Computing Bearing Seat Elevations

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**Title**  
PGSuper Tutorial – Bearing Seat Elevations  

**Publication No.**  
BS01292014-3

**Abstract**  
This document demonstrates how to manually compute bearing seat elevations with the basic version of PGSuper as well as using the advanced features of PGSuper Professional.

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**Notes**

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<th>Staff – BridgeSight Software</th>
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**Specification**  
AASHTO LRFD Bridge Design Specifications  
PGSuper Professional Version 1.3

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Introduction

New users may not know that the basic version of PGSuper has powerful geometry capabilities that rival stand-alone bridge geometry and COGO programs. PGSuper can model complex horizontal and vertical curve roadway geometries with curve transitions, non-prismatic deck geometries, non-parallel girders, and many other configurations. We encourage you to check out the advanced geometrics tutorials at PGSuper.com for more information. PGSuper Professional enhances the basic PGSuper application by providing computational and reporting capabilities including reporting of deck elevations at any location and computation of bearing seat elevations.

Bearing seat elevations can be determined manually using PGSuper’s basic geometric output and some hand calculations. However, by building on the robust geometry capabilities of the software, PGSuper Professional adds the ability to automatically obtain top of bearing and bearing seat elevations with the BridgeSight Bearing Seat Elevations Report. This white paper discusses the computation of bearing seat elevations using both methods.

Computation of Bearing Seat Elevations

For simple bridge geometries the computation of bearing seat elevations is a simple task of deducting the vertical height of the superstructure, adjusted for the grade of the profile and the girder, from the finished grade elevation at the point of bearing. These calculations must be done by hand with the basic version of PGSuper. PGSuper Professional directly computes both the top of bearing and bearing seat (bottom of bearing) elevations for every girder and every pier in the bridge and presents them in an easy to read report.

The elevations are computing using the following equations:

Top of Bearing Elevation

\[ Top \ of \ Bearing \ Elevation = Finished \ Grade \ Elevation \]
\[ - \left( \sqrt{ProfileGrade^2 + 1} \right) (Overlay \ Depth + Slab \ Offset) \]
\[ - \left( \sqrt{GirderGrade^2 + 1} \right) (Height \ of \ Girder \ – \ Bearing \ Recess) \]

Bearing Seat Elevation = Top of Bearing Elevation – Bearing Height

The terms are defined in Figure 1.
When a bridge is modeled with an Overlay, the finished grade elevation is taken to be at the top of the overlay. When the bridge is modeled with a Sacrificial Depth or Future Overlay, the finished grade elevation is taken to be at the top of the deck.

In cases when the overlay is defined with a pressure load as shown in Figure 2, the overlay depth is computed based on an assumed unit weight of 140 lbs/ft$^3$. 

![Figure 1](image1.png)

**Figure 1**

![Figure 2](image2.png)

**Figure 2** – Overlay defined with pressure loading
Modeling Bearing Recesses

Bearing dimensions must be known in order to compute the top of bearing and bearing seat elevations. Bridge owners may use different details for precast-prestressed girder bearings. At locations where girders rest on elastomeric bearing pads, some owners provide a recess in the bottom of the girder to receive the bearing, others do not, and some build up a bearing surface beneath the girder to provide a level surface. These three cases are illustrated in Figure 3.

![Figures showing three cases of bearing recesses](image)

Girder setting elevations are typically given on intermediate pier plan sheets. When the girders are framed integrally into the bent cap, the setting elevation is typically the top of a temporary bearing. In Figure 4, the temporary bearing is a block of oak wood. The “top of oak block elevation” is given in the plans.

![Figure 4 showing temporary bearing and setting elevation](image)
Hand Calculation of Bearing Seat Elevations with PGSuper

The basic version of PGSuper does not directly compute the top of bearing and bearing seat elevations, so you must compute them by hand. Fortunately, PGSuper makes it easy to get the information needed for the calculations. The information required is the finished grade elevation at the intersection of the centerline of bearing and the centerline of the girder, the profile grade at this intersection point, the grade of the girder, and the depth of the deck and girder.

The finished grade elevations and girder grade are available in the Bridge Geometry Report. Select View | Reports | Bridge Geometry Report to create the report. The finished grade elevations are shown in Figure 5 and the girder grade is shown in Figure 6. The profile grade can be estimated using the difference in station and elevation between the centerline of bearing and the first 10\textsuperscript{th} point along the girder.

![Figure 5](image)

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Figure 5

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Figure 6
The depth of the deck and girder can be obtained from the Details Report. Select View | Reports | Details Report to create the report. The depth of the deck is shown in Figure 7 and the depth of the girder is shown in Figure 8.

The top of bearing elevation can be computed using this information. From the finished grade elevation, deduct the grade adjusted vertical dimensions to obtain the top of bearing, bearing seat, and/or setting elevations.
Automated Computation of Bearing Seat Elevations using PGSuper Professional

PGSuper Professional computes top of bearing, bearing seat, and/or setting elevations automatically. The elevations are found in the BridgeSight Bearing Seat Elevations Report. Creating this report is a straightforward process.

Select View | Reports | BridgeSight Bearing Seat Elevations Report. In the report configuration dialog, shown in Figure 9, select the chapters to include in the report and specify the bearing dimensions. Press the OK button and you’ll have the elevations instantly.

![Figure 9](image_url)

**Options to Specify Bearing Dimensions**

There are three options for specifying the bearing dimensions used to compute the top of bearing and bearing seat elevations.

**Option 1 – Specify a single bearing dimension for all abutments/piers**

With this option a single bearing recess and height is used at all locations.

**Option 2 – Specify one bearing dimension for simple supports and another for continuous/integral supports.**

This option works great for simple span precast-prestressed girder bridges that are made continuous for live load. The bearing dimensions defined for Simple Bearings are used at all abutments/piers that have a Hinge or Roller boundary condition. The bearing dimensions defined for Continuous/Integral Bearings...
are used at all other locations. This option can generate bearing seat elevations at end abutments and top of “oak block” dimensions at all the intermediate piers in one report.

Option 3 – Specify bearing dimensions at each abutment/pier

This is the most general option. The bearing dimension at the back and ahead sides of every pier and abutment are explicitly defined.

Bearing Seat Elevations Report

The BridgeSight Bearing Seat Elevations Report has two chapters. The Summary chapter lists the top of bearing and bearing seat elevations. This information is ideal for transcription to bridge plan sheets. The Details chapter provides all the details used to compute the elevations.

Excerpts of the BridgeSight Bearing Seat Elevations Report are given in Figure 10 and Figure 11 below. The Summary Chapter lists the Top of Bearing Elevation and the Bearing Seat Elevation at the Back and Ahead side of every pier and abutment. Note that the actual profile grade, not an estimated value, is used in the calculation.

![](image)

Figure 10

The Details chapter lists all of the dimensions used in computing the elevations. Details include the station, offset, and finished grade elevation at the intersection of the centerlines of girder and bearing making it easy for you to compare results with your roadway design software.
Conclusion

Once again, PGSuper Professional makes your life easier by computing bearing seat elevations in seconds. The computation of bearing seat elevations for a complex bridge structure can take hours if done manually, or you could input your geometric data into another program – that doesn’t sound easy!

We invite you to check out this, and all of the other time-saving features in PGSuper Pro by taking a 30 day demonstration at http://bridgesight.com/TrialOffer. Have a great day!
Customizing PGSuper
PGSuper has an advanced software architecture that allows third parties to extend and enhance its capabilities. At BridgeSight Inc., we can add new capabilities to meet your needs. For details, contact us at

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PGSuper Professional
BridgeSight Inc. is offering an enhanced version of PGSuper called PGSuper Professional. In addition to all the great features in the free version of PGSuper you get:

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- Export Analysis Results to Excel
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