TETRA TECH

Daniel Stuard, PE

Structural Design Engineer

Mr. Stuard is a structural design engineer with experience designing steel and concrete structures for bridges, flood walls, retaining walls, navigation locks, fish passage facilities and dams. He has experience with IBC, ASCE 7, ACI 318, AISC 360, AWWA D103, AASHTO, WSDOT Bridge Design Manual, the USACE Manuals (including the Hurricane and Storm Damage Risk Reduction System Guidelines), guidelines from the Department of the Interior and Bureau of Reclamations, and The Engineering Guidelines for the Evaluation of Hydropower Projects (FERC). His expertise includes SAP 2000, Ansys, BridgeLink, PGSuper, XBRate, GTStrudl, LPILE, GROUP, spColumn, CWALSHT, Solid Works, AutoCAD, and MathCAD.

EDUCATION

MS Civil Engineering (Structural Engineering), University of Washington (2010)

BS Civil Engineering, University of Washington (2009)

REGISTRATION/CERTIFICATION

Professional Engineer, Civil: WA License No. 51620 (2014)

Professional Engineer, Civil: CA License No. C89213 (2015)

YEARS OF EXPERIENCE

11 years

YEARS WITH TETRA TECH

9 years

OFFICE LOCATION

Bellevue, WA

AREAS OF EXPERTISE

Bridge Design

Bridge Load Rating

Hydropower Plant Design

Structural Design and Analysis

Stability Analysis

Steel Design

Reinforced Concrete Design

Foundation Design

Retaining Wall Design

TETRA TECH PROJECT EXPERIENCE

Patton Bridge Load Rating, King County, Auburn, WA (2018)
Structural Engineer. The three-span bridge is 252 feet long. Spans one and three consists of two cell concrete reinforced box girders. Performed a load rating for Patton Bridge, evaluating both the steel and concrete members, using the WSDOT BDM, AASHTO LRFD Bridge Design Specification, the AASHTO Manual for Bridge Evaluation and the program SAP2000 for his analysis. Daniel also rated the repair that help support the steel box girders. Utilized the Hili PROFIS program, and ACI 318-14 to rate the post epoxy anchors of the steel brackets.

North Fork Load Rating, King County, North Bend, WA (2018)
Structural Engineer. The three-span bridge is 252 feet long. Spans one and three consists of two cell concrete reinforced box girders. The concrete box girder's geometry and reinforcement vary along the length of the bridge. Performed a load rating for North Fork Bridge, evaluating both the steel and concrete members, using the WSDOT BDM, AASHTO LRFD Bridge Design Specification, the AASHTO Manual for Bridge Evaluation and the program SAP2000 for his analysis.

Lower Coal Creek Flood Hazard Reduction Project, City of Bellevue, King County, WA (2016-2020)
Structural Engineer. Performed the seismic analysis, lateral spreading pushover analysis, design and detailing of the bridge superstructure, abutments, and shafts. Designed the bridge according to the WSDOT Bridge Design Manual and the AASHTO LRFD Bridge Design Specifications. Analyzed the bridge using BridgeLink, LPILE, and SAP2000. Also load rated the bridges according to the WSDOT Bridge Design Manual and the AASHTO Manual for Bridge Evaluation. The Lower Coal Creek Flood Hazard Reduction Project included replacing five existing culverts with bridges that meet current traffic and fish passage guidelines.

Bridge Load Rating Calculations, Port of Seattle, Seattle, WA (2015-2016)
Structural Engineer. The Port of Seattle requested load ratings to be performed on four their structures. Performed the load ratings for all the structures following the WSDOT BDM, AASHTO LRFD Bridge Design Specification and the AASHTO

2013 Interim Revisions to the Manual for Bridge Evaluation 2010. Utilized CONBOX results as well as the programs GTStrudl and PGSuper for his analysis.

Seabeck Creek Restoration Design, Kitsap County, WA (2019-2021)
Structural Engineer. Performed the seismic analysis, design, and detailing of the bridge superstructure, abutments, wing walls, and piles. Designed the bridge according to the WSDOT Bridge Design Manual and the AASHTO LRFD Bridge Design Specifications. Analyzed the bridge using BridgeLink, LPILE, GROUP, and SAP2000. Also load rated the bridge according to the WSDOT Bridge Design Manual and the AASHTO Manual for Bridge Evaluation. The Seabeck Creek Restoration Design Project included replacing an existing culvert with bridges that meet current traffic and fish passage guidelines.

Carpenter Creek Bridge on West Kingston Road, Kitsap County, Kingston, WA (2018)
Structural Engineer. This project replaced an existing 5-foot-diameter culvert conveying Carpenter Creek under West Kingston Road with a 150-foot two span bridge to provide salmon smolt access to the Carpenter Creek Estuary. Designed, detailed, and produced drawings for the precast concrete girders, bridge deck, intermediate pier and abutments following the WSDOT Bridge Design Manual, AASHTO Design Specifications, and AASHTO LRFD Seismic Bride Design Guide Specifications. Analyzed the bridge using PGSuper and SAP2000.

SE 272nd Street (SR 516) between Jenkins Creek and 185th Place SE, City of Covington, King County, WA (2012-2020)
Structural Engineer. This project widened SE 272nd Street (SR 516) from a two lane to a five lane roadway in the area of Jenkins Creek. Improvements included a new bridge at the crossing of Jenkins Creek SE, in Covington, Washington. The single span bridge is 88 feet wide by 64.5 feet long. Designed the drilled shafts, abutment bents, wing walls, and the precast prestressed superstructure. Designed the bridge according to the WSDOT Bridge Design Manual and the AASHTO LRFD Bridge Design Specifications. Analyzed the bridge using BridgeLink, LPILE, GROUP and SAP2000. Also created the bridge design drawings and performed reinforcing quantity takeoffs.

Lower Massey Creek Floodwall and Creek Enhancement, City of Des Moines, King County, WA (2013-2016)
Structural Engineer. The Lower Massey Creek project designed a new flood wall. Reviewed geotechnical information and assumptions in the design of the floodwall to minimize the sheet pile wall embedment using WSDOT Design Manuals and AASHTO LRFD Bridge Design Specifications.

DDR for Inner Harbor Navigation Canal Lake Borgne Surge Barrier Project, USACE New Orleans District, New Orleans, LA (2015-2018)
Structural Engineer. Responsible for retrieving and filtering all applicable final design submittals from the project document repository and providing the necessary documentation to subcontractors for the purpose of producing a Design Documentation Report (DDR). Additionally, responsible for writing the structural sections of the DDR for the Bayou Bienvenue vertical lift gate. These sections included the pile foundation, gate monoliths, lift gate towers, vehicular bridge, and control building sections.

Shiroro Hydroelectric Power Station Design Services for Phase 2, North South Power Company Limited, Kaduna River, Nigeria (2015-2018)
Structural Engineer. Performed a load rating analysis of the 62-foot, three-span bridge which consists of steel wide flange girders concrete deck using the AASHTO LRFD Bridge Design Specifications, 2012. Proposed to move heavy equipment across the intake access foot bridge as part of this project.

TETRA TECH

Cheng Yang, PhD, PE, SE

Senior Structural Engineer

Cheng has experience on a wide range of bridge engineering projects involving review, analysis, design, load rating and retrofit of reinforced concrete and steel bridge structures. He is knowledgable with all aspects of bridge design, including the design of both superstructure and substructure for steel tub girder, concrete box girder, and conventional beam bridges with shallow and deep foundations. He is experienced with three-dimensional computer modeling of complex bridges, including steel truss, precast segmental and cable-stay bridges, as well as rail/structure interaction for CWR He has Seismic design experience includes both LRFD displacement design guide and AASHTO force based specification.

PREVIOUS PROJECT EXPERIENCE

Burnside Street/Willamette River Bridge Rehabilitation Feasibility Study, Oregon Department of Transportation, Multnomah County, OR (2015-2016)
Structural Engineer. Load Rating for the bridge including stringer, girder, floor beam and crossbeam. Load rating according to the Oregon LRFR Manual and AASHTO LRFR. Lead feasibility study for the repair of Pier 1. Pier 1 has crack on the south column. Retrofit includes the bolster and cofferdam shoring development for under water construction.

Union Ave Viaduct and Schuster Parkway Bridge Load Rating, City of Tacoma, WA (2016)
Structural Engineer. Completed load rating analyses of two bridges for evaluating the effect of 1-inch overlay weight. Union Avenue Viaduct Bridge has prestressed concrete I girder with 15 main spans and 3 ramp spans. Schuster Parkway Bridge has 3 cells concrete box girder with 7 spans. PGSuper and CONBOX were used to load rate the bridges.

SE 272nd Street (SR 516) between Jenkins Creek and 185th Place SE, City of Covington, WA (2012-2021)
Senior Structural Engineer. Designed superstructure, bearing, abutment wall, wing wall, shaft cap and shaft, and prepare plans.

South Lander Street Grade Separation, Seattle Department of Transportation, Seattle, WA (2016-2017)
Structural Engineer. The grade separation bridge includes 320 feet west approach structure, 4-span prestressed girder bridge and 300-foot east approach structure between 1st and 4th Avenues. Designed the approach embankment with lightweight geofoam (EPS) to exert no additional net load on the soil or existing utilities. The bridge was designed according to AASHTO LRFD Specification and Seismic Design Guide.

EDUCATION

PhD, Civil Engineering, North Carolina State University (1995)

MCE, Civil Engineering, North Carolina State University (1990)

BS, Harbor and River Engineering, National Taiwan Ocean University, Taiwan (1984)

REGISTRATION/CERTIFICATION

Professional Engineer, Civil & Structural: WA License No. 48428 (2011)

Structural Engineer: CA License No. S6513 (2017)

Professional Engineer, Civil: CA License No. 74221 (2009)

Professional Engineer, Civil: CA License No. 74221 (2009)

Professional Engineer, Civil: TX License No. 103864 (2009)

Professional Engineer, Civil: IL License No. 062052362 (1998)

Professional Engineer, Civil: FL License No. 47688 (1994)

PROFESSIONAL AFFILIATION

American Institute of Steel Construction (AISC)

American Society of Civil Engineers (ASCE)

YEARS OF EXPERIENCE

18 years

YEARS WITH TETRA TECH

1 year

OFFICE LOCATION

Bellevue, WA

AREAS OF EXPERTISE

Steel & Concrete Bridge Structures Design & Analysis

Load Rating & Retrofitting

Illinois State Toll Highway Authority Segmental Box Girder Ramps Rating Project, Various Locations, IL
Project Engineer in charge of load rating of three curved single cell segmental box girder bridge ramps: Ramp EN (902 ft), Ramp SE(1997 ft) and Ramp SW(1958 ft). Performed three superstructures load ratings which included the longitudinal load ratings of shear, moment, stress and principal tensile stress, and transverse load rating of shear, moment and stress. Computed the substructure load ratings which included post-tensioned straddle bent cap load rating and post-tensioned column load rating. The load rating was accomplished by developing time-dependent SAP2000 3-dimentional finite element models and using MathCAD and EXCEL spreadsheets to calculate the inventory

I-595 To Turnpike North – Ramp R-7 (Bridge 32)
Structural Engineer. Structural design for a horizontally curved steel two trapezoidal box girders bridge. The bridge consists of seven spans for a total of 1,619 feet long and with integral post-tensioned pier caps. Led the design of the superstructure and load rating. Performed stress analysis (FEM) for the bottom flange opening at pier 5.

I-595 To Turnpike South – Ramp R-9 (Bridge 31)
Structural Engineer. Structural design for a horizontally curved steel two trapezoidal box girders bridge. The bridge consists of nine spans for a total of 2,090 feet long and with steel integral straddle bent caps. Checked the design of the superstructure and computed the load rating.

I-595 Over Turnpike (Bridge 23)
Structural Engineer. Structural design for a horizontally curved steel three trapezoidal box girders bridge. The bridge consists of three spans for a total of 600 feet long and with sharp skews at pier and abutment. Checked the design of the superstructure and computed the load rating.

Harry Hines/I-35/Trinity River Structure, Texas DOT, Irving, TX
Lead Structural Engineer, in charge of nonlinear finite element Rail/Structural interaction analysis (GTSTRUDL) of the 70 spans LRT bridge. Computed longitudinal and transverse design loads for substructure and bearing due to rail broken, thermal and train brake forces. Performed standard DART train live load distribution and designed prestressed concrete girder superstructure for Orange Line extension Section I-1 of Phase IIB design-build project.

US90 Bridge Over Biloxi Bay, Mississippi DOT, Biloxi, MS
Design Engineer for the design-build project. The bridge consists of 71-span for a total of 8,800 feet of precast prestressed and post-tensioned girders. Performed substructure design and superstructure load rating. Responsible for defining superstructure stiffness to redistribute ship impact loads to substructures and designing pile foundations for various column types. The redistribution of load is accomplished by integrating the applications of FB-PIER, LARSA and Excel.

Gateway Harbor, Chicago Public Building Commission, Chicago, IL
Lead Structural Engineer for the commercial boat landing piers. Performed the design and analysis of triangle shaped deck pier in the north and rectangular shaped deck pier in the south. North section is a nine span structure on various multiple rows of piles. South section includes six spans with two rows of piles. Both structures are supported by concrete filled steel pipe piles. The boat piers were designed as moment resisting reinforced concrete frame on two-foot diameter vertical and battered concrete pipe piles with conical tips. The structures are modeledusing the computer program SAP2000. The design vessel is Odyssey II. Design is according to Unified Facilities Criteria (UFC 4-159- 03) and Strength Design for Reinforced-Concrete Hydraulic Structures (EM1110-2-2104).

TETRA TECH

Lower Coal Creek Bridges

OWNER

City of Bellevue

LOCATION

Bellevue, WA

DURATION

2016 - 2018

COST

$1,257,126

REFERENCES

Jim Stockwell
(425) 452-4868

KEY FEATURES

- Bridge design and load rating
- Fish passage
- Traffic control
- Construction staging and administration
- Utility coordination
- Public involvement
- City/WSDOT standards

PROJECT DESCRIPTION

High flows in Coal Creek cause overbank flooding into the Newport Shores neighborhood and limit capacity for the storm drain system. The preliminary design phase recommended replacing the existing culverts on Lower Coal Creek in the Newport Shores neighborhood with 24-foot simple span bridges supported by drilled shafts to meet current fish passage, seismic, and traffic safety design standards. The superstructure consisted of precast concrete slab girders to minimize the deck thickness and shorten construction duration to ensure the over water work was completed within the fish window. Abutments constructed of cast-in-place concrete grade beams supported by two 42-inch drilled shafts were designed to keep all cast-in-place concrete work above the water table and avoid dewatering the site and the consequent settlement risk to neighboring homes. Drilled shaft foundations were selected because of the poor soils susceptibility to settlement, liquefaction and lateral spreading. The bridge replacement was accomplished in three parts. The Group 1 project included bridge replacement at one location and was constructed in 2017. Group 2 covered two additional bridges with a new storm drain outfall to the creek and will be constructed in 2018. Group 3 covered two additional bridges plus two new storm drain outfalls to Lake Washington.

Tetra Tech performed bridge load ratings and provided construction support for replacing existing culverts at five locations with single-span bridges that meet current traffic and fish passage guidelines. Tetra Tech performed the seismic analysis, lateral spreading pushover analysis, design and detailing of the bridge superstructure, abutments and shafts. The bridge was designed according to the WSDOT Bridge Design Manual and the AASHTO LRFD Bridge Design Specifications. The bridge was analyzed using BridgeLink, LPILE and SAP2000.

North Fork Bridge 1221 - Load Rating

OWNER

King County Department of Transportation

LOCATION

North Bend, WA

DURATION

2018

COST

$50,000

REFERENCES

Stephen Jiang
(206) 477-3541
stephen.jiang@kingcounty.gov

KEY FEATURES

- Bridge load rating analysis
- Structural analysis

PROJECT DESCRIPTION

This project was performed for King County and consists of developing a load rating results report for North Fork Bridge (1221) that includes the 2014 FHWA and WSDOT loading requirements for the Notional Rating Load (NRL) and Specialized Hauling Vehicles (SHV). The load rating analysis was performed using SAP 2000 version 19 and followed the guidance of the most current WSDOT Bridge Design Manual, AASHTO Manual for Bridge Evaluation (MBE) 2nd Edition (2011) and all interims up to 2015, and AASHTO LRFD Bridge Design Specification 7th Edition (2014) and all interims through 2016. The load rating used the LRFR method per King county requirements. The load rating results report include the Load Rating Data and Assumption Memo, all data collected and used to perform the load rating (as-builts, inspection reports, photographs, etc.), structural analysis models input and output, sketches, hand calculations, QC documentation and the WSDOT BDM LRFR Bridge Rating Summary form. Recommendations for load posting were provided. A Draft and Final Load Rating Results Report were submitted.

North Fork Bridge is a three-span bridge, totaling 252 feet in length. It was designed by Homer M. Hadley and constructed in 1951. The two end spans are two-cell reinforced concrete box girders that are continuous over an intermediate pier and the center span consists of two 60-ft long simple span steel wide flange girders with a cast-in-place concrete deck. Typical of Homer Hadley designs, the box girder geometry and steel reinforcement was optimized to save material and changed continually along the spans and the concrete has little reserve strength to accommodate larger modern vehicles. The shear capacity of the concrete box girders was determined using the AASHTO modified compression field theory to more accurately determine the full shear strength of the concrete. Because the longitudinal reinforcement steel was curtailed at many locations there is not sufficient longitudinal reinforcement to account the for the combined effect of shear and flexure when using the modified compression field theory. Shear controlled the load rating and posting recommendations were provided.

Patton Bridge 3015 - Load Rating

OWNER

King County Department of Transportation

LOCATION

Auburn, WA

DURATION

2018

COST

$92,860

REFERENCES

Stephen Jiang
(206) 477-3541
stephen.jiang@kingcounty.gov

KEY FEATURES

- Bridge load rating analysis
- Structural analysis

PROJECT DESCRIPTION

Patton Bridge is a three-span 430-foot-long bridge. It was designed by Homer M. Hadley and constructed in 1950. The two end spans are two-cell reinforced concrete box girders that are continuous over an intermediate pier and the center span consists of two 100-foot-long simple span steel box girders with a cast-in-place concrete deck. Typical of Homer Hadley designs, the box girder geometry and steel reinforcement was optimized to save material and changed continually along the spans and the concrete has little reserve strength to accommodate larger modern vehicles. The shear capacity of the concrete box girders was determined using the AASHTO modified compression field theory to more accurately determine the full shear strength of the concrete. Because the longitudinal reinforcement steel was curtailed at many locations, there is not sufficient longitudinal reinforcement to account the for the combined effect of shear and flexure when using the modified compression field theory. Shear controlled the load rating and posting recommendations were provided.

Tetra Tech worked with King County to develop a load rating results report for Patton Bridge (3015) that included the 2014 FHWA and WSDOT loading requirements for the Notional Rating Load and Specialized Hauling Vehicles. The load rating analysis was performed using SAP2000 version 19 and followed the guidance of the most current WSDOT Bridge Design Manual, AASHTO Manual for Bridge Evaluation (MBE) 2nd Edition (2011) and all interims up to 2015, and AASHTO LRFD Bridge Design Specification 7th Edition (2014) and all interims through 2016. The load rating used the LRFR method per King County requirements. The load rating results report included the Load Rating Data and Assumption Memo, all data collected and used to perform the load rating (as-builts, inspection reports, photographs, etc.), structural analysis models input and output, sketches, hand calculations, QC documentation and the WSDOT BDM LRFR Bridge Rating Summary form. Tetra Tech provided recommendations for load posting and submitted a Draft and Final Load Rating Results Report.

Patton Bridge has concrete corbels that extend from the end of the concrete box girder to support the ends of the steel box girders that make up the center span. One of these corbels has significant damage, and as a safety measure, the bridge was retrofitted with steel brackets in 2005 to support the steel box girders. The brackets are anchored to the concrete with epoxy anchors and bolted and welded to the steel box girders. Tetra Tech conducted a separate load rating analysis of this retrofit and the existing concrete corbels to show that the corbels did not control the bridge load rating. The additional analysis evaluated the dead load and live load distribution to each bracket and the capacity of the bracket elements. Tetra Tech also checked the load distribution from the brackets into the concrete box girder webs to ensure the load distribution used for the concrete girder load rating is valid. To perform this analysis, Tetra Tech developed a 3-D shell model of the concrete box girder in SAP2000 and analyzed the steel brackets per AASHTO and the epoxy anchors using AASHTO, ACI 318-14 Chapter 17 (Anchoring to Concrete) and the Hili PROFIS program.