REFFERENCES

- A. Christian, “Bridge Failures-Lessons learned,” Bridge Engineering Course, University of Buffalo, 2010.
- A. Cran, “Design and Testing Composite Open Web Steel Joists,” Technical Bulletin 11, Stelco, 1972.
- AASHTO LRFD Bridge Design Specifications, 4th Ed., 2007. American Association of State Highway and Transportation Officials (AASHTO), AASHTO LRFD Bridge Design Specification, Washington, D.C., 1998
- Alexandre, and A. Mendes, “Composite Steel-Concrete Bridges with Double Composite Action,” IST, Technical University of Lisbon, Portugal.
- American National Standard, SJI-CJ-2010, ‘Standard Specification for Composite Steel Joists C-J series’. Anon, “Constructional Steel Design: An International Guide,” Elsevier, London,1993.
- ASCE Task Committee on Design Criteria for Composite Structures in Steel and Concrete, “Proposed Specification and Commentary for Composite Joists and Composite Trusses,” ASCE, Journal of Structural Engineering, 1996, v. 122. 162
- Astaneh-Asl A. Behavior and design of steel and composite structures including seismic effects, EPS, 2008.
- Astaneh-Asl, “Progressive Collapse of Steel Truss Bridges, the case of I-35W collapse,” Z7th International Conference on Steel Bridges, Guimarães, Portugal, 2008.
- Ballarini, and T. Okazaki, “The Infamous Gusset Plates,” University of Minnesota Pres*s*, Minnesota.
- Berthellemy J. Ponts mixtes — Be´tonnage des dalles. Ouvrages d’art, n° 13, nov. 1993, SETRA. Bagneux
- Birajdar, H. S., Maiti, P. R., & Singh, P. K. (2014). Failure of Chauras Bridge. Engineering Failure Analysis, 45, 339–346. doi:10.1016/j.engfailanal.2014.06.015
- Bouchair, J. Bujnak and P. Duratna, “Connection in Steel-Concrete Composite Truss,” Steel Structures and Bridges, *Procedia Engineering*, 2012, v. 40, pp. 96-101.
- Brattland, and D. J. L. Kennedy, “Flexural Tests of Two Full-Scale Composite Trusses,” *Canadian Journal of Civil Engineering*, 1992, v. 19, pp. 279-295.
- BS 5400:1978, Steel, concrete and Composite bridges - Part 2, Specification for loads, Europe, 2005.
- BS EN 1993-1-1:2005, Design of steel structures - Part 1-1: General rules and rules for buildings, Europe, 2005.
- C. Wang, and D. J. Kaley, “Composite Action of Concrete Slab and OpenWeb Joist (Without the Use of Shear Connectors),” AISC Engineering Journal, 1967, v. 4.
- Canadian Institute of Steel Construction (CISC), Handbook of Steel Construction, CAN/CSA S16.1 94, Section 16, Open-Web Steel Joists, 7th Edition, Willowdale, Ontario, 1997.

- CEN. Eurocode 4: 'Design of composite steel and concrete structures. Part 2: General rules and rules for bridges', Brussels, 2005.
- Chapter 27, "Trusses', Instiute for Steel Development & Growth (INSDAG)," Kolkata -700 019, India.
- Construction Risk Management, Listing of USA Bridge Failures from January 1, 1980 to December 31, 2009, CRM, 2012.
- Cruz, and A. J. Reis, "Pontes com tabuleiros misto açobetão: utilização de betões leves de alto desempenho," 3º Encontro de Construção Metálica e Mista, Aveiro, 2001.
- D. J. Victor, Essentials of Bridge Engineering, Oxford & IBH Publications co. pvt. Ltd., New Delhi, India.
- D. Matteis et al. "Steel –concrete composite bridges – Sustainable design guide", SETRA, France, 2010.
- D. Xue, Y. Liu, J. He, and B. Ma, "Experimental study and numerical analysis of a composite truss joint," Journal of Constructional Steel Research, 2011, v. 67, pp. 957-964.
- EN 1994-1-1:2004 Eurocode 4: Design of composite steel and concrete structures - Part 1-1: General rules and rules for buildings.
- ENV 1994-2. Eurocode-4: Design of composite steel and concrete structures, Part 2: Composite bridges. CEN; 2001.
- G. Dauner, G. Decorges, A. Oribasi, and D. Wéry, "The Lully Viaduct, a Composite Bridge with Steel Tube Truss," *Journal of Constructional Steel Research*, 1998, Paper 55.
- Gara, G. Leoni, and L. Dezi, "Slab Cracking Control in Continuous Steel Concrete Bridge Decks," Journal of Bridge Engineering, ASCE, 2013, v.18, pp. 1319-1327.
- Garg, R. K.,Chandra S., & Kumar. A. (2013). A study of U.S. bridge failures (1980–2012) (Tech. Report No. MCEER-13- 0008). New York: Multidisciplinary Center for Earthquake Engineering Research, University at Buffalo, State University of New York
- H. Azmi, Composite Open-Web Trusses with metal Cellular Floor, Master of Engineering thesis, McMaster University, Hamilton, Ontario, 1972.
- H. G. Lembeck, "Composite Design of Open Web Steel Joists," Master of Science Thesis, Washington University, St. Louis, MO., 1965.
- H. Iyengar, and J.J. Zils, "Composite Floor Syatem for Sears Tower", *Engineering Journal*, American Institute of Steel Construction, 1973, v. 10, pp. 74-81.
- H. K. Ryu, C. S. Shim, S. P. Chang, and C. H. Chung, "Inelastic behaviour of externally prestressed continuous composite box-girder bridge with prefabricated slabs," Journal of Constructional Steel Research, 2004, v. 60, pp. 989-1005.
- H. K. Ryu, Y. J. Kim, and S. P. Chang, "Crack control of a continuous composite two girder bridge with prefabricated slabs under static and fatigue loads," Engineering Structures, 2007, v. 29, pp. 851-864.
- H. Petroski, Article on The paradox of failure, August, 04, 2007.

- H. R. Tide, and T. V. Galahbos, "Composite Open-Web Steel Joists", Research Report No.4, Structural Division, Civil and Environmental Engineering Department, Washington University, St. Louis, 1968. R. H. Wang, Q. S. Li, Q. Z. Luo, J. Tang, H. B. Xiao, and Y. Q. Huang, "Nonlinear analysis of plate truss composite steel girders," Engineering Structures, 2003, v. 25, pp. 1377-1385.
- http://www.bridgeforum.org/dir/collapse/year/0000-3000.html
- Imhof, "Risk Assessment of Existing Bridge Structures," Ph.D. Thesis, University of Cambridge, USA, 2004.
- IRC 22-2015, "Standard Specifications and Code of Practice for Road Bridges Section VI (Composite Construction-Limit state design)," Indian Road Congress, 2015, India.
- IRC 24-2010, Standard specifications and code of practice for road bridges, Section V, Steel road bridges (Limit State Method) (Third revision), India, 2010.
- IRC 6-2017, 'Standard specifications and code of practice for road bridges', Section II, Loads and Load combinations (Seventh revision), India, 2017.
- IS 1343-1980, Code of Practice for Prestressed Concrete, India, 1999.
- IS 13780-1993, Indian Standard Hardmetals-Compression test,1993.
- IS 456-2000 Plain and Reinforced Concrete - Code of Practice (Fourth-Revision)
- IS 800-2007, Indian Standard, Code of Practice for General Construction in Steel (based on limit state method), India, 2007.
- J. Brozzetti, "Design development of steel-concrete composite bridges in France," Journal of Constructional Steel Research, 2000, v. 55, pp. 229-243.
- J. He, Y. Liu, A. Chen and T. Yoda, "Experimental study on inelastic mechanical behaviour of composite girders under hogging moment," Journal of Constructional Steel Research, Elsevier, 2010, v. 66, pp. 37-52.
- J. Machacek, and M. Charvat, "Local effects of truss node forces on shear connection in composite truss beams," Sustainable Solutions in Structural Engineering and Construction, ISEC Press, 2014.
- J. Machacek, and M. Cudejko, "Composite steel and concrete bridge trusses," Engineering Structures, 2011, v. 33, pp. 3136-3142.
- J. Machacek, and M. Cudejko, "Longitudinal shear in composite steel and concrete trusses", Engineering Structures, 2009, v. 31, pp. 1313-1320.
- J. Machacek, and M. Cudejko, "Steel and concrete composite bridge trusses", METNET, Aarhus, 2011.
- J. R. U. Mujagic, W. S. Easterling, T. M. Murray, "Design and behaviour of light composite steel concrete trusses with drilled standoff screw shear connections,"Journal of Constructional Steel Research, 2010, v. 66, pp. 1483-1491.
- J. R. Ubejd Mujagi, W. S. Easterling, and T. M. Murray, "Drilled standoff screws for shear connection in light composite steel - concrete trusses," Journal of Constructional Steel Research, 2007, v.63, pp. 1404-1414.
- J. Reis, "Bridge decks: composite systems for improved aesthetics and environmental impact," Proc. 3rd International Meeting on Composite Bridges, Madrid, 2001, pp. 645-59.

- J. Reis, "Steel concrete composite bridges: options and design issues", 7th International Conference on Steel Bridges, Guimarães, Portugal, 2008.
- Jacques B., "Design development of steel-concrete composite bridges in France," Journal of constructional steel research, 2000, v. 55, pp. 229-243.
- K. Goyal, "New Technologies used/being used in construction of mega bridges at Chenab and Bogibeel," Indian Railway Institute of Civil Engineers (IRICEN), Pune.
- K. Wardhana, and F. C. Hadipriono, "Analysis of Recent Bridge Failures in the United States," Journal of Performance of Constructed Facilities, ASCE, 2003, v. 17, pp. 144-150.
- Korea Highway Bridge Specifications, Korean Ministry of Construction and Transportation, 2005.
- Lee, G. C., Mohan, S. B., Huang, C., & Fard, B. N. (2013). A study of U.S. bridge failures (1980–2012) (Tech. Report No. MCEER-13- 0008). New York: Multidisciplinary Center for Earthquake Engineering Research, University at Buffalo, State University of New York.
- Liao, T. Okazaki, R. Ballarini, A. E. Schultz, and T. V. Galambos, "Nonlinear Finite Element Analysis of Critical Gusset Plates in the I-35W Bridge in Minnesota," Journal of Structural Engineering, ASCE, 2011, v. 137, pp. 59- 68.
- M. Imam, and M. K. Chryssanthopoulos, "A review of metallic bridge failure statistics," Philadelphia, USA, IABMAS, 2010.
- Machaceka, and M. Charvat, "Design of Shear Connection between Steel Truss and Concrete Slab," 11th International Conference on Modern Building
- Materials, Structures and Techniques (MBMST), Procedia Engineering, 2013,v. 57, pp. 722-729, Elsevier.
- Millanes, "Outstanding composite steel-concrete bridges in the Spanish HSRL," Proceedings of the 7th International conference on steel bridges, Guimarães, 2008, pp. 73-84.
- National Transportation Safety Board (NTSB), "Collapse of I-35W Highway Bridge, Minneapolis, Minnesota, August 1, 2007," Highway Accident Report NTSB/HAR-08/03, Washington, DC, 2008.
- Ohgaki, "State of the Arts of Hybrid structures consisting of steel and concrete in Japan," 2011.
- P. Johnson, and R. I. Ivanov, "Local effects of concentrated longitudinal shear in composite Bridge Beams," The Structural Engineer, 2001, v. 79, pp. 19-23.
- Ponts Mixtes, Recommandations pour maı ˆtriser la fissuration des dalles. SETRA, Bagneux, 1995
- R. T. Brown, and A. H. Zureick, "Lightweight composite truss section decking," *Marine Structures*, 2001, v. 14, pp. 115-132.
- Reis, and J. J. O. Pedro, "Composite Truss Bridges: new trends, design and research," *Steel Construction,* Wiley Online Library, 2011, v. 4, pp. 176-182.
- S. Easterling, D. R. Gibbings, and T. M. Murray, "Strength of Shear Studs in Steel Deck on Composite Beams and Joists," American Institute of Steel Constructio*n,* 2003, pp. 44-55.

- S. H. Kim, J. H. Kim, J. H. Ahn and H. W. Song, "An analytical investigation of thermal prestressing method for continuous composite girder bridges," *Magazine of Concrete Research*, 2007, v. 59, pp. 165-178.
- S. H. Kim, J. H. Kim, J. H. Ahn and H. W. Song. "An analytical investigation of thermal prestressing method for continuous composite girder bridges," Magazine of Concrete Research, 2007, 59, No. 3, April, 165–178.
- S. Hao, "I-35W Bridge Collapse," Journal of Bridge Engineering*, ASCE,* 2010, v. 15, pp. 608-614.
- S. Kravanja, and S. Silih, "Optimization based comparison between composite I beams and composite trusses," Journal of Constructional Steel Research, 2003, v. 59, pp. 609-625.
- S. P. Chang, and C. S. Shim, "Continuous Composite Bridges with Precast Decks," *Korean Journal of Steel Structures*, 2001, v. 1, pp. 123-132.
- S. P. Timoshenko and James M. Gere, Theory of Elastic stability, TATA McGRAW-HILL, India, 2010.
- S. Rankovic, D. Drenic, "Static strength of the shear connectors in steel-concrete composite beams-Regulations and research analysis". Architecture and Civil Engineering, Vol. 2, 2002, pp. 251-259.
- S. Shim, and S. P. Chang, "Cracking of continuous composite beams with precast decks," Journal of Constructional Steel Research*,* 2003, v. 59, pp. 201-214.
- S. Shim, J. W. Whang, C. H. Chung, and P. G. Lee, "Design of Double Composite Bridges using High Strength Steel," The Twelfth East Asia-Pacific Conference on Structural Engineering and Construction, *Procedia Engineering*, 2011, v. 14, pp. 1825-1829.
- S. Walbridgea, and A. Nussbaumer, "Probabilistic fatigue analysis of shop and field treated tubular truss bridges," Journal of Constructional Steel Research*,* 2008, v. 64, pp. 156-166.
- SJI-CJ-2010, American National Standard, "Standard Specification for Composite Steel Joists C-J series".
- STAAD.Pro v8i Select Series 6 - Technical reference Manual- Bentley
- Y. Liu, H. Xin, J. He, D. Xue, and B. Ma, "Experimental and analytical study on fatigue behavior of composite truss joints," Journal of Constructional Steel Research*,* 2013, v. 83, pp. 21-36.
- Z. Šavor, M. Šavor, J. Gao, and M. Franetović, "Failures of Arch Bridges Causes, Lessons Learned and Prevention," 3rd Chinese - Croatian Joint Colloquium on Sustainable Arch Bridge*s*, Zagreb, Croatia, 2011.

ANNEXURE A: STAADPro editor file for Non-composite model

```
STAAD SPACE
START JOB INFORMATION
ENGINEER DATE 09-May-18
END JOB INFORMATION
INPUT WIDTH 79
UNIT MMS NEWTON
JOINT COORDINATES
1 0 0 0; 2 230 0 0; 3 680 0 0; 4 910 0 0; 5 230 -300 0; 6 680 -300 0;
7 0 0 300; 8 230 0 300; 9 680 0 300; 10 910 0 300; 11 230 -300 300;
12 680 -300 300;
MEMBER INCIDENCES
1 1 2; 2 2 3; 3 3 4; 4 2 5; 5 3 6; 6 4 6; 7 1 5; 8 5 6; 9 1 7; 10 2 8; 11 3 9;
12 4 10; 13 5 11; 14 6 12; 15 7 8; 16 8 9; 17 9 10; 18 8 11; 19 9 12; 20 10 12;
21 7 11; 22 11 12;
DEFINE MATERIAL START
ISOTROPIC STEEL
E 211805.7
POISSON 0.3
DENSITY 7.68195e-005
ALPHA 1.2e-005
DAMP 0.03
TYPE STEEL
STRENGTH FY 650 FU 700 RY 1.5 RT 1.2
END DEFINE MATERIAL
MEMBER PROPERTY AMERICAN
1 TO 3 8 TO 17 22 PRIS YD 8 ZD 8
4 TO 7 18 TO 21 PRIS YD 25.4 ZD 25.4
CONSTANTS
MATERIAL STEEL ALL
SUPPORTS
1 7 PINNED
4 10 FIXED BUT FX MX MY MZ
LOAD 1 LOADTYPE Dead  TITLE BUCKLING
JOINT LOAD
2 3 8 9 FY -1
PERFORM BUCKLING ANALYSIS MAXSTEP 1000 PRINT ALL
FINISH
```

ANNEX B: STAADPro editor file for Composite model

STAAD SPACE
START JOB INFORMATION
ENGINEER DATE 05-Dec-19
END JOB INFORMATION
INPUT WIDTH 79
UNIT METER KN
JOINT COORDINATES
1 0 0 0; 2 0.23 0 0; 3 0.68 0 0; 4 0.91 0 0; 5 0.23 -0.3 0; 6 0.68 -0.3 0;
7 0 0 0.26; 8 0.23 0 0.26; 9 0.68 0 0.26; 10 0.91 0 0.26; 11 0.23 -0.3 0.26;
12 0.68 -0.3 0.26; 13 0.0766667 0 0; 14 0.153333 0 0; 15 0.32 0 0; 16 0.41 0 0;
17 0.5 0 0; 18 0.59 0 0; 19 0.756667 0 0; 20 0.833333 0 0; 21 0.0766667 0 0.26;
22 0.153333 0 0.26; 23 0.756667 0 0.26; 24 0.833333 0 0.26; 25 0.32 0 0.26;
26 0.41 0 0.26; 27 0.5 0 0.26; 28 0.59 0 0.26; 29 0 0.001 0; 30 0.23 0.001 0;
31 0.68 0.001 0; 32 0.91 0.001 0; 33 0 0.001 0.26; 34 0.23 0.001 0.26;
35 0.68 0.001 0.26; 36 0.91 0.001 0.26; 37 0.0766667 0.001 0;
38 0.153333 0.001 0; 39 0.32 0.001 0; 40 0.41 0.001 0; 41 0.5 0.001 0;
42 0.59 0.001 0; 43 0.756667 0.001 0; 44 0.833333 0.001 0;
45 0.0766667 0.001 0.26; 46 0.153333 0.001 0.26; 47 0.756667 0.001 0.26;
48 0.833333 0.001 0.26; 49 0.32 0.001 0.26; 50 0.41 0.001 0.26;
51 0.5 0.001 0.26; 52 0.59 0.001 0.26; 64 0.91 0 0.13; 65 0 0 -0.05;
66 0.23 0 -0.05; 67 0.68 0 -0.05; 68 0.91 0 -0.05; 69 0.0766667 0 -0.05;
70 0.153333 0 -0.05; 71 0.32 0 -0.05; 72 0.41 0 -0.05; 73 0.5 0 -0.05;
74 0.59 0 -0.05; 75 0.756667 0 -0.05; 76 0.833333 0 -0.05; 77 0 0.001 -0.05;
78 0.23 0.001 -0.05; 79 0.68 0.001 -0.05; 80 0.91 0.001 -0.05;
81 0.0766667 0.001 -0.05; 82 0.153333 0.001 -0.05; 83 0.32 0.001 -0.05;
84 0.41 0.001 -0.05; 85 0.5 0.001 -0.05; 86 0.59 0.001 -0.05;
87 0.756667 0.001 -0.05; 88 0.833333 0.001 -0.05; 89 0 0 0.31; 90 0.23 0 0.31;
91 0.68 0 0.31; 92 0.91 0 0.31; 93 0.0766667 0 0.31; 94 0.153333 0 0.31;
95 0.756667 0 0.31; 96 0.833333 0 0.31; 97 0.32 0 0.31; 98 0.41 0 0.31;
99 0.5 0 0.31; 100 0.59 0 0.31; 101 0 0.001 0.31; 102 0.23 0.001 0.31;
103 0.68 0.001 0.31; 104 0.91 0.001 0.31; 105 0.0766667 0.001 0.31;
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115 0 0.001 -0.025; 116 0.0511111 0.001 0; 117 0.0511111 0.001 -0.025;
118 0.0766667 0.001 -0.025; 119 0.0255556 0.001 -0.05;
120 0.0511111 0.001 -0.05; 121 0.102222 0.001 0; 122 0.102222 0.001 -0.025;
123 0.127778 0.001 0; 124 0.127778 0.001 -0.025; 125 0.153333 0.001 -0.025;
126 0.102222 0.001 -0.05; 127 0.127778 0.001 -0.05; 128 0.178889 0.001 0;
129 0.178889 0.001 -0.025; 130 0.204444 0.001 0; 131 0.204444 0.001 -0.025;
132 0.23 0.001 -0.025; 133 0.178889 0.001 -0.05; 134 0.204444 0.001 -0.05;
135 0.26 0.001 0; 136 0.26 0.001 -0.025; 137 0.29 0.001 0;
138 0.29 0.001 -0.025; 139 0.32 0.001 -0.025; 140 0.26 0.001 -0.05;
141 0.29 0.001 -0.05; 142 0.35 0.001 0; 143 0.35 0.001 -0.025;
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159 0.56 0.001 -0.025; 160 0.59 0.001 -0.025; 161 0.53 0.001 -0.05;

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174 0.756667 0.001 -0.025; 175 0.705556 0.001 -0.05; 176 0.731111 0.001 -0.05;
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ELEMENT PROPERTY
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DEFINE MATERIAL START
ISOTROPIC STEEL
E 2.05e+008
POISSON 0.3
DENSITY 76.8195
ALPHA 1.2e-005

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DAMP 0.03
TYPE STEEL
STRENGTH FY 670000 FU 713000 RY 1.5 RT 1.2
ISOTROPIC CONCRETE
E 2.17185e+007
POISSON 0.17
DENSITY 23.5616
ALPHA 1e-005
DAMP 0.05
TYPE CONCRETE
STRENGTH FCU 50000
END DEFINE MATERIAL
MEMBER PROPERTY AMERICAN
4 6 TO 8 18 20 TO 22 PRIS YD 0.0254 ZD 0.0254
9 TO 14 94 PRIS YD 0.0127 ZD 0.0127
1 TO 3 5 15 TO 17 19 23 TO 38 PRIS YD 0.008 ZD 0.008
MEMBER PROPERTY AMERICAN
39 TO 62 PRIS YD 0.0055
CONSTANTS
BETA 5 MEMB 39
BETA 0 MEMB 52
MATERIAL STEEL MEMB 1 TO 62 94
MATERIAL CONCRETE MEMB 128 TO 589
SUPPORTS
1 7 PINNED
4 10 FIXED BUT FX MX MY MZ
LOAD 1 LOADTYPE Dead  TITLE DL
SELFWEIGHT Y -1
JOINT LOAD
2 3 8 9 FY -49.05
PERFORM ANALYSIS PRINT ALL
FINISH
```

Annexure C: STAAD editor file for 60.0m deck type composite bridge

STAAD SPACE
START JOB INFORMATION
ENGINEER DATE 07-Dec-19
END JOB INFORMATION
INPUT WIDTH 79
UNIT METER KN
JOINT COORDINATES
3 6 0 0; 4 9 0 0; 5 12 0 0; 6 15 0 0; 7 18 0 0; 8 21 0 0; 9 24 0 0; 10 27 0 0;
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134 76 77; 144 57 82; 146 82 83; 147 83 59; 148 83 57; 149 83 58; 150 82 84;
151 84 86; 152 86 88; 153 88 90; 154 90 92; 155 92 94; 156 94 96; 157 96 98;
158 98 100; 159 100 102; 166 77 102; 171 67 92; 173 93 69; 174 67 93;
175 93 94; 177 91 65; 178 90 91; 179 91 67; 180 66 91; 181 68 93; 182 69 94;
183 65 90; 184 88 89; 185 89 65; 186 63 89; 187 89 64; 188 63 88; 189 63 87;
190 87 86; 191 61 86; 192 61 87; 193 87 62; 194 61 85; 195 85 84; 196 59 84;
197 60 85; 198 59 85; 199 69 95; 200 95 96; 201 70 95; 202 95 71; 203 71 96;
204 71 97; 205 97 98; 206 72 97; 207 98 73; 208 97 73; 209 73 99; 210 99 100;
211 74 99; 212 100 75; 213 99 75; 214 75 101; 215 101 102; 216 101 76;
217 101 77; 221 3 426; 222 4 427; 223 5 428; 224 6 429; 225 7 430; 226 8 431;
227 9 432; 228 10 433; 229 11 434; 230 12 435; 231 13 436; 232 14 437;
233 15 438; 234 16 439; 235 17 440; 236 18 441; 237 19 442; 238 20 443;
239 21 444; 240 22 445; 241 23 446; 245 28 82; 246 30 84; 247 32 86; 248 34 88;
249 36 90; 250 38 92; 251 40 94; 252 42 96; 253 44 98; 254 46 100; 255 48 102;
262 28 84; 263 82 30; 264 30 86; 265 84 32; 266 32 88; 267 86 34; 268 34 90;
269 88 36; 270 36 92; 271 90 38; 272 38 94; 273 92 40; 274 40 96; 275 94 42;
276 42 98; 277 96 44; 278 44 100; 279 98 46; 280 46 102; 281 100 48;
749 426 57; 752 427 58; 755 428 59; 758 429 60; 761 430 61; 764 431 62;
767 432 63; 770 433 64; 773 434 65; 776 435 66; 779 436 67; 782 437 68;
785 438 69; 788 439 70; 791 440 71; 794 441 72; 797 442 73; 800 443 74;
803 444 75; 806 445 76; 809 446 77; 810 426 427; 811 427 428; 812 428 429;

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813 429 430; 814 430 431; 815 431 432; 816 432 433; 817 433 434; 818 434 435;
819 435 436; 820 436 437; 821 437 438; 822 438 439; 823 439 440; 824 440 441;
825 441 442; 826 442 443; 827 443 444; 828 444 445; 829 445 446;
ELEMENT INCIDENCES SHELL
831 3 426 427 4; 832 426 57 58 427; 833 4 427 428 5; 834 427 58 59 428;
835 5 428 429 6; 836 428 59 60 429; 837 6 429 430 7; 838 429 60 61 430;
839 7 430 431 8; 840 430 61 62 431; 841 8 431 432 9; 842 431 62 63 432;
843 9 432 433 10; 844 432 63 64 433; 845 10 433 434 11; 846 433 64 65 434;
847 11 434 435 12; 848 434 65 66 435; 849 12 435 436 13; 850 435 66 67 436;
851 13 436 437 14; 852 436 67 68 437; 853 14 437 438 15; 854 437 68 69 438;
855 15 438 439 16; 856 438 69 70 439; 857 16 439 440 17; 858 439 70 71 440;
859 17 440 441 18; 860 440 71 72 441; 861 18 441 442 19; 862 441 72 73 442;
863 19 442 443 20; 864 442 73 74 443; 865 20 443 444 21; 866 443 74 75 444;
867 21 444 445 22; 868 444 75 76 445; 869 22 445 446 23; 870 445 76 77 446;
ELEMENT PROPERTY
831 TO 870 THICKNESS 0.225
DEFINE MATERIAL START
ISOTROPIC STEEL
E 2.05e+008
POISSON 0.3
DENSITY 76.8195
ALPHA 1.2e-005
DAMP 0.03
TYPE STEEL
STRENGTH FY 253200 FU 407800 RY 1.5 RT 1.2
ISOTROPIC CONCRETE
E 2.17185e+007
POISSON 0.17
DENSITY 23.5616
ALPHA 1e-005
DAMP 0.05
TYPE CONCRETE
STRENGTH FCU 27579
END DEFINE MATERIAL
MEMBER PROPERTY AMERICAN
38 39 66 70 73 74 79 80 85 86 90 91 94 95 99 101 104 106 109 110 148 149 173 -
177 180 181 186 187 192 193 197 198 201 202 206 208 211 213 216 217 -
245 TO 255 262 TO 280 -
281 PRIS AX 0.007862 IX 0.00033088 IY 0.00028816 IZ 4.27e-005
MEMBER PROPERTY INDIAN
221 TO 241 749 752 755 758 761 764 767 770 773 776 779 782 785 788 791 794 -
797 800 803 806 809 TO 829 TABLE ST ISMB600
MEMBER PROPERTY INDIAN
40 41 48 49 150 151 158 -
159 PRIS AX 0.036576 IX 0.003527 IY 0.0017797 IZ 0.001747
5 TO 24 42 TO 47 115 TO 134 152 TO 156 -
157 PRIS AX 0.04102 IX 0.004522 IY 0.002577 IZ 0.0019458
34 59 64 67 68 71 72 75 TO 78 81 92 93 96 144 166 171 174 175 178 179 182 -
183 TO 185 188 199 200 -
203 PRIS AX 0.0114637 IX 0.000650402 IY 5.20233e-005 IZ 0.000598378
36 37 82 TO 84 87 TO 89 97 98 100 102 103 105 107 108 146 147 189 TO 191 194 -
195 TO 196 204 205 207 209 210 212 214 -
215 PRIS AX 0.021865 IX 0.00132741 IY 0.000204891 IZ 0.00112251
CONSTANTS
MATERIAL STEEL MEMB 5 TO 24 34 36 TO 49 59 64 66 TO 68 70 TO 110 115 TO 134 -
144 146 TO 159 166 171 173 TO 175 177 TO 217 221 TO 241 245 TO 255 -
262 TO 281 749 752 755 758 761 764 767 770 773 776 779 782 785 788 791 794 -
797 800 803 806 809 TO 829
MATERIAL CONCRETE MEMB 831 TO 870
SUPPORTS
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28 82 PINNED
48 102 FIXED BUT FX MX MY MZ
LOAD 1 LOADTYPE Dead  TITLE DL+SIDL+CRASHBARRIER
SELFWEIGHT Y -1.1
JOINT LOAD
4 TO 22 58 TO 76 FY -29.14
3 23 57 77 FY -14.57
LOAD 2 LOADTYPE Wind  TITLE WIND LOAD
JOINT LOAD
5 7 9 11 13 15 17 19 21 30 32 34 36 38 40 42 44 46 FZ 33
3 23 28 48 FZ 17.5
LOAD 3 LOADTYPE Seismic  TITLE EQZ
JOINT LOAD
30 32 34 36 38 40 42 44 46 FZ 51.2
28 48 FZ 25.6
5 7 9 11 13 15 17 19 21 FZ 151.5
3 23 FZ 75.75
LOAD 4 LOADTYPE Dead  TITLE BREAKING
JOINT LOAD
3 TO 23 57 TO 77 FX 4
PERFORM ANALYSIS PRINT ALL
PARAMETER 1
CODE AISC
PARAMETER 2
CODE AISC
PARAMETER 3
CODE INDIAN
STEEL TAKE OFF ALL
FINISH
```

Annexure D: STAAD editor file for 60.0m through type composite bridge

STAAD SPACE
START JOB INFORMATION
ENGINEER DATE 09-Jun-19
END JOB INFORMATION
INPUT WIDTH 79
UNIT METER KN
JOINT COORDINATES
3 6 0 0; 4 9 0 0; 5 12 0 0; 6 15 0 0; 7 18 0 0; 8 21 0 0; 9 24 0 0; 10 27 0 0;
11 30 0 0; 12 33 0 0; 13 36 0 0; 14 39 0 0; 15 42 0 0; 16 45 0 0; 17 48 0 0;
18 51 0 0; 19 54 0 0; 20 57 0 0; 21 60 0 0; 22 63 0 0; 23 66 0 0; 30 6 8 0;
31 12 8 0; 32 18 8 0; 33 24 8 0; 34 30 8 0; 35 36 8 0; 36 42 8 0; 37 48 8 0;
38 54 8 0; 39 60 8 0; 40 66 8 0; 45 9 4 0; 46 15 4 0; 47 21 4 0; 48 27 4 0;
49 33 4 0; 50 39 4 0; 51 45 4 0; 52 51 4 0; 53 57 4 0; 54 63 4 0; 58 6 0 7;
59 9 0 7; 60 12 0 7; 61 15 0 7; 62 18 0 7; 63 21 0 7; 64 24 0 7; 65 27 0 7;
66 30 0 7; 67 33 0 7; 68 36 0 7; 69 39 0 7; 70 42 0 7; 71 45 0 7; 72 48 0 7;
73 51 0 7; 74 54 0 7; 75 57 0 7; 76 60 0 7; 77 63 0 7; 78 66 0 7; 81 6 8 7;
82 12 8 7; 83 18 8 7; 84 24 8 7; 85 30 8 7; 86 36 8 7; 87 42 8 7; 88 48 8 7;
89 54 8 7; 90 60 8 7; 91 66 8 7; 93 9 4 7; 94 15 4 7; 95 21 4 7; 96 27 4 7;
97 33 4 7; 98 39 4 7; 99 45 4 7; 100 51 4 7; 101 57 4 7; 102 63 4 7;
106 6 8 3.5; 108 6 6 0; 109 6 6 7; 111 12 8 3.5; 112 12 6 0; 113 12 6 7;
115 18 8 3.5; 116 18 6 0; 117 18 6 7; 119 24 8 3.5; 120 24 6 0; 121 24 6 7;
123 30 8 3.5; 124 30 6 0; 125 30 6 7; 127 36 8 3.5; 128 36 6 0; 129 36 6 7;
131 42 8 3.5; 132 42 6 0; 133 42 6 7; 135 48 8 3.5; 136 48 6 0; 137 48 6 7;
139 54 8 3.5; 140 54 6 0; 141 54 6 7; 143 60 8 3.5; 144 60 6 0; 145 60 6 7;
147 66 8 3.5; 148 66 6 0; 149 66 6 7; 180 9 8 3.5; 181 15 8 3.5; 182 21 8 3.5;
183 27 8 3.5; 184 33 8 3.5; 185 39 8 3.5; 186 45 8 3.5; 187 51 8 3.5;
188 57 8 3.5; 189 63 8 3.5; 191 9 0 3.5; 192 15 0 3.5; 193 21 0 3.5;
194 27 0 3.5; 195 33 0 3.5; 196 39 0 3.5; 197 45 0 3.5; 198 51 0 3.5;
199 57 0 3.5; 200 63 0 3.5; 203 6 0 3.5; 204 12 0 3.5; 205 18 0 3.5;
206 24 0 3.5; 207 30 0 3.5; 208 36 0 3.5; 209 42 0 3.5; 210 48 0 3.5;
211 54 0 3.5; 212 60 0 3.5; 213 66 0 3.5;
MEMBER INCIDENCES
4 4 5; 6 6 7; 8 8 9; 10 10 11; 12 12 13; 13 13 14; 14 14 15; 15 15 16;
16 16 17; 17 17 18; 18 18 19; 19 19 20; 20 20 21; 21 21 22; 22 22 23;
35 15 132; 36 17 136; 37 19 140; 38 21 144; 39 23 148; 49 36 37; 50 37 38;
51 38 39; 52 39 40; 56 30 45; 57 31 46; 58 32 47; 59 33 48; 60 34 49; 62 37 51;
63 38 52; 64 39 53; 65 40 54; 75 50 15; 76 51 15; 77 52 17; 78 53 19; 79 54 21;
94 50 13; 95 50 14; 96 51 17; 97 51 16; 98 52 18; 99 52 19; 100 53 20;
101 53 21; 102 54 22; 103 54 23; 107 50 36; 110 3 203; 111 4 191; 112 5 204;
113 6 192; 114 7 205; 115 8 193; 116 9 206; 117 10 194; 118 11 207; 119 12 195;
120 13 208; 121 14 196; 122 15 209; 123 16 197; 124 17 210; 125 18 198;
126 19 211; 127 20 199; 128 21 212; 129 22 200; 130 23 213; 133 30 106;
134 31 111; 135 32 115; 136 33 119; 137 34 123; 138 35 127; 139 36 131;
140 37 135; 141 38 139; 142 39 143; 143 40 147; 158 58 59; 159 59 60;
160 60 61; 161 61 62; 162 62 63; 163 63 64; 164 64 65; 165 65 66; 166 66 67;
167 67 68; 168 68 69; 169 69 70; 170 70 71; 171 71 72; 172 72 73; 173 73 74;
174 74 75; 175 75 76; 176 76 77; 177 77 78; 180 58 109; 181 60 113; 182 62 117;
183 64 121; 184 66 125; 185 68 129; 186 70 133; 187 72 137; 188 74 141;
189 76 145; 190 78 149; 192 81 82; 193 82 83; 194 83 84; 195 84 85; 196 85 86;
197 86 87; 198 87 88; 199 88 89; 200 89 90; 201 90 91; 202 81 93; 203 82 94;
204 83 95; 205 84 96; 206 85 97; 207 88 99; 208 89 100; 209 90 101; 210 91 102;
212 93 60; 213 94 62; 214 95 64; 215 96 66; 216 97 68; 217 98 70; 218 99 70;
219 100 72; 220 101 74; 221 102 76; 225 58 93; 226 93 59; 227 94 61; 228 94 60;
229 95 62; 230 95 63; 231 96 64; 232 96 65; 233 97 66; 234 97 67; 235 98 68;
236 98 69; 237 99 72; 238 99 71; 239 100 73; 240 100 74; 241 101 75;
242 101 76; 243 102 77; 244 102 78; 248 98 87; 252 106 81; 259 108 30;
260 109 81; 268 111 82; 269 112 31; 270 113 82; 276 115 83; 277 116 32;
278 117 83; 284 119 84; 285 120 33; 286 121 84; 292 123 85; 293 124 34;
294 125 85; 300 127 86; 301 128 35; 302 129 86; 308 131 87; 309 132 36;

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310 133 87; 316 135 88; 317 136 37; 318 137 88; 324 139 89; 325 140 38;
326 141 89; 332 143 90; 333 144 39; 334 145 90; 340 147 91; 341 148 40;
342 149 91; 429 30 180; 430 81 180; 431 180 82; 432 180 31; 433 31 181;
434 82 181; 435 181 83; 436 181 32; 437 32 182; 438 83 182; 439 182 84;
440 182 33; 441 33 183; 442 84 183; 443 183 85; 444 183 34; 445 34 184;
446 85 184; 447 184 86; 448 184 35; 449 35 185; 450 86 185; 451 185 87;
452 185 36; 453 36 186; 454 87 186; 455 186 88; 456 186 37; 457 37 187;
458 88 187; 459 187 89; 460 187 38; 461 38 188; 462 89 188; 463 188 90;
464 188 39; 465 39 189; 466 90 189; 467 189 91; 468 189 40; 473 191 59;
478 192 61; 483 193 63; 488 194 65; 493 195 67; 498 196 69; 503 197 71;
508 198 73; 513 199 75; 518 200 77; 602 3 4; 603 5 6; 604 7 8; 605 9 10;
606 11 12; 608 30 31; 609 31 32; 610 32 33; 611 33 34; 612 34 35; 613 45 5;
614 46 7; 615 47 9; 616 48 11; 617 49 13; 619 3 45; 620 46 5; 621 47 7;
622 48 9; 623 49 11; 624 3 108; 625 5 112; 626 7 116; 627 9 120; 628 11 124;
629 13 128; 631 45 4; 632 46 6; 633 47 8; 634 48 10; 635 49 12; 707 35 36;
712 203 58; 717 204 60; 722 205 62; 727 206 64; 732 207 66; 737 208 68;
742 209 70; 747 210 72; 752 211 74; 757 212 76; 762 213 78; 763 203 191;
764 191 204; 765 204 192; 766 192 205; 767 205 193; 768 193 206; 769 206 194;
770 194 207; 771 207 195; 772 195 208; 773 208 196; 774 196 209; 775 209 197;
776 197 210; 777 210 198; 778 198 211; 779 211 199; 780 199 212; 781 212 200;
782 200 213;
ELEMENT INCIDENCES SHELL
784 3 203 191 4; 785 203 58 59 191; 786 4 191 204 5; 787 191 59 60 204;
788 5 204 192 6; 789 204 60 61 192; 790 6 192 205 7; 791 192 61 62 205;
792 7 205 193 8; 793 205 62 63 193; 794 8 193 206 9; 795 193 63 64 206;
796 9 206 194 10; 797 206 64 65 194; 798 10 194 207 11; 799 194 65 66 207;
800 11 207 195 12; 801 207 66 67 195; 802 12 195 208 13; 803 195 67 68 208;
804 13 208 196 14; 805 208 68 69 196; 806 14 196 209 15; 807 196 69 70 209;
808 15 209 197 16; 809 209 70 71 197; 810 16 197 210 17; 811 197 71 72 210;
812 17 210 198 18; 813 210 72 73 198; 814 18 198 211 19; 815 198 73 74 211;
816 19 211 199 20; 817 211 74 75 199; 818 20 199 212 21; 819 199 75 76 212;
820 21 212 200 22; 821 212 76 77 200; 822 22 200 213 23; 823 200 77 78 213;
ELEMENT PROPERTY
784 TO 823 THICKNESS 0.225
DEFINE MATERIAL START
ISOTROPIC STEEL
E 2.05e+008
POISSON 0.3
DENSITY 76.8195
ALPHA 1.2e-005
DAMP 0.03
ISOTROPIC CONCRETE
E 2.17185e+007
POISSON 0.17
DENSITY 23.5616
ALPHA 1e-005
DAMP 0.05
TYPE CONCRETE
STRENGTH FCU 27579
END DEFINE MATERIAL
MEMBER PROPERTY INDIAN
110 TO 130 473 478 483 488 493 498 503 508 513 518 712 717 722 727 732 737 -
742 747 752 757 762 TO 782 TABLE ST ISMB600
MEMBER PROPERTY INDIAN
75 95 TO 103 133 TO 143 217 225 TO 234 236 TO 244 252 268 276 284 292 300 -
308 316 324 332 340 429 TO 468 619 TO 623 631 TO 634 -
635 PRIS AX 0.007862 IX 0.0003309 IY 0.000288 IZ 4.27e-005
51 52 192 193 200 201 608 -
609 PRIS AX 0.036576 IX 0.003527 IY 0.0017797 IZ 0.001747
4 6 8 10 12 TO 22 49 50 158 TO 177 194 TO 199 602 TO 606 610 TO 612 -
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707 PRIS AX 0.04102 IX 0.004522 IY 0.002577 IZ 0.0019458
35 36 39 59 60 62 76 94 107 180 183 TO 187 190 205 TO 207 215 216 218 235 -
248 259 260 285 286 293 294 301 302 309 310 317 318 341 342 616 617 624 627 -
628 TO 629 PRIS AX 0.011463 IX 0.000650402 IY 5.20233e-005 IZ 0.00059838
37 38 56 TO 58 63 TO 65 77 TO 79 181 182 188 189 202 TO 204 208 TO 210 212 -
213 TO 214 219 TO 221 269 270 277 278 325 326 333 334 613 TO 615 625 -
626 PRIS AX 0.021865 IX 0.00132741 IY 0.000204891 IZ 0.00112251
CONSTANTS
MATERIAL STEEL MEMB 4 6 8 10 12 TO 22 35 TO 39 49 TO 52 56 TO 60 62 TO 65 -
75 TO 79 94 TO 103 107 110 TO 130 133 TO 143 158 TO 177 180 TO 190 -
192 TO 210 212 TO 221 225 TO 244 248 252 259 260 268 TO 270 276 TO 278 284 -
285 TO 286 292 TO 294 300 TO 302 308 TO 310 316 TO 318 324 TO 326 332 TO 334 -
340 TO 342 429 TO 468 473 478 483 488 493 498 503 508 513 518 602 TO 606 -
608 TO 617 619 TO 629 631 TO 635 707 712 717 722 727 732 737 742 747 752 -
757 762 TO 782
MATERIAL CONCRETE MEMB 784 TO 823
SUPPORTS
3 58 PINNED
23 78 FIXED BUT FX MX MY MZ
LOAD 1 LOADTYPE Dead  TITLE DL
SELFWEIGHT Y -1.1
JOINT LOAD
4 TO 22 59 TO 77 FY -29.14
3 23 58 78 FY -14.57
LOAD 2 LOADTYPE Wind  TITLE WL(+Z)
JOINT LOAD
5 7 9 11 13 15 17 19 21 31 TO 39 FZ 33
3 23 30 40 FZ 17.5
LOAD 3 LOADTYPE None  TITLE EQZ
JOINT LOAD
31 TO 39 FZ 51.2
3 23 30 40 FZ 25.6
5 7 9 11 13 15 17 19 21 FZ 151.5
3 23 FZ 75.75
LOAD 4 LOADTYPE None  TITLE BREAKING EFFECT
JOINT LOAD
3 TO 23 58 TO 78 FX 4
PERFORM ANALYSIS
PARAMETER 1
CODE AISC UNIFIED 2010
STEEL TAKE OFF ALL
FINISH
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LIST OF PUBLICATIONS

1. Abhishek Sharma, Krishankant Pathak, Pramod K. Singh (2021). Analytical Comparison of Composite and Non-Composite through Type and Deck Type Steel Truss Bridges. Civil Engineering and Architecture, 9(4), 969 - 975. DOI: 10.13189/cea.2021.090401

2. Abhishek Sharma, K. K. Pathak, P. K. Singh (2021). Experimental Investigation of Non-composite and Composite Deck Bridges. Civil Engineering and Architecture, 9(3), 770-777. DOI: 10.13189/cea.2021.090318.

3. Abhishek Sharma, K. K. Pathak, P. K. Singh (2021). Analysis of Steel-RCC composite Deck Bridge. Turkish Journal of Computer and Mathematical Education, Vol. 12, No. 4, 212-220.

4. R.K.Agrahari, K.K.Pathak, A.Sharma "Seismic acceleration amplification factor model for non-structural components in RC frame structures". Journal of Structural Engineering-2020

5. Narayan, A Sharma, K.K.Pathak,"Buckling analysis of space frames using experimental and numerical techniques". Journal of Structural Engineering-2020

6. A.Sharma, P.K.Singh, K.K. Pathak, "RCC deck with steel truss composite bridge". 33rd Indian Engineering congress-2018.

7. P. K.Singh, A. Sharma, K. K.Pathak , "Robust box type minor bridge". 33rd Indian Engineering congress -2018.

8. Kshitiz Banwal, Abhishek Sharma, Pramod K. Singh, K. K. Pathak, "Experimental and Numerical Investigations of an Under slung Steel Bridge", INSDAG Year book 2017-2018.

9. A.Sharma, P.K.Singh, K.K.Pathak,"Under Slung Steel Truss Bridge with Composite RCC Deck Bridge". International Journal of Engineering Research in Mechanical and Civil Engineering (IJERMCE) Vol 2, Issue 11, November 2017.

10. K.K.Pathak, P.K.Singh, Abhishek sharma, Repair and Rehabilitation of a Minor Bridge in Shravasti District (UP), India. NBM&CW Infra Construction and Equipment Magazine.

11. A.Kumar, A.Sharma, S.Mandal, R.Kumar, K Agarwal, A. Meena (2016). A parametric study in Interference effects if Adjacent Buildings subjected to Wind Loading. The Eighth National Conference on Wind Engineering, December 16-17, 2016, IIT (BHU), Varanasi, India.