BRADD Software Executive Summary

Software Description and Functionality

PennDOT's **Br**idge **A**utomated **D**esign and **D**rafting Software (BRADD) is a computer software program that was developed for PennDOT to automate the bridge design process from problem definition through contract drawing development. BRADD combines and automates the design, analysis, and drafting process for specific types of simple span bridges. The software provides user friendly Windows-based Graphical User Interface (GUI) menu driven input, numerous application design programs, and a drawing generation built around Bentley's MicroStation CADD technology to enable an engineer to design and produce scaled contract drawings automatically for simple span bridges.

The BRADD Software, Version 3.2.5.0, was written as a tool for the Load and Resistance Factor Design, of simple span concrete, steel, and prestressed concrete bridges with span lengths ranging from 18 feet to 200 feet. The software supports tangent geometry, horizontal curves (chord beams) and vertical curves. The bridge skew (PennDOT definition) can range from 25 degrees to 90 degrees. Available cross-section types are normal, symmetrical, superelevation, and superelevation transition. The maximum bridge width is limited by the following: a maximum of 20 beams in the cross section for all structure types, with or without sidewalks; a maximum of 8 design (12 feet) lanes (curb-to-curb) in the cross section for all structure types, with or without sidewalks; and an absolute maximum (out-to-out) of 125.54 feet. The minimum bridge width is limited to 13 feet.

Available superstructure types are P/S Adjacent Box Beams, P/S Spread Box Beams, P/S I-Beams, Steel Rolled Beams and Steel Plate Girders. The Abutment types, referred to in this documentation as traditional abutments, can be either Stub Abutment, Cantilever Abutment, or Wall Abutments supported by either spread footings or footings on piles. The user can also select an integral abutment and enter input to draft integral abutments, although no design for the integral abutments or wings is provided. BRADD can also be run to design and draft the superstructure only using a "Superstructure Only" option. For the "Superstructure Only" option, the abutment type is specified as "SuperOnly" and the user needs only to input if there is a backwall and the type of wingwall at each abutment. In addition, for spread superstructures, BRADD can design and draft the superstructure only for integral abutments with minimum input for the abutment wingwalls. Superstructure details related to integral abutments are drafted as part of the superstructure drawings. However, no design or drafting for the integral abutments or wings is provided for the superstructure only option.

The current version of the BRADD Software, Version 3.2.5.0, only supports English (US) units. Previous versions of BRADD, including Versions 3.1.0.0 through 3.1.4.1 supported both US and metric units.

The BRADD Software consists of approximately:

- 4600 FORTRAN routines (730,000 lines of code)
- 590 dimensions/parameter/data files (92,500 lines of data)
- 260 graphics details containing 976 overlays

The software is compiled using Intel(R) Fortran Compiler with Microsoft Visual Studio 2017. The Graphical User Interface for BRADD is compiled using Microsoft Visual Basic 2017. It consists of approximately 150 files with 83,000 lines of code.

BRADD's generation of design drawings is accomplished by three FORTRAN programs that are linked by a fourth FORTRAN program. The first program, the sheet generation program, evaluates key parametric values such as superstructure type, substructure type, span length, etc. to determine the appropriate design drawings that need to be produced. A subroutine is then called for each bridge layout drawing, which evaluates other parametric values and decides which details need to be placed. Each detail is divided into a series of layers, which can be overlaid on top of each other to construct the final bridge detail. All engineering details are created using a generic drawing generation system that utilizes two additional FORTRAN programs.

This system brings together information from design and dimensioning programs with specific detail information, which has been defined using a parametric drafting language (PDL). This allows details to be defined by coordinates that are located by design and dimensioning variables and constants. After definition of the coordinates, the detail is built by connecting control points together to form elements, which are placed to scale in a MicroStation design file (.DGN) by calling command line MicroStation applications to generate the MicroStation design file elements. The presence of Bentley's MicroStation or PowerDraft is required during DGN design drawing generation to place the elements. Also, BRADD is able to create generic exchange design file format (.DXF) drawings, which can then be interpreted by most CADD software.

Software Information Version 3.2.5.0

The BRADD Software automates the bridge design process by incorporating PennDOT's bridge geometry (BRGEO), superstructure (STLRFD, PSLRFD, BPLRFD), and substructure (ABLRFD) design programs into the subsystem that designs and analyzes the specific types of simple span bridges.

The version number and date of the programs incorporated into this version of BRADD are as follows:

Program	Description	Version	Release Date
BRGEO*	Bridge Geometry	1.1	May 1998
ABLRFD**	LRFD Abutment and Retaining Wall Design and Analysis	1.16.0.0	January 2017
BPLRFD**	LRFD Bearing Pad Design and Analysis	1.7.0.0	June 2015
PSLRFD**	LRFD Prestressed Concrete Girder Design and Rating	2.11.0.0	June 2017
STLRFD**	LRFD Steel Girder Design and Rating	2.4.0.0	October 2016

Note: * This program is not modified from the standalone version, but is enhanced by additional functionality when installed and used in BRADD.
** These programs are unchanged from the standalone version when installed and used in BRADD.

Workstation Hardware and Software Requirements for Version 3.2.5.0

BRADD is supported on Windows 7, Windows 8, Windows 8.1, and Windows 10 operating systems. In order to load BRADD and produce design files and drawings, it is recommended that a workstation (PC) has 1,100 MB of free space.

BRADD contains features with two non-critical dependencies on Microsoft Office. One feature is the option to export BRADD Input tabular information directly to an Excel spread-sheet. Microsoft Office 2007 or newer must be installed in order for this to work properly. Another feature is the option to open both the "BRADD Technical Questions" and the "BRADD Revision Requests" on the "Help" pull-down menu as templates and the option to open Excel spread sheets like the Designer Checklist. Microsoft Office 2003 or newer must be installed in order for these features to work properly. However, BRADD can be run without using these features.

In order to produce design drawing files in MicroStation format (.DGN), either Bentley's **MicroStation** or **PowerDraft** must be installed and operating on your workstation. The following versions of MicroStation and PowerDraft are acceptable:

MicroStation: V8i (SELECTSeries 1, version 08.11.07 or newer), and CONNECT (Update 9 or newer).

PowerDraft: V8i (SELECTSeries 1, version 08.11.07 or newer).

BRADD drawings cannot be generated using the initial version of MicroStation V8i (version 08.11.05) or any version of PowerDraft CONNECT due to restrictions from Bentley.

This page is intentionally left blank.

1 GENERAL DESCRIPTION

1.1 PROGRAM IDENTIFICATION

Program Title:	Bridge Automated Design and Drafting Software
Program Name:	BRADD
Version:	3.2.5.0
Subsystems:	Superstructure and Substructure
Authors:	Pennsylvania Department of Transportation and Michael Baker International

ABSTRACT:

The Bridge Automated Design and Drafting Software (BRADD) is a computer software program that was developed for the Pennsylvania Department of Transportation to automate the bridge design process from problem definition through contract drawing development. The software utilizes CADD technology to improve design productivity and to reduce the time required to produce contract documents.

BRADD has been developed as a tool for the Load and Resistance Factor Design (LRFD) of simple span bridges. BRADD computations are performed in accordance with the AASHTO LRFD Bridge Design Specifications and the Pennsylvania Department of Transportation Design Manual Part 4. BRADD designs concrete, steel, and prestressed concrete bridges having span lengths of 18 feet to 200 feet.

The software was developed to run on the Windows 7 operating system and equipment, and was written in FORTRAN. It has also been tested to run successfully on the Windows 8, Windows 8.1, and Windows 10 operating systems. The user interacts with the software through a Windows-based Graphical User Interface (GUI) system. All design software was written for the Load and Resistance Factor Design Method in accordance with the AASHTO specifications and PennDOT's Design Manuals. These application programs also provide output for the engineer to review. The user can perform a number of different design alternatives and can compute quantities and costs for each alternative for comparison purposes.

The selected design can then be documented as a set of scaled design drawings suitable for incorporation into a plan set. Each of the sheets (design drawings) is created as a separate MicroStation Design File that utilizes a reference file that contains a pre-specified group of bridge design details. Paper (electrostatic) plots can then be produced from the design files.

BRADD's generation of design drawings is accomplished by three FORTRAN programs that are linked by a fourth FORTRAN program. The first program, the sheet generation program, evaluates key parametric values such as superstructure type, substructure type, span length, etc. to determine the appropriate design drawings that need to be produced. A subroutine is then called for each bridge layout drawing, which evaluates other parametric values and decides which details need to be placed. Each detail is divided into a series of layers, which can be overlaid on top of each other to construct the final bridge detail. All engineering details are created using a generic drawing generation system that utilizes two additional FORTRAN programs. This system brings together information from design and dimensioning programs with specific detail information, which has been defined using a parametric drafting language (PDL). This allows details to be defined by coordinates that are located by design and dimensioning variables and constants. After definition of the coordinates, the detail is built by connecting control points together to form elements, which are placed to scale in a MicroStation design file (.DGN) by calling a command line MicroStation application to generate the MicroStation design file elements. The presence of Bentley's MicroStation V8i or CONNECT or PowerDraft V8i is required during DGN design drawing generation to place the elements. Also, BRADD is able to create generic exchange design file format (.DXF) drawings, which can then be interpreted by most CADD software.

1.2 ABBREVIATIONS

This section provides definitions of abbreviations that are commonly used throughout this User's Manual.

AASHTO	-	American Association of State Highway and Transportation Officials.
BRADD	-	Bridge Automated Design and Drafting System.
DM-2	-	Pennsylvania Department of Transportation Design Manual Part 2.
DM-3	-	Pennsylvania Department of Transportation Design Manual Part 3.
DM-4	-	Pennsylvania Department of Transportation Design Manual Part 4.

DM-2, DM-3 and DM-4 can be obtained from PennDOT's website:

http://www.penndot.gov/

LRFD Specifications - AASHTO LRFD Bridge Design Specifications,
This publication can be ordered from:
American Association of State Highway and Transportation Officials
444 North Capitol Street, N.W., Suite 249
Washington, DC 20001
AASHTO's LRFD Bridge Design Specifications

PennDOT - Pennsylvania Department of Transportation.

US - Customary System of Units; “English” and “US” are used interchangeably.

1.3 REFERENCES

The following BRADD resources provide the additional basic information and documentation about the BRADD Software:

1. PennDOT BRADD System Manual, Version 3.2.5.0
   This manual contains information specific to the purpose of maintaining the BRADD software. This manual is intended for the programmer and system manager to document the system design and software. This manual is maintained by the PennDOT BRADD project manager, and is only available to PennDOT BRADD project support personnel.

2. PennDOT BRADD Example Manual, Version 3.1.0
   This manual contains the example problems that were used to verify the BRADD software. The example problems include backup calculations used to verify the numerical accuracy of BRADD. This manual is maintained by the PennDOT BRADD project manager, and is only available to PennDOT BRADD project support personnel.

3. BRADD on-line menu help
   The menu help provides the limits on and a detailed description of the input items for all menus. See Chapter 5 of this User’s Manual for instructions on using this resource.

The following PennDOT application programs are incorporated into and used by BRADD to perform the design computations. The User’s Manuals for the version of these programs incorporated into this version of BRADD are included as a part of the documentation package for the BRADD software and should be referenced as needed:

ABLRFD - PennDOT LRFD Abutment and Retaining Wall Analysis and Design program.

BPLRFD - PennDOT LRFD Bearing Pad Design and Analysis program.

BRGEO - PennDOT Bridge Geometry program.

PSLRFD - PennDOT LRFD Prestressed Concrete Girder Design and Rating program.

STLRFD - PennDOT LRFD Steel Girder Design and Rating program.

The following PennDOT standards are used by BRADD as the basis for all design graphic details presented on the design drawings. The version of these standards used by this version of BRADD is included as a part of the documentation package for the BRADD System and should be referenced as needed:

BD-600M Series - PennDOT Bureau of Project Delivery Standards for Bridge Design
BC-700M Series - PennDOT Bureau of Project Delivery Standards for Bridge Construction
RC-0M to 100M Series - PennDOT Bureau of Project Delivery Standards for Roadway Construction

The following PennDOT publication is used by BRADD as the basis for all construction items and quantities presented on the design drawings and in the design calculations. The version of this publications used by this version of BRADD is included as a part of the documentation package for the BRADD System and should be referenced as needed:

Publication 408 - PennDOT Specifications

In addition, a link named “Construction Items List” is available on the BRADD Help pulldown menu containing instructions for accessing ECMS and displaying the current construction items list.

The version of the PennDOT application programs, standards, and publications used by this version of BRADD and included as a part of the documentation package for the BRADD System may not be the most up-to-date or current version of these items. The current version of the PennDOT application programs, standards, and publications **must** be used in the preparation of all plans submitted to the Department.

The current version of the PennDOT application programs listed above can be ordered from the PennDOT website, http://www.penndot.gov/, under “Services & Software”, the Engineering Software link.

The current version of the PennDOT standards and publications listed above can be ordered from:

Pennsylvania Department of Transportation
Sales Store
P.O. Box 2028
Harrisburg, PA 17105-2028

2 PROGRAM DESCRIPTION

2.1 GENERAL

The purpose of this program is to provide a tool for bridge engineers to automate the bridge design process from problem definition through contract drawing development. BRADD has been developed as a tool for Load and Resistance Factor Design (LRFD). It can be utilized for simple span bridges only. The software utilizes CADD technology to improve design productivity and to reduce the time required to produce contract documents.

BRADD designs concrete, steel, and prestressed concrete bridges having span lengths of 18 feet to 200 feet. Computations within BRADD are performed in accordance with the AASHTO LRFD Bridge Design Specifications and the Pennsylvania Department of Transportation Design Manual Part 4.

The software was developed to run on the Windows 10 based operating system and equipment and was written in FORTRAN. It has also been tested to run successfully on the Windows 8, Windows 8.1, and Windows 7 operating systems. The user interacts with the software through a Windows-based Graphical User Interface (GUI) system. BRADD uses various application programs from PennDOT and other sources to perform the design computations. These application programs also provide output for the engineer to review. The user can perform a number of different design alternatives and can compute quantities and costs for each alternative for comparison purposes.

The selected design can then be documented as a set of scaled design drawings suitable for incorporation into a plan set. Each of the sheets (design drawings) is created as a separate MicroStation Design File that utilizes a reference file that contains a pre-specified group of bridge design details. Paper (electrostatic) plots can then be produced from the design files.

2.2 PROGRAM FUNCTIONS

BRADD performs the following functions:

1. Compute Superstructure - The program designs the superstructure based on parameters entered by the user. The program can design a prestressed concrete adjacent box beam, a prestressed concrete spread box beam, a prestressed concrete spread I-beam, a steel rolled beam, and a steel plate girder. The superstructure design includes the framing plan, load definitions, beam design, elastomeric bearing pads and anchor bolts, diaphragm locations, dapping and sole plates, and slab dimensions and reinforcement. For steel beams, it also includes shear connectors, beam stiffeners, and web-to-flange welds.

2. Compute Substructure - Similar to the superstructure, the program designs the substructure based on user-entered parameters. The program can design reinforced concrete cantilever high abutments, wall abutments, and stub abutments. The substructure design includes the abutment and wingwall design, the superstructure loads, the abutment geometry and bearing seat width, the footing, the pile footing layout, and the intersection of the abutment and wingwall footing. The program also designs the reinforced concrete cantilever flared or U-wing wingwalls and footings as a part of the substructure design. The Compute Substructure is not required when the abutments are 'SuperOnly' and only the superstructure is designed and drafted.

3. Compute Seismic - The program designs various bridge components to resist seismic forces. These components include the dowels, anchor bolts, shear blocks, cheekwalls, footing reinforcing details, and minimum support length. The program computes the seismic forces based on a combination of orthogonal seismic shear forces. This accounts for the directional uncertainty of earthquake motions and the simultaneous occurrences of earthquake forces in two perpendicular directions. The program then combines these orthogonal seismic shear forces into two load cases, based on whether the bearing is fixed or expansion.

4. Compute Quantities and Costs - The program computes quantities and costs for each bridge item. The program first computes quantities for the superstructure, substructure, and total structure. It also develops the information required for reinforcing bar schedules, accounting for cover, laps and hooks, varying lengths, and various rebar types. The program then uses the user-entered unit costs to compute the total cost of each item, as well as the cost for the superstructure, substructure, and total structure.

5. Generate Design Drawings - The program generates design drawings based on the previously described design computations. The program can generate design drawings for the entire bridge, for the superstructure only, for Abutment 1 only, for Abutment 2 only, or for a Type, Size, and Location (TS&L) study.

The program functions listed above are described in further detail in Chapter 3 of this manual.

2.3 STRUCTURE TYPES

This program can be used to design a variety of structure types, incorporating various geometric configurations, superstructure types, deck types, abutment types, and wingwall types. The selected geometric configuration affects the available superstructure types. Similarly, the selected superstructure type affects the available abutment types, and the selected abutment type affects the available wingwall types.

Presented in Table 2.3-1 is a matrix showing the available superstructure types for various geometric configurations. The geometric configuration includes both the horizontal geometry and the vertical geometry.

Table 2.3-1 Matrix of Geometric Configurations versus Superstructure Types

Superstructure Type	Geometry Configuration			
	Horiz. Curve = Yes Vertical Curve = Yes	Horiz. Curve = No Vertical Curve = Yes	Horiz. Curve = Yes Vertical Curve = No	Horiz. Curve = No Vertical Curve = No
Prestressed Concrete Adjacent Box Beam	√ (1)	√	√ (1)	√
Prestressed Concrete Spread Box Beam	√	√	√	√
Prestressed Concrete I-Beam	√	√	√	√
Steel Rolled Beam	√	√	√	√
Steel Plate Girder	√	√	√	√

Note: (1) Fully superelevated, composite, flared wingwalls only.

Presented in Table 2.3-2 is a matrix showing the available abutment types for various superstructure types. This table illustrates that high and stub abutments are available for spread beams only, while wall abutments are available for both adjacent and spread beams. On BD-621M, Sheet 1 of 2, standard reinforced concrete abutment typical sections are shown. Referring to this standard for BRADD, a stub abutment is the equivalent of a "TYPICAL SECTION WITH BACKWALL", TYPE I; a high abutment is the equivalent of a "TYPICAL SECTION WITH BACKWALL", TYPE II; and a wall abutment is the equivalent of a "TYPICAL SECTION WITHOUT BACKWALL". Integral abutments are available only for spread superstructures. Both abutments of a superstructure must be either traditional abutments or integral abutments.

The SuperOnly abutment type is used by BRADD when the user wants to design and generate drawings for a superstructure only. The only input for the SuperOnly high/stub/wall abutment is for specifying whether or not there is a backwall and the type of wingwall, flared or u-wing. The only input for the SuperOnly integral abutment is for specifying wingwall lengths, inlet information and detail option for the approach slab.

Table 2.3-2 Matrix of Abutment Types versus Superstructure Types

Superstructure Type	Abutment Type					
	Traditional			Integral	SuperOnly High/Stub/Wall	SuperOnly Integral
	High	Wall	Stub			
Prestressed Concrete Adjacent Box Beam		√			√	
Prestressed Concrete Spread Box Beam	√	√	√	√	√	√
Prestressed Concrete I-Beam	√	√	√	√	√	√
Steel Rolled Beam	√	√	√	√	√	√
Steel Plate Girder	√	√	√	√	√	√

Presented in Table 2.3-3 is a matrix showing the available wingwall types for various abutment types. Similar to the previous table, the traditional abutment types include high, wall, and stub abutments.

Table 2.3-3 Matrix of Abutment Types versus Wingwall Types

Wingwall Type	Traditional Abutment Type			Integral Abutment
	High	Wall	Stub	
U-wing	√	√ (1)	√	√
Flared Wing	√	√	√	

Note: (1) Does not apply to adjacent box beams on a horizontal curve.

Presented in Table 2.3-4 is a matrix showing various other available superstructure features for each superstructure type. This table includes sidewalks and concrete composite decks. Bituminous and noncomposite decks are not used in BRADD.

Table 2.3-4 Matrix of Other Superstructure Features versus Superstructure Types

Superstructure Types	Other Superstructure Features		
	Sidewalk		Concrete Deck
	Traditional Abutments	Integral Abutments	Composite
Prestressed Concrete Adjacent Box Beam	√		√
Prestressed Concrete Spread Box Beam	√		√
Prestressed Concrete I-Beam	√		√
Steel Rolled Beam	√		√
Steel Plate Girder	√		√

2.4 ASSUMPTIONS AND LIMITATIONS

The following sections summarize the basic assumptions and limitations that control the functionality of BRADD. BRADD users should also review the DESIGNER NOTES, the DESIGN NOTES, and the DRAFTING NOTES that are worksheets in the Designer Checklist for additional assumptions and limitations and for other items that a designer must do to generate a complete set of design drawings. A read only copy of the Designer Checklist is available through the help on the GUI. Also, each time a set of drawings is generated in BRADD, a uniquely named copy of the Designer Checklist is generated and the file is opened for the user to reference after each generation. The Designer Checklist will be revised as needed.

2.4.1 Assumptions

The following is the list of basic assumptions for BRADD:

1. Skew, as used herein, is defined as the PennDOT skew angle, with a positive skew measured counterclockwise from a line parallel to the centerline of beam. As shown in Figure 2.4.1-1, AASHTO skew angle (θ_A) is negative and PennDOT skew angle (θ_P) is positive.

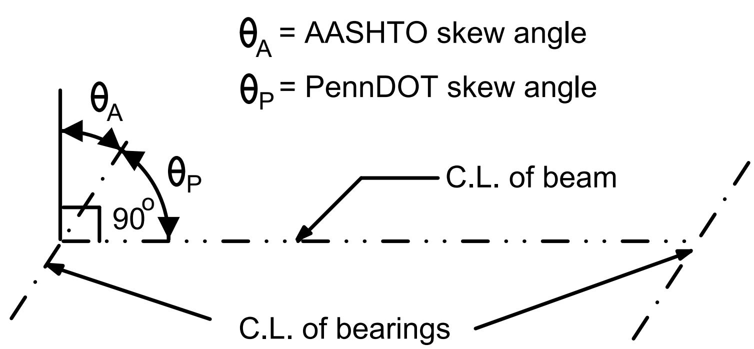

Figure 2.4.1-1 Skew Angle

2. Adjacent box beams are assumed composite.
3. If the alternate sidewalk detail is selected, the sidewalk to be entered by the user is the width of the top surface plus 1 inch for the slope as detailed on BD-601M.
4. The integral sidewalk detail always slopes towards the edge of the deck, which is not in accordance with BC-701M for bridges over roadways.
5. If the protected sidewalk detail is selected, with an raised sidewalk, the height of the sidewalk adjacent to the barrier is always set to 8” by BRADD.
6. All steel plate girders, rolled beams, and prestressed spread beam structures are assumed composite.
7. The terms “fascia” and “exterior” are used interchangeably within the BRADD Software and within its documentation.

8. Temperature reinforcement for the abutment and wingwall stems (i.e. front face vertical and horizontal reinforcement; back face horizontal reinforcement) is specified and detailed as per DM-4 Part B Section 5.10.8.
9. All rebar spacing is assumed to be center-to-center unless otherwise noted.
10. All concrete is assumed to be normal weight concrete.
11. Approach slabs for all traditional abutment bridges are assumed to be as per RC-23M.
12. The minimum haunch thickness called out on the Typical Section detail for steel beams and plate girders is based on BD-601M, Sheet 8, TABLE 1: MINIMUM HAUNCH THICKNESSES. Plan Camber is assumed to be the total dead load camber.

2.4.2 Limitations

The following is the list of basic limitations for BRADD:

1. The labeling of all dimensions on the design drawings will be in feet-inches, except for stations and elevations which will be in feet to two decimal places. These decisions are based on: DM-3 Section 1.4; Publication 122M, Surveying and Mapping Manual, Chapter 1, Section 1.3; and typical standard industry practice.
2. The labeling of work points' coordinates and offsets on both the Stake-Out Plan design drawing and the Adjacent Beam Deck Layout design drawing will be in feet to three decimal places.
3. Span lengths must be between 18 feet and 200 feet (inclusive).
4. For all span lengths of bridges with traditional abutments, there is calculated and detailed one fixed end and one expansion end. Although this conflicts with DM-4 Part B Section 14.6.1.1P for spans 35 feet and less, BRADD uses this methodology with permission of PennDOT's Chief Bridge Engineer. For superstructures with integral abutments, both abutments are fixed.
5. Maximum bridge widths are limited by the following for all structure types, with or without sidewalks: a maximum of 20 beams in the cross section; a maximum of 8 design (12 feet) lanes (curb-to-curb) in the cross section; or the absolute maximum (out-to-out) of 125.54 feet.
6. Minimum bridge widths are limited to 13 feet.
7. BRADD will detail only two roadway lanes for all superstructure types, no matter what width of roadway lane is entered by the user.
8. Skew of all steel superstructures must be greater than 25 degrees, for superstructures with traditional abutments.
9. Skew of all prestressed superstructures must be greater than 30 degrees, for superstructures with traditional abutments.
10. For superstructures with integral abutments, the minimum skew angle is:

    45 degrees for spans <= 90 feet
    60 degrees for spans > 90 feet and <= 130 feet
    70 degrees for spans > 130 feet

11. BRADD will only design bridges with parallel abutments.
12. The minimum number of beams is three for spread box beams and four for all other beam types. The maximum number of beams is twenty for all beam types.
13. The FRAMING PLAN option is not available for superstructures on a horizontal curve.
14. Adjacent box beams cannot use the integral sidewalk detail of BD-601M and BD-615M because of probable interference between the barrier and beam reinforcement.
15. For steel plate girders, hybrid girders are not allowed.
16. For steel superstructures with skews less than 70 degrees, the user must design and detail all intermediate and end diaphragms.
17. For steel superstructures, the user must design and detail any required girder/beam splices.
18. Only rectangular elastomeric bearings are designed and detailed.
19. BRADD does not design dual structures and therefore does not show any center of roadway type barrier details.
20. Only the beam section properties at the centerline of the span are placed on the design drawings.
21. The angle of flared wingwalls must be between 15 degrees and 75 degrees (inclusive) as measured from the front face of the abutment. (U-wingwalls are considered to be at an angle of 90 degrees.)
22. BRADD does not detail on the design drawings any barriers on top of the U-wings adjacent to or on the same side of the bridge as a sidewalk.
23. The Autowing option for the design of the wingwalls is only intended for use at the TS&L step in the design process. The Autowing option cannot be used for final design.
24. When generating drawings for either of the abutments using the Autowing option for the design of the wingwalls, the ALL option is not available.
25. The design of the beams, bearing pads, abutments, and wingwalls is restricted by and limited to the functionality available within the design option of the given design programs (STLRFD, PSLRFD, BPLRFD, and ABLRFD). BRADD incorporates and uses these programs as is, with no modifications and/or enhancements. The design results of these programs, based on the user and BRADD generated input, are used by BRADD as is, with no modifications and/or enhancements.
26. The values in an engineering program input file may vary slightly from the values shown in that same engineering program's output file due to display limitations. However, internally the engineering program uses the values that are in the input file, not the values that are displayed in the output files.
27. Abutments with backwalls are not an option for adjacent box beam structures.
28. For prestressed beams using the user defined bearing option, sole plate design is not provided. However, user input dapping depth is provided to allow beam design with dapping.
29. For staged construction, a construction joint is shown on the typical section and slab reinforcing plan for the superstructure and the transverse steel in the deck is spliced at the joint. For the substructure, a construction joint is shown in the abutment plan and elevation and the

reinforcement is computed and detailed accordingly. Impacts from staged construction during design is not considered by BRADD. For spread superstructures a warning message is given if the input distance to the superstructure construction joint does not lie along the top flange of one of the beams.

30. For superstructures with integral abutments, a Chief Bridge Engineer warning will be issued if the maximum beam depth is greater than 6 feet.
31. For superstructures with integral abutments, the maximum vertical grade is 5%. BDTD has interpreted this criterion to mean that if the straight line slope between the bearing seat elevations at each end of any beam in the cross section is greater than 5%, then an Integral Abutment Bridge cannot be designed for this geometry.
32. For superstructures with integral abutments, sidewalks are not permitted by BRADD.
33. For superstructures with integral abutments, only parallel beams will be generated for horizontal curves.
34. For superstructures with integral abutments, the minimum beam depth for rolled beams is 18”.
35. The Stake-Out Plan is not generated for Superstructure Only designs with traditional abutments. The Stake-Out Plan is generated for Superstructure Only designs with integral abutments.
36. When there is a horizontal curve, BRADD assumes the entire bridge is on the curve; from back of Abutment 1 to back of Abutment 2 but not including the wings, for traditional abutments; or between the ends of the approach slabs for integral abutments. Thus, the PC and PT should not be located on the bridge excluding the limit of the wings. If the PC or PT is located on the bridge, then the geometry and thus the drawings on the bridge prior to the PC and beyond the PT are suspect and need to be verified by hand. Also, if the entire sweep of the horizontal curve is located off the bridge, the geometry should be defined as not having a horizontal curve.
37. Adjacent box beams cannot be used on a curved horizontal alignment with U-wings. Only flared wingwalls are supported for adjacent box beams with a curved horizontal alignment.

2.5 Designer Checklist

A Designer Checklist is provided in the BRADD GUI help and during the generation of drawings for all jobs. The Designer Checklist is to be used by the Designer for completing the design and drawings produced by BRADD. The checklist contains separate worksheets for Designer Notes, Design Notes and Drafting Notes. These are provided not only as a checklist but also as documentation of the additional assumptions and limitations of BRADD that are not listed above.

The Designer Checklist can be accessed from the Help pulldown in BRADD by selecting "Designer Checklist". This provides a read-only copy of the file. At the conclusion of the generation of BRADD drawings, a uniquely named file is also provided and is opened for the user to review and use. See Chapter 7 for additional information regarding this file and its location.

DESIGNER NOTES

GENERAL

On the DESIGNER NOTES, the DESIGN NOTES and the DRAFTING NOTES worksheets, Designer is defined as the responsible registered professional engineer in charge of the structure design and under whose direct supervision the structure drawings are being prepared.

DESIGNER RESPONSIBILITY

BRADD is a software tool for the Designer to use in the design and drafting of contract drawings for single span bridges.

Therefore, the Designer is responsible for the as-necessary and appropriate revisions of and additions to the BRADD generated design and drawings to ensure that the final contract drawings produced by the Designer are complete and sufficient for construction of the as-designed bridge.

DESIGN SPECIFICATIONS SUMMARY

BRADD Version 3.2.5.0 produced design and drawings are based on the following versions of the design specifications:

PENNDOT's Design Manual Part 4
Publication No. 15M, April 2015 Edition

AASHTO's LRFD Bridge Design Specifications
Customary U.S. Units, Seventh Edition, 2014

The Designer is responsible for ensuring that the BRADD produced design and drawings are acceptable and satisfy the current design criteria contained within the latest versions of the PENNDOT and AASHTO design specifications.

DESIGNER NOTES

CONSTRUCTION SPECIFICATIONS SUMMARY

BRADD Version 3.2.5.0 produced design and drawings are based on the following versions of PENNDOT's Construction Specifications:

PENNDOT's Construction Specifications

Publication No. 408/2016, Year 2016 Edition with Change No. 3
Effective October 6, 2017

The Designer is responsible for ensuring that the BRADD produced design and drawings are acceptable and comply with the current criteria contained within the latest version of PENNDOT's Construction Specifications.

CONSTRUCTION ITEMS SUMMARY

BRADD Version 3.2.5.0 produced design and drawings are based on the PENNDOT's ECMS Construction Items List as of October 24, 2017.

The Designer is responsible for ensuring that the BRADD produced design and drawings are acceptable and comply with the current construction items contained within the latest version of PENNDOT's Construction Items Catalog.

STRIKE-OFF LETTER SUMMARY

BRADD Version 3.2.5.0 produced design and drawings are based on the following PENNDOT Strike-off Letters:

PENNDOT's Active Strike-Off Letters issued through October 2017, except for the following: SOL 483-17-02: Bridge Design Standards, BD-600M Series (Pub. 218M): April 2016 Edition (Change 1), and BC-700M Series (Pub. 219M): September 2016 Edition (Change 1)

The Designer is responsible for ensuring that the BRADD produced design and drawings are acceptable and comply with the provisions of ALL currently ACTIVE Strike-Off Letters.

DESIGNER NOTES

DESIGN PROGRAM SUMMARY

The version number and date of the PENNDOT design programs incorporated into BRADD Version 3.2.5.0 are as follows:

Bridge Geometry
Name: BRGEO
Version No.: 1.1
Release Date: May 1998

LRFD Abutment and Retaining Wall Design and Analysis
Name: ABLRFD
Version No.: 1.16.0.0
Release Date: January 2017

LRFD Bearing Pad Design and Analysis
Name: BPLRFD
Version No.: 1.7.0.0
Release Date: June 2015

LRFD Prestressed Concrete Girder Design and Rating
Name: PSLRFD
Version No.: 2.11.0.0
Release Date: June 2017

LRFD Steel Girder Design and Rating
Name: STLRFD
Version No.: 2.4.0.0
Release Date: October 2016

DESIGNER NOTES

BC, BD, and RC STANDARDS SUMMARY

The release date of the PENNDOT Bridge Construction (BC), Bridge Design (BD), and Roadway Construction (RC) Standards incorporated into and used for design and drafting by BRADD Version 3.2.5.0 are as follows:

Standard	Description	Date
BC-701M	Protective Fence	September 30, 2016
BC-707M	PA HT Bridge Barrier	September 30, 2016
BC-708M	Thrie-Beam to PA Type 10M Bridge Barrier Transition Connection	September 30, 2016
BC-709M	PA Type 10M Bridge Barrier	September 30, 2016
BC-716M	Aluminum Pedestrian Railing	September 30, 2016
BC-718M	Alternate Railing Details	September 30, 2016
BC-720M	Aluminum or Steel Bridge Hand Railing	September 30, 2016
BC-732M	Permanent Metal Deck Forms	September 30, 2016
BC-734M	Anchor Systems	September 30, 2016
BC-735M	Wall Construction & Expansion Joint Details	September 30, 2016
BC-736M	Reinforcement Bar Fabrication Details	September 30, 2016
BC-739M	Bridge Barrier to Guide Rail Transition	September 30, 2016
BC-751M	Bridge Drainage	September 30, 2016
BC-752M	Concrete Deck Slab Details	September 30, 2016
BC-753M	Steel Girder Details	September 30, 2016
BC-754M	Steel Diaphragms for Steel Beam / Girder Structures (Straight Girders Only)	September 30, 2016
BC-755M	Bearings	September 30, 2016
BC-757M	Steel Pile Tip Reinforcements & Splices	September 30, 2016
BC-767M	Neoprene Strip Seal Dam for Prestressed Concrete & Steel I-Beam Bridges	September 30, 2016
BC-775M	Miscellaneous Prestress Details	September 30, 2016
BC-779M	Structure Mounted Sound Barrier Walls	September 30, 2016
BC-788M	Typical Waterproofing and Expansion Details	September 30, 2016
BC-794M	Utility Attachment & Support Details, Prestressed Bridges	September 30, 2016
BD-601M	Concrete Deck Slab For Beam Bridges	April 29, 2016
BD-611M	Concrete Diaphragm Details for Steel I-Beam Structures	April 29, 2016
BD-615M	PA HT Bridge Barrier	April 29, 2016
BD-617M	PA Type 10M Bridge Barrier	April 29, 2016
BD-618M	Concrete Vertical Wall Bridge Barrier	April 29, 2016
BD-620M	Steel Girder Bridges Lateral Bracing Criteria and Details	April 29, 2016
BD-621M	Reinforced Concrete Abutments	April 29, 2016
BD-622M	R. C. Abutments with Backwall	April 29, 2016
BD-624M	R. C. Abutments without Backwall	April 29, 2016

DESIGNER NOTES

BD-625M	Wingwall Length	April 29, 2016
BD-628M	Bridge Approach Slabs (only Sheets 23 and 35 of 35 apply to BRADD)	April 29, 2016
BD-651M	Requirements for Tendons, Dowels, Shear Block, Diaphragms, Skew Limitations and Backwalls P/S Concrete I-Beam, PA Bulb-Tee and Box Beam Bridges	April 29, 2016
BD-652M	Prestressed Beam Sizes and Section Properties	April 29, 2016
BD-653M	Typical Framing Plans and Details	April 29, 2016
BD-655M	Typical Superstructure Sections	April 29, 2016
BD-656M	Typical Longitudinal Sections	April 29, 2016
BD-657M	I-Beam and Box Beam Bridges With Backwall and Without Backwall	April 29, 2016
BD-660M	Deck Slab and Steel Reinforcement Placement P/S Concrete I-Beams and Box Beam Bridges	April 29, 2016
BD-661M	Box Beam Reinforcement Details	April 29, 2016
BD-662M	I-Beam and PA Bulb-Tee Beam Reinforcement Details	April 29, 2016
BD-667M	Integral Abutment	April 29, 2016
RC-11M	Classification of Earthwork for Structures	June 1, 2010
RC-12M	Backfill at Structures	June 1, 2010
RC-23M	Bridge Approach Slabs	June 1, 2010
RC-50M	Guide Rail to Bridge Barrier Transitions	June 1, 2010
RC-52M	Type 2 Strong Post Guide Rail	June 1, 2010

The Designer is responsible for ensuring that the BRADD produced design and drawings are acceptable and comply with the latest versions of the PENNDOT Standards.

DESIGN NOTES

	Description	Checked	Applicable
	GENERAL		
1	Review the prestressed, steel, seismic, and abutment log and associated output files for errors and warning messages. It is the responsibility of the Designer to take appropriate corrective action as required.		
2	Error messages in the output files of the analysis runs of the prestressed and steel programs do not prevent the successful design and drawing generation by BRADD. The Designer is responsible as stated above to take any and all corrective actions due to these error messages.		
3	Check for any warning messages on the design drawings and design computations. The Designer must take the appropriate corrective action as required.		
4	Check all the output files for any "Chief Bridge Engineer/ District Bridge Engineer" warnings. Design drawings generated from designs with these warnings should not be used unless proper approval has been obtained and as directed by the Designer.		
5	The Designer is responsible for designing and detailing on the design drawings all bearings, other than rectangular elastomeric bearings, for this structure.		
6	The Designer is responsible for complying with the requirements of DM-4 PP Section 3.2.1 regarding minimum number of beams in the cross section.		
7	Circular elastomeric bearings are not designed and/or detailed by BRADD.		
8	Whether or not the bridge is skewed, circular elastomeric bearings are NOT mandatory for any steel or prestressed beam structure. However, as per the Chief Bridge Engineer, for both steel and prestressed beams, the use of round elastomeric bearings MUST be considered and investigated by the Designer before pot bearings are used.		

DESIGN NOTES

	Description	Checked	Applicable
9	BRADD uses only the input item 'HORIZONTAL CURVE (Y/N)' to determine if the bridge is on a horizontal curve. When there is a horizontal curve, BRADD assumes the entire bridge is on the curve; from back of Abutment 1 to back of Abutment 2, but not including the wings for traditional abutments; or between the ends of the approach slabs for integral abutments. Thus, the PC and PT should not be located on the bridge. If the PC or PT is located on the bridge, then the geometry and thus the drawings on the bridge prior to the PC and beyond the PT is suspect and needs to be verified by hand. Also, if the entire sweep of the horizontal curve is located off the bridge, the geometry should be defined as not having a horizontal curve.		
10	For steel superstructures, diaphragm details and dimensions are only provided for structures with skews greater than or equal to 70 degrees and girder spacings less than or equal to 8' - 0". For all other steel superstructures, the Designer must design and detail on the design drawings all diaphragms and diaphragm connections.		
11	For composite adjacent box beams on a horizontal curve, the Designer must check the design drawings for a deck thickness warning. If the deck thickness is greater than 8", no second (bottom) mat of reinforcing is specified or detailed on the design drawings. The Designer is responsible to revise the design drawings and quantities accordingly for the addition of a second mat of reinforcing.		
12	For composite adjacent box beams on a horizontal curve, the Designer may have to modify the safety wings to fit the curved geometry. U-wings are not permitted for composite adjacent box beams on a horizontal curve.		
13	Safety wings are not provided for flared wings at either abutment on any side of the structure that has a sidewalk.		
14	Guide rail connections for all structures with sidewalks must be detailed on the design drawings as directed by the Designer.		
15	If a special attachment of the guide rail to the safety wing barrier is required, the Designer must specify and detail the attachment on the design drawings.		

DESIGN NOTES

	Description	Checked	Applicable
16	For structures with sidewalks, the Designer is responsible for detailing on the design drawings all railings necessary and appropriate to meet project specific traffic and pedestrian safety standards.		
17	Abutment and wingwall design drawings generated using the AUTOWING design option are intended for TS&L purposes only. These design drawings should not be used for final design.		
18	The wall abutment centerline-of-bearing is not necessarily located at the center of the top of the wall. The top width of the abutment as input by the user may be increased by BRADD in order to accommodate the bearing pads. If this occurs, the Designer may want to consider eliminating the batter.		
19	For abutments with a backwall and with a paving notch, the beginning and ending of structure stations are located at the top of the backwall at the paving notch. For abutments with a backwall and without a paving notch, the beginning and ending of structure stations are located at the top of the backwall at the rear face of the backwall.		
20	For abutments without a backwall and with a paving notch, the beginning and ending of structure stations are located at the top of deck at the paving notch. For abutments without a backwall and without a paving notch, the beginning and ending of structure stations are located at the top of deck at the rear face of the abutment.		
21	For integral abutments, the beginning and ending of structure stations are located at the top of the end diaphragm at the paving notch.		
22	The Designer is responsible for changing the 'BITUMINOUS WEARING COURSE' item description in the Tabulation of Quantity detail on the QUANTITIES SHEET if something different than what BRADD provides is to be specified and used.		
23	The Designer is responsible for changing the 'SCUPPER, TYPE 1' item description in the Tabulation of Quantity detail on the QUANTITIES SHEET if something different than what BRADD provides is to be specified and used.		
24	The Designer must independently verify quantities of Class 3 Excavation and Selected Borrow Excavation, Structure Backfill given in the Tabulation of Quantity detail on the QUANTITIES SHEET.		

DESIGN NOTES

	Description	Checked	Applicable
25	For bridges with integral abutments, the Designer must calculate the quantity of Class 3 Excavation, No. 57 Coarse Aggregate, Geotextile and Select Borrow Excavation used for any Scour Protection shown on the plans, and enter the values in the Approximate Quantities detail on the QUANTITIES SHEET.		
26	Add the soil exploration sheet(s) to end of the design drawings (plan sheets) as directed by the Designer.		
27	The Designer is responsible for all design and detailing of slope wall protection.		
28	If you have selected "Yes" for the "Consolidation of Barmarks" input on the Project Control menu, the Designer is responsible for identifying and removing redundant barmark callouts.		
29	For superstructure only designs with traditional abutments, no Elevation detail is drawn.		
30	For bridges with PA Type 10M Bridge Barriers the approach roadway width is less than the bridge curb-to-curb (gutterline-to-gutterline) width due to the THRIE-BEAM TO PA TYPE 10M BRIDGE BARRIER TRANSITION CONNECTION as per BC-708M Sheet 1.		
31	For bridges with Vertical Wall Bridge Barriers or Alternate Vertical Wall Bridge Barriers the approach roadway width is less than the bridge curb-to-curb (gutterline-to-gutterline) width due to the THRIE-BEAM TO VERTICAL WALL BRIDGE BARRIER TRANSITION CONNECTION as per BC-703M Sheet 1.		

DESIGN NOTES

	Description	Checked	Applicable
	DESIGN		
1	Based on and using engineering judgment, any given LRFD design for a SKEWED structure using the LRFD distribution factors may NOT be sufficient for the analysis and design of the following items: cross-frames (diaphragms) of steel structures; bearings; and the uplift check at the bearings, if the values produced for these items indicate a need to be verified by a more precise analysis method. The Designer is responsible for determining the sufficiency of any structure design and details produced by BRADD.		
2	The Designer is responsible for ensuring that the number, size, and placement of the bearing stiffeners is sufficient to transfer the girder reaction from the girder to the bearing. The Designer is responsible for taking any necessary and appropriate corrective action to ensure that the load is uniformly distributed over the entire area of the bearing.		
3	The Designer must design and detail on the design drawings all splices, either welded or bolted, if required, for steel superstructures.		
4	If a splice is being added to a steel superstructure, the Designer is responsible for ensuring that the distance between transverse stiffeners and the splice location conform to the requirements of BC-753M.		
5	The Designer is responsible for ensuring that the design and details of the structure comply with the jacking requirements of DM-4 Article 14.6.4.2P.		
6	The Designer is responsible for providing a note on the design drawings, if necessary, requiring the contractor to provide temporary lateral support to the beams during construction based on and as per the requirements of DM-4 Article 14.7.6.3.9d.1.2P.		
7	If the average deck thickness used for the design of all the adjacent box beams is significantly different from the actual average deck thickness for each adjacent box beam, then the Designer, based on and using engineering judgment, is responsible for ensuring that the minimum deck thickness requirement is satisfied. See Chapter 3 of the BRADD Users Manual for further discussion and details on this issue.		

DESIGN NOTES

	Description	Checked	Applicable
8	The Designer must design and detail on the design drawings all barriers on top of the U-wings adjacent to or on the same side of the bridge as a sidewalk.		
9	The Designer is responsible for ensuring all backwall criteria have been satisfied as listed in DM-4 Article 11.6.1.7P BACKWALLS AND END DIAPHRAGMS.		
10	The Designer is responsible for reviewing rebar size and spacing for constructability. Alternative rebar selections may be more practical.		
11	For steel superstructures, the Designer is responsible for designing and detailing the designed welds connecting the sole plate to the bottom flange of the steel girder as specified in BC-755M, Sheet 1, note 4.		
12	The Designer is responsible for verifying that the geometry of an Option 1 (as per BC-755M) type sole plate on the fascia beams does not interfere with the cheek walls, especially for adjacent beam structures.		
13	For steel girders spaced greater than 14 feet center-to-center, the Designer must check if lateral bracing is required.		
14	For severe skews, the Designer must check the end of barrier reinforcing for conformance with the spacing requirements of the applicable standard and make changes as deemed necessary.		
15	For cases where anchor bolts are designed at the expansion end of the bridge, the Designer is responsible for checking the seismic log file to verify that the anchor bolts provide sufficient resistance to the seismic forces. If a warning is present in the seismic log file indicating the anchor bolts do not provide sufficient reisistance, then the Designer is responsible for designing and detailing an alternative method to resist the seismic forces.		
16	The Designer is responsible for ensuring that the embedment length of the anchor bolts are based on the bearing resistance of the concrete as per DM-4 Article 14.8.3.1 and AASHTO Article 14.8.3.1.		
17	If a "Construction Wind Load Path" other than LATERAL is specified, the Designer must take any and all necessary actions as specified in BD-620M and provide any and all necessary bracing details as specified in BD-620M.		

DESIGN NOTES

	Description	Checked	Applicable
18	If the Designer specifies a "Construction Wind Speed" less than 70 mph as required by BD-620M Note R6 on Sheet 1 of 6, then the Designer must take any and all necessary actions as specified in BD-620M.		
19	BRADD accounts for the additional 1" minimum of concrete in the slab overhang as shown in BD-601M as dead load on the girder. When the maximum edge of deck thickness is less than or equal to the deck thickness + 2", the bottom of slab overhang is held level. When the maximum edge of deck thickness is greater than the deck thickness + 2", the bottom of slab overhang is sloped and the edge of deck thickness is set to the deck thickness + 1". In either case, the Designer is responsible for determining if the additional dead load that BRADD calculates based on the 1" minimum additional slab thickness is sufficient. Additional dead load can be added by the Designer if needed.		
20	For spread superstructures with a horizontal curve, deck reinforcement placed radially should be checked. Deck reinforcement placed near the abutments may not be correct if the center line of bearing of either abutment approaches coincidence with the radial line of the reinforcement. This condition occurs when the stations of the corners of the slab at an abutment are close in value. The Designer is responsible for checking and ensuring that the detailing of the deck reinforcement on the drawings is correct and accurate, and must take any appropriate corrective action.		
21	For steel superstructures with concrete end diaphragms, BRADD uses a diaphragm width of 1' - 3", based on the minimum value shown in BD-611M, for the calculation of the end diaphragm weight used in the design. The actual width of the diaphragm as detailed on the drawings may be greater. The Designer is responsible for determining if the additional dead load due to a greater diaphragm width should be accounted for by providing the input for an additional DC1 load on the girder.		
22	For staged construction, the Designer is responsible for determining if a temporary beam retainer is required, as per BD-655M Sheet 2 of 2. If required, the Designer is responsible for designing and detailing on the design drawings the temporary beam retainer and anchor bolts.		

DESIGN NOTES

	Description	Checked	Applicable
23	BRADD designs and details only lap splices for the reinforcement for staged construction. BRADD does not consider the use mechanical couplers for the reinforcement for staged construction. If the Designer determines that mechanical couplers are necessary and required for the reinforcement for staged construction, then the Designer is responsible for the design and detailing of the mechanical couplers and the detailing of the reinforcement to account for the mechanical couplers.		
24	For steel superstructures, if a handrail is required by the Designer then the Designer is responsible to ensure that the intermediate stiffeners designed and detailed by BRADD meet the minimum size requirements as per BC-753M Sheet 2 of 2, and is also responsible to take any necessary and appropriate corrective action.		
25	For prestressed superstructures where one abutment has a backwall and the other abutment does not have a backwall, the possibility exists that the distance from the centerline of bearing to the end of the beam will differ at each end of the beam. This situation will cause an unsymmetrical prestressing condition for all strand configurations. Since the beam design using the PSLRFD program assumes a symmetrical prestressing condition, the Designer is responsible for verifying the validity of the strand pattern and end prestressing forces produced by BRADD.		
26	The detailing of the vertical reinforcement for both the abutment stem and wing wall stems is based on the given design section height. The Designer is responsible for checking and ensuring that the detailing of this reinforcement on the drawings is appropriate for the entire length of the given stem.		
27	If sound barrier loads have been input by the Designer, then the Designer is responsible for modifying the barrier designed and detailed by BRADD to accommodate the sound barrier as per BD-601M and BD-679M. The Designer is also responsible for checking the design and detailing of the superstructure for the modified barrier.		

DESIGN NOTES

	Description	Checked	Applicable
28	If a warning message regarding unsymmetrical debonding is issued for straight and draped strand PSLRFD analysis runs, the Designer must check that this warning message can be ignored because it applies to the crack control debonding pattern used in the PSLRFD analysis runs. The actual crack control debonding pattern is the contractors responsibility.		
29	For steel plate girders, the minimum/maximum plate thickness entered must correspond EXACTLY to one of the values that appears in the STLRFD thickness table (see BRADD "Flange Thickness Table" input to identify which table has been selected). This is a workaround for a known issue in the STLRFD program. If the value input for the minimum/maximum plate thickness does not exactly equal a value that appears in the Thickness Table selected (see STLRFD User Manual Tables 1 and 2 included with the DP2 command) BRADD may not be able to optimally design the steel girders.		
30	For a User Defined barrier, the Designer is responsible for the detailing of the barrier, including the reinforcement, on the design drawings.		
31	For Traditional Abutments, if a Designer note similar to the following, "ABLRFD is unable to design the backwall bars to match the stem bar spacing. The designed splice is too long for the height of the backwall. The designer must resolve this issue." appears on the design drawings, then the Designer is responsible to make the necessary revisions to eliminate this condition.		
32	On the abutment footing layout drawing of traditional abutments with pile footing, check for notes under the pile spacing tables and for any Designer notes. The Designer is responsible for taking any necessary and appropriate corrective action.		
33	For Integral Abutments, if required, determine the minimum diameter of the pre-augered holes in accordance with DM-4 Appendix G Section 1.4.2.1.		

DESIGN NOTES

	Description	Checked	Applicable
34	For Integral Abutments, if a Designer note similar to the following "The piles are too far away from the construction joint. the BD-667M, Sheet 1, Typical Elevation detail shows a 2’-6” max. dimension to the free edge of the Abutment Pile Cap. For this bridge the construction joint is more than 2’-6” away from the centerline of the nearest pile in the stage 1 side." appears on the design drawings, then the Designer is responsible to adjust the pile spacing as necessary.		
35	For Integral Abutments, if a Designer note similar to the following "The staged construction joint has not been considered in the computation or the detailing of the abutment reinforcement. The reinforcement needs to be modified by the designer to accommodate the staged construction line as required." appears on the design drawings, then the Designer is responsible to adjust the reinforcement as necessary.		
36	The Designer is responsible to perform all construction load design and analysis required as per DM-4 Part B Section 2.10P.		
37	For the PA Type 10M Bridge barriers, the uniform load for the barrier and railing that BRADD uses is as per BD-617M Sheet 1 Note 16 which states that the loads given assume a uniform 7'-6" post spacing along the length of the superstructure. The Designer is responsible for determining if additional dead load is required to account for the actual post spacing. Additional dead load can be added by the Designer, if needed, on the "Uniform Loads per Beam" menu.		
38	For PA I-beams with web depths of 12", 17", and 23", and for PA Bulb-Tee beams with web depths of 8", 16", and 24", the Designer is responsible for modifying the intermediate diaphragm reinforcing as necessary to accommodate the reinforcing requirements of BD-655M Sheet 1.		
39	The Designer is responsible for complying with the requirements of the PROTECTED SIDEWALK note on Sheet 4 of BD-601M.		
40	For steel girder bridges, the Designer is responsible for determining if the ALTERNATE INTERMEDIATE DIAPHRAGM TYPE detail, as per BC-754M, must be used. If so, the Designer is responsible for the design and detailing of the ALTERNATE INTERMEDIATE DIAPHRAGM TYPE detail, as per BC-754M, Sheet 1, on the design drawings.		

DESIGN NOTES

	Description	Checked	Applicable
41	The Designer is responsible for verifying that the quantity of the membrane waterproofing on the back of the abutments has been calculated consistent with the details and dimensions given on BC-788M, Sheets 1, 2, 3, 4, 5, and 12.		
42	For P/S Concrete AASHTO I-Beam and PA Bulb-Tee Beam bridges, the Designer is responsible for determining if STEEL MID-SPAN DIAPHRAGMS, as per BC-770M, should be used. If so, the Designer is responsible for the design and detailing of the STEEL MID-SPAN DIAPHRAGMS, as per BC-770M, on the design drawings.		
43	The Designer is responsible for verifying that the rollover on the shoulder in a super-elevated section is 8% or less as per the AASHTO Green Book.		
44	The Designer is responsible for verifying that the design and detailing of the stirrups for P/S Box Beams satisfies the requirements of Legend Note 8 on BD-661M, Sheet 2, and for making any necessary changes as required.		
45	The abutment elevation does not show the stepped bridge seat. Refer to the ABUTMENT 1/2 BEARING SEAT ELEVATION SHEET.		
	S.O.L. NOTES		

DRAFTING NOTES

	Description	Checked	Applicable
	GENERAL		
1	Rearrange overlapping text and dimensions on all Design Drawings.		
2	Fill in sheet design numbers on the design drawings incorporating the correct number of soil exploration sheet(s).		
3	Add cross-reference notes referencing views to details of that view on another design drawing as directed by the Designer (e.g., FOR ABUTMENT 1 TYPICAL SECTION SEE SHEET 7 OF 22).		
4	Add the initials of the Designer, drafter, and checker to the lower left hand corner detail on each design drawing as per DM-4 PP Section 1.6.4.3.		

	PLAN VIEW, GENERAL PLAN SHEET		
1	Add the approach slab, roadway, and shoulder dimensions as directed by the Designer.		
2	Add the approach guide rail as directed by the Designer.		
3	Add the roadway approach drainage, if applicable, as directed by the Designer.		
4	Add the existing structure outline, if applicable, as directed by the Designer.		
5	Add any utilities, if applicable, as directed by the Designer.		
6	Add the alignment and location of any obstacle spanned and the necessary detail information for waterway, grade separation or railroad structures as directed by the Designer.		
7	Add the normal distance between abutments, if requested, as directed by the Designer.		
8	Add slope protection and scour treatment, if applicable, as directed by the Designer.		
9	Add contours as directed by the Designer.		

	ELEVATION VIEW, GENERAL PLAN or ELEVATION SHEET		
1	Show the railing posts and spacings as required as per BC-716M, if applicable, as directed by the Designer.		
2	Show the handrail posts and spacings as required as per BC-720M, if applicable, as directed by the Designer.		

DRAFTING NOTES

	Description	Checked	Applicable
3	Show stream, roadway, or railroad under the structure as directed by the Designer.		
4	Add required and actual vertical clearance as directed by the Designer.		
5	Add horizontal clearances, if applicable, as directed by the Designer.		
6	Add the applicable water elevations for normal flow and flood elevations as directed by the Designer.		
7	Add ground lines on the Elevation View as directed by the Designer.		
8	Add the estimated pile tip elevation for each abutment with piles as directed by the Designer.		
9	Adjust the Elevation View detail on the GENERAL PLAN SHEET if it overlaps the PE block as directed by the Designer.		

	REMAINDER OF GENERAL PLAN SHEET		
1	Add the superelevation and runout data, if applicable, as directed by the Designer.		
2	Add the recommended Date in the Title Block as directed by the Designer.		

	QUANTITIES SHEET		
1	Review the Supplemental Drawing detail information for completeness and accuracy as directed by the Designer.		
2	Review the Tabulation of Quantity detail information for completeness and accuracy as directed by the Designer.		
3	The Designer is responsible for determining the quantity for the Bridge Structure Lump Sum Item 'QUICK PILE LOAD TEST' in the Tabulation of Quantity detail, and placing that value on the design drawing.		
4	The Designer is responsible for determining the quantity of the '1091-0050 (11) PROTECTIVE COATING FOR REINFORCED CONCRETE SURFACES (PENETRATING SEALERS, BRIDGE SUPERSTRUCTURE)' item description in the Tabulation of Quantity detail for the Approach Slabs of Integral Abutment bridges, and placing those values on the design drawing.		

DRAFTING NOTES

	Description	Checked	Applicable
5	If the structure design requires a joint other than a neoprene strip seal joint at an abutment, the Designer is responsible for placing the item description and its value in the Tabulation of Quantity detail.		
6	The Designer is responsible for determining the quantity of any item required but not included in the Tabulation of Quantity detail, and placing the item description and its value on that design drawing.		
7	Fill-in the hydraulic data and traffic information (ADTT) as directed by the Designer. Supply the overtopping flood as required by DM-2 as directed by the Designer.		

	GENERAL NOTES SHEET		
1	The Designer must review all GENERAL NOTES for applicability, and then determine and take the appropriate corrective action as required.		
2	Add any special notes to the general notes, as required, as directed by the Designer.		
3	Fill-in the year the ADTT is reported for the fatigue design as directed by the Designer. For prestressed concrete structures, fill-in the ADTT as directed by the Designer.		
4	Fill-in the waterway conservation officer information as directed by the Designer.		
5	Fill-in all information required for pile installation METHOD C as directed by the Designer.		
6	For replacement and rehabilitation projects, add notes 1, 2, and 4 of DM-4 PP Section 1.7.4.2, as directed by the Designer.		

	STAKE OUT PLAN SHEET		
1	Add diagonal dimensions on the stake out plan, if requested, as directed by the Designer.		

DRAFTING NOTES

	Description	Checked	Applicable
	TYPICAL SECTION SHEET		
1	Add the location of utilities, if applicable, to the typical section as directed by the Designer.		
2	The typical sidewalk detail always slopes towards the edge of the deck, which is not in accordance with BC-701M for bridges over roadways. The Designer is responsible for determining and taking any appropriate corrective action.		

	SUPERSTRUCTURE SHEETS		
1	Add the distance from the centerline of roadway to the centerline beam to the Framing Plan detail, if requested, as directed by the Designer. (Note: Centerline of roadway to fascia beam given).		
2	Add the following note, as a minimum as per DM-4 Article 5.4.3.6P and as directed by the Designer, to the BEAM DETAIL SHEET of all prestressed concrete structures: EPOXY COAT ALL REBARS FOR A DISTANCE OF 9' FROM THE BEAM END ADJACENT TO A DECK JOINT.		
3	The Designer is responsible for designing and detailing on the design drawings concrete end diaphragms used for steel structures that exceed the restrictions and limitations of BD-611M. Concrete end diaphragms used for steel structures detailed by BRADD apply only to those structures meeting the girder depth and deck movement restrictions and limitations of BD-611M.		
4	The Designer is responsible for complying with all of the 'INSTRUCTIONS FOR DETAILING HAUNCH REINFORCEMENT ON CONSTRUCTION PLANS' given on BD-601M Sheet 8.		
5	For both steel and prestressed beam superstructures, beam section properties are provided only at the centerline of span of the beams. The Designer is responsible for providing the beam section properties requested and/or required at any additional locations along the beams.		

DRAFTING NOTES

	Description	Checked	Applicable
6	If the structure design requires a neoprene strip seal joint with a movement classification greater than 4", the Designer is responsible for designing and detailing on the design drawings the required joint.		
7	The Designer is responsible for designing and detailing on the design drawings any joint other than a neoprene strip seal joint at an abutment.		
8	The Designer is responsible for verifying that any and all Type 1 scuppers specified and shown for spread beam superstructures can be placed and used as per the requirements of BC-751M sheet 1.		
9	The Designer is responsible for designing and detailing on the design drawings any and all deck drains or scuppers for adjacent box beam superstructures with sidewalks.		
10	For spread beam structures on a horizontal curve, when the transverse reinforcement bar in the curved deck slab consists of a single non-varying bar, the Designer is responsible for ensuring that the length of the single non-varying transverse reinforcement bar in the curved deck slab provides the required concrete cover over the entire length of the curved deck.		
11	For structures with an out-to-out width greater than 75', the Designer is responsible for checking all reinforcement bar schedules for a Designer note indicating bars with excessive lengths. If such a note appears, the Designer is responsible for taking the action necessary to properly detail all reinforcing.		
12	The Designer is responsible for checking for lift-off conditions as described in DM-4 Article 14.7.6.3.5. If a lift-off condition is expected, the Designer is responsible for providing a note on the plans with all necessary information as described in DM-4 Article 14.7.6.3.5.		
13	The Designer is responsible for checking the feasibility of the diaphragm reinforcement details given for spread prestressed beam superstructures. If the space between beams is less than the required length to adequately develop the reinforcement for one splice, provide sleeves through the ends of beams as directed by the Designer.		

DRAFTING NOTES

	Description	Checked	Applicable
14	The Designer is responsible for detailing and showing on the design drawings the lines that represent the Modified Deflection Joints in the barrier.		
15	The TYPICAL STRAND CONFINEMENT detail has to be updated for plank beams as directed by the Designer.		
16	For spread box beam and prestressed I-beam superstructures which have full depth diaphragms and use Sole Plate Option 1 type bearings from BC-755M, Sheet 2 of 4, the Designer must provide block outs for the sole plates and anchor bolts.		
17	The Designer is responsible for designing and detailing on the design drawings the SKEWS EXCEEDING BEAM LIMITS detail, from BD-653M, sheet 2 of 2, as appropriate. This detail is for spread box beams only. If the skew is sharper than that allowed by the SKEW LIMITATIONS table of BD-651M, sheet 1 of 2, this detail should be used.		
18	For Prestress superstructures, if the BRADD "User Defined Bearing Pad" input option was selected and the "User Defined Dap" input option was also selected, then the Designer must complete the Dap Information Table that is located on the "Beam Fabrication Details" sheet.		
19	The Designer is responsible for designing and detailing on the design drawings the PLAN - SKEWED STRUCTURES detail, from BD-611M, as appropriate. This detail is for steel beam and girder bridges with concrete end diaphragms.		
20	The Designer is responsible for adding the BITUMINOUS PAVEMENT callout to the ABUTMENT WITHOUT BACKWALL details as per BD-656M, Sheets 3 and 4.		
21	The Designer is responsible for adding the V-NOTCH callout between the barrier and the deck or sidewalk along the edge of deck on all applicable details.		
22	For bridges with a total width no more than 36', the Designer is responsible for determining if the S7 bars in the deck slab reinforcing should be eliminated and if the S2 bars can be replaced as per the note at the bottom of BD-601M, Sheet 8. If so, the Designer is responsible for all the necessary changes to the deck slab reinforcing details, reinforcement bar schedule, and reinforcement bar quantity.		

DRAFTING NOTES

	Description	Checked	Applicable
23	The Designer is responsible for determining if the 9-7/8" radius and the 1" radius callouts on the front face of the Typical, Alternate, and PA HT Bridge barriers, as shown on BD-601M and BD-615M, should be called out on the Barrier Reinforcing details on the Barrier & Misc. Details sheet.		
24	For expansion bearings with anchor bolts, the note "Draw nut finger tight and back off ¼ turn and peen bolt threads at face of nuts." should be removed as per BC-755M, this note is only applies to the fixed bearing.		

	ELASTOMERIC BEARING DETAILS SHEET		
1	Add a note cross referencing the design drawings containing the sole plate details, bearing details, bearing seat details, and anchor bolt details as directed by the Designer.		
2	Add job specific details or notes as directed by the Designer.		
3	The Designer must designate on the drawings the type, locations, and number of elastomeric bearing pads to be tested, if required.		

	ABUTMENT SHEETS		
1	Add the centerline bearing/centerline roadway station, if required, as directed by the Designer.		
2	Add weephole locations to the abutment and wingwall elevation views as directed by the Designer. Adjust the reinforcement quantity on the Reinforcement Bar Schedule detail and on the Tabulation of Quantity detail, if necessary.		
3	Add rock lining or proposed finished ground line on the elevation view of the abutment and wingwall section as directed by the Designer.		
4	The Designer is responsible for ensuring that the slope section from the front face of the stem on the abutment and the wingwall sections matches the information on the Elevation View of the GENERAL PLAN or ELEVATION VIEW SHEET. This only applies if the slope section is different than a 2:1 slope or if rock lining is applied.		

DRAFTING NOTES

	Description	Checked	Applicable
5	For a traditional abutment with two panels in a wingwall, if the panel located farthest from the abutment has a width that is larger than the width of the panel nearest to the abutment, such that the back of the farthest panel footing extends beyond the nearest panel footing, then the Designer must revise the wingwall longitudinal footing reinforcement in the farthest panel in that portion of the footing that extends beyond the nearest panel in order to ensure that the portion of the footing that extends beyond the nearest panel has the proper longitudinal reinforcement.		
6	Add abutment bars to the footing plan for severe skews, if requested, as directed by the Designer.		
7	Identify the location, number, and length of all test piles on each pile footing plan as directed by the Designer.		
8	The Designer must designate on the design drawings which piles are to be battered in each partially battered row for all abutment and wing wall footings. The number of battered piles required per row is given on the design drawings.		
9	Add any additional information for CIP concrete or steel beam piles as directed by the Designer.		
10	For HIGH abutments, the Designer is responsible for checking the length of the transverse temperature reinforcement in the back face of the stem between the beam seat and the stem at the top of the back face batter, and take appropriate corrective action as required.		
11	The Designer is responsible for detailing on the design drawings all barriers on top of the U-wings adjacent to or on the same side of the bridge as a sidewalk.		
12	Add shear blocks to the elevation view of the abutment as directed by the Designer.		
13	BRADD does not comply with the Expansion and Skew Detail given on BC-767M. The Designer is responsible for checking and modifying the geometry if required.		
14	The Designer may need to revise the number of paving notch bar marks indicated on the abutment elevation between roadway barriers for abutments with a backwall. An additional bar mark for the backwall area outside of the roadway barriers may be required where there is no notch.		

DRAFTING NOTES

	Description	Checked	Applicable
15	For Integral Abutment bridges with tapered wingwalls, the Designer is responsible for modifying the detailing of the vertical reinforcement in the tapered wingwalls to add the 2' - 1" lap splice above the construction joint as per the ATTACHED TAPERED WINGWALL ELEVATION detail on BD-667M, Sheet 5.		
16	For Integral Abutment bridges, BRADD shows the PIPE PILE-TO-PILE CAP CONNECTION DETAIL as per BD-667M, Sheet 8. If required, the Designer is responsible for modifying this detail on the design drawings to show the correct number of reinforcement bars in the PLAN detail and the correct beam type in the SECTION W-W detail.		