AASHTO WSDOT Questionnaire: Prestressed Girder Design Criteria

	Question 1: What type of section properties policy does your state use for design of precast prestressed girder bridges?	Question 2: What allowable tension stress at Service III policy does your state have for design of precast prestressed girder bridges?	Question 3: What continuity policy does your state have for design of continuous precast prestressed girder bridges?	Question 4: What prestress loss policy does your state have for design of precast prestressed girder bridges?
Alaska DOT&PF Elmer Marx Technical Engineer II 907-465-6941 elmer.marx@alaska.gov	Gross Section properties	Zero tension at service limit state	AASHTO with zero tension for fully continuous for live load and 6*sort(f'c) for simple span behavior	Minimum (lesser loss) of simplified and refined method per AASHTO.
Alabama DOT Nick Walker Designer Bridge Bureau, 334-242-6644 walkern@dot.state.al.us	Gross section properties	Zero tension at service limit state	Simple span moments for superimposed dead loads and live load	Approximate Estimate of Time-Dependent Losses Per AASHTO LRFD Article 5.9.5.3
Arkansas Highway and Transportation Department Carl Fuselier State Bridge Engineer (501) 569-2362 carl.fuselier@arkansashighways.com	Gross Section properties	Per AASHTO LRFD Table 5.9.4.2.2-1	Per AASHTO LRFD Section 5.14.1.4 - Bridges Composed of Simple Span Precast Girders Made Continuous	Approximate Estimate of Time-Dependent Losses Per AASHTO LRFD Article 5.9.5.3
AZ DOT Navaphan Viboolmate Bridge Design Section Leader 602-712-8478 nviboolmate@azdot.gov	Transformed Section Properties	Per AASHTO LRFD Table 5.9.4.2.2-1	Simple span moments for superimposed dead loads and live load	AASHTO LRFD Article 5.9.5.3 for span up to 140 feet and AASHTO LRFD Article 5.9.5.4 for span greater than 140 feet.
Caltrans Jim Ma Senior Bridge Engineer/Prestressed Concrete Specialist (916)227-8175 Jim_Ma@dot.ca.gov	Transformed Section Properties	Use a) with California Amendment of "No tension subjected to permanent loads only"	Per AASHTO LRFD Section 5.14.1.4 - Bridges Composed of Simple Span Precast Girders Made Continuous	Refined Estimates of Time-Dependent Losses Per AASHTO LRFD Article 5.9.5.4
Colorado DOT Michael L. McMullen Temp PEI, Retired PEII720-318-8158 Michael_McMullen@mindspring.com	Transformed Section Properties. Generally.	Per AASHTO LRFD Table 5.9.4.2.2-1 Generally	Historically Simple span for positive moments, and continuous for negative composite loads, but this is changing. Technically the answer should be a) but we have	Normally refined, but, again for many structural elements it makes no practical difference. Historically we required somewhat lower allowed tension for pretensioned girders if

			not been diligent with keeping our design processes up. Also for many bridges it does not seem to make any practical difference.	lump sum methods were used since the lump sum methods of the Standard specifications sometimes differed drastically for the stresses and concrete strengths we used (at the time these were high stresses, strengths, and prestressing levels). Personally I think the detail in the code detailed method gives the impression that the predictions are more accurate than they are, and requires information only known to the actual fabricator for the girders, or perhaps not even then. (GIGO) The data set the code is based on is not broad enough, and concrete and environmental conditions are not that predictable. When we have done segmental structures the creep and shrinkage tests were not consistent enough from sample to sample to be of any use whatsoever. If precision is required for the prediction of material properties, concrete is the wrong material.
District of Columbia DOT Konjit Eskender, P.E. Project Engineer 202-671-4568 Konjit.Eskender@dc.gov	Transformed Section Properties	Per AASHTO LRFD Table 5.9.4.2.2-1	Per AASHTO LRFD Section 5.14.1.4 - Bridges Composed of Simple Span Precast Girders Made Continuous	Do not have a policy on time-dependent losses; but follow AASHTO (either a or b)
Florida DOT Christina Freeman / Dennis Golabek Structures Design Engineer 850-414-4190 christina.freeman@dot.state.fl.us	Transformed Section Properties	When analyzing stresses of simple span beams, limit stresses in accordance with LRFD Table 5.9.4.1.2-1 with the exception that for the outer 15 percent of the design span, tensile stress at the top of beam may not exceed 12 x square root of f'ci at release. For transient loads during construction the tensile stress limit may be taken as 6 x square root of f'c. It is not necessary to check tensile stresses in the top of simple	FDOT policy is to use only post-tensioning to splice beam segments within simple spans and/or to establish continuity between adjacent spans. Furthermore, in the design of pretensioned beams made continuous by field-applied post-tensioning, the pretensioning shall be designed such that, as a minimum, the following conditions are satisfied: A. The pretensioning shall meet the minimum steel provisions of LRFD [5.7.3.3.2].	Approximate Estimate of Time-Dependent Losses Per AASHTO LRFD Article 5.9.5.3 For simple supported beams

		span beams in the final condition.	B. The pretensioning shall be capable of resisting all loads applied prior to post-tensioning, including a superimposed dead load equal to 50% of the uniform weight of the beam, without exceeding the stress limitations for pretensioned concrete construction. C. The pretensioning force shall be of such magnitude that the initial midspan camber at release, including the effect of the dead load of the beam, is at least ½". In computing the initial camber, the value of the modulus of elasticity shall be in accordance with SDG 1.4.1 for the minimum required strength of concrete at release of the pretensioning force, and the pretensioning force in the strands shall be reduced by losses due to elastic shortening and steel relaxation. D. Anchorage zones of post-tensioning ducts, and beam lengths in which ducts deviate both horizontally and vertically, require integrated drawings in accordance with SDG 4.5. E. The limitation on the percentage of debonded strands of the pretensioned strand group at the ends of beams may be increased to 37.5% provided post-tensioning is applied to the beams prior to casting the deck concrete and provided that the total number of debonded strands is equal to or less than 25% of the total area of pretensioned and post-tensioned strands at the time of placement of the deck concrete.	
Hawaii DOT	Gross Section properties	Zero tension at service limit	Per AASHTO LRFD Section	Either is accepted. An estimate is an

Paul Santo Bridge Design Engineer 808-692-7611 paul.santo@hawaii.gov		state	5.14.1.4 - Bridges Composed of Simple Span Precast Girders Made Continuous	estimate!
Idaho Transportation Department Luis Zarate Technical Engineer 2208-334-8545 luis.zarate@itd.idaho.gov	Gross Section Properties, have allowed the use of Transformed Section Properties	Per AASHTO LRFD Table 5.9.4.2.2-1	We design continuous prestressed girder bridges as simple spans for all loads, but then add reinforcement over the piers to control cracking. We do use 5.14.1.4 to design the positive moment connection at the pier. We also allow the girder to be designed fully continuous for live load and superimposed dead with approval.	Approximate Estimate for I girder bridges designed with composite deck. b) for everything else.
Illinois DOT John Ciccone Senior Standards Engineer 217-782-9111 John.Ciccone@Illinois.gov	Gross Section properties	Per AASHTO LRFD Table 5.9.4.2.2-1	Generally IDOT follows 5.14.1.4 however some of the particulars were modified based on our experience. These are noted in our in house manuals and design guides. For example IDOT chose to adopt a 45 day rule instead of the 90 day rule specified in 5.14.1.4. Our 45 day rule requires the fabricator to hold a beam at the yard for 45 days before shipping. When you consider deck forming after delivery we estimate 60 days before a beam is locked into the structure. The reinforcement used to handle the positive restraint moments is designed for a minimum capacity of 1.2 Mcr. This reinforcement has been standardized for the sections we use and is either 2 or 3 - #8 hooked bars. Detailed calculation for creep and shrinkage are not required.	Approximate Estimate of Time-Dependent Losses Per AASHTO LRFD Article 5.9.5.3
Indiana DOT Randy Strain INDOT Bridge Standards Engineer 317-232-3339	Gross section properties as calculated in LEAP Conspan	Per AASHTO LRFD Table 5.9.4.2.2-1 In accordance with the code	Girders Made Continuous Per 5.14.1.4 and detailed per Standards	Approximate Estimate of Time-Dependent Losses Per AASHTO LRFD Article 5.9.5.3 Unless there are unique design requirements this requirement is per code.

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Iowa DOT Kenneth F. Dunker Transportation Engineer Specialist 515-233-7920 kenneth.dunker@dot.iowa.gov	Transformed section for service, camber, and deflection	Table 5.9.4.1.2-1 for transfer, Table 5.9.4.2.2-1 for service	Generally 5.14.1.4, simple for service and strength, continuous for deflection and substructure loads	Approximate Estimate of Time-Dependent Losses Per AASHTO LRFD Article 5.9.5.3
KDOT John Jones Br. Manual Engineer 785-368-7175 jjones@ksdot.org	Gross Section properties	Per AASHTO LRFD Table 5.9.4.2.2-1	Simple span moments for superimposed dead loads and live load	Approximate Estimate of Time-Dependent Losses Per AASHTO LRFD Article 5.9.5.3
Louisiana DOT Jenny Fu Assistant Bridge Design Administration 225 379 1321 Zhengzheng.fu@la.gov	Transformed section properties	Per AASHTO LRFD Table 5.9.4.2.2-1	Simple span moments for superimposed dead loads and live load	Both Approximate Estimate and Refined Estimates of Time-Dependent Losses are allowed. Approximate method is typically used
Maryland State Highway Administration Jeff Robert Senior Project Engineer410-545-8327 jrobert@sha.state.md.us	Transformed Section Properties	Per AASHTO LRFD Table 5.9.4.2.2-1	Per AASHTO LRFD Section 5.14.1.4 - Bridges Composed of Simple Span Precast Girders Made Continuous	Refined Estimates of Time-Dependent Losses Per AASHTO LRFD Article 5.9.5.4
Michigan DOT John Lazar Transportation Engineer 14 Lic Spl 517-335-3381 lazarj@michigan.gov	Gross Section properties	Per AASHTO LRFD Table 5.9.4.2.2-1	Simple span moments for positive Live Load and Superimposed Dead Load moments and Continuous for negative Live load and Superimposed Dead Load moments over the piers.	Approximate Estimate from Article 5.9.5.3
Minnesota DOT Dave Dahlberg Bridge Design Manual and Policy Engineer 651.366.4491 dave.dahlberg@state.mn.us	Gross Section properties	Zero tension at service limit state	All precast prestressed girder bridges are designed as simple span for all loads. The deck is cast continuous over the piers with additional top mat rebar included in the vicinity of the pier. The deck is saw cut partial depth and sealed at the pier to "guide" the anticipated crack in the deck.	Approximate Estimate of Time-Dependent Losses Per AASHTO LRFD Article 5.9.5.3
Mississippi DOT Nick Altobelli, PE State Bridge Engineer 601-359-7200 nalto@mdot.state.ms.us	Transformed Section Properties	Per AASHTO LRFD Table 5.9.4.2.2-£)	Per AASHTO LRFD Section 5.14.1.4 - Bridges Composed of Simple Span Precast Girders Made Continuous	Approximate Estimate of Time-Dependent Losses Per AASHTO LRFD Article 5.9.5.3

MoDOT Gregory Sanders Structural Development and Support Engineer 573.526.0245 gregory.sanders@modot. Mo.gov	Transformed Section Properties	Per AASHTO LRFD Table 5.9.4.2.2-1	Per AASHTO LRFD Section 5.14.1.4 - Bridges Composed of Simple Span Precast Girders Made Continuous	Refined Estimates of Time-Dependent Losses Per AASHTO LRFD Article 5.9.5.4
Montana DOT Jeff Olsen, P.E Bridge Area Engineer – Billings District 406-444-7610 jolsen@mt.gov	We use gross properties as a standard, but may use transformed on a case-by-case basis	Per AASHTO LRFD Table 5.9.4.2.2-1	Per AASHTO LRFD Section 5.14.1.4 - Bridges Composed of Simple Span Precast Girders Made Continuous	We use the approximate method with gross section properties and the refined method if we are using the transformed section properties.
NCDOT Todd M Garrison, PE Advanced Engineer (919) 707-6538 tgarrison@ncdot.gov	Gross Section properties (routinely used) Transformed Section Properties (used when beneficial)	Per AASHTO LRFD Table 5.9.4.2.2-1 (for AASHTO girders and modified bulb tees) b) Zero tension at service limit state (for cored slab and box beam units, and for all girders in corrosive environments)	Simple span moments for superimposed dead loads and live load	a) Approximate Estimate of Time-Dependent Losses Per AASHTO LRFD Article 5.9.5.3 b) Refined Estimates of Time-Dependent Losses Per AASHTO LRFD Article 5.9.5.4
Nebraska Department Of roads Fouad Jaber Assistant State Bridge Engineer 402-479-3967 fouad.jaber@nebraska.gov	Gross Section properties	Our present policy is to use 0.095sq.rtf'c and rate for 0.19sq.rtf"c	Per AASHTO LRFD 5.14.1.4	We don't have a policy but in general we use the approximate method
NHDOT David L. Scott In-House Design Chief (603) 271-2731 dscott@dot.state.nh.us	Transformed Section Properties	Zero tension at service limit state	NH has not done a continuous precast prestressed girder bridge since prior to LRFD implementation. When we design our next one, our first attempt will be option A.	Approximate Estimate of Time-Dependent Losses Per AASHTO LRFD Article 5.9.5.3
NJDOT Eric Kraehenbuehl Manager 609-530-2552 eric.kraehenbuehl@dot.state.nj.us	Gross Section properties	Zero tension at service limit state	Per AASHTO LRFD Section 5.14.1.4 - Bridges Composed of Simple Span Precast Girders Made Continuous	Refined Estimates of Time-Dependent Losses Per AASHTO LRFD Article 5.9.5.4
NMDOT Zann Jones Civil Engineer Advanced (505) 827-5583 zann.jones@state.nm.us	Gross Section properties	Per AASHTO LRFD Table 5.9.4.2.2-1	Per AASHTO LRFD Section 5.14.1.4 - Bridges Composed of Simple Span Precast Girders Made Continuous	Approximate Estimate of Time-Dependent Losses Per AASHTO LRFD Article 5.9.5.
NV DOT Todd Stefonowicz Ass't Chief Structures Engr 775.888.7550 tstefonowicz@dot.state.nv.us	Net section properties	Per AASHTO LRFD Table 5.9.4.2.2-1	Per AASHTO LRFD Section 5.14.1.4 - Bridges Composed of Simple Span Precast Girders Made Continuous	Approximate Estimate of Time-Dependent Losses Per AASHTO LRFD Article 5.9.5.3

NYS DOT Rajesh Taneja Assistant Director, Bridge Design Bureau 518-457-2595 rtaneja@dot.state.ny.us	Gross Section Properties Composite with slab.	Per AASHTO LRFD Table 5.9.4.2.2-1 (for HL-93 Live Load) 1. For NYSDOT Design Permit Vehicle stress limit is $0.14\sqrt{f'c}$ (for other than segmentally constructed bridges) 2. All bridges in NYS are subjected to severe corrosion conditions.	Simple span moments for superimposed dead loads and live load We also design the slab joint over the pier for superimposed dead loads & live load.	Refined Estimates of Time-Dependent Losses Per AASHTO LRFD Article 5.9.5.4 We use Commercial Software, LEAP software from Conspan and Virtis/Opis
Ohio DOT Sean Meddles Bridge Standards Engineer 614-466-2464 Sean.Meddles@dot.state.oh.us	Gross Section properties	Per AASHTO LRFD Table 5.9.4.2.2-1	ODOT requires designers to consider two loading conditions: 1. Simple span for non-composite loadings and continuous for live load and composite dead load including an allowance for future wearing courses. 2. Simple span for all non-composite and composite loadings excluding an allowance for future wearing courses.	Approximate Estimate of Time-Dependent Losses Per AASHTO LRFD Article 5.9.5.3
Oklahoma DOT Roland Sison Designer (405) 325-4140 rsison@odot.org	Gross Section properties	Per AASHTO LRFD Table 5.9.4.2.2-1	Simple span moments for superimposed dead loads and live load	Refined Estimates of Time-Dependent Losses Per AASHTO LRFD Article 5.9.5.4
Oregon DOT Craig Shike Interim Bridge Standards Managing Engineer 503-986-3323 Craig.L.SHIKE@odot.state.or.us	Gross Section properties Oregon does not permit the prestress gain due to live load to be included in the prestress loss calculation. Therefore, use of transformed section properties is not permitted since it would automatically include the prestress gain due to live load.	Simple spans – 0.0948*sqrt(f'c). This is 50% the tension allowed in LRFD. This level of allowable tension was selected after a study of designs prepared using the standard specifications with 0.0948*sqrt(f'c) for HS25 loading and no tension for HS20 loading. Precast prestressed concrete slabs, boxes and girders form the majority of Oregon's bridge inventory. When LRFD was introduced, Oregon did not want to begin building new	Oregon follows Section 5.14.1.4, but also requires bridges to be evaluated as if they were simply supported with the tension near midspan limited to 0.19*sqrt(f'c).	Oregon believes the refined estimate of losses per 5.9.5.4 provides the best accuracy. Before this method was available, Oregon used a method which provided similar estimates. Oregon has never seen a prestressed member with noticeable moment cracks. For this reason, we believe the refined method provides a satisfactory level of conservatism.

		bridges under the LRFD code which would have less load capacity than those already in our inventory. The tension limitation of 0.0948*sqrt(f'c) ensures LRFD bridges will never be a weak link on the Oregon highway system. When continuous for live load, 0.0948*sqrt(f'c) and verify tension due to positive moment does not exceed 0.19*sqrt(f'c) when spans are considered to act as simply supported.		
PennDOT Tom Macioce Chief Bridge Engineer 717.787.2881 tmacioce@pa.gov	Gross Section Properties are used for all stiffness analysis and DL stress analysis. Transformed Section Properties used for LL stresses analysis. PSLRFD uses transformed section properties for LL stress analysis only (not for stiffness analysis). See the attached pages for the PSLRFD UM. The transformed section properties take into account the transformed effects of the prestressing strands (mild steel neglected). This is in accordance to DM-	Always use 0.0948 √f'c	For Prestressed concrete beam bridges made continuous for superimposed dead load and live load, all structure components are designed for the more critical condition of full continuity or the complete loss of continuity at the diaphragms over the interior supports. Positive moment steel in the continuity diaphragm(s) is not required since the structure design is not predicated on ensuring continuity.	Refined Estimates of Time-Dependent Losses Per AASHTO LRFD Article 5.9.5.4
South Carolina DOT Barry Bowers Structural Design Support Engineer 803-737-4814 bowersbw@scdot.org	Gross Section properties	Tensile stress limits for fully prestressed concrete members shall conform to the requirements for "Other Than Segmentally Constructed Bridges" in LRFD Article 5.9.4. Projects located in Beaufort, Berkeley, Charleston,	Where practical, multiple span bridges composed of precast, prestressed concrete girders should be detailed as continuous with continuity diaphragms at interior supports to eliminate expansion joints in the deck slab. When precast, prestressed concrete girders	In analyzing stresses and/or determining the required length of debonding, stresses shall be limited to the values in LRFD Article 5.9.4. Projects located in Beaufort, Berkeley, Charleston, Colleton, Dorchester, Georgetown, Horry, and Jasper Counties shall be designed using

		Colleton, Dorchester, Georgetown, Horry, and Jasper Counties shall be designed using the stress limits for severe corrosive conditions. Projects located in all other counties shall be designed using the stress limits for moderate corrosion conditions.	are detailed as continuous for live load and superimposed dead load, the following apply: • All structural components shall be designed for the more critical condition of either assuming a fully effective connection at the continuity diaphragm (fully continuous span) or assuming complete loss of continuity (simple spans). • Restraint moments caused by girder creep and shrinkage may be neglected. • A positive moment connection shall be provided with a factored resistance, <ϕMn, of not less than 1.2 Mcr, as specified in AASHTO LRFD Article 5.14.1.4.9. See the *SCDOT Bridge Drawings and Details* (available at the SCOOT website) for preferred details of positive moment reinforcement in girders. • The specification of the minimum age of the precast girder when continuity is established is not required. • The requirements of AASHTO LRFD Articles 5.14. 1.4.6, 5.14.1.4.7, and 5.14.1.4.8 shall apply. • The design of continuity diaphragms at interior supports may be based on the strength of the concrete in the girders when the ends of girders are directly opposite each other	the stress limits for severe corrosive conditions. Projects located in all other counties shall be designed using the stress limits for moderate corrosion conditions.

			across a continuity diaphragm.	
Texas DOT Gregg A. Freeby, P.E. State Bridge Engineer 512 416-2192 Gregg.freeby@txdot.gov	Gross Section properties	Initial tension in the amount of 0.24*sqrt (f'ci) is allowed. Based on TxDOT experience, additional bonded reinforcement is not required. Final tension in the amount of 0.19*sqrt(f'c) is allowed. Tension in the amount of 0.24*sqrt(f'c) is allowed for checking concrete stresses during deck and diaphragm placement.	TxDOT does not design continuous precast prestressed girder bridges. All girders are simple span. The slab is continuous over the interior supports but this is neglected in girder design.	TxDOT method is to use AASHTO LRFD Bridge Design Specifications 2004, 3rd. Ed., Article 5.9.5 Loss of Prestress.
Utah DOT Joshua J Sletten Structures Design Manager801-633-6314jsletten@utah.gov	Gross section properties	AASHTO LRFD	AASHTO LRFD girders made continuous	A & B are acceptable A. Approximate Estimate of Time-Dependent Losses B. Refined Estimates of Time-Dependent Losses
Virginia DOT Julius Volgyi, JR Assistant State Structure and Bridge Engineer 804 786-7537 Julius.volgyi@vdot.virginia.gov	Gross Section properties	per AASHTO LRFD Table 5.9.4.2.2-1	Per AASHTO LRFD Section 5.14.1.4 - Bridges Composed of Simple Span Precast Girders Made Continuous	Approximate Estimate of Time-Dependent Losses Per AASHTO LRFD Article 5.9.5.3 VDOT do not include gains
Washington State DOT Bijan Khaleghi Bridge Design Engineer 360 705-7181 khalegb@wsdot.wa.gov	Gross Section properties	Zero tension at service limit state	Simple span moments for superimposed dead loads and live load	Refined Estimates of Time-Dependent Losses Per AASHTO LRFD Article 5.9.5.4
Wisconsin DOT David Kiekbusch Structural Development Engineer 608-266-5084 david.kiekbusch@dot.wi.gov	Gross Section properties	Per AASHTO LRFD Table 5.9.4.2.2-1	Per AASHTO LRFD Section 5.14.1.4 - Bridges Composed of Simple Span Precast Girders Made Continuous	Approximate Estimate of Time-Dependent Losses Per AASHTO LRFD Article 5.9.5.3