T-3 Ballot Item

Overview of 2011 Ballot Items

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AASHTO Subcommittee on Bridges and Structures
Technical Committee for Seismic Design T-3
Norfolk, Virginia
Mark Mahan – Team Leader, Caltrans
Elmer Marx – Alaska DOT
Chris Unanwa – Caltrans
Jaro Simek – Caltrans
Dan Tobias – Illinois DOT
Chyuan-Shen Lee – Washington State DOT
Stephanie Brandenberger – Montana DOT
Derrell Manceaux – FHWA
Mehdi Raoof-Malayeri – Missouri DOT
Lee Marsh - BergerABAM
35 Individual Ballot Items (#s 8 to 43 of Agenda)
2 Ballot Items – Affect LRFD Specs
33 Ballot Items – Affect Seismic Guide Specs
Last major revision in 2008 (2009 1st Edition GS)
8. **GS 1.3 – Replacement Flow Charts**
   - Provided charts for General, by SDC, and fdn & detailing
   - Simplified for improved readability and easier use
   - *Fdn & Det (Fig 1.3-5) changed > capacity protection and P-Delta for C&D only*

9. **GS 2.1 and 2.2 – New Definitions**
   - Defines “Oversized pile shaft”
   - Updated notation *(linked to other ballot items)*

10. **GS 3.2 – Liquefaction, Flow or Spread**
    - Re-words permission for inelastic action in piles and shafts with liquefaction, liquefaction-induced lateral flow, or liquefaction-induced lateral spreading

11. **GS C3.3 – Liquefaction, Flow or Spread**
    - Makes commentary consistent with Item 10
12. GS C3.4.1 – Error correction to USGS CD-ROM
   - $F_a$ is used in lieu of $F_{p,g,a}$ on CDROM. Table in GS is correct

13. GS C3.4.1 – Two decimal places for accelerations

14. GS C3.6 – Temporary structure accelerations in CDs
   - At Owner’s discretion contract docs should indicate if bridge was designed as temporary (< 5yrs) using reduced seismic accelerations

15. GS C3.7 – Live load with seismic
   - When LL considered with EQ, recommend $\gamma_{EQ}$ of 0.5 as in LRFD for typical bridges (better estimate for critical or essential bridges)
   - No need to include LL in seismic mass
   - LL need not be included in pushover analysis
16. **LRFD C3.10.2.1** – Error correction in USGS CD-ROM
   - Same issue as with GS is recognized in LRFD

17. **LRFD 3.10.9.2** – Connection force load path
   - For lower seismic zones prescribed connection force should be followed through the load path to foundation

18. **GS 4.2.1** – Subtended angle limit for analysis as straight, 30 deg
   - The limit of subtended angle for which a bridge can be analyzed as “straight” is recommended to be 30 degrees for the GS. It is 90 deg in the LRFD
Fly-by of Ballot Items

19. GS 4.6 - Connection force load path
   - Same connection force load path requirement as for lower SDC bridges as for LRFD

20. GS C4.9 – Definition of plastic hinging calculations
   - The basic displacement calculations for a plastically deforming cantilever are added to the commentary. This should help clarity and consistency of application. Figures are added also

21. GS C4.11.1 – Use of elastic forces
   - Cases where substructure is so strong as to make capacity protection uneconomical are recognized and elastic design is permitted with Owner’s permission and force-increase factor (1.2 to 2.0) to suppress brittle actions
22. GS 4.11.2 – Plastic hinging figure improvement
   - Existing figures have been added to define overstrength moment conditions in typical bents, longitudinal and transverse
   - Caption to Figure 4.11.2-2 should read “Integral”, not “Nonintegral”

23. GS 4.12.3 – SDC D single-span support length
   - In SDC D a calculated displacement is required for the support length calculation, and this is not available for single-spans. Thus, use 150% of basic support length (consistent with SDC C)

24. GS 4.13.1 – Restrainer design reference
   - For Critical or Essential bridges restrainer or extended support lengths are recommended. Extended support length formula in commentary
   - Reference to Retrofit Manual restrainer calc is provided

25. GS 4.14 – Shear key overstrength too conservative
   - Overstrength for shear keys is reduced from 2*Vn to 1.5*Vn
26. GS 5.6.2 – Improved $E_{I_{\text{eff}}}$ charts
   - New charts clarify horizontal axis variable, $P/(f'\text{ce}^*\text{Ag})$

27. GS 6.4.5 – Footing joint shear reinforcement
   - Joint shear steel is required in cap beams and should be in footings, particularly where column bars turn outward
   - The prescriptive Caltrans method is adopted here for SDC C&D
   - #5 @ 12 EW within $D_{\text{ftg}}$ of column + anchorage requirements

28. GS 6.8 – Analysis w/ liquefaction
   - Language regarding analysis of structure in liquefied condition is made mandatory
   - Structure designed for nonliquefied configuration shall be analyzed for liquefied condition with no reduction in spectrum
29. GS 8.4.4 – In-ground hinge limits increased
   – In-ground plastic hinge confined concrete strain limits permitted to go as high as 0.02 vs 0.008 limit currently suggested.

30. GS 8.5 – Essentially Elastic definition improved & cautionary note about member size added
   – $M_{ne}$ set by 0.003 concrete strain or steel reaches table strain limit
   – Suggest minimizing member strength for to limit overstrength forces

31. GS 8.6.1 – Added defn for non-oversized shaft $V_u$, and $V_c$ outside hinge zone increased
   – SDC B $V_u = \min (\text{elastic or } V_{po} \text{ as determined for SDC C and D})$
   – SDC C & D $V_u$ from p-y type SSI or based on IP to 2D within shaft
   – $V_c$ outside hinge zone consistent with hinge zone ($3 \text{ vs } 2\sqrt{f'c}$)
32. GS 8.6.2 – Improved readability of shear equations
   – Equations reformatted using shear adjustment factor to read better
   – Diameter of column core defined to center of spiral or hoop

33. GS C8.6.3 – Interlocking spiral side steel
   – Side steel required between spirals along long side
   – Spaced every other spiral turn or hoop and anchored into core

34. GS C8.8.4 – Column longitudinal steel cutoffs
   – Commentary recommending extension of column steel as far as possible
     into joint region, near opposite face
   – With two-stage drop caps, extend column bars to top of lower stage

35. GS 8.8.9 – Location of hoop weld details
   – With welded hoops, stagger weld splices at circumference 1/3 points
   – With interlocking spirals, welds should be inside interlock region
36. GS 8.8.10 – Col. long. steel cutoffs in shafts
   - Minimum column bar embeds into oversized shafts, $l_d + D_c$ alternate with $l_d + 2D_c$

37. GS C8.8.11 – Transverse steel spacing col-to-shaft
   - The transverse steel spacing is opened up to twice that of the column in the shaft transition (column splice) zone

38. GS 8.9 – Flexural overstrength for shafts
   - Shaft $M_{ne}$ strength $\geq 1.25$ Moment from $M_{po}$ of column, under liquefied conditions this may be scaled back to 1.0 w/ Owner’s permission

39. GS 8.10 – Girder-to-column moment distribution for precast bridges
   - 2/3rds of the longitudinal seismic moment may be resisted within effective width, $Beff$
   - The other 1/3 is resisted outside, if tributary width permits
Fly-by of Ballot Items

40. GS 8.13 – Improved joint shear definitions
   – The joint shear equation variables have been more clearly defined
   – Provisions require joints that do not fit geometry of T and Knee joints to be designed using strut-and-tie models

41. GS 8.13.4 – Revised T & Knee-joint shear requirements
   – Expands article to cover both T and Knee configurations
   – Provides new requirements of knee joints and improved figures

42. GS 8.14.1 – Improved isolation gap requirements
   – Requires full gap across flares, if flares are to be isolated
   – Provides method for calculating rotation demand to prevent gap closure

43. GS 8.15 – Moment-reducing hinge details
   – Design requirements for column shear keys for moment-reducing hinge details provided, including gap requirements to prevent closure
Thank you!