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AASHTOWare & Permitting

Michigan Bridge Week



Special Projects Engineer?

- Bridge Scour Evaluation and Mitigation
- Manage Overhead Structure Inspection Program
- Manual Writing and Upkeep
- Transportation Asset Management Plan (TAMP)
- Bridge Life Cycle Cost Analysis and Planning
- Over legal Permitting

ITD Over-legal Permitting Journey

Since we built bridge to 1990's - check heavy trucks over trouble bridges.



ITD Over-legal Permitting Journey

1990's to 2021 - DMV screens by factor to determine which permits need bridge analysis. Bridge office puts bridge speed and lane restrictions on permit based on BrR analysis. Process 50-70 permits a week, 300-400 bridges analyzed. Bridge hours 60-80 a week



ITD Over-legal Permitting Journey

Starting August 4 2021- All over-legal permits analyzed on every bridge on route. Truckers can create routes, and enter truck configurations. The full bridge analysis and self issue permits takes about 5 minutes.

First 6 months weekly average

- 270 permits
- 23,000 bridges analyzed
- Bridge hours 20-30 hours

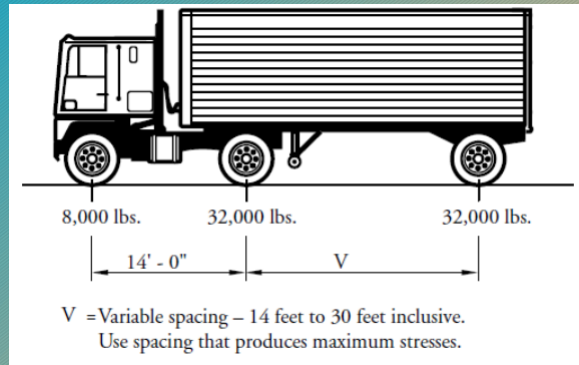


Types of Loads

- Legal Loads
- Divisible Over Legal Loads - Annual Permits
- Indivisible Over Legal Loads - Single Trip Permits

Bridge Design Loads

- HL-93



Potential Bridge Loads

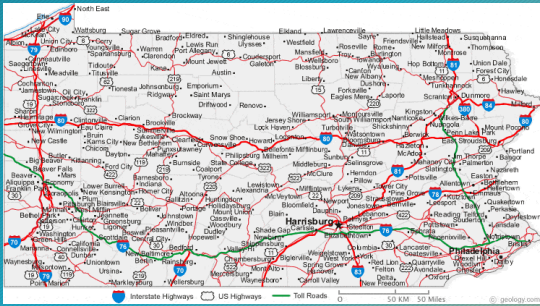






Routing or Rating

Pennsylvania

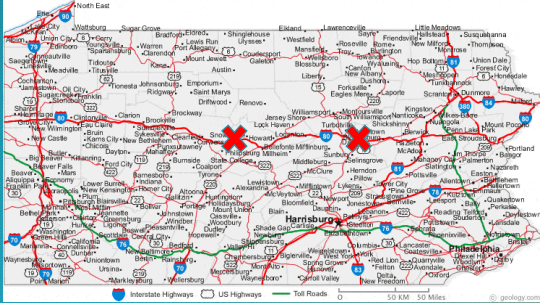


Idaho



Routing or Rating

Pennsylvania

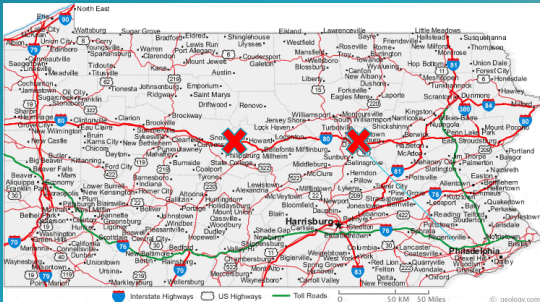


Idaho



Routing or Rating

Pennsylvania



Idaho



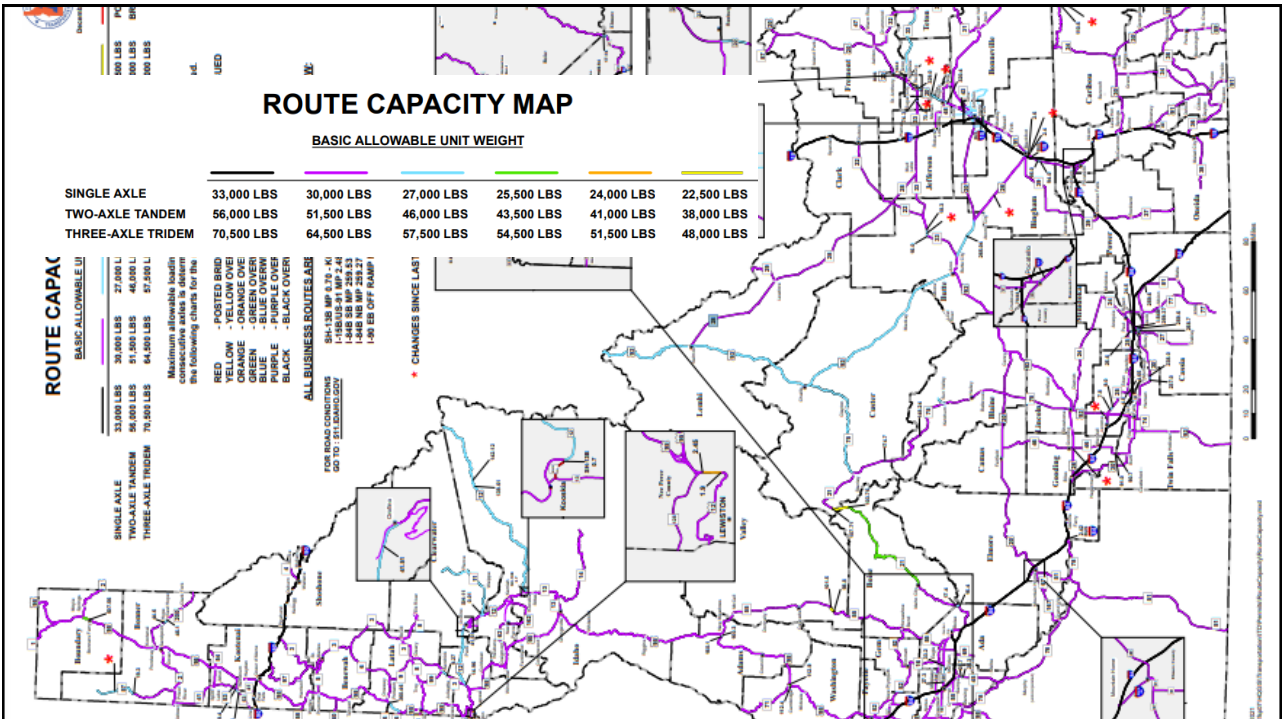
What type of permitting does your Agency need?

Rule Based

- Faster
- Conservative
- Set it and forget it

Analysis Based

- Slower
- More effort on data
- Can get trucks over with less restrictions



Truck Factors / Bridge Factors

- Quick screening tool for Bridge Capacity and Truck Loads
 - Combines axle weights and spacing
- At ITD the truck factor is based on Federal Formula B

$$w = 500 \left(\frac{\ell n}{n-1} + 12n + 36 \right)$$

- w = the maximum weight in pounds that can be carried on a group of two or more axles to the nearest 500 pounds (230 kg).
- ℓ = spacing in feet between the outer axles of any two or more consecutive axles.
- n = number of axles being considered.

- Factor developed for all axle groupings use highest

Bridge Factors

- Bridge Factor is based on Rating Factors for Legal trucks

HS-20	Truck	36	U11	Gusset	Fastener Resistance	1.76	63
Idaho - Type 3	Truck	27	U11	Gusset	Fastener Resistance	2.04	55
Idaho - Type 3S2	Truck	39.5	G2 - Int. Gir.	1.5	Flexural - Steel Strength	2.10	83
Idaho - Type 3-3	Truck	39.5	G2 - Int. Gir.	1.5	Flexural - Steel Strength	2.04	81
Idaho - 121k	Truck	60.5	G2 - Int. Gir.	1.5	Flexural - Steel Strength	1.63	99
CALTRANS P13	Truck	157	G2 - Int. Gir.	1.5	Flexural - Steel Strength	0.84	132

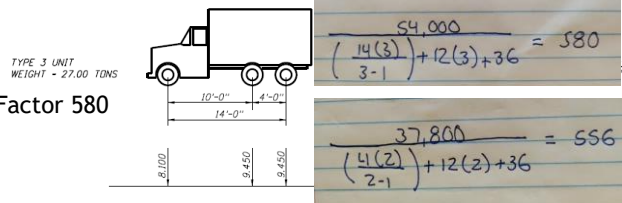
$$2.04 * 580 = 1183$$

$$2.10 * 552 = 1159$$

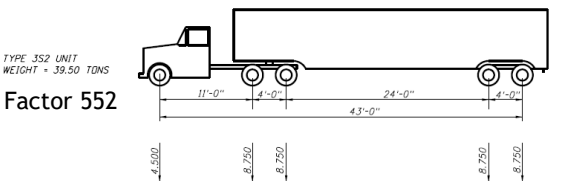
$$2.04 * 494 = 1007$$

Bridge Factor is 1007

Factor 580

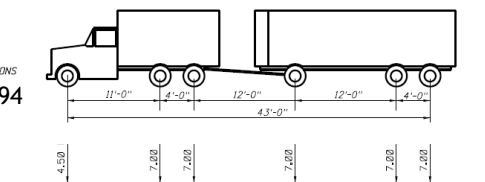


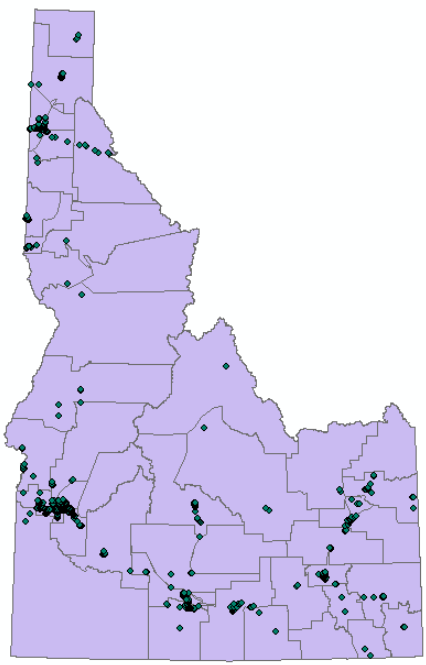
Factor 552




Truck Factors

Factor 494







Idaho Transportation Department
Overhead Structure Inspection Report

S1000421
Route: US 95 Location: Sandpoint Bypass

Location Data

District:	District 1	Route:	US 95
County:	Bonner	Latitude:	48° 16' 54.10"
Location:	Sandpoint Bypass	Longitude:	116° 32' 53.60"
400 Bridge ID# applicable:		Administrative Jurisdiction:	District 1

Inspection Data

Inspection Date:	5/18/2018	Overall Condition:	6 Satisfactory
Inspection Time:	36	Drawing No.:	
Inspector:	Dan Rodriguez	Project Key No.:	
Equipment Req.:	Standard LB vehicle		
Traffic Control Information:	None required.		

Roadway Data

Classification:	Traffic:	Clearance:
Roadway:	Lanes:	Min Vertical Clearance:
Kind of Highway:	ADT Total:	Min Lateral UnderClear:
Design Level of Service:	Truck ADT:	Min Lateral UnderClear Left:
Traffic Direction:	ADT Year:	
Functional Class:		

Structure Data

Material Type:	Steel	Structure Length:	34.00 ft	No. of Spans:	1
Design Type:	CHD; Cantilever - Mono	Max Span Length:	34.00 ft	Year Built:	

Element Condition

Element/Description	Inventories	Galvanized Steel, Cantilever, No Paint				
		Total	State 1	State 2	State 3	State 4
T20-Concrete Foundation	Mod	1.00 each	1.00	0.00	0.00	0.00
Reinforced concrete foundation						
T20-Steel Anchor Bolt	Mod	12.00 each	12.00	0.00	0.00	0.00
Steel anchor rods						
T20-Steel Base Plate	Mod	1.00 each	1.00	0.00	0.00	0.00
Steel base plate						
T20-Steel End Support Column	Mod	25.00 ft	25.00	0.00	0.00	0.00
Steel end support column						
T20-Steel Support-to-Chord Connection	Mod	1.00 each	0.00	1.00	0.00	0.00
Steel end support column to chord connection for steel monobut.						
T20-Steel Single Chord Span	Mod	34.00 ft	0.00	1.00	0.00	0.00
1 of 28 steel end support columns to chord connection bolts to bases						
T20-Steel Single Chord Span	Mod	34.00 ft	34.00	0.00	0.00	0.00
Single steel chord span for steel cantilever monobut.						

Overhead Structure Inspection Report
S1000421

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Know Your Inventory

- Bridges not Load Rated in AASHTOWare BrR
 - Tables
 - Rules
 - Excel sheets
 - Engineering Judgement (no plans)
- Bridges Load Rated in AASHTOWare BrR
 - Load Rating Tool
 - LFD Member Alternative
 - LRFR
 - Check out to run

Tables, Rules, Excel, Engineering Judgement

Truck Length (ft)	VW _{alone} (kips)	VW _{5mph} (kips)	VW _{Only5mphCL} (kips)
100	250	250	250
110	250	250	250
120	250	250	272
130	250	250	294
140	250	250	317
150	250	250	340
160	250	250	362
170	250	260	385
180	250	275	408
190	254	291	430
200	267	306	453
210	281	321	475
220	294	337	498
230	307	352	500
240	321	367	500
250	334	382	500

Weight (kips)	Requirement
225 to <250	Slow to 45 mph
250 to <275	Slow to 5 mph
275 to <325	Slow to 5 mph Only vehicle on the bridge in the direction of travel (centered in travelway)
325 to <400	Slow to 5 mph Only vehicle on the bridge in the direction of travel (centered in travelway) Trailer axles must be a minimum of 16 feet wide
400 to <600	Slow to 5 mph Only vehicle on the bridge in the direction of travel (centered in travelway) Only one lane of traffic allowed in the opposing direction Trailer axles must be a minimum of 16 feet wide

18770	
Requirement	Factor
Normal Travel	< 659
45mph	< 700
25mph	< 783
5mph	< 785
OV	< 1009
OV 5 mph	< 1359
Manual	>= 1359

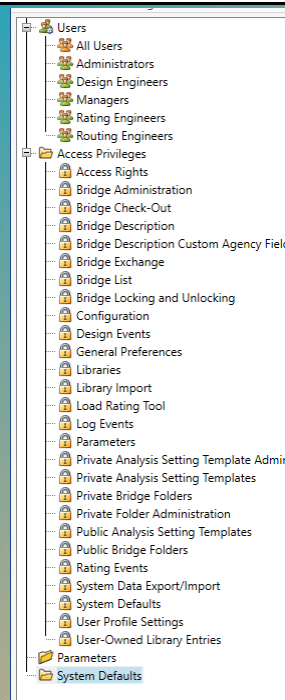
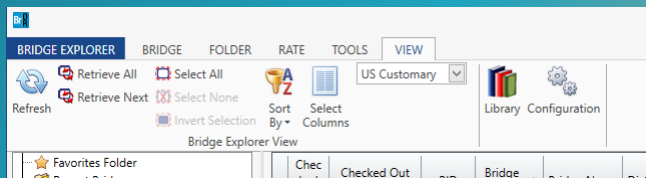
AASHTOWare BrR

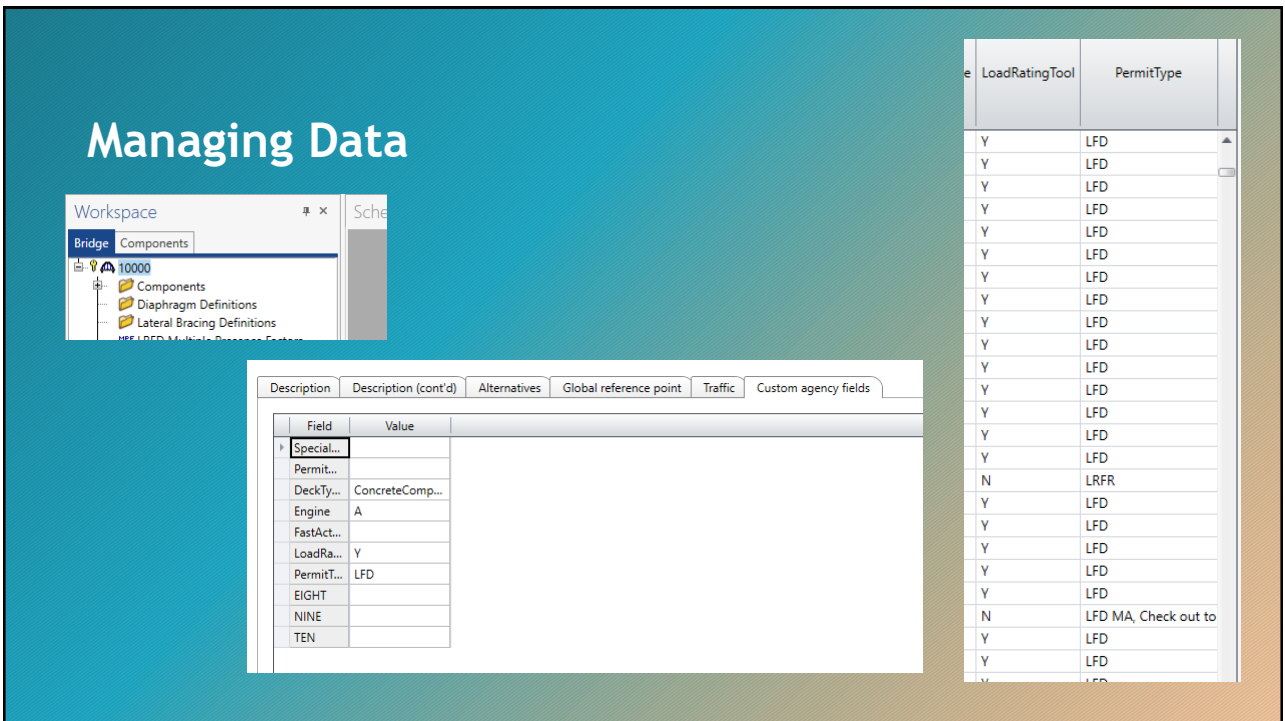
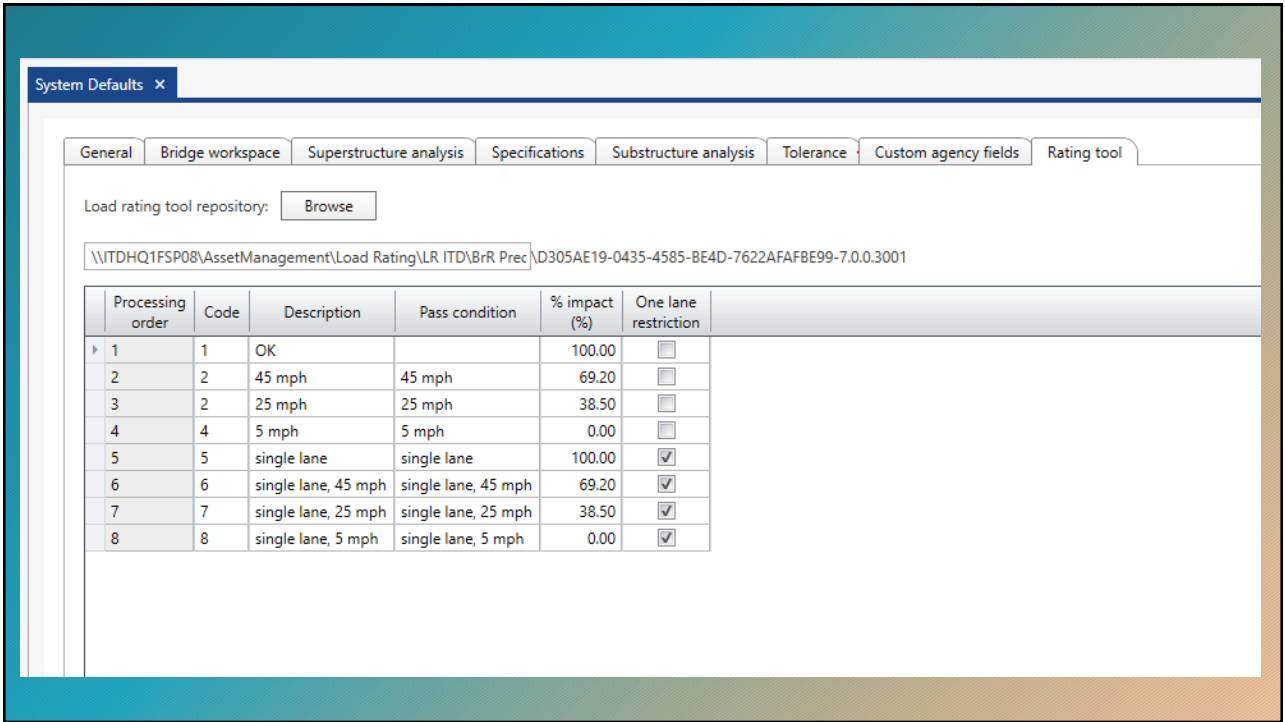
- Load Rating Tool
- LFD Member Alternative
- LRFR
- Check Out To Run
- 3D FEM

History of Load Rating Tool

- AASHTOWare BrR
 - Gold standard for Load Rating
 - Too slow for permitting - ratings take 5+ minutes for each bridge
- Load Rating Tool
 - Uses pre-processed influence lines to quickly determine rating - 100 ratings / second
 - Began upgrade to BrR 10 years ago
 - First included in 6.8.2 with limited capabilities
 - 7.2 released last week includes LRFR

Load Rating Tool Rules





Load Rating Tool

Permit application number:

Application date:

Requested by:

Minimum allowable rating factor:

Comment:

Bridges Vehicles **Rating results**

Filter results: Pass Fail Exceptions

Vehicle	Rating level	BID	Bridge ID	Route number	Code	Description	Inventory rating factor	Operating rating factor	Controlling impact	Pass conditions	Analysis warnings
240k Test Truck (Do not dele...	Oper...	1740	15790_o...	00084	1	OK	0.759	1.267	1.000		
240k Test Truck (Do not dele...	Oper...	1741	15795_o...	00084	1	OK	0.803	1.342	1.000		
240k Test Truck (Do not dele...	Oper...	1825	26220	00000	1	OK	1.645	2.748	1.000		
240k Test Truck (Do not dele...	Oper...	1858	33435	00000	1	OK	1.330	2.221	1.000		
240k Test Truck (Do not dele...	Oper...	1916	26261	00000	1	OK	1.119	1.873	1.000		
240k Test Truck (Do not dele...	Oper...	1917	26280	00055	1	OK	0.734	1.604	1.000		
240k Test Truck (Do not dele...	Oper...	1930	21600	07433		Denied	0.575	0.959	1.000		
240k Test Truck (Do not dele...	Oper...	1930	21600	07433	2	45 mph	0.619	1.032	0.692	45 mph	
240k Test Truck (Do not dele...	Oper...	2061	33415	07023		Denied	0.502	0.839	1.000		
240k Test Truck (Do not dele...	Oper...	2061	33415	07023		Denied	0.541	0.903	0.692		
240k Test Truck (Do not dele...	Oper...	2061	33415	07023		Denied	0.585	0.978	0.385		
240k Test Truck (Do not dele...	Oper...	2061	33415	07023	4	5 mph	0.653	1.091	0.000	5 mph	
240k Test Truck (Do not dele...	Oper...	2063	34015	00016	1	OK	0.709	1.296	1.000		
240k Test Truck (Do not dele...	Oper...	2125	21451	07553	1	OK	7.058	11.786	1.000		
240k Test Truck (Do not dele...	Oper...	2130	25866	00000	1	OK	1.325	2.212	1.000		
240k Test Truck (Do not dele...	Oper...	2168	25876	00000	1	OK	1.339	2.237	1.000		
240k Test Truck (Do not dele...	Oper...	2172	25836	09273	1	OK	1.408	2.351	1.000		
240k Test Truck (Do not dele...	Oper...	2175	34020	00016	1	OK	0.882	1.472	1.000		
240k Test Truck (Do not dele...	Oper...	2176	34010	00016	1	OK	0.840	1.553	1.000		

Create rating results file... View rating results file...

Close

Managing Load Rating Tool Files / Data

- We review Load Rating Tool files monthly
 - Create for new structures
 - Update for changed structures
 - Delete for structures no longer in inventory

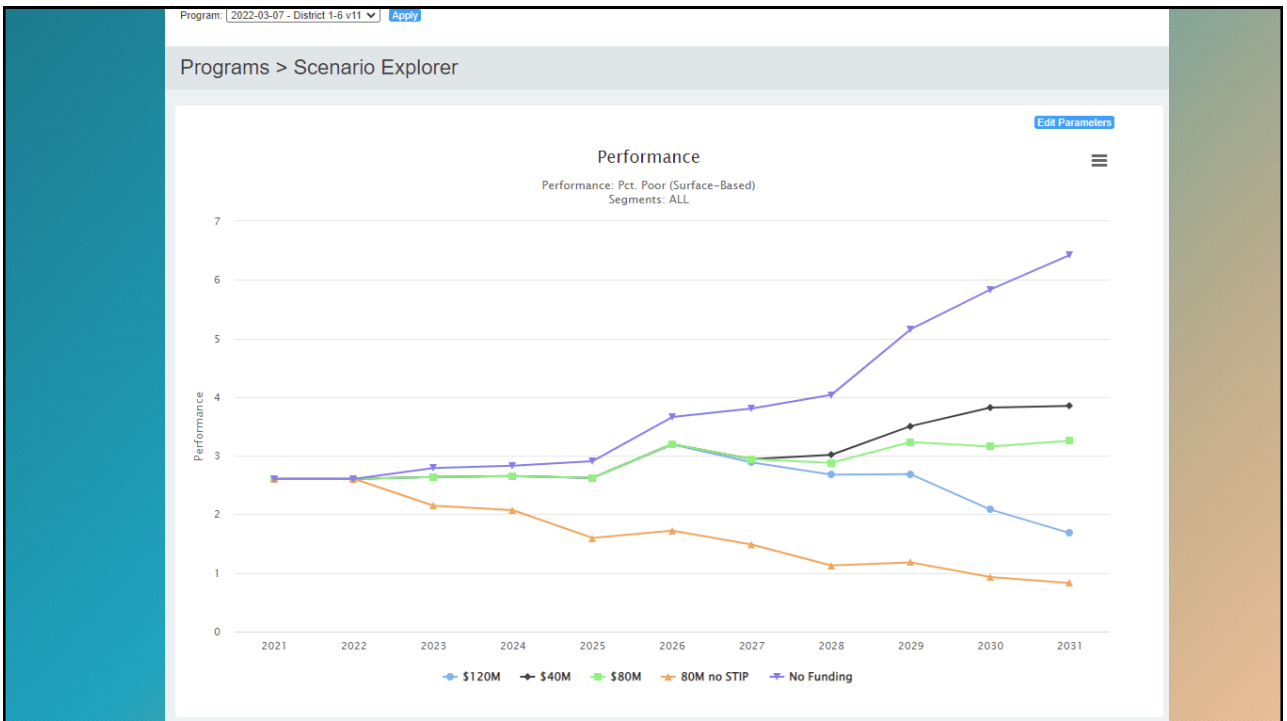
Precomputed Data

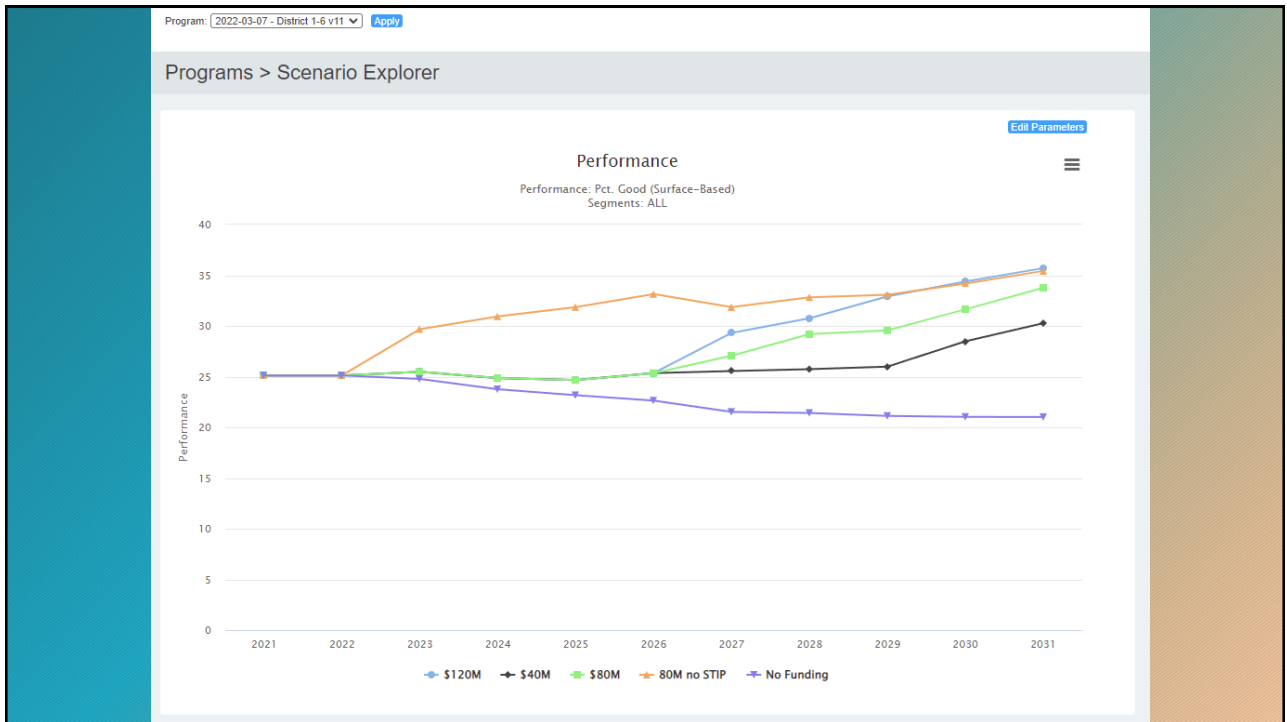
Generate Maintain

Precomputed data				Bridge database				Select	
BID	Bridge ID	NBI structure ID	Date accepted	Created by	Bridge ID	NBI structure ID	Date last modified	Last modified by	
ler	18670	000000000018...	2/7/2018	Tisha Hyde				<input type="checkbox"/>	
ler	18675	000000000018...	2/25/2019	Anthony Beau...				<input type="checkbox"/>	
ler	18735	000000000018...	7/13/2017	Tisha Hyde				<input type="checkbox"/>	
ler	12930	000000000012...	9/4/2017	Tisha Hyde				<input type="checkbox"/>	
ler	12920	000000000012...	2/26/2019	Anthony Beau...				<input type="checkbox"/>	
ler	12925	000000000012...	1/17/2017	Tisha Hyde				<input type="checkbox"/>	
ler	17690	000000000017...	7/6/2017	Tisha Hyde				<input type="checkbox"/>	
ler	18300	000000000018...	4/15/2019	Tyler Haney				<input type="checkbox"/>	
ler	26678	000000000026...	2/4/2018	Tisha Hyde				<input type="checkbox"/>	
ler	29586	000000000029...	2/4/2018	Tisha Hyde				<input type="checkbox"/>	
11...	31258	000000000031...	1/19/2021	Jake Legler	31258	000000000031...	7/7/2017	Tisha Hyde	<input type="checkbox"/>
11...	10396	000000000010...	1/19/2021	Jake Legler	10396	000000000010...	2/10/2018	Tisha Hyde	<input type="checkbox"/>
11...	13485	000000000013...	1/19/2021	Jake Legler	13485	000000000013...	3/3/2021	Tyler Haney	<input checked="" type="checkbox"/>
11...	11050	000000011050	1/19/2021	Jake Legler	11050	000000011050	3/29/2019	Anthony Beau...	<input type="checkbox"/>
11...	11055	000000011055	1/19/2021	Jake Legler	11055	000000011055	3/29/2019	Anthony Beau...	<input type="checkbox"/>
11...	11160	000000011160	1/19/2021	Jake Legler	11160	000000011160	6/16/2017	Tisha Hyde	<input type="checkbox"/>
11...	11185	000000000011...	1/19/2021	Jake Legler	11185	000000000011...	2/25/2019	Anthony Beau...	<input type="checkbox"/>
11...	11190	000000000011...	1/19/2021	Jake Legler	11190	000000000011...	6/25/2017	Tisha Hyde	<input type="checkbox"/>
11...	15680	000000000015...	1/19/2021	Jake Legler	15680	000000000015...	2/26/2019	Anthony Beau...	<input type="checkbox"/>
11...	15805	000000000015...	1/19/2021	Jake Legler	15805	000000000015...	3/9/2018	Tyler Haney	<input type="checkbox"/>
11...	16520	000000000016...	1/19/2021	Jake Legler	16520	000000000016...	1/31/2014	Tisha Hyde	<input type="checkbox"/>
11...	16525	000000000016...	1/19/2021	Jake Legler	16525	000000000016...	1/31/2014	Tisha Hyde	<input type="checkbox"/>
11...	16865	000000000016...	1/19/2021	Jake Legler	16865	000000000016...	2/10/2018	Tisha Hyde	<input type="checkbox"/>
11...	16870	000000000016...	1/19/2021	Jake Legler	16870	000000000016...	2/10/2018	Tisha Hyde	<input type="checkbox"/>
11...	16920	000000000016...	1/19/2021	Jake Legler	16920	000000000016...	2/10/2018	Tisha Hyde	<input type="checkbox"/>
11...	16925	000000000016...	1/19/2021	Jake Legler	16925	000000000016...	2/10/2018	Tisha Hyde	<input type="checkbox"/>

Select All Select Outdated Select Not Found Clear Selected Update Selected Delete Selected

Close





Other Considerations

- Max weight (other) for self issuance
- Max weight (other) to go through system
- Non Standard Gauge Vehicles

Data Updates

- ITD updates bridge and load rating information quarterly
 - Backup of BrR database
 - Zip file of Load Rating Tool files
 - Spreadsheet with inventory information
- Able to make emergency changes via 511 restrictions system
- Can update bridge models and inventory information in between but testing is cumbersome

Data Testing

- 1) 121k Test - Run the 121k Truck over all State bridges through system. Match rating method and Operating Rating result.
- 2) 240k Test - Run the 240k Truck over all State bridges through system. Match speed and lane requirements
- 3) Side by Side - Run permits manually and make sure they match bridges on route, ratings, and requirements.

Data Testing

- Initial system setup - 121k Test, 240k Test, Side by Side
- Data updates - 121k Test, 240k Test
- Ongoing QA - Side by Side

System Monitoring

- Real Time monitoring for error bridges. Bridge where results are expected but system returns none.
- Monitoring of Failed and Manual results for bridges that are causing problems

Questions



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