Wind Load Risk - Philosophical Design Discrepancy

Between

Guide Specifications for Wind loads on Bridges during Construction 2017

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• Guide Specifications for Wind Loads on Bridge during Construction addresses:
  • Bridge superstructure before deck is cast
  • Permanent bridge substructure
  • But defers to Guide Design Specifications for Bridge Temporary Works for design of temporary falsework

• Guide Design Specifications for Bridge Temporary Works addresses wind load on temporary works only

• Therefore no direct conflict between scope of guide documents
Guide Specifications for Wind Loads on Bridge during Construction & Guide Design Specifications for Bridge Temporary Works

Share Same:

- Windspeed charts based on 3 second wind gust with 7% probability of exceedance in 50 years
- Similar wind pressure formula methodology

But differ with respect to wind speed Reduction factor “R”
2016 Interim Revisions to LRFD Bridge Design Specifications

- Basic wind pressure equation: $P_z = 2.56 \times 10^{-6}V^2K_zGCD$ \hspace{1cm} (3.8.1.2.1-1)

Guide Specifications for Wind Loads on Bridge during Construction

- Basic wind pressure equation: $P_z = 2.56 \times 10^{-6}V^2R^2K_zGCD$ \hspace{1cm} (4.2.1-1)

- Pressure equation shares formula with LRFD Bridge specifications
  - BUT with addition of wind speed reduction “R”
  - “R” factor ranges from a minimum of .65 to 1
    (dependent on construction duration and bridge importance)
  - Exposure and elevation coefficient “$K_z$ based on logarithmic wind profiles

Guide Design Specifications for Bridge Temporary Works

- Wind pressure equation terminology differs from LRFD Bridge Specifications
  - Basic wind Force equation for trussed towers and lattice framework
    $F = q_zGC_fA_f$ \hspace{1cm} (C-1)
    where wind pressure $q_z$ (psf) = $0.00256K_zK_{zt}K_dV^2$
  - (Basic wind Force equation for solid surfaces similar)
  - Terminology based on ASCE 7 Wind Provisions
  - Developed prior to 2016 LRFD Bridge specification wind load total rewrite
  - Exposure and elevation coefficient “$K_z$ based on power law wind profiles
Guide Specifications for Wind loads on Bridge During Construction

Wind speed reduction factors “R”

- Table based on inactive work site. For active work site “R” = 1.0 with 20mph max wind speed
- “R” based 7% probability of return over the construction durations indicated. For durations longer than 7 years “R” = 1

Table 4.2.1-1— Wind Speed Reduction Factor during Construction, R

<table>
<thead>
<tr>
<th>Superstructure Construction Duration</th>
<th>Wind Speed Reduction Factor during Construction R</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-6 weeks</td>
<td>0.65</td>
</tr>
<tr>
<td>6 weeks to 1 year</td>
<td>0.73</td>
</tr>
<tr>
<td>&gt;1-2 years</td>
<td>0.75</td>
</tr>
<tr>
<td>&gt;2-3 years</td>
<td>0.77</td>
</tr>
<tr>
<td>&gt;3-7 years</td>
<td>0.84</td>
</tr>
</tbody>
</table>
Revision Warranted in wind load design criteria
Design Specifications for Bridge Temporary Works

- Should not need more demanding wind load design criteria than Guide Specifications for Wind Loads on Bridge during Construction. Result in unnecessary construction cost.

- Wind design load risk philosophy accepted in Guide Specifications for Wind Loads on Bridge during Construction should be sufficient
Revise *Guide Design Specifications for Bridge Temporary Works* to correlate with wind design risk philosophy of *Guide Specifications for Wind Loads on Bridge during Construction*

- **Option 1** – Self-contained wind design load provisions
  - Section 2.2.5.2 and Appendix C – Delete existing and meld LRFD Bridge Design specifications for wind load and *Guide Specifications for Wind Loads on Bridge during Construction* including wind speed reduction factor “R” to wind pressure equation

- **Option 2** – Piggy back on LRFD Bridge Design specifications
  - Rewrite Section 2.2.5.2 directing reader to requirements of LRFD 3.8.1.2 “Wind Load on Structures”, but with amended wind pressure equation 3.8.1.2-1 including wind speed reduction factor “R”