Work Order under an active Open End Agreement or new Agreement. The funding source and involvement of various Central Office areas such as the Planning Deputate, the Bureau of Maintenance & Operations and the Bureau of Project Delivery should be coordinated through the Statewide Roundabout Coordinator.

The Expedited Screening Guidelines were developed for single lane roundabouts. However, multi-lane roundabouts should also be considered where appropriate as per DM-2, Chapter 3, NCHRP-672 and the 2010 HCM.

A. Expedited Screening Guidelines for Single Lane Roundabouts

These guidelines have been developed to expedite selection of candidate sites for single lane roundabouts during Pre-TIP and TIP Planning. The guidelines presented are only intended for initial screening and do not represent mandatory criteria for roundabouts. Therefore, these guidelines are not to be used when time is available for thorough analysis of a site, such as during Step 6, "Preliminary Engineering / NEPA Decision" of the Transportation Program Development and Project Delivery Process. As always, sound land use principles including the expected or best use of the surrounding land should be accounted for when selecting appropriate roundabout locations.

The site selection should be based on one or more of the following three primary needs:

- Safety
    - High crash locations. This can be obtained from:
        - The Statewide High Crash Location List
            - The initial focus should be on the top 5% of locations
        - The Intersection Safety Implementation Plan (ISIP)
        - Stop controlled intersection crash cluster locations
            - Crash Data Analysis and Retrieval Tool (CDART) Statewide Year End Cluster Report

- Capacity
    - Intersections with operational issues
        - Level of Service D, E or F

- Access
    - Intersections with more than four legs
    - Highway Occupancy Permit locations

The following existing site conditions are desirable:

- ADT < 20,000 (All legs combined)
- PHV on the critical leg plus conflicting flow < 1,300
- Profile grade ≤ 4%
- Skew angle ≥ 75°

The following site conditions may limit the prudency and/or effectiveness of a roundabout:

- Locations that would require displacements.
    - Right-of-way impacts (Account for sidewalk, buffer and cut/fill slopes)
        - Inscribed Diameter of 130-ft. to 180-ft. (WB-67) – Use 190-ft. (State Routes)
        - Inscribed Diameter of 105-ft. to 150-ft. (WB-50) – Use 160-ft.
- Locations with multiple Section 4(f) properties.
- Intersections close to signalized intersections. (Use 1,000-ft.)
- Corridors with frequent signalized intersections unless upgrading entire corridor.
- Intersections close to active Railroad crossings. (Use 1,000-ft.)
- Intersections with high pedestrian activity. (i.e. city centers)
- Intersections with oversize loads usage and no alternate route available.
- Intersections on emergency detour routes for roadways with oversize loads usage.

The following are several examples of sites where a roundabout should be considered when the above needs and conditions are met:

- Intersections where signals are proposed.
- Intersections where beacons are existing.
- Intersections where widening for turn lanes is proposed.
- Intersections with 4-way stop control within 5 years of signal warrant capacity.
- Intersections where safety improvements are proposed.

AC.2. COST/BENEFIT METHODOLOGY

This section outlines items to include in a cost/benefit (C/B) analysis along with measurement techniques and sources of cost information to determine the cost effectiveness of a roundabout option. This methodology may be used during Planning and/or Project Development. An Intersection Cost Comparison Spreadsheet is available for Department use through the Statewide Roundabout Coordinator.

A. Safety Benefits

At an existing signalized or stop-controlled intersection, the safety benefits of roundabouts can be quantified by the number of crashes expected to be reduced at an intersection. The 2010 Highway Safety Manual (HSM) contains crash modification factors (CMFs) for changing intersection control in Chapter 14. For example, converting a signalized intersection to a roundabout has a CMF of 0.52 which is approximately a 48% reduction in total crashes. Converting a stop control intersection to a roundabout has a CMF of 0.56 which is approximately a 44% reduction in total crashes. These are for all settings (Rural, Urban, Suburban, Single-lane and Multi-lane Roundabouts), all types of crashes, and all severities. Reductions in injury crashes are more profound with the conversion of signalized and stop controlled intersections to roundabouts, 78% reduction in crashes (CMF 0.22) and 82% reduction in crashes (CMF 0.18), respectively. Fatalities are rare events, particularly at roundabouts. In the future, PennDOT will be developing State specific CMFs. Until that time, the national CMFs provided in the HSM are acceptable for use.

For a new intersection with no crash history, an average number of crashes for similar stop-controlled or signalized intersections in the area may be used as an assumed crash history if a stop-controlled or signalized intersection were constructed. CMFs may then be applied to the assumed number of crashes to estimate the reduction in crashes with a roundabout.

Table 1 shows the economic costs for crashes. The HSM as well as Pennsylvania specific values are provided. Due to terminology differences some values are blank.

Table1: Economic Costs for Crashes

Crash Severity	HSM Economic Cost	Pennsylvania Economic Cost
Fatal	$4,008,900	$6,146,552
Major Injury		$1,342,853
Disabling Injury	$216,000	
Moderate Injury		$89,803
Evident Injury	$79,000	
Minor/Unknown Injury		$7,130
Possible Injury	$44,900	
Property Damage Only	$7,400	$2,852
Fatal/Injury*	$158,200	

*Use when CMFs do not distinguish between injury and fatal crashes

B. Operational Benefits

Drivers at roundabouts often experience less delay than drivers at stop-controlled or signalized intersections. The steps to quantify the difference in delay are outlined below:

1. Compute peak-hour delay with and without a roundabout using the Highway Capacity Manual (HCM). Other software packages such as SIDRA, Arcady, RODEL, VISSIM and PARAMICS are available, but the HCM is the Department standard. Determine the difference between peak-hour delay per vehicle with and without a roundabout.

2. Compute the peak-hour delay savings for all vehicles passing through the intersection during the peak hour. Alternately, a delay per occupant may be used if an average number of occupants can be determined.
3. Compare peak-hour volumes to volumes in other hours and proportionally estimate delay savings for these other hours. Alternately, steps 1 and 2 could be computed for all hours of the day.
4. Once the total delay for all vehicles or occupants for a given time period (day, year, multiple years, etc) has been computed, apply the cost of time. PennDOT currently uses the urban mobility values established annually by the Texas Transportation Institute.

C. Fuel and Emissions Benefits

Roundabouts usually offer a reduction in delay compared to signalized or stop-controlled intersections, which results in a reduction in fuel consumption and emissions. Pollutants to include in an emissions analysis are carbon monoxide, carbon dioxide, hydrocarbons, and nitrogen oxides. Individuals do not directly bear any costs associated with emissions, so their inclusion in the cost-benefit analysis is optional.

In general, the reduction in fuel consumption (and emissions, if desired) may be quantified in two ways:

- The first method is to assume fuel consumption and emission rates, and apply these to the previously-calculated delay savings. The AASHTO Red Book, "User and Non-User Benefit Analysis for Highways" should be used for obtaining these rates.
- The second method is to use software to directly compute fuel consumption and emissions. Options include traffic analysis software or emission modeling software. Refer to Publication 46, Traffic Engineering Manual, Chapter 12 for PennDOT supported software.

Using either method, the associated cost is then computed using a one year rolling average retail price of gasoline and diesel fuel in the study area. Estimates for costs associated with emissions may be applied as well.

D. Operations and Maintenance Costs

Costs in this category associated with roundabouts include power and maintenance of lighting, and maintenance of pavement marking, signing, and landscaping.

Costs in this category associated with signalized intersections include maintenance of signal equipment such as the controller, bulbs, and detection equipment; electrical supply to the signal (approximately $3000 per year per NCHRP Report 672); and signal retiming every few years (approximately $2500 to $3100 per retiming per NCHRP Report 672). Previously-noted costs associated with roundabouts (lighting, pavement marking, signing, and landscaping) apply as well.

AC.3. PUBLIC INVOLVEMENT

This section discusses public involvement activities for projects where a roundabout may be a viable option. Public involvement may be minimal during planning, but should be a significant focus during project development. Refer to Publication 295 "Public Involvement Handbook" for general public involvement guidance. Guidance is provided here in regards to the purpose and audience of public involvement; and public involvement activities that are recommended.

A. Purpose and Audience

While roundabouts often have clear benefits associated with traffic safety and efficient operations, negative public perception based on other types of circular intersections remains the greatest hindrance to the implementation of roundabouts. Without predetermining the alternative, targeted public involvement activities can help provide fact-based data for local media and the public in order to encourage objective consideration of a proposed project where a roundabout is a viable option. The focus of the education activities are not to advocate for the construction of roundabouts, but to provide factual information on the safety, efficiency of operation, and ease of use of roundabouts compared to other intersectional alternatives for the proposed location.

As noted in *NCHRP 672: Roundabouts an Informational Guide: Second Edition*, public involvement activities should be tailored towards a particular audience, which may include the audiences identified in Table 2. Since roundabouts affect stakeholders in different ways, the message or activity should be adjusted according to the target audience. In addition, the level of effort required can vary considerably based on the audience's previous experience with roundabouts.

Table 2: Key themes and the target audience of a roundabout education program

Key Themes of Roundabout Education Activities		**Target Audiences**	
• **General Description**, including a historical perspective • **Identification of roundabouts**, including the difference between roundabouts and traffic circles • **Safety**, including overall crash rates and crash severity • **Efficiency and capacity,** focused on the user-level experience	• **Environmental and economic impacts** of roundabouts compared to other intersection treatments • **Maintenance and Construction of a Roundabout** • **Role of a roundabout in the 21st century transportation system**, including the use of roundabouts as gateway treatments, land-use and air-quality issues, and other transportation planning issues like sustainability, large-scale evacuation and climate-change adaptation.	**Stakeholders** • Police Department • Fire Department • Advocacy groups for the visually-impaired • Trucking industry • Transit operators • Other groups	**Citizens** • Older drivers • Younger drivers • Driving instructors • Pedestrians • Bicyclists • School students • Amish

B. Public Involvement Activities

Public involvement activities may be presented in a variety of ways using several different tools. Presented below are several examples of mediums and tools used as roundabout education activities by other jurisdictions throughout the United States. Most of the information provided has either been developed in-house by the various agencies, or with the help of consultants or other outside organizations. Additionally, it could be helpful to work in collaboration with local organizations or national organizations with a local presence such as AARP and Motor Carrier groups to not only identify issues important to each stakeholder group, but also develop strategies for targeted education efforts.

The public involvement activities briefly described below can engage and educate the public during the course of project development where a roundabout is a viable option. The following section provides recommendations for the types of activities, and their use at the different stages in the project development process.

B.1. Public Meetings

Public meetings that allow for direct engagement with the public, and the opportunity to bring the public into the design process are important. This allows for early identification of potential problems, the ability to highlight issues important to a community, and the project to gain acceptance through public ownership of the proposed project. Prior to environmental clearance, all viable options must be presented without presupposing an alternative.

A general roundabout presentation should be given at the public meetings to inform the community of the benefits and operational characteristics of roundabouts. If possible, a local community leader should be utilized to either introduce the speakers or speak constructively of a roundabout option. A roundabout case study should also be presented. Classroom style public meetings to include driver education and presentations should be considered. Interactive scale models, videos, and traffic simulation are recommended at public meetings. Additionally, the attendees should be informed of the nearest existing roundabout and be given relevant information regarding its design and functionality.

B.2. Informational Brochures

The following informational brochures are available to educate the public about roundabouts:

- PennDOT Publication 578 – Single-Lane Roundabouts, General Information and Driving Tips for Motorists
- PennDOT Publication 579 – Roundabouts, General Information for Bicyclists and Pedestrians
- PennDOT Publication 580 – Multi-Lane Roundabouts, General Information and Driving Tips for Motorists
- FHWA Publication FHWA-SA-08-006 – Roundabouts A Safer Choice

Strategies for distributing the brochures include having them available at community gatherings or events, directly mailing them to citizens, placing them in rest areas and service stations, or placing them in grocery bags at local stores.

B.3. Media Announcements

Provide press releases and make key staff available for newspaper or television interviews in order to provide general information in regards to roundabouts. When a roundabout first opens, more specific project related information such as navigating the roundabout should be provided. In addition, the District may consider setting up a phone hotline to answer questions related to roundabouts.

B.4. Websites

It is recommended that project specific websites be developed for projects where a roundabout is a viable option.

The public should also be made aware of and directed to websites that provide general roundabout information. Many of the informational websites also host other roundabout education material such as brochures and videos. Additionally, some websites contain animations of roundabouts that include a simulation tool that shows vehicles and multimodal users navigating roundabouts.

The following websites are useful and contain links to other informational websites:

- http://safety.fhwa.dot.gov/intersection/roundabouts
- http://www.dot.state.pa.us – Search Roundabouts

B.5. Informational Videos

Informational videos have been effectively used throughout the country to educate and inform the public about roundabouts. Videos have been developed by various states. However, PennDOT does not currently have a general roundabout video. The videos can be used at public meetings in lieu of or in addition to a presentation, and can also be hosted on the project website or linked from the website to hosted sites like YouTube. Consideration should be given to displaying an informational video on televisions at local stores or malls and on local cable access stations. Additionally, videos can also be developed for use as 30-second public-service announcements for public access television or audio only for the radio.

C. Summary of Recommended Public Involvement Activities from Planning through Construction

Following is a summary of recommended public involvement activities from Planning through Construction. This is not intended to be an all inclusive list, as other innovative types of public involvement may arise.

C.1. Planning

During the planning stage of a project where a roundabout may be a viable option, the following public involvement activities are recommended:

- Informational Brochures
  - Make available at the public meetings, and at local municipal offices and other public locations.
- Websites
  - Direct the public to informational sites such as FHWA's and PennDOT's roundabout sites.
- Informational videos
  - Present at the public meetings and make available to municipalities.

C.2. Preliminary Engineering

During preliminary engineering where a roundabout may be a viable option the following public involvement activities are recommended:

- Public Meetings
  - Provide specific information on roundabouts at meetings with the public, elected officials and special interest groups
- Informational Brochures
  - Make available at the public meetings, and at local municipal offices and other public locations.
- Project Newsletters
- Websites
  - Develop a project specific website.
  - Direct the public to other informational sites such as FHWA's and PennDOT's roundabout sites.
- Informational videos
- Media announcements

C.3. Final Design

During final design the following public involvement activities are recommended:

- Public Meeting
- Informational Brochures
- Project Newsletters
- Website updates
- Media announcements

C.4. Construction

During construction the following public involvement activities are recommended:

- Website
  - The project website should be updated regularly to include significant changes in traffic patterns.

- Media announcements
  - Media announcements should be issued at the start of construction and when there are significant changes in traffic patterns.
- Changeable/Variable Message Signs
  - Changeable or variable message signs and other informative signing may be necessary upon the roundabout being open to traffic.

D. Public Education

Educating the public including local officials on the safety and operational advantages of roundabouts is key to ensuring increased implementation of roundabouts throughout the state. All Districts should take advantage of opportunities to inform the public of the benefits of roundabouts beyond just project specific instances. This may include having the previously mentioned brochures available in the reception area of the District Offices. The Districts may have their Roundabout Coordinator or other designee periodically present at MPO/RPO and Township meetings throughout their District.

The Pennsylvania Driver's Manual includes a page on roundabouts that covers instructions on using turn signals in a roundabout, and making decisions with pedestrians, bicycles and emergency vehicles.

A.C.4 REFERENCES

The following manuals are recommended for guidance when developing roundabout or potential roundabout projects:

- NCHRP Report 672, "Roundabouts an Informational Guide, Second Edition"
- AASHTO, "A Policy on Geometric Design of Highways and Streets"
- AASHTO, "User and Non-User Benefit Analysis for Highways"
- Highway Capacity Manual
- Manual on Uniform Traffic Control Devices
- Highway Safety Manual
- Publication 13M, Design Manual Part 2
- Publication 46, Traffic Safety Manual
- Publication 295, Public Involvement Handbook

There is also significant information related to roundabouts available on the internet that has been developed by the FHWA as well as various states and countries. Only a few sites have been referenced in this Appendix.

APPENDIX AD

STUDY PROCESS TO EVALUATE BRIDGE CLOSURE AND REMOVAL

AD.0. BRIDGE REDUNDANCY ELIMINATION PROCESS

The purpose of this GIS-based process is to identify bridges for removal that are operationally redundant. As part of bridge asset management, the inventory of bridges should be optimized by removing state- and locally-owned bridges that are operationally redundant. Removing operationally redundant bridges provides a long-term cost savings without negatively impacting traffic.

The MPOs and RPOs should work with PennDOT districts and local municipalities to develop a list of bridges that are operationally redundant. Those bridges will be prioritized and systematically added to the TIP for removal. The MPOs and RPOs will be the lead for the study. This process can be used to evaluate bridges at a regional, county, or corridor level, or be used to evaluate single or multiple bridge locations for a specific project.

The process below provides a methodology for identifying bridges that are candidates for removal. The methodology uses GIS-based screening, combined with additional study and coordination with transportation stakeholders. The results of this process will be incorporated into the Linking Planning and NEPA screening forms for proposed bridge removal projects as part of the process for selecting and prioritizing TIP projects.

Bridges being evaluated for the program shall not be currently on the TIP for major rehabilitation or replacement.

AD.1. THE PROCESS FOR IDENTIFYING OPERATIONALLY REDUNDANT BRIDGES FOR REMOVAL IS AS FOLLOWS:

A. Step 1. Obtain bridge data utilizing the Bridge Management System (BMS) for State and Local Bridges; this information can be obtained through the following website: ftp://ftp.dot.state.pa.us/public/Bureaus/PlanningResearch/GIS/. From this ftp site, download Local_Bridges.zip and State_Bridges.zip. These files once unzipped are shape files with point features for use in Arc Map. These files are updated every two years.

Note: The BMS system is designed to store data on every highway-related structure in Pennsylvania that has a length of 8' or greater for State bridges and greater than 20' for Local bridges.

The downloaded shape files have177 attributes; among them are:

- BMS ID
- BMS BRKEY

- Year Built
- County
- PennDOT Engineering District
- Location
- Owner/Agency Administration Area
- Feature Carried
- Feature Intersected
- AADT
- ADTT
- Detour Length (May need to request from the District Bridge Unit)
- Federal Aid Route
- Structure Length
- Structure Type
- Posted Status
- Whether the structure is structurally deficient, operationally obsolete, or both
- Sufficiency Rating

B. Step 2. Generate a map using the BMS data downloaded from Step 1. The following additional data items drawn from existing county, MPO/RPO data layers, layers downloaded from Pennsylvania Spatial Data Access (PASDA) (http://www.pasda.psu.edu/), or available through PA DOT Arc GIS Online shall be incorporated on the map. (If a data item listed below is not relevant to your area it is not necessary to include):

- State and local roads with labels
- Rivers, creeks and streams with labels
- Railroads with labels
- BMS Bridge IDs
- Areas of proposed industrial, commercial, and residential development (e.g., from county and local comprehensive plans and zoning maps)
- Structures already selected for closure and removal; programed on the TIP, listed on the TYP and from current or previous studies
- Locations of emergency management services (police, fire, ambulance, and hospitals)
- Important agricultural locations (e.g., active agriculture, ag security areas, ag easements)
- If available, additional layers such as location of schools. County GIS Departments and the GNIS layers available from PASDA are good sources.

In addition to the symbology in the map legend for the layers listed above, some additional symbology will aid analysis:

- AADT - <99 (orange); 100-199 (yellow); 200-499 (blue); ≥500 (green)
- Detour Length (Circle the bridge point in blue if detour length is less than 5 miles)

Note: Do not include any bridges on a two or three digit PA Travel Route. These bridges will not be considered for removal.

C. Step 3. Evaluate and determine where the area for the operationally redundant bridge identification process will be implemented (county wide or localized within county or specific region). Coordinate with the PennDOT district and state, county and local planning partners once data on map is verified.

D. Step 4. Develop and prioritize initial list of operationally redundant structures utilizing the following criteria. The first set of criteria can be queried in the GIS:

- AADT< 200 and detour length < 5 miles
- AADT≥200 and <500 and detour length < 2 miles
- Structure is SD or FO
- Structure is already posted
- Year Built
- Length of dead end road (after closure) measured from both sides of the bridge

These criteria require coordination with local stakeholders and the PennDOT district:

- EMS Network does not utilize this structure
- Programmed future maintenance:
    - Previously Completed
    - Scheduled
    - Length of any associated construction (< 1 mile) and the right-of-way footprint

E. Step 5. Update the map showing results from the analysis in Step 4. Indicate in the map legend those bridges with:

- Possible for Closure (red) - Collect additional data (Step 6)
- Not Possible for Closure (green) - No further evaluation

F. Step 6. Export Bridge layers from GIS into an Excel spreadsheet. Work with the District Bridge unit to add the following data items to the spreadsheet for further evaluation of potential bridges. Some of this data must be collected in the field or if possible obtained from available agency records:

- AADT (This is provided in BMS, however a current traffic count at the bridge is ideal as well as a traffic count on the detoured traffic route.)
- Length of Dead End Streets - Measured along the proposed center line from both sides of the bridge.
- Length of New Roadway Relocation - Measured along proposed center line.
- Subdivision and Land Development Ordinance Requirement - Maximum length of cul-de-sac allowed by governing body ordinance.
- Residential Dwelling Units - The number of dwelling units on each side of the bridge that connect residences to the road. Calculate the units by using the newest edition of the *ITE Trip Distribution for Residential Dwelling Units* versus the AADT.
- Future residential, commercial, and industrial development as indicated in local and county comprehensive plans and zoning ordinances.
- Business Access Points - The number of driveways on each side of the bridge that connect the business to the road. This should include farms.

Note: Up-to-date aerials can be helpful and may replace field view in remote areas; however, field view is preferable.

- Historic Status - Identify if bridge is on the National Register of Historic Places, or eligible for National Register.
- Lane Count of Bridge - Is bridge posted for one-lane? (Verify during field work.)
- Roadway Width in RMS - Measure from edge to edge of pavement or curb to curb. (Verify during field work.)
- Normal Travel Time and Detour Travel Time along designated detour route.
- Percent Change in Travel Time - The formula is:

$$\left[\left(\frac{\text{Detour Time}}{\text{Normal Travel Time}}\right)-1\right]*100\%$$

- Sidewalks - Are sidewalks present leading to the bridge? (Verify during field work or with Video Log)

- Utilities – Are utilities carried by the bridge or crossed by the bridge? (Verify during field work.)

- Railroad Presence – Is the bridge over a railroad?
- Define Function of the Road - Determine if road is regional or local based on access points and AADT. (This differs from FHWA functional classification.)
- Flooding/Road Closure - List of roads typically closed due to flooding. (Contact county emergency services for a list of roads.)
- Scour Critical Bridge Indicator – Category A, B, C or D.
- Bridge Risk Assessment - This information may be obtained from PennDOT for your area. Cost of Replacing Bridge - If known costs are unavailable, assume:
    - Length*width (24ft minimum) = area
    - Area*price per square foot ($650 per square foot, 2013 dollars)

  Note: Widths of less than a 24ft could be considered operationally obsolete.
- Cost Per Vehicle - Divide the cost of replacing bridge by AADT for the cost per vehicle.

G. Step 7. Evaluate data. Evaluate all the factors in determining the selected bridges for potential closure and removal:

- AADT - Should be evaluated in two different ways:
    - Determine if the traffic is local or regional according to the access points.
    - Consider if traffic can be handled on another road.
- Length of Dead End Street - Review municipalities' subdivision and land development ordinances for dead end streets and cul-de-sac lengths. If requirements are not met, evaluate zoning and future developments to determine if opportunities exist for rerouting the dead end street.
- The potential for environmental impacts to natural resources, cultural resources, and socioeconomic resources resulting from any construction, such as a cul-de-sac, resulting from bridge closure or removal. The LPN screening forms and MPMS IQ (https://www.dot7.state.pa.us/mpms_iq/) provide a GIS query to help identify environmental resources in the vicinity of the proposed project.

- Right-of-way footprint for acquisition and residential/economic impacts.
- Residential Dwelling Units - Use this information to determine the number of people affected and to determine usage, regional or local traffic crossing the bridge.
- Future Residential, Commercial, and Industrial Development - Use this information to determine the future need for the crossing being considered for removal.
- Business Access Points - Use this information to determine regional or local traffic crossing the bridge.
- Function of Road - Regional or local traffic; for example, considering local traffic it would be less likely recommended for closure then regional due to the fact that regional traffic has more options for traversing the transportation network.
- Lane Count of Bridge - If bridge is one lane, consideration must be given that this bridge is probably operationally obsolete. Cost of replacement will be increased; when bridge is replaced it will become a two lane bridge. This may be a more favorable bridge to consider closing than a two lane bridge.
- Time Studies - Establish an acceptable threshold for the study area for detour time. Emergency response should be evaluated based on a time study and should not increase response by a significant amount of time. School bus routes should also be evaluated based on a time study.
- Percent Change in Travel Time - This is another indicator of the effect on local traffic if bridge was closed.
- Roadway Width - If width of roadway is less than 20 ft, the bridge could be a candidate for closure.
- Sidewalks - If sidewalks are present, consider the impacts to pedestrian movements if the bridge is removed.
- Utilities Carried by Bridge – If utilities are carried by the bridge, consider the impacts if the bridge is removed. PUC files should be investigated to determine what PUC Orders exist regarding maintenance or ownership of the structure.
- Railroad Presence – PUC files should be investigated to determine what PUC Orders exist regarding maintenance/ownership of the structure.
- Flooding/Road Closure - This should be analyzed in two different ways:
    - If road floods in the vicinity of bridge, the bridge could be a candidate for closure and removal.
    - If a bridge is a candidate for closure and removal, the surrounding network of roads should be checked to ensure a flooding issue does not exist on the other roads. Consider the impact to emergency services.
- Age of Bridge, Size and Risk Assessment - When evaluating competing bridges look at long term cost by: age of bridge, size (square foot), and risk assessment (if available from PennDOT).
- Historic status - Between two similar bridges, the historic status may be used to determine which bridge remains in service.
- Lane Count of Bridge - Evaluate one lane bridge versus two lane bridge; consider keeping the two lane bridge open instead of the one lane bridge.
- Cost Per Vehicle - This should be used to evaluate bridges on a more proportional cost/benefit comparison.

The spreadsheet should provide enough data to create a list of recommended bridges to consider for closure and removal. However, due to the proximity of two or more bridges that may be considered, a head to head evaluation should be completed with all competing bridges for closure that serve that same general area. This will be based more on a cost than transportation impact.

H. Step 8. Perform field views/studies for structures meeting the criteria and selection process addressed above. Verify the following:

- Economic Impacts
- Residential Impacts
- Traffic Data
- Detour Route
    - No SD structures on Detour Route
- Environmental Impact Footprint
- Right-Of-Way Acquisition Footprint
- Utility Impacts

I. Step 9. Re-evaluate structures based on field view findings.

- Develop final list of operationally redundant bridges in cooperation with planning partners and PennDOT districts.
- Develop mitigation strategies based on planning partner recommendations.

J. Step 10. Perform implementation and mitigation strategies.

- Present study to elected officials.
- Issue press release to all state, county and local planning partners with list of operationally redundant bridges.
- "Town Meeting" with public to present list of operationally redundant bridges, cost savings and mitigation strategies.
- Coordination with PennDOT Planning and Programming to develop LPN screening forms for proposed bridge removal TIP projects that incorporate mitigation strategies:
    - Installation of a cul-de-sac.
    - Installation of signage indicating bridge closure and dead-end roadway.
    - Installation of signage for Detour until the bridge is removed.
    - NBIS inspection costs covered until bridge is removed.
    - Costs associated with removal of bridge once closed.
    - Costs associated with press releases notifying public on bridge maintenance costs being deferred due to closure or removal candidate.
    - Funds to relocate roadway if dead-end roadway not feasible.
    - Any associated construction must not involve construction of new structures other than storm water management structures.
    - Funds to improve local transportation network in vicinity of bridge.

Bridge Elimination Candidates in XX County

BRIDGE_ID1	BRKEY	Latitude Deg	Min	Sec	Longitude Deg	Min	Sec	LOCATION	LENGTH	Proposed Width	Area	450.00	DECK AREA Sqft

BRKEY	FCARRIED	FINTER	TYPE	YR BUILD	POST STATUS	SINGLE TON	COMBO TON	DECK	SUP	SUB	CULV	SD	FO	SUFFRATE

BRKEY	MUN CODE	ADT	DETOUR	CURB to CURB	STUDY CODE	G_R CODE	Length of Dead End Street north/east	Length of Dead End Street south/west	SALDO Requirement

BRKEY	Residential Access Points	Business Access Points	Historic Register Status	Lane Count	Roadway width	Normal Travel Time	Detour Travel Time	% Change in travel Time

BRKEY	Sidewalks	Function of roadway	Flooding	Cost	Risk Assessment	Reason not to move forward	PennDOT

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