

AASHTOWare Bridge Design and Rating

2017 Modernization Update

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Modernization Update

*The modernization proposes to create **more powerful, easier to use** tools to assist agencies in designing and load rating their inventory in a **more cost-effective** manner.*

Modernization Update

Modernization began in July 2016

- User Interface Design and Development
 - Identified windows to be redesigned based on comments from the users
 - 90% of the windows will retain the Legacy look and behavior

Modernization Update

- User Interface Design and Development (continued)
 - Prepared mockups of windows for approval by the Modernization Technical Advisory Group and Task Force:
 - Detailed mockups of windows to be redesigned
 - Summary mockups of the windows that will not be redesigned
 - Numerous rounds of review by the TAG

Modernization Update

- Example of a redesigned Bridge Explorer

Legacy ←

Modernized →

Different appearance, same functionality

| BID | Bridge ID | Bridge Name | District | County | Facility | Location |
|-----|-----------------------------|--------------------------|------------|---------|----------|----------|
| 1 | TrainingBridge1 | Training Bridge 1(LRFD) | District 1 | 01 Abbe | SR 0051 | Pittsbur |
| 2 | TrainingBridge2 | Training Bridge 2(LRFD) | Unknow | Unknow | N/A | N/A |
| 3 | TrainingBridge3 | Training Bridge 3(LRFD) | District 1 | 01 Abbe | I-79 | Pittsbur |
| 4 | PCITrainingBridge1 | PCI TrainingBridge1(LFD) | | | | |
| 5 | PCITrainingBridge2 | PCITrainingBridge2(LRFD) | | | | |
| 6 | PCITrainingBridge3 | PCI TrainingBridge3(LFD) | | | | |
| 7 | PCITrainingBridge4 | PCITrainingBridge4(LRFD) | | | | |
| 8 | PCITrainingBridge5 | PCI TrainingBridge5(LFD) | | | | |
| 9 | PCITrainingBridge6 | PCITrainingBridge6(LRFD) | | | | |
| 10 | Example7 | Example 7 PS (LFD) | | | | |
| 11 | RCTrainingBridge1 | RC Training Bridge1 | | | | |
| 12 | TimberTrainingBridge1 | Timber Tr. Bridge1 | | | | |
| 13 | FSys GFS TrainingBridge1 | FloorSystem GFS T | | | | |
| 14 | FSys FS TrainingBridge2 | FloorSystem FS Tra | | | | |
| 15 | FSys GF TrainingBridge3 | FloorSystem GF Tra | | | | |
| 16 | FLine GFS TrainingBridge1 | FloorLine GFS Train | | | | |
| 17 | FLine FS TrainingBridge2 | FloorLine FS Trainin | | | | |
| 18 | FLine GF TrainingBridge3 | FloorLine GF Trainin | | | | |
| 19 | TrussTrainingExample | Truss Training Exam | | | | |
| 20 | LRFD Substructure Example 1 | LRFD Substructure | | | | |
| 21 | LRFD Substructure Example 2 | LRFD Substructure | | | | |
| 22 | LRFD Substructure Example 3 | LRFD Substructure | | | | |
| 23 | LRFD Substructure Examole 4 | LRFD Substructure | | | | |

| BID | Bridge ID | Bridge name | District | County | Facility | Location |
|-----|------------------------|------------------------------|-------------|--------------|-------------|------------|
| 1 | TrainingBridge1 | Training Bridge 1(LRFD) | District 11 | 01 Abbeville | SR 0051 | Pittsburgh |
| 2 | TrainingBridge2 | Training Bridge 2(LRFD) | Unknown | Unknown (P) | N/A | N/A |
| 3 | TrainingBridge3 | Training Bridge 3(LRFD) | District 11 | 01 Abbeville | I-79 | Pittsburgh |
| 4 | PCITrainingBridge1 | PCI TrainingBridge1(LFD) | | | | |
| 5 | PCITrainingBridge2 | PCITrainingBridge2(LRFD) | | | | |
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| 9 | PCITrainingBridge6 | PCITrainingBridge6(LRFD) | | | | |
| 10 | Example7 | Example 7 PS (LFD) | | | | |
| 11 | RCTrainingBridge1 | RC Training Bridge1(LFD) | | | | |
| 12 | TimberTrainingBrid... | Timber Tr. Bridge1 (ASD) | | | | |
| 13 | FSys GFS TrainingB... | FloorSystem GFS Train... | District 6 | 15 Colleton | NJ-Turnpike | NJCity |
| 14 | FSys FS TrainingBri... | FloorSystem FS Training... | District 11 | 333 Norfolk | I-95 | NYC |
| 15 | FSys GF TrainingBri... | FloorSystem GF Training... | District 7 | 06 Barnwell | I-95 | ATL |
| 16 | FLine GFS Training... | FloorLine GFS Training B... | District 1 | 01 Abbeville | I-75 | JAX |
| 17 | FLine FS TrainingBr... | FloorLine FS Training Bri... | District 2 | 02 Aiken | I-75 | GNV |
| 18 | FLine GF TrainingBr... | FloorLine GF Training Bri... | District 1 | 01 Abbeville | I-95 | NY |

Modernization Update

- Example of the Library - Legacy

The screenshot displays the Bridge Design/Rating software interface. On the left, the Library Explorer shows a tree structure of steel shapes, including Rolled Beams, PS Shapes, Timber Shapes, and Vehicles. The main window shows a table of steel shapes with columns for Name and Description. A detailed view of a W 40x593 rolled beam is shown, including its dimensions and properties.

| Name | Description |
|----------|---|
| W 40x277 | W 40x277 Imported from AISC Tables (2011) |
| W 40x277 | W 40x277 Imported from AISC Tables (1994) |
| W 40x278 | W 40x278 Imported from AISC Tables (1994) |
| W 40x278 | W 40x278 Imported from AISC Tables (2011) |
| W 40x294 | W 40x294 Imported from AISC Tables (2011) |
| W 40x297 | W 40x297 Imported from AISC Tables (2011) |
| W 40x297 | W 40x297 Imported from AISC Tables (1994) |
| W 40x321 | W 40x321 Imported from AISC Tables (1994) |
| W 40x324 | W 40x324 Imported from AISC Tables (2011) |
| W 40x327 | W 40x327 Imported from AISC Tables (2011) |
| W 40x331 | W 40x331 Imported from AISC Tables (2011) |
| W 40x331 | W 40x331 Imported from AISC Tables (1994) |
| W 40x362 | W 40x362 Imported from AISC Tables (2011) |
| W 40x372 | W 40x372 Imported from AISC Tables (2011) |
| W 40x372 | W 40x372 Imported from AISC Tables (1994) |
| W 40x392 | W 40x392 Imported from AISC Tables (1994) |

Library - Steel Shapes - Rolled Beam

Name: W 40x593
Description: W 40x593 Imported from AISC T tables (2011)
Year: 2011

Store units as: US SI
Library: Standard Agency Defined

All dimensions are in in

Area = 174.000 in²
Nominal load = 593.000 lb/ft
Ix = 50400.000 in⁴
Iy = 2520.000 in⁴
Zx = 2760.000 in³
Zy = 481.000 in³
Nominal depth = 40.0000 in

Rolled beam type: W Shape M Shape S Shape HP Shape

Dimensions: tf = 3.2300, k1 = 2.1250, k = 4.4100, d = 43.0000, tw = 1.7900, bf = 16.7000

Modernization Update

- Example of the Library - Modernized

AASHTOWare Bridge Design and Rating

BRIDGE EXPLORER LIBRARY

New Copy & Paste Open Delete Schematic Close Manage

- DOT
- Nail
- Corrugated Metal Panel
- Factors
 - LFD
 - LRFD
 - LRFR
- Materials
 - Concrete
 - Prestress Bar
 - Prestress Strand
 - Reinforcing Steel
 - Soil
 - Structural Steel
 - Timber
 - Wearing Surface
 - Weld
- Prestress Beam Shapes
 - I Beams - Narrow Top Flange
 - I Beams - Wide Top Flange
 - Box Beams - Circular Void
 - Box Beams - Rectangular Void
 - Tee Beams
 - U Beams
- Steel Beam Shapes
 - Angles
 - Channels
 - Rolled Beam**
 - Tees
 - LRFD DF Applicability Ranges
 - LRFD Substructure Design Settings
- Timber Beam Shapes

| Library | Units | Name |
|----------|-------|----------|
| Standard | US | W 44x335 |
| Standard | US | W 44x290 |
| Standard | US | W 44x262 |
| Standard | US | W 44x230 |
| Standard | US | W 40x593 |
| Standard | US | W 40x503 |
| Standard | US | W 40x431 |
| Standard | US | W 40x372 |
| Standard | US | W 40x321 |
| Standard | US | W 40x297 |

Steel Beam Shapes: W 40x593

Name: W 40x593
Description: W 40x593 Imported from AISC Tables (1994)
Year: 1994

All dimensions are in inches

| | | |
|----------------|-----------|-----------------|
| Area: | 174.000 | in ² |
| Nominal load: | 593.000 | lb/ft |
| Ix: | 50400.000 | in ⁴ |
| Iy: | 2520.000 | in ⁴ |
| Zx: | 2759.999 | in ³ |
| Zy: | 481.000 | in ³ |
| Nominal depth: | 40.0000 | in |

Rolled beam type
 W shape M shape

Steel Beam Shapes: W 40x321

Name: W 40x321
Description: W 40x321 Imported from AISC Tables (1994)
Year: 1994

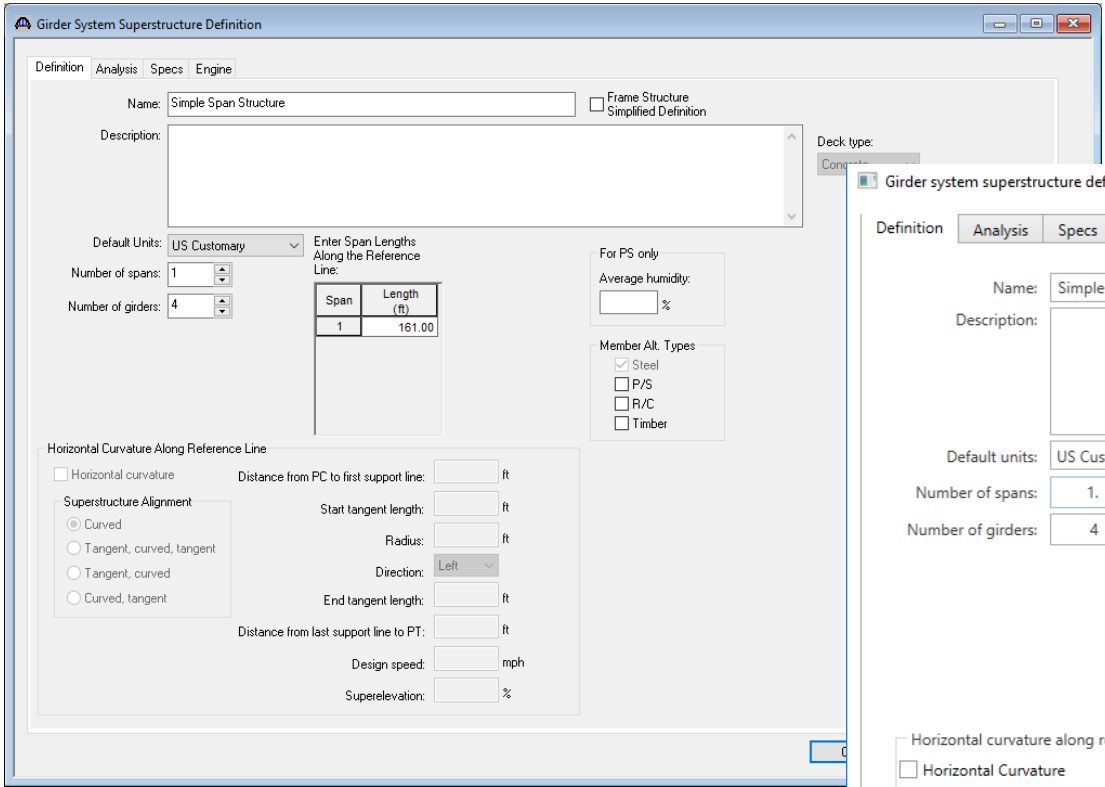
All dimensions are in inches

| | |
|----------------|----|
| Area: | 94 |
| Nominal load: | 32 |
| Ix: | 25 |
| Iy: | 11 |
| Zx: | 14 |
| Zy: | 23 |
| Nominal depth: | 40 |

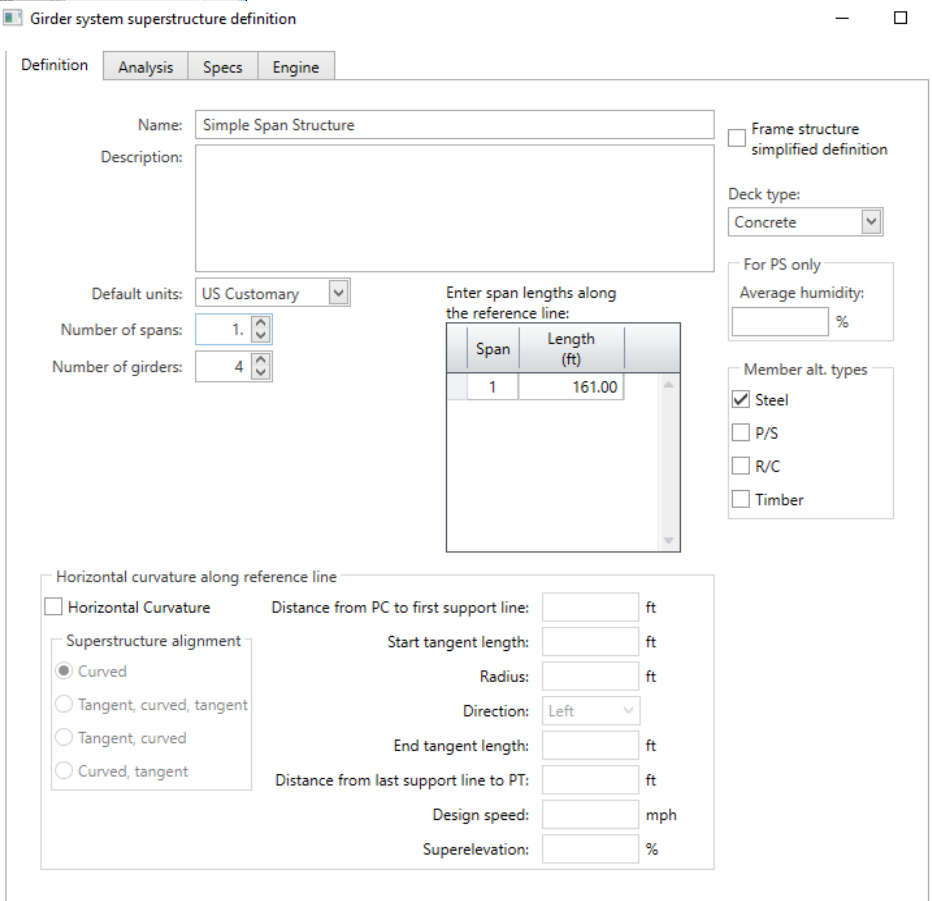
Rolled beam type
 W shape M shape

Modernization Update

- Example – Structure Definition



← Legacy

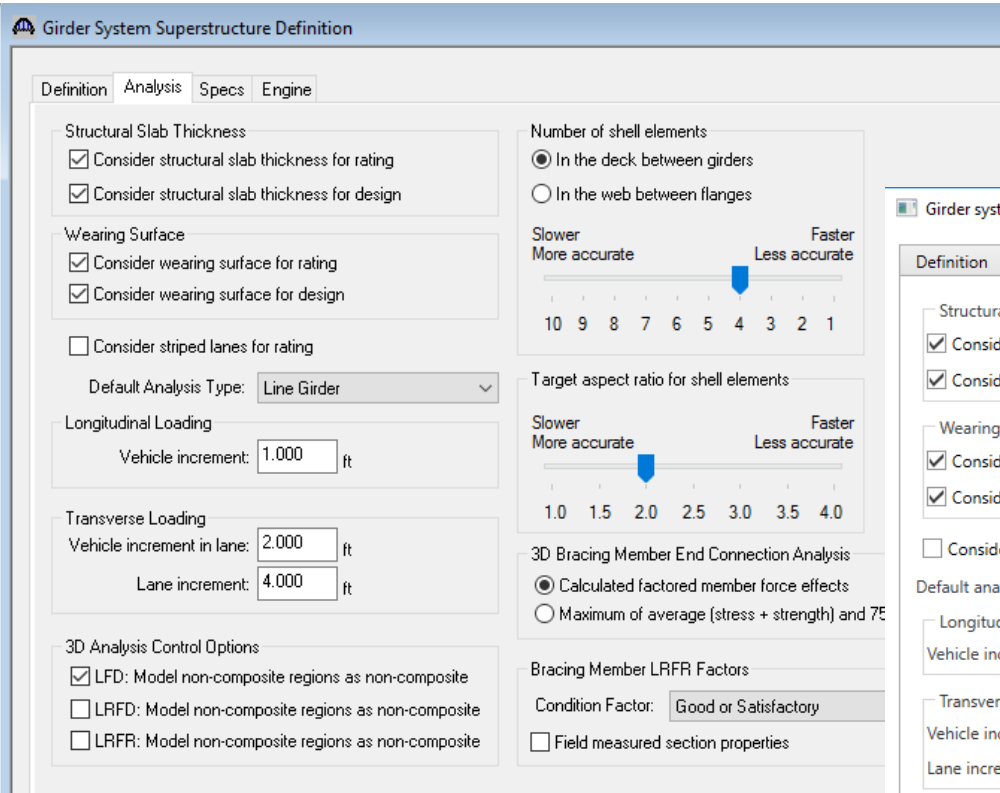


Modernized →

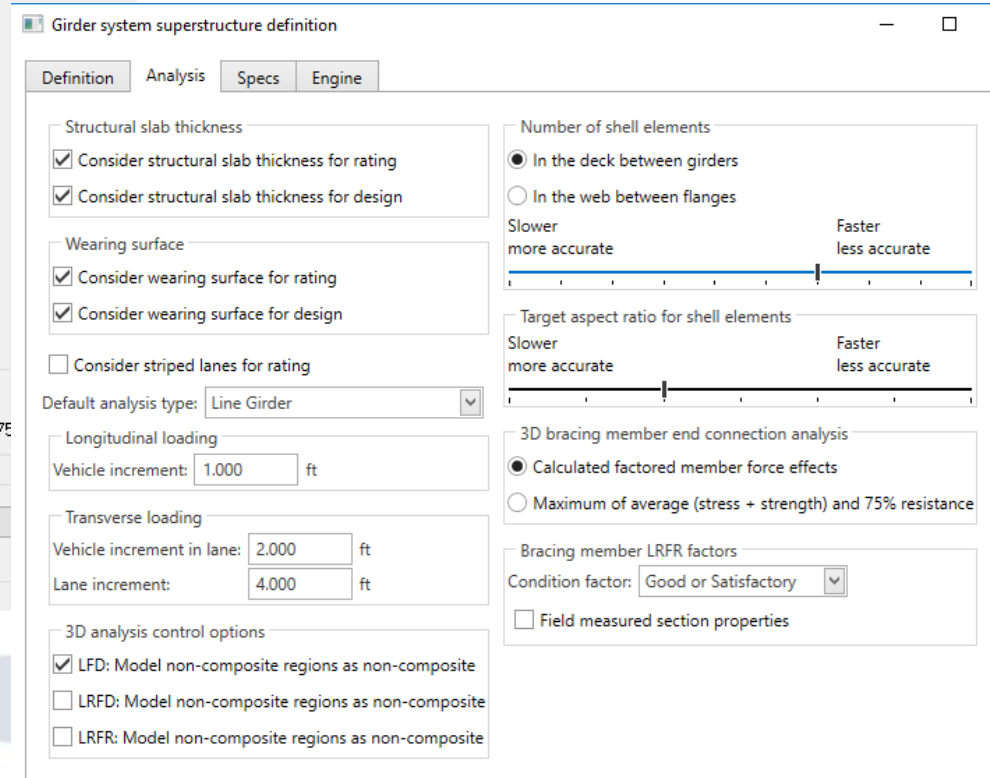
Same appearance and functionality

Modernization Update

- Example – Structure Definition



← Legacy



Modernized →

Same appearance and functionality

Modernization Update

- Analysis Module Development
 - Based on the pattern established for the P/S Design Tool released with 6.8.0
 - Initial development focused on implementing LRFR and spec-checking (LRFD) for P/S I multi-girder systems
 - Currently work has progressed to include reinforced concrete and steel multi-girder systems, concrete multi-celled boxes and substructures

Modernization Update

Timeline:

- Phase 1 – Modernize the analytical modules
 - Release June 2018 (includes Legacy maintenance release)
- Phase 2 – Modernize the user interface and the rest of the system
 - Release June 2019 (includes last Legacy maintenance release)
- Phase 3 – Implement selected user-requested enhancements
 - Release June 2020

Modernization Update

Timeline:

- Phase 1 – Modernize the analytical modules
 - Release June 2018 (version 6.8.3)
 - Includes Legacy maintenance release
 - Existing user interface with the modernized analysis engine
 - Both the modernized engine and the legacy engine will be available for use

(At this point, since no enhancements have been implemented, the analysis results of the modernized engine should (closely) match the legacy engine analysis results)

Modernization Update

Timeline:

- Phase 2 – Modernize the user interface and the rest of the system
 - Release June 2019
 - Includes last Legacy maintenance release 6.8.4
 - The modernized user interface and the modernized engine – i.e. ***the fully modernized system – version 7.0***

Modernization Update

Timeline:

- Phase 3 – Implement selected user-requested enhancements
 - Release June 2020 (version 7.1)
 - The fully modernized system with selected user-requested enhancements

Modernization Update

Software Design

Architecture Workshop conducted March 2014 - architecture design initiated

- Identified experiments for evaluation options
 - Data Access
 - Pure ADO.Net
 - ADO.Net – Strongly Typed
 - Entity Framework
 - Payload Serialization (Bridge Objects, Library Objects, etc.)
 - RESTful Web Services
 - User Interface
 - WPF / MVVM
 - 3rd Party User Controls

Modernization Update

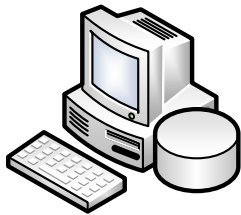
Software Design

- Completed an architecture design to satisfy those requirements.
- Prepared conceptual mockups of the new user interface
- Continued the software design of the analysis engine based on the P/S Design Tool engine design

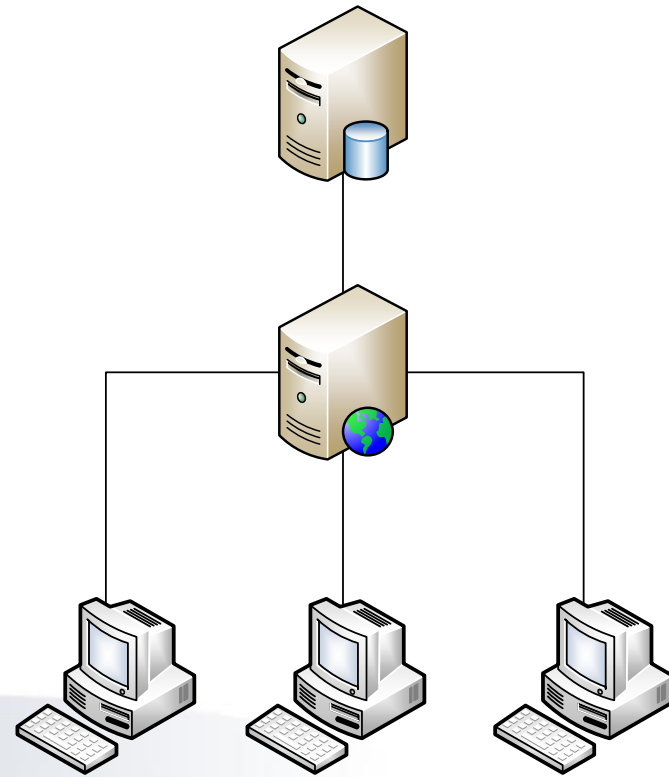
Modernization Update

Software Design - Architecture

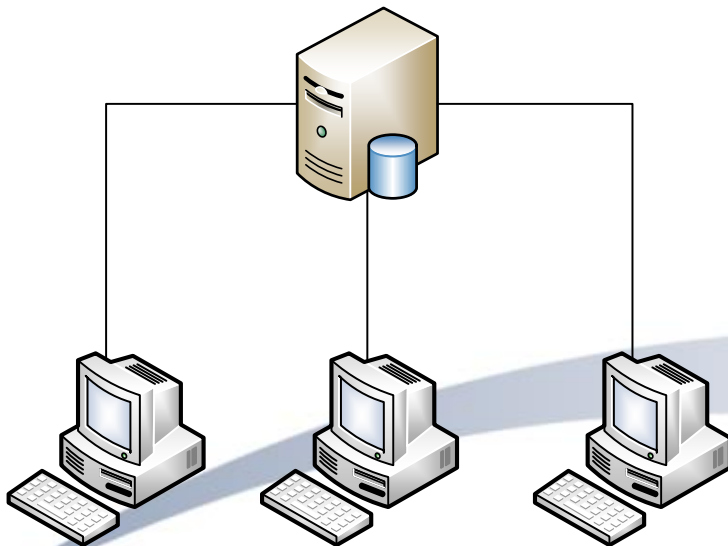
Client-Server with Local Database



Service Oriented Architecture



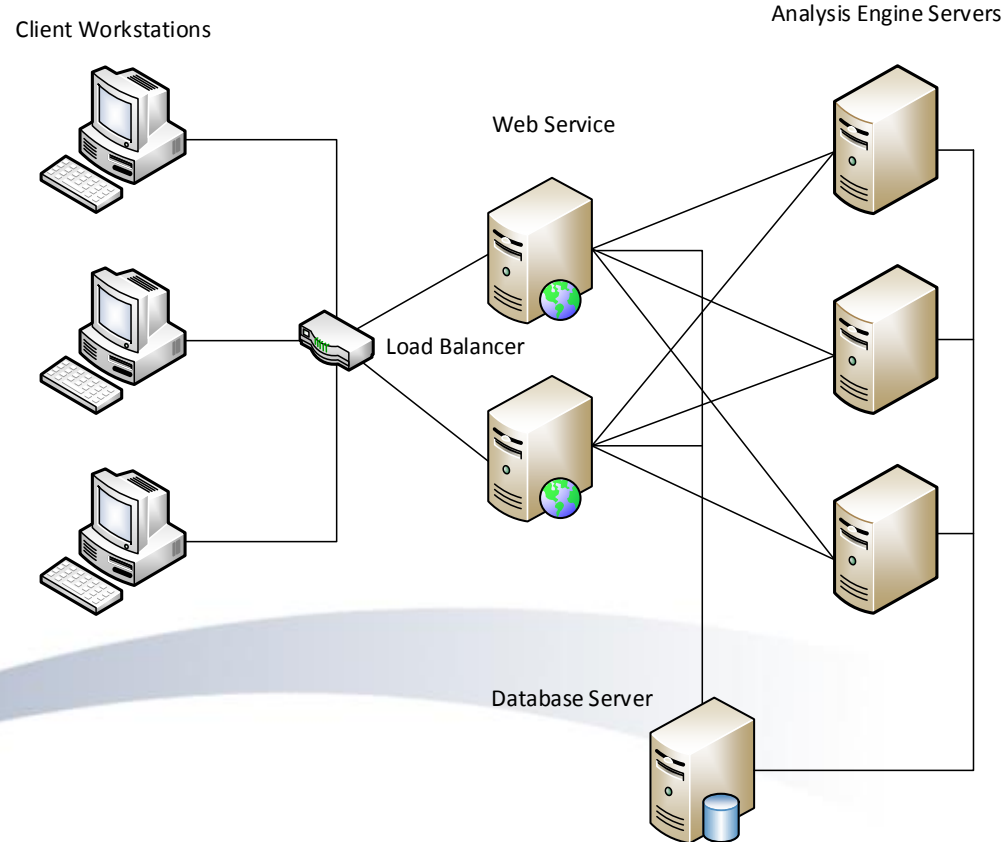
Client-Server Architecture with Shared Database



Modernization Update

Software Design - Architecture

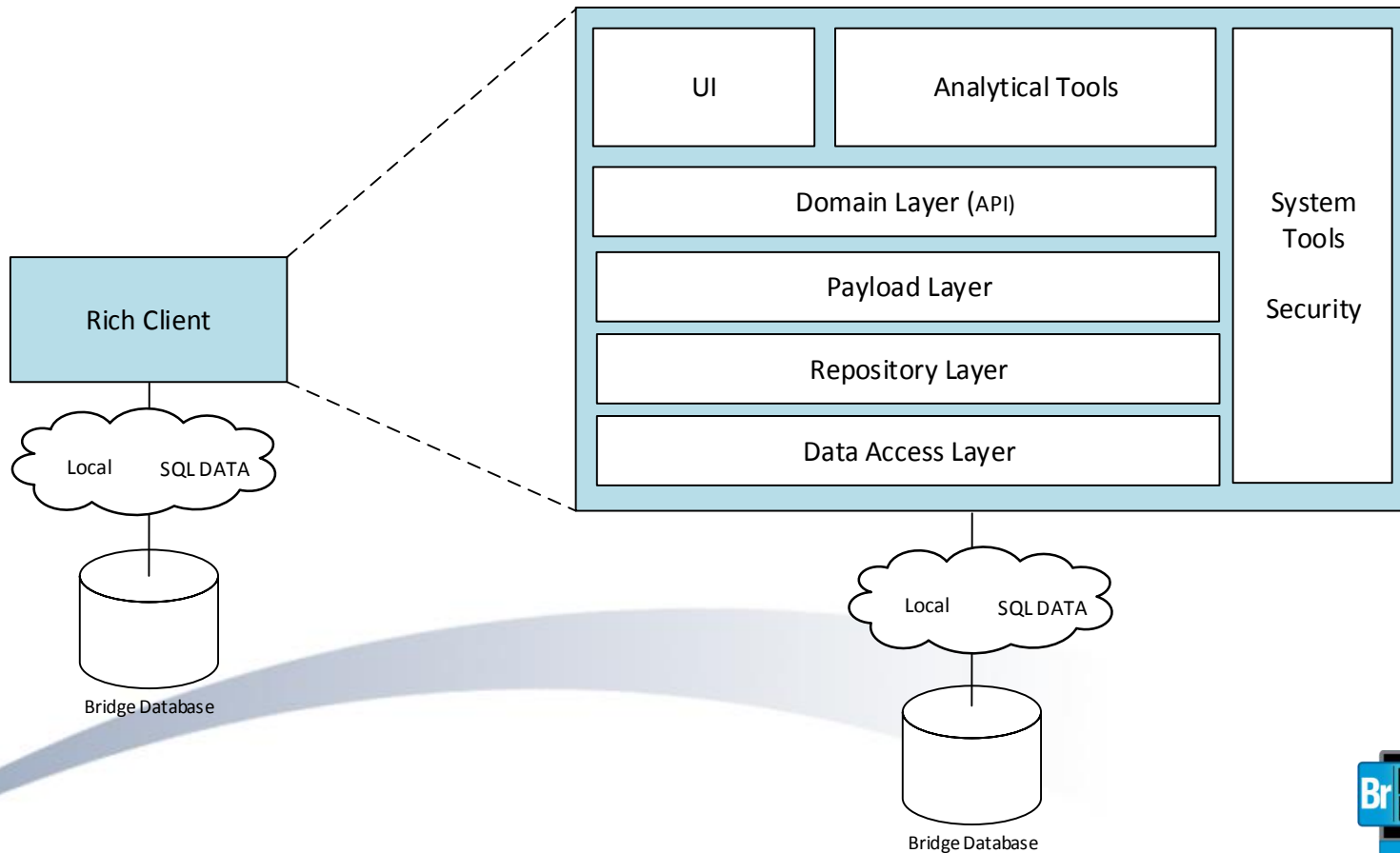
Proposed Architecture can be enhanced to support server side analysis



Modernization Update

Software Design - Architecture

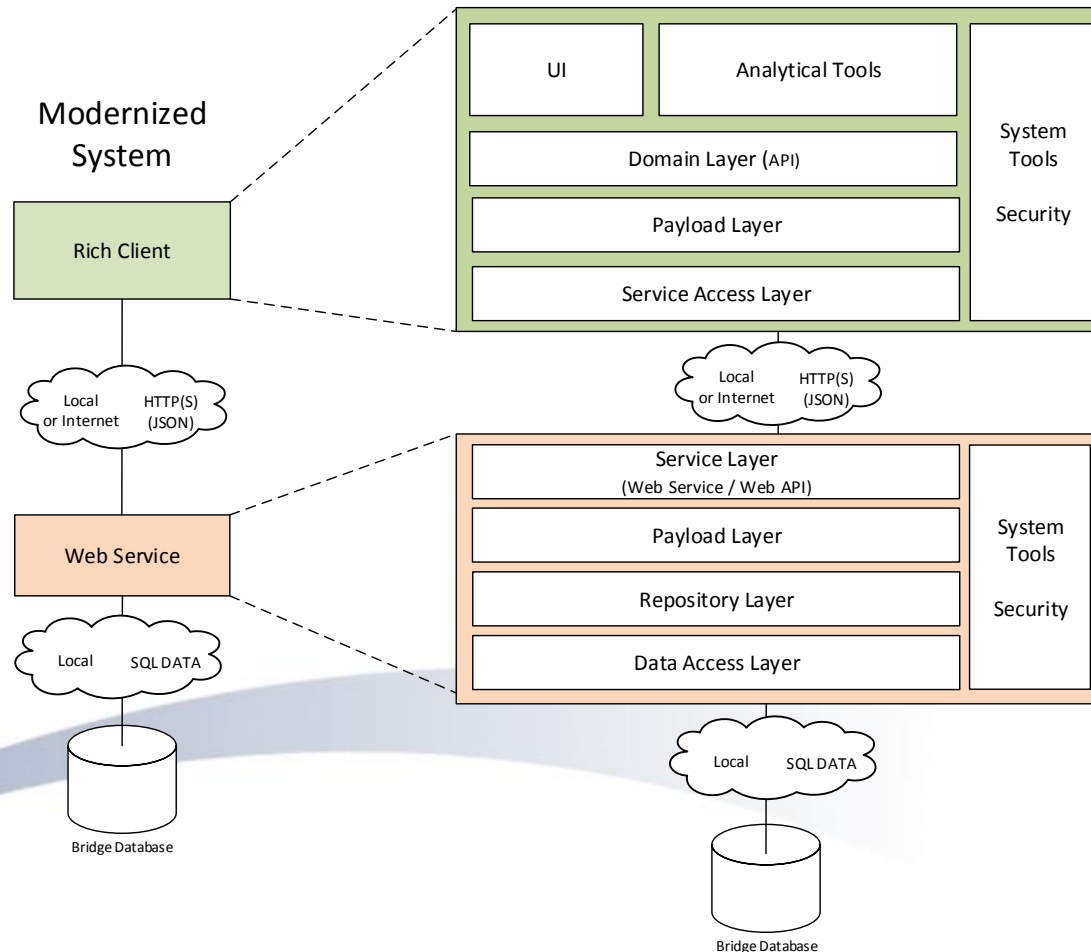
Architecture – Layered Views



Modernization Update

Software Design - Architecture

Architecture – Layered Views



Modernization Update

In conclusion...

Improve efficiency for more than 500 consultants and 40 agencies.

“It’s all about the data!” Licensing agencies have an enormous investment in their bridge data. ***The data and your investment will be preserved.***

Thank you