

# **PGSuper Tutorials**

**from BridgeSight Software**

## **PGSuper 2.8.2 and PGSuper Professional 1.3.1 Update**

**BridgeSight**  
**Software**<sup>™</sup>

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<b>Title</b>	PGSuper Tutorial – Modeling Wearing Surfaces		<b>Publication No.</b>	BS01292014-5
<b>Abstract</b>	This document describes the updates for PGSuper Version 2.8.2 and PGSuper Professional Version 1.3.1			
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## Introduction

In conjunction with the September 2014 release of PGSuper 2.8.2 by the Washington, Texas, and Kansas Departments of Transportation, BridgeSight Inc. has released PGSuper Professional 1.3.1. This is a maintenance release of PGSuper 2.8 that resolves minor issues with the software. PGSuper Professional has been updated to be compatible with this release.

This document provides an overview of the issues addressed in this release. Discussion regarding two warning messages that have been concerning to users is also presented.

## Updates to PGSuper Version 2.8.2

Several minor issues have been resolved with this update. The issues are:

- Fixed reporting of reactions for load rating vehicles. Reactions are now provided in one location of the Load Rating Report.
- Fixed problem opening old files that used spline curves to model the edge of deck.
- Fixed problem modeling complex deck edges using compound spline curves.
- Fixed problem of vehicles used only for negative moment effects being considered for positive moment yield stress ratios in the load rating analysis.
- Fixed problem modeling unique spacing at each end of a span. Spacing values would be applied at the wrong end of the span.
- Fixed problem with negative moment capacity calculations. Mild reinforcement in the girder was not included in the capacity analysis even if the Project Criteria specified it was to be included.
- Fixed problem with schematic image of connection geometry for end abutments.
- Fixed problem detecting invalid deck rebar definition.
- Fixed problem with erroneous spec check Fail result for positive moment checks at the ends of girders.
- Fixed problem applying live load distribution factors to live load reactions in multi-span bridges with different number of girders in each span.
- Fixed problem creating Hauling Report for cases when the hauling analysis is disabled.
- Fixed problem with the live load load factor for permit load ratings. An invalid load factor was used if the ADTT was exactly 5000.
- Reduced the size of load rating reports.
- Added feature to disable stirrup layout checks.
- Added factor to define the variability of camber. It was previously assumed to be 50%.

***NOTE: PGSuper files saved with version 2.8.2 cannot be opened with version 2.8.0.***

## Warnings

PGSuper goes beyond the basic service and strength analysis performed by other precast-prestressed girder design software by considering real bridge design, detailing, construction, and performance concepts. PGSuper warns engineers when potential problems could occur. These warnings don't necessarily mean that anything is wrong, they simply bring the engineers attention to potential problems so that they can be given additional consideration.

Two warning messages new to PGSuper version 2.8.0 have been causing undue concern amongst designers. Design engineers are being warned about possible problems with stirrup layout and the potential for girders end up with sag.

**WARNING: Stirrup zone lengths are not compatible with stirrup spacings. Refer to the Stirrup Layout Geometry Check for more information.**

**WARNING: Screed Camber is greater than the camber at time of deck casting. The girder may end up with a sag.**

The aim of this discussion is to provide additional information to help design engineers better interpret these warnings.

## Stirrup Zone Lengths

PGSuper models real bridge structures. The information you code into your PGSuper model is either transcribed from or will be documented in a set of bridge plans. The transverse reinforcement in your PGSuper project should reflect that actual reinforcement in the girders. The transverse reinforcement is evaluated to make sure the spacing and zone lengths are compatible. For the example below, Zone #2 has a length of 1.8 ft and a spacing of 3.5 inches. This translated into 6.1714 spaces at 3.5". The number of spaces is typically a whole number. This warning is issued when the number of spaces is not a whole number.

Zone #	Zone Length ft	B/Si
1	0.125	
2	1.8	
3	12	
4	0.75	
5	9.75	

## Stirrup Layout Geometry Check

Zone	Stirrup Layout	Status
1	1 Spa. @ 1 <sup>1</sup> / <sub>2</sub> " = 1 <sup>1</sup> / <sub>2</sub> "	OK
2	6.17143 Spa. @ 3 <sup>1</sup> / <sub>2</sub> " = 1'-9 <sup>5</sup> / <sub>8</sub> "	Zone length is not compatible with stirrup spacing
3	24 Spa. @ 6" = 12'-0"	OK
4	1 Spa. @ 9" = 9"	OK
5	13 Spa. @ 9" = 9'-9"	OK
6	53 Spa. @ 1'-6" (Max) = 79'-1 <sup>3</sup> / <sub>4</sub> "	OK
7	13 Spa. @ 9" = 9'-9"	OK
8	1 Spa. @ 9" = 9"	OK
9	24 Spa. @ 6" = 12'-0"	OK
10	6.17143 Spa. @ 3 <sup>1</sup> / <sub>2</sub> " = 1'-9 <sup>5</sup> / <sub>8</sub> "	Zone length is not compatible with stirrup spacing
11	1 Spa. @ 1 <sup>1</sup> / <sub>2</sub> " = 1 <sup>1</sup> / <sub>2</sub> "	OK

The purpose of this warning is to alert that the stirrup spacing and zone length don't add up. This is something you might want to investigate. Perhaps this is exactly what you want.

PGSuper 2.8.2 adds an option in the Project Criteria, Limits and Warnings tab to disable this warning if so desired.

General Warnings

Issue a Spec Check warning if stirrup zone lengths are incompatible with stirrup spacings

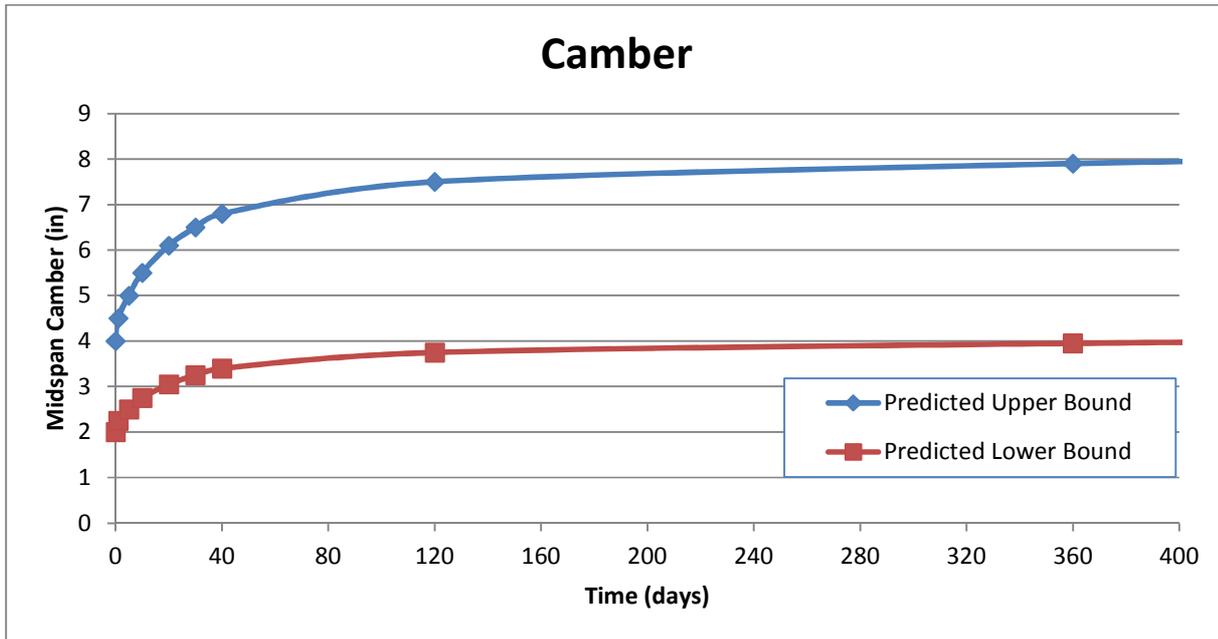
### ***Girder Sag Warning***

Generally speaking, girders that sag are undesirable. They are not necessarily structurally deficient but they can lead to problems such as undesirable aesthetics or drainage issues. PGSuper alerts you to the potential for the girder to end up with sag; however this doesn't mean it will actually sag. Many factors determine the final profile of the girder. The purpose of the warning is to alert of a possible problem so that it can be investigated more thoroughly.

PGSuper models two important factors related to camber and deflection; duration of un-restrained camber growth and natural variability of camber. From the time of prestress release to the time of deck placement, prestressed girders are typically stored as simple span beams and the camber growth is unrestrained. Camber growth is typically fully restrained when the cast-in-place deck is installed. The weight of the deck works against the tendency for camber growth. The composite deck significantly increases the stiffness of the girder section making any additional camber minute.

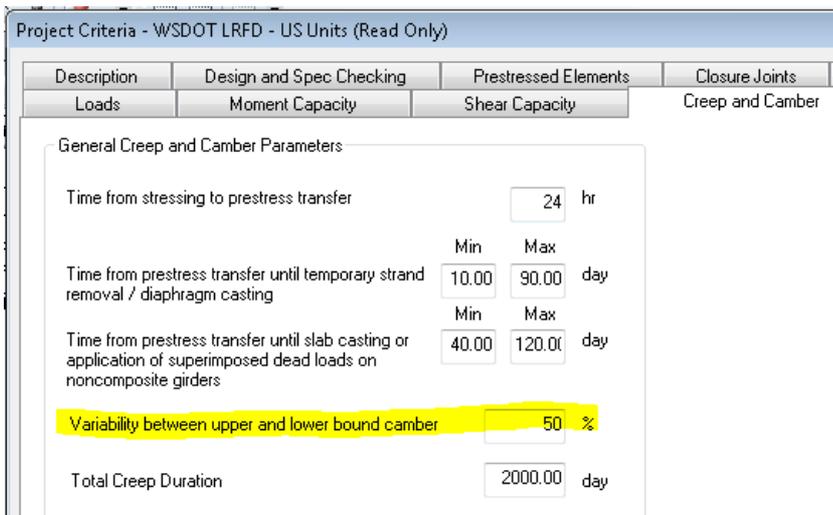
At design time it is generally impossible to know the exact timing when the cast-in-place deck will be installed. So, PGSuper models two construction sequences where camber is computed based on a minimum and maximum time from prestress transfer to deck placement. The difference in construction timing translates into a difference in camber at the time of deck placement. The girder will sag if the deflection due to the deck weight is greater than the camber.

Camber itself has a natural variation. It is well establish that if identical girders are built at the exact same time they will all have different initial camber and different camber growth. PGSuper accounts for this by computing an upper bound and lower bound camber values. Actual cambers are predicted to be somewhere between the predicted upper bound and predicted lower bound cambers as shown in the graph below.



To determine if a girder has the potential to sag, PGSuper compares the deflection of the bare girder due to the dead load of the wet deck to the camber of the girder at the time of deck casting. PGSuper uses the lower bound camber for the minimum timing of deck placement for the camber at the time of deck placement. This would be the absolute worst case scenario. If the deflection due to the weight of the wet slab is very close to or exceeds the lower bound camber, the sag warning is issued.

In PGSuper Version 2.8.0, the lower bound of camber was hard coded to be 50% of the upper bound value. This variability value works well for WSDOT designs. However, camber variability depends on many factors including local practices, materials, and environmental factors such as temperature and humidity. PGSuper 2.8.2 adds a parameter in the Project Criteria library to set the variability between the upper and lower bound cambers. This will allow owner agencies to better represent their local circumstances.



In addition, a new option has been added to the Project Criteria, Limits and Warnings tab. That allows selection of whether upper, lower, or average bound camber will be used when determining when to create the warning.

Warn if there is a potential for girders to sag under dead load effects

Base sag detection on

## Summary

PGSuper Version 2.8.2 and PGSuper Professional 1.3.1 have been upgraded to provide designers, load raters, fabricators, and other engineers with the best precast-prestressed girder software available. BridgeSight Inc. is proud to provide software development services to the Texas and Kansas Departments of Transportation and to coordinate development activities on their behalf with the Washington State Department of Transportation. This unique software development partnership continues to result in excellent software for bridge engineers around the world.

## 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:

- BridgeSight's one-of-a-kind Girder Design Dashboard™
- PGSuper to AASHTOWare Bridge Exporter
- 3D Visualization
- Export Analysis Results to Excel
- Enhanced Library Management
- LandXML Data Exchange
- Enhanced Reporting
- Toll-free telephone support
- Direct Email support
- High priority treatment in the PGSuper.com Support Forums
- Exceptional customer service from registered Professional Engineers

***If you like PGSuper, you'll love PGSuper Professional!***

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