

Part D4: Operations



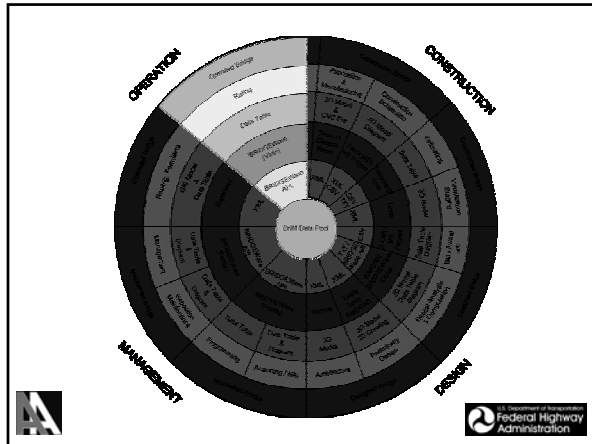
Overview (D4-Operations)

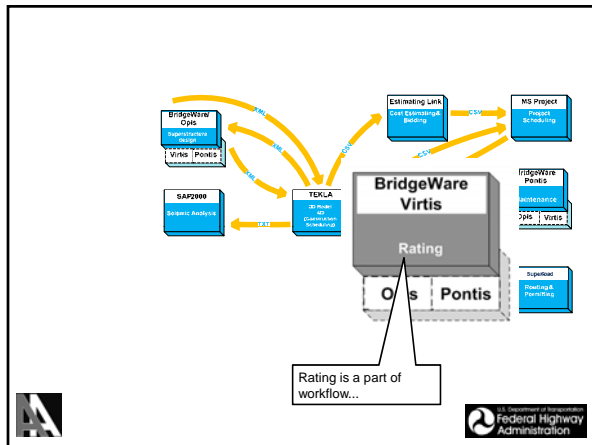
- Where BridgeWare Fits (in the lifecycle)
- Load Rating (Individual Bridge)
 - Steel Alternate
 - Concrete Alternate
- Load Rating (Multiple Bridges)
 - Bridges on Network(s)
 - Permitting

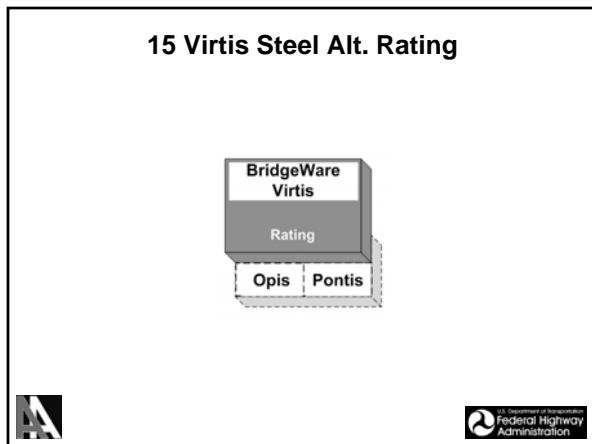


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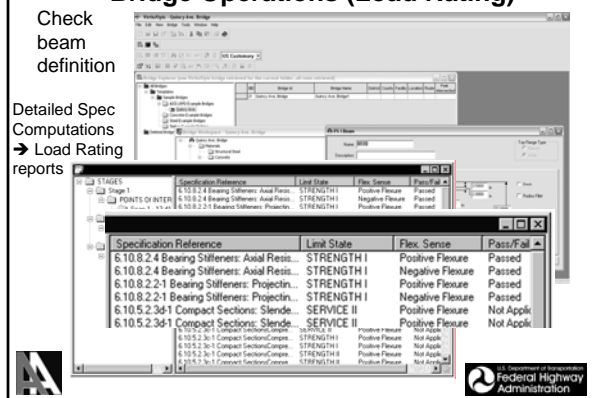


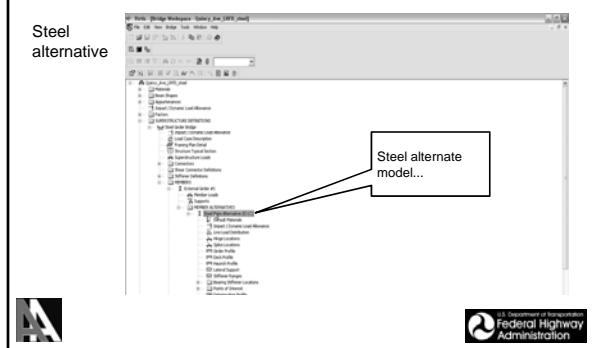




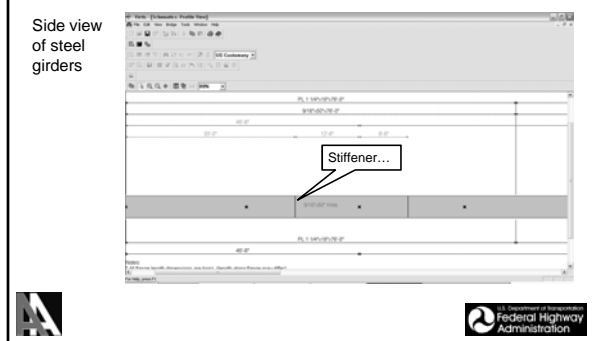
Check
beam
definition

Detailed Spec Computations
→ Load Rating reports



Steel
alternative

Side view
of steel
girders



15 Virtis Steel Alt. Rating

Define
rating load
case



15 Virtis Steel Alt. Rating

Run rating
analysis
using
BRASS



15 Virtis Steel Alt. Rating

Rating
results:
rating
factors

Rating	Permit	Inventory	Operating	Legal	Permit
Rating	Rating	Rating	Rating	Rating	Rating
(Ton)	Factor	Factor	Factor	Factor	Factor
115.02	1.158	1.501			
102.48	1.351	1.752			
115.02	0.865	1.121			
109.31					

Rating
results:
rating
factors



Rating
results:
Moment
diagram



Rating
results:
Shear
diagram



15 Virtis Steel Alt. Rating

Define deterioration Profile: Thickness loss and location

% Thickness Loss (%)	Support Number	Start Distance (ft)	Length (ft)	End Distance (ft)
20.0	1	30.00	5.00	35.00
50.0	2	50.00	5.00	55.00
30.0	1	100.00		100.00

Section loss (%)...

Loss position...

Federal Highway Administration

15 Virtis Steel Alt. Rating

Side view of steel girders after defining section loss

Section loss...

Federal Highway Administration

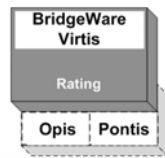
15 Virtis Steel Alt. Rating

Rerun rating analysis and get rating results: rating factors

The rating factors change...

Federal Highway Administration

14 Virtis Concrete Alt. Rating



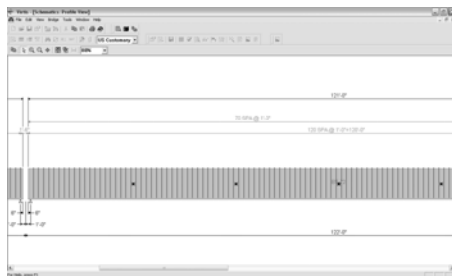
14 Virtis Concrete Alt. Rating

Concrete alternative

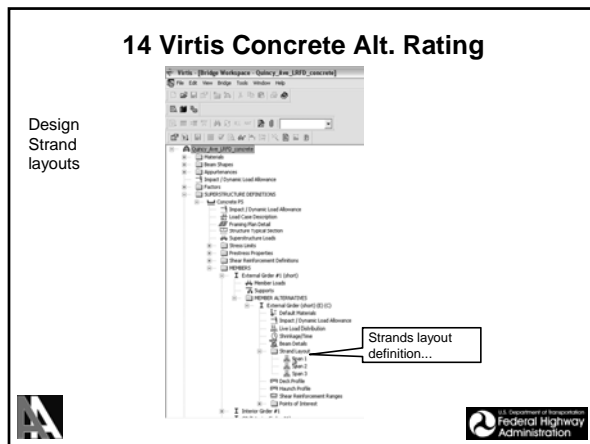


14 Virtis Concrete Alt. Rating

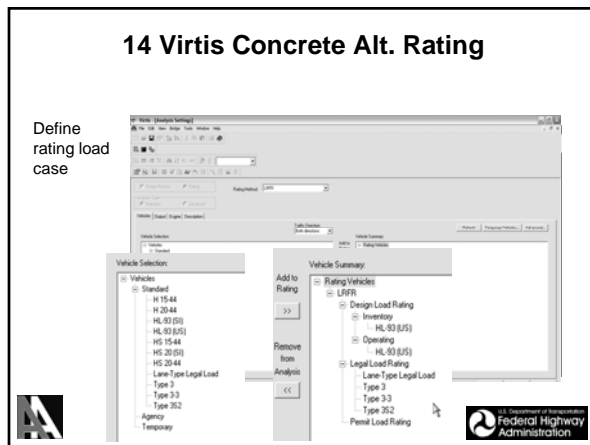
Side view of Concrete girders

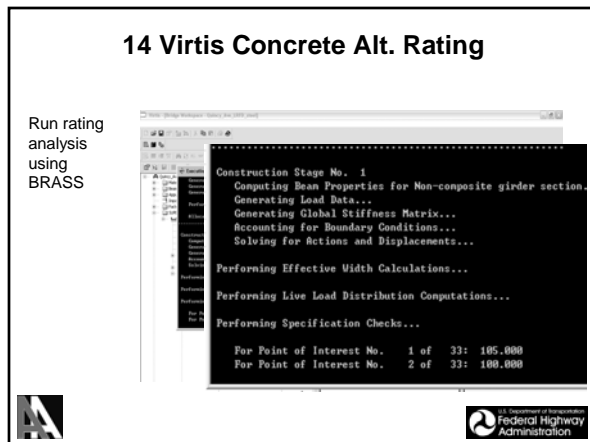


Design Strand layouts



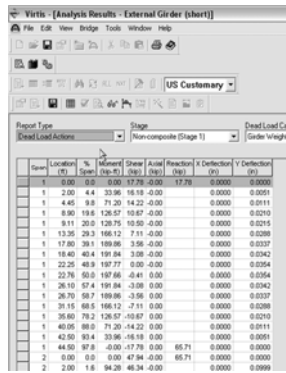
Define
rating load
case



Run rating
analysis
using
BRASS

14 Virtis Concrete Alt. Rating

Rating results:
Moment
and Shear
Force

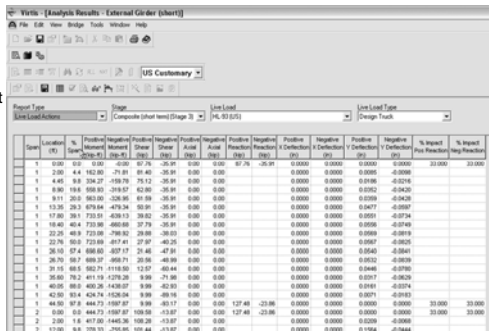


Location (ft)	% Moment (ft-k)	% Shear (kips)	Dead Load (kips)	Reaction (kips)	Deflection (in)	Deflection (in)
1	0.00	0.00	0.00	17.79	-0.00	0.0000
1	2.00	4.4	32.96	18.18	-0.00	0.0000
1	4.45	9.8	71.20	14.22	-0.00	0.0111
1	8.90	19.6	126.57	10.87	-0.00	0.0210
1	9.11	20.0	126.75	10.50	-0.00	0.0215
1	13.35	29.3	166.12	7.11	-0.00	0.0208
1	17.80	39.1	199.86	3.56	-0.00	0.0207
1	18.40	40.4	199.84	3.08	-0.00	0.0242
1	22.25	48.9	197.77	0.00	-0.00	0.0354
1	22.76	50.0	197.66	-0.41	0.00	0.0354
1	26.10	57.4	199.84	-3.08	0.00	0.0242
1	26.70	58.7	199.86	-3.56	0.00	0.0307
1	31.15	65.5	166.12	-7.11	0.00	0.0208
1	35.60	79.2	126.57	-10.87	0.00	0.0210
1	40.05	88.0	71.20	-14.22	0.00	0.0111
1	42.50	92.4	32.96	-18.18	0.00	0.0000
1	44.50	97.8	-0.00	-17.79	0.00	0.0000
2	0.00	0.00	0.00	47.94	-0.00	0.0000
2	2.00	1.6	94.28	45.34	-0.00	0.0099



14 Virtis Concrete Alt. Rating

Rating results:
Moment
and Shear
Force



Location (ft)	% Moment (ft-k)	% Shear (kips)	Dead Load (kips)	Reaction (kips)	Deflection (in)	Deflection (in)	% Impact	% Impact
1	0.00	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0000
1	2.00	4.4	162.80	21.81	81.48	-0.00	0.0000	0.0000
1	4.45	9.8	294.27	139.79	75.12	-0.00	0.0000	0.0186
1	8.90	19.6	588.53	279.57	42.56	-0.00	0.0000	0.0372
1	9.11	20.0	603.00	224.96	41.99	-0.00	0.0000	0.0399
1	13.35	29.3	879.34	479.34	28.91	-0.00	0.0000	0.0477
1	17.80	39.1	733.01	439.13	28.82	-0.00	0.0000	0.0591
1	18.40	40.4	733.01	400.60	27.19	-0.00	0.0000	0.0598
1	22.25	48.9	733.01	288.82	28.80	-0.00	0.0000	0.0819
1	22.76	50.0	733.01	247.47	27.87	-0.00	0.0000	0.0847
1	26.10	57.4	688.00	337.17	21.46	-0.00	0.0000	0.0848
1	26.70	58.7	688.00	288.71	20.88	-0.00	0.0000	0.0852
1	31.15	65.5	603.01	1118.00	13.57	-0.00	0.0000	0.0446
1	35.60	79.2	411.19	1279.28	9.99	-0.00	0.0000	0.0317
1	40.05	88.0	400.29	1428.07	9.99	-0.00	0.0000	0.0181
1	42.50	92.4	424.74	1528.04	9.99	-0.00	0.0000	0.0071
1	44.50	97.8	444.73	1597.87	9.99	-0.00	0.0000	0.0000
2	0.00	0.00	0.00	47.94	127.48	-0.00	0.0000	0.0000
2	2.00	1.6	417.46	146.36	108.29	-0.00	0.0000	0.0209
2	17.00	0.0	109.10	290.86	109.44	-0.00	0.0000	0.1484



14 Virtis Concrete Alt. Rating

Change
Strand
layouts



Strand Layout - Span 1

Left hwp pt. dist. (ft): 18.50

Left hwp pt. radius: 0.00

Right hwp pt. dist. (ft): 18.50

Right hwp pt. radius: 0.00

Force: 150 kips

Left CSS: 18.0000 in

Mid CSS: 2.0000 in

Right CSS: 18.0000 in



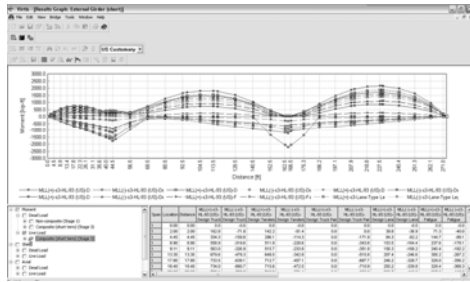
14 Virtis Concrete Alt. Rating

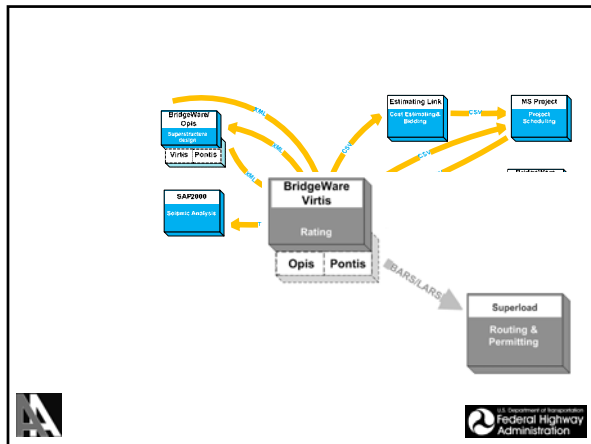
Re-rating
results:
Moment
and Shear
Force

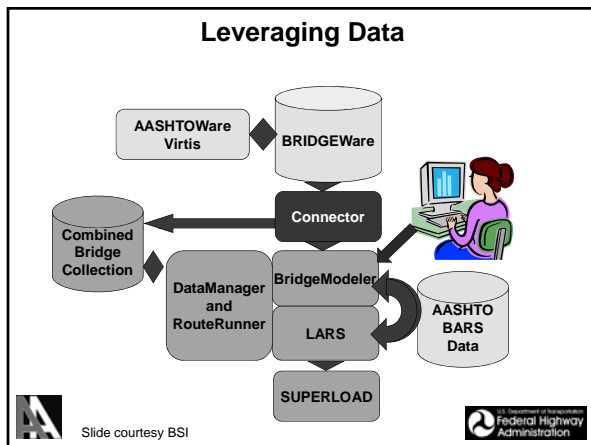
Lane	Location (ft)	Span	Moment (kip-ft)	Shear (kip)	Axial (kip)	Reaction (kip)	C Deflection (in)	V Deflection (in)
1	0.00	0.00	0.00	17.79	0.00	17.79	0.0000	0.0000
1	2.00	4.4	33.96	16.19	0.00	0.0000	0.0000	0.0000
1	4.45	8.8	71.20	14.22	0.00	0.0000	0.0111	0.0000
1	8.90	13.2	108.47	10.67	0.00	0.0000	0.0210	0.0000
1	13.35	17.6	145.74	10.60	0.00	0.0000	0.0215	0.0000
1	17.80	22.0	183.01	7.11	0.00	0.0000	0.0208	0.0000
1	22.25	26.4	220.28	3.58	0.00	0.0000	0.0207	0.0000
1	26.70	30.8	257.55	0.00	0.00	0.0000	0.0204	0.0000
1	31.15	35.2	294.82	-3.58	0.00	0.0000	0.0207	0.0000
1	35.60	39.6	332.09	-7.11	0.00	0.0000	0.0208	0.0000
1	40.05	44.0	369.36	-10.67	0.00	0.0000	0.0210	0.0000
1	44.50	48.4	406.63	-14.22	0.00	0.0000	0.0215	0.0000
1	48.95	52.8	443.90	-17.79	0.00	0.0000	0.0219	0.0000
1	53.40	57.2	481.17	-21.35	0.00	0.0000	0.0224	0.0000
1	57.85	61.6	518.44	-24.91	0.00	0.0000	0.0229	0.0000
1	62.30	66.0	555.71	-28.48	0.00	0.0000	0.0234	0.0000
1	66.75	70.4	592.98	-32.04	0.00	0.0000	0.0239	0.0000
1	71.20	74.8	630.25	-35.61	0.00	0.0000	0.0244	0.0000
1	75.65	79.2	667.52	-39.17	0.00	0.0000	0.0249	0.0000
1	80.10	83.6	704.79	-42.74	0.00	0.0000	0.0254	0.0000
1	84.55	88.0	742.06	-46.30	0.00	0.0000	0.0259	0.0000
1	89.00	92.4	779.33	-49.87	0.00	0.0000	0.0264	0.0000
1	93.45	96.8	816.60	-53.43	0.00	0.0000	0.0269	0.0000
1	97.90	101.2	853.87	-57.00	0.00	0.0000	0.0274	0.0000
1	102.35	105.6	891.14	-60.56	0.00	0.0000	0.0279	0.0000
1	106.80	110.0	928.41	-64.13	0.00	0.0000	0.0284	0.0000
1	111.25	114.4	965.68	-67.69	0.00	0.0000	0.0289	0.0000
1	115.70	118.8	1002.95	-71.26	0.00	0.0000	0.0294	0.0000
1	120.15	123.2	1040.22	-74.82	0.00	0.0000	0.0299	0.0000
1	124.60	127.6	1077.49	-78.39	0.00	0.0000	0.0304	0.0000
1	129.05	132.0	1114.76	-81.95	0.00	0.0000	0.0309	0.0000
1	133.50	136.4	1152.03	-85.52	0.00	0.0000	0.0314	0.0000
1	137.95	140.8	1189.30	-89.08	0.00	0.0000	0.0319	0.0000
1	142.40	145.2	1226.57	-92.65	0.00	0.0000	0.0324	0.0000
1	146.85	149.6	1263.84	-96.21	0.00	0.0000	0.0329	0.0000
1	151.30	154.0	1301.11	-99.78	0.00	0.0000	0.0334	0.0000
1	155.75	158.4	1338.38	-103.34	0.00	0.0000	0.0339	0.0000
1	160.20	162.8	1375.65	-106.91	0.00	0.0000	0.0344	0.0000
1	164.65	167.2	1412.92	-110.47	0.00	0.0000	0.0349	0.0000
1	169.10	171.6	1450.19	-114.04	0.00	0.0000	0.0354	0.0000
1	173.55	176.0	1487.46	-117.60	0.00	0.0000	0.0359	0.0000
1	178.00	180.4	1524.73	-121.17	0.00	0.0000	0.0364	0.0000
1	182.45	184.8	1562.00	-124.73	0.00	0.0000	0.0369	0.0000
1	186.90	189.2	1599.27	-128.30	0.00	0.0000	0.0374	0.0000
1	191.35	193.6	1636.54	-131.86	0.00	0.0000	0.0379	0.0000
1	195.80	198.0	1673.81	-135.43	0.00	0.0000	0.0384	0.0000
1	200.25	202.4	1711.08	-138.99	0.00	0.0000	0.0389	0.0000
1	204.70	206.8	1748.35	-142.56	0.00	0.0000	0.0394	0.0000
1	209.15	211.2	1785.62	-146.12	0.00	0.0000	0.0399	0.0000
1	213.60	215.6	1822.89	-149.69	0.00	0.0000	0.0404	0.0000
1	218.05	220.0	1860.16	-153.25	0.00	0.0000	0.0409	0.0000
1	222.50	224.4	1897.43	-156.82	0.00	0.0000	0.0414	0.0000
1	226.95	228.8	1934.70	-160.38	0.00	0.0000	0.0419	0.0000
1	231.40	233.2	1971.97	-163.95	0.00	0.0000	0.0424	0.0000
1	235.85	237.6	2009.24	-167.51	0.00	0.0000	0.0429	0.0000
1	240.30	242.0	2046.51	-171.08	0.00	0.0000	0.0434	0.0000
1	244.75	246.4	2083.78	-174.64	0.00	0.0000	0.0439	0.0000
1	249.20	250.8	2121.05	-178.21	0.00	0.0000	0.0444	0.0000
1	253.65	255.2	2158.32	-181.77	0.00	0.0000	0.0449	0.0000
1	258.10	259.6	2195.59	-185.34	0.00	0.0000	0.0454	0.0000
1	262.55	264.0	2232.86	-188.90	0.00	0.0000	0.0459	0.0000
1	267.00	268.4	2270.13	-192.47	0.00	0.0000	0.0464	0.0000
1	271.45	272.8	2307.40	-196.03	0.00	0.0000	0.0469	0.0000
1	275.90	277.2	2344.67	-199.60	0.00	0.0000	0.0474	0.0000
1	280.35	281.6	2381.94	-203.16	0.00	0.0000	0.0479	0.0000
1	284.80	286.0	2419.21	-206.73	0.00	0.0000	0.0484	0.0000
1	289.25	290.4	2456.48	-210.29	0.00	0.0000	0.0489	0.0000
1	293.70	294.8	2493.75	-213.86	0.00	0.0000	0.0494	0.0000
1	298.15	299.2	2531.02	-217.42	0.00	0.0000	0.0499	0.0000
1	302.60	303.6	2568.29	-220.99	0.00	0.0000	0.0504	0.0000
1	307.05	308.0	2605.56	-224.55	0.00	0.0000	0.0509	0.0000
1	311.50	312.4	2642.83	-228.12	0.00	0.0000	0.0514	0.0000
1	315.95	316.8	2680.10	-231.68	0.00	0.0000	0.0519	0.0000
1	320.40	321.2	2717.37	-235.25	0.00	0.0000	0.0524	0.0000
1	324.85	325.6	2754.64	-238.81	0.00	0.0000	0.0529	0.0000
1	329.30	330.0	2791.91	-242.38	0.00	0.0000	0.0534	0.0000
1	333.75	334.4	2829.18	-245.94	0.00	0.0000	0.0539	0.0000
1	338.20	338.8	2866.45	-249.51	0.00	0.0000	0.0544	0.0000
1	342.65	343.2	2903.72	-253.07	0.00	0.0000	0.0549	0.0000
1	347.10	347.6	2940.99	-256.64	0.00	0.0000	0.0554	0.0000
1	351.55	352.0	2978.26	-260.20	0.00	0.0000	0.0559	0.0000
1	356.00	356.4	3015.53	-263.77	0.00	0.0000	0.0564	0.0000
1	360.45	360.8	3052.80	-267.33	0.00	0.0000	0.0569	0.0000
1	364.90	365.2	3090.07	-270.90	0.00	0.0000	0.0574	0.0000
1	369.35	369.6	3127.34	-274.46	0.00	0.0000	0.0579	0.0000
1	373.80	374.0	3164.61	-278.03	0.00	0.0000	0.0584	0.0000
1	378.25	378.4	3201.88	-281.59	0.00	0.0000	0.0589	0.0000
1	382.70	382.8	3239.15	-285.16	0.00	0.0000	0.0594	0.0000
1	387.15	387.2	3276.42	-288.72	0.00	0.0000	0.0599	0.0000
1	391.60	391.6	3313.69	-292.29	0.00	0.0000	0.0604	0.0000
1	396.05	396.0	3350.96	-295.85	0.00	0.0000	0.0609	0.0000
1	400.50	400.4	3388.23	-299.42	0.00	0.0000	0.0614	0.0000
1	404.95	404.8	3425.50	-302.98	0.00	0.0000	0.0619	0.0000
1	409.40	409.2	3462.77	-306.55	0.00	0.0000	0.0624	0.0000
1	413.85	413.6	3500.04	-310.11	0.00	0.0000	0.0629	0.0000
1	418.30	418.0	3537.31	-313.68	0.00	0.0000	0.0634	0.0000
1	422.75	422.4	3574.58	-317.24	0.00	0.0000	0.0639	0.0000
1	427.20	427.2	3611.85	-320.81	0.00	0.0000	0.0644	0.0000
1	431.65	431.6	3649.12	-324.37	0.00	0.0000	0.0649	0.0000
1	436.10	436.0	3686.39	-327.94	0.00	0.0000	0.0654	0.0000
1	440.55	440.4	3723.66	-331.50	0.00	0.0000	0.0659	0.0000
1	445.00	445.2	3760.93	-335.07	0.00	0.0000	0.0664	0.0000
1	449.45	449.6	3798.20	-338.63	0.00	0.0000	0.0669	0.0000
1	453.90	453.6	3835.47	-342.20	0.00	0.0000	0.0674	0.0000
1	458.35	458.0	3872.74	-345.76	0.00	0.0000	0.0679	0.0000
1	462.80	462.4	3910.01	-349.33	0.00	0.0000	0.0684	0.0000
1	467.25	467.2	3947.28	-352.89	0.00	0.0000	0.0689	0.0000
1	471.70	471.6	3984.55	-356.46	0.00	0.0000	0.0694	0.0000
1	476.15	476.0	4021.82	-360.02	0.00	0.0000	0.0699	0.0000
1	480.60	480.4	4059.09	-363.59	0.00	0.0000	0.0704	0.0000
1	485.05	485.2	4096.36	-367.15	0.00	0.0000	0.0709	0.0000
1	489.50	489.6	4133.63	-370.72	0.00	0.0000	0.0714	0.0000
1	493.95	494.0	4170.90	-374.28	0.00	0.0000	0.0719	0.0000
1	498.40	498.4	4208.17	-377.85	0.00	0.0000	0.0724	0.0000
1	502.85	502.8	4245.44	-381.41	0.00	0.0000	0.0729	0.0000
1	507.30	507.2	4282.71	-384.98	0.00	0.0000	0.0734	0.0000
1	511.75	511.6	4320.00	-388.54	0.00	0.0000	0.0739	0.0000
1	516.20	516.0	4357.27	-392.11	0.00	0.0000	0.0744	0.0000
1	520.65	520.4	4394.54	-395.67	0.00	0.0000	0.0749	0.0000
1	525.10	525.2	4431.81	-399.24	0.00	0.0000	0.0754	0.0000
1	529.55	529.6	4469.08	-402.80	0.00	0.0000	0.0759	0.0000
1	534.00	534.4	4506.35	-406.37	0.00	0.0000	0.0764	0.0000
1	538.45	538.8	4543.62	-409.93	0.00	0.0000	0.0769	0.0000
1	542.90	543.2	4580.89	-413.50	0.00	0.0000	0.0774	0.0000
1	547.35	547.6	4618.16	-417.06	0.00	0.0000	0.0779	0.0000
1	551.80	552.0	4655.43	-420.63	0.00	0.		

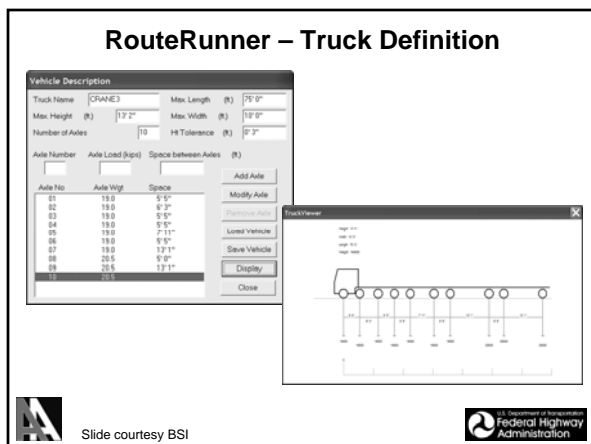
14 Virtis Concrete Alt. Rating

Re-rating
results:
Moment
Diagrams









End-to-End Permitting Functionality

The integration of automated, specialized, OS/OW functionality includes

Permit Administration

Routing

Bridge Analysis

Restriction Management

Routing/PermitSlides courtesy of BSI

Routing

- Route Selection
- Continuity Checking
- Validation
- Clearance Checking
- Integration w/ Live Load Bridge and Restrictions Analysis

Permit Administration

Routing

Overview - Routing

STATE 44

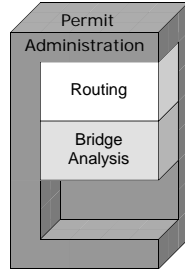
HUTCHINSON

MERCER

Bridge Analysis

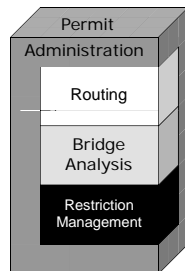
The integration of automated, specialized, OS/OW functionality includes

- Live Load Analysis
- Analysis of the specific vehicle for each specific bridge crossed over



Restriction Management

- Analysis and management of all temporary route restrictions (closure, attribute, and informational)



Do Your Own Routing