LOAD AND RESISTANCE FACTOR RATING (LRFR) SUMMARY FOR PRESTRESSED CONCRETE GIRDERS

LEVEL		VEHICLE	WEIGHT (W) (TONS)	CONTROLLING LOAD RATING (#)	MINIMUM RATING FACTORS (RF)	TONS = W × RF	STRENGTH I LIMIT STATE											SERVICE III LIMIT STATE						COMMENT NUMBER
								MOMENT					SHEAR						MOMENT					
							LIVE-LOAD FACTORS (γ_{LL})	DISTRIBUTION FACTORS (DF)	RATING FACTOR	SPAN	GIRDER LOCATION	DISTANCE FROM LEFT END OF SPAN (ft)	DISTRIBUTION FACTORS (DF)	RATING FACTOR	SPAN	GIRDER LOCATION	DISTANCE FROM LEFT END OF SPAN (ft)	LIVE-LOAD FACTORS (γ_{LL})	DISTRIBUTION FACTORS (DF)	RATING FACTOR	SPAN	GIRDER LOCATION	DISTANCE FROM LEFT END OF SPAN (ft)	
DESIGN LOAD RATING		HL-93 (INVENTORY)	N/A	1	1.17	--	1.75	0.789	1.48	C	I	44.4	0.964	1.17	C	I	2.3	0.80	0.838	1.31	A	EL/ER	60.9	1, 2, 3
		HL-93 (OPERATING)	N/A		1.71	--	1.35	0.789	1.92	C	I	44.4	0.964	1.71	C	I	2.3	N/A	--	--	--	--	--	1, 2, 3
		HS-20 (INVENTORY)	36.000	2	1.47	52.9	1.75	0.789	2.02	C	I	44.4	0.964	1.47	C	I	2.3	0.80	0.838	1.93	A	EL/ER	60.9	1, 2, 3
		HS-20 (OPERATING)	36.000		1.90	68.4	1.35	0.789	2.61	C	I	44.4	0.964	1.90	C	I	2.3	N/A	--	--	--	--	--	1, 2, 3
LEGAL LOAD RATING	SINGLE VEHICLE (SV)	SNSH	13.500		4.55	61.4	1.40	0.789	5.89	C	I	44.4	0.964	4.55	C	I	2.3	0.80	0.838	4.68	A	EL/ER	60.9	1, 2, 3
		SNGARBS2	20.000		3.18	63.6	1.40	0.789	4.30	C	I	44.4	0.964	3.18	C	I	2.3	0.80	0.838	3.34	A	EL/ER	60.9	1, 2, 3
		SNAGRIS2	22.000		2.93	64.5	1.40	0.789	4.04	C	I	44.4	0.964	2.93	C	I	2.3	0.80	0.838	3.10	A	EL/ER	60.9	1, 2, 3
		SNCOTTS3	27.250		2.28	62.1	1.40	0.789	2.93	C	I	44.4	0.964	2.28	C	I	2.3	0.80	0.838	2.32	A	EL/ER	60.9	1, 2, 3
		SNAGGRS4	34.925		1.83	63.9	1.40	0.789	2.41	C	I	44.4	0.964	1.83	C	I	2.3	0.80	0.838	1.88	A	EL/ER	60.9	1, 2, 3
		SNS5A	35.550		1.83	65.1	1.40	0.789	2.36	C	I	44.4	0.964	1.83	C	I	2.3	0.80	0.838	1.85	A	EL/ER	60.9	1, 2, 3
		SNS6A	39.950		1.66	66.3	1.40	0.789	2.15	C	I	44.4	0.964	1.66	C	I	2.3	0.80	0.838	1.67	A	EL/ER	60.9	1, 2, 3
		SNS7B	42.000		1.59	66.8	1.40	0.789	2.05	C	I	44.4	0.964	1.61	C	I	2.3	0.80	0.838	1.59	A	EL/ER	60.9	1, 2, 3
	TRUCK TRACTOR SEMI-TRAILER (TTST)	TNAGRIT3	33.000		2.03	67.0	1.40	0.789	2.62	C	I	44.4	0.964	2.06	C	I	2.3	0.80	0.838	2.03	A	EL/ER	60.9	1, 2, 3
		TNT4A	33.075		1.98	65.5	1.40	0.789	2.63	C	I	44.4	0.964	1.98	C	I	2.3	0.80	0.838	2.03	A	EL/ER	60.9	1, 2, 3
		TNT6A	41.600		1.64	68.2	1.40	0.789	2.14	C	I	44.4	0.964	1.68	C	I	2.3	0.80	0.838	1.64	A	EL/ER	60.9	1, 2, 3
		TNT7A	42.000		1.64	68.9	1.40	0.789	2.14	C	I	44.4	0.964	1.66	C	I	2.3	0.80	0.838	1.64	A	EL/ER	60.9	1, 2, 3
		TNT7B	42.000		1.58	66.4	1.40	0.789	2.20	C	I	44.4	0.964	1.58	C	I	2.3	0.80	0.838	1.67	A	EL/ER	60.9	1, 2, 3
		TNAGRIT4	43.000		1.57	67.5	1.40	0.789	2.10	C	I	44.4	0.964	1.57	C	I	2.3	0.80	0.838	1.61	A	EL/ER	60.9	1, 2, 3
		TNAGT5A	45.000		1.51	68.0	1.40	0.789	1.99	C	I	44.4	0.964	1.51	C	I	2.3	0.80	0.838	1.53	A	EL/ER	60.9	1, 2, 3
		TNAGT5B	45.000	3	1.47	66.2	1.40	0.789	1.97	C	I	44.4	0.964	1.47	C	I	2.3	0.80	0.838	1.52	A	EL/ER	60.9	1, 2, 3

LOAD FACTORS:

DESIGN LOAD RATING FACTORS	LIMIT STATE	γ_{DC}	γ_{DW}
	STRENGTH I	1.25	1.50
	SERVICE III	1.00	1.00

NOTES:

MINIMUM RATING FACTORS ARE BASED ON THE STRENGTH I AND SERVICE III LIMIT STATES.

ALLOWABLE STRESSES FOR SERVICE III LIMIT STATE ARE AS REQUIRED FOR DESIGN.

∗ ACTUAL EL AND ER PROPERTIES VARY THROUGHOUT SPAN DUE TO VARYING OVERHANG. THESE PROPERTIES WERE USED FOR THE LOAD RATING.

COMMENTS:

1. GIRDERS DESIGNED AS SIMPLE SPANS FOR FLEXURE. GIRDERS DESIGNED AS SIMPLE-MADE-CONTINUOUS (FOR LIVE LOAD AND SUPERIMPOSED DEAD LOAD) FOR SHEAR.
2. 4" AVERAGE HAUNCH ASSUMED FOR SPAN A AND 4½" HAUNCH ASSUMED FOR SPANS B AND C. HAUNCH CONCRETE IS NOT INCLUDED IN SECTION PROPERTIES. THE HAUNCH HEIGHT IS INCLUDED FOR ECCENTRICITY TO THE DECK.
3. Ec, GIRDER = 5,589 (FINAL, SPAN A)
   Ec, GIRDER = 4,888 Ksi (FINAL, SPANS B AND C)
   Ec, DECK = 4,067 Ksi
   Eps = 28,500 Ksi

CONTROLLING LOAD RATING
1 DESIGN LOAD RATING (HL-93)
2 DESIGN LOAD RATING (HS-20)
3 LEGAL LOAD RATING ∗∗
∗∗ SEE CHART FOR VEHICLE TYPE

GIRDER LOCATION
I - INTERIOR GIRDER
EL - EXTERIOR LEFT GIRDER
ER - EXTERIOR RIGHT GIRDER

TABLE OF SECTION RESISTANCES (SPAN A)

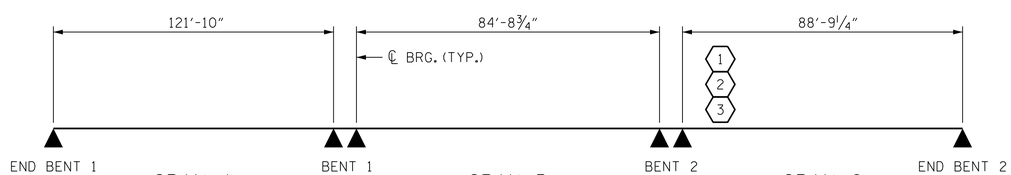
		CL BRG.	0.1L	0.2L	0.3L	0.4L	0.5L	0.6L	0.7L	0.8L	0.9L	CL BRG.
INTERIOR GIRDER (I)	ΦVn (KIPS)	902	453	443	366	372	366	376	376	459	465	1017
	ΦMn (KIP-FT)	--	13491	13996	14264	14532	14692	14532	14264	13996	13491	--
EXTERIOR GIRDER (EL, ER)	ΦVn (KIPS)	902	450	437	360	365	360	370	371	456	465	1018
	ΦMn (KIP-FT)	--	13469	13955	14223	14490	14651	14490	14223	13955	13469	--

TABLE OF SECTION RESISTANCES (SPAN B)

		CL BRG.	0.1L	0.2L	0.3L	0.4L	0.5L	0.6L	0.7L	0.8L	0.9L	CL BRG.
INTERIOR GIRDER (I)	ΦVn (KIPS)	750	437	439	360	363	355	362	357	436	664	749
	ΦMn (KIP-FT)	--	6709	7876	7960	8093	8147	8093	7960	7876	6709	--
EXTERIOR GIRDER (EL, ER)	ΦVn (KIPS)	749	458	440	360	363	355	361	357	436	666	748
	ΦMn (KIP-FT)	--	6700	7847	7930	8063	8116	8063	7930	7847	6700	--

TABLE OF SECTION RESISTANCES (SPAN C)

		CL BRG.	0.1L	0.2L	0.3L	0.4L	0.5L	0.6L	0.7L	0.8L	0.9L	CL BRG.
INTERIOR GIRDER (I)	ΦVn (KIPS)	756	661	352	351	354	347	299	298	343	659	513
	ΦMn (KIP-FT)	--	6840	7897	7964	8097	8151	8097	7964	7897	6840	--
EXTERIOR GIRDER (EL, ER)	ΦVn (KIPS)	757	663	353	351	354	347	311	313	343	659	513
	ΦMn (KIP-FT)	--	6820	7856	7922	8055	8108	8055	7922	7856	6820	--



LRFR SUMMARY

SECTION DATA (SPAN A):

INTERIOR COMPOSITE Ixx = 1,132,048 IN^4
INTERIOR COMPOSITE y_b = 53.82 IN.
∗ EXTERIOR COMPOSITE Ixx = 1,115,064 IN^4
∗ EXTERIOR COMPOSITE y_b = 53.31 IN.
COMPOSITE SECTION PROPERTIES ARE TRANSFORMED TO EQUIVALENT GIRDER CONCRETE USING Ec = 5589 KSI
STRAND AREA NOT INCLUDED IN SECTION PROPERTIES.
y_b MEASURED FROM BOTTOM OF GIRDER

SECTION DATA (SPAN B):

INTERIOR COMPOSITE Ixx = 1,184,414 IN^4
INTERIOR COMPOSITE y_b = 55.40 IN.
∗ EXTERIOR COMPOSITE Ixx = 1,143,293 IN^4
∗ EXTERIOR COMPOSITE y_b = 54.16 IN.
COMPOSITE SECTION PROPERTIES ARE TRANSFORMED TO EQUIVALENT GIRDER CONCRETE USING Ec = 4888 KSI
STRAND AREA NOT INCLUDED IN SECTION PROPERTIES.
y_b MEASURED FROM BOTTOM OF GIRDER

SECTION DATA (SPAN C):

INTERIOR COMPOSITE Ixx = 1,190,337 IN^4
INTERIOR COMPOSITE y_b = 55.58 IN.
∗ EXTERIOR COMPOSITE Ixx = 1,133,103 IN^4
∗ EXTERIOR COMPOSITE y_b = 53.86 IN.
COMPOSITE SECTION PROPERTIES ARE TRANSFORMED TO EQUIVALENT GIRDER CONCRETE USING Ec = 4888 KSI
STRAND AREA NOT INCLUDED IN SECTION PROPERTIES.
y_b MEASURED FROM BOTTOM OF GIRDER

PROJECT NO. U-2579B
FORSYTH COUNTY
STATION: 52+94.28 -Y4RPBD-

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
RALEIGH

STANDARD
LRFR SUMMARY FOR PRESTRESSED CONCRETE GIRDERS
(NON-INTERSTATE TRAFFIC)

DESIGNED BY:	J. SMITH	DATE :	APR 2014
DRAWN BY:	R. KHARWA	DATE :	APR 2014
CHECKED BY:	J. SHERMAN	DATE :	MAY 2014
DESIGN ENGINEER OF RECORD:	J. DOUGHTY	DATE :	MAY 2014

DRAWN BY : MAA 1/08
CHECKED BY : GM/DI 2/08
REV. 11/12/08RR MAA/GM
REV. 10/1/11 MAA/GM

PARSONS BRINCKERHOFF
434 FAYETTEVILLE STREET
SUITE 1500
RALEIGH, NC 27601
LICENSE NO. F-0165

NORTH CAROLINA PROFESSIONAL SEAL 032967 ENGINEER JASON R. DOUGHTY
DocuSigned by: Jason R Doughty 6/2/2014
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REVISIONS						SHEET NO.
NO.	BY:	DATE:	NO.	BY:	DATE:	S-589
1			3			TOTAL SHEETS
2			4			707

STR. #16 STD. NO. LRFR1

6/2/2014
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