URS

FILE: V:\Projects\Cline Avenue\Load Rating Analysis\Revised LL Long Rating\Orig Ab with increased Vc AASHTO\Segment3\EB Rating\[Shear Design.xls]Web Design (t=1)
Forces Worksheet: V:\Projects\Cline Avenue\Load Rating Analysis\Revised LL Long Rating\Orig Ab with increased Vc AASHTO\Segment3\EB Rating\[Forces.xls]
Props&Reinf Worksheet: V:\Projects\Cline Avenue\Load Rating Analysis\Revised LL Long Rating\Orig Ab with increased Vc AASHTO\Segment3\EB Rating\[Props&Reinf.xls]

PROJECT: **Cline Avenue Mainline Seg 3 EB** CALCS BY: TSP DATE: 01/21/09
DESCRIPTION: **Ultimate Shear Check** CHECKED BY: DATE:

Web Reinforcement Requirements **Load combination: Strength 1** ***Rating Truck:*** HL-93 ***LL Factor:*** *Inventory*

Material Properties:

Concrete
f'c = ***5.0*** ksi
ϕ_v = ***0.90***

P-T Strands
f_{pu} = ***270*** ksi
f_{pe} = ***176*** ksi

Reinforcement
fy = ***60.0*** ksi

Box Girder Properties:

Web Thickness
b_v = ***11.95*** in

Effective Width of Shear Flow Path
be= ***5.50*** in

Notes:
1. All shears are vertical unless noted otherwise.
2. Web thickness is horizontal, box depth is vertical.

Calc All RF

Calc RF

Member Number	Node Number	(ksi) Perm Load Stress (top fiber)	(ksi) Perm Load Stress (bott. fiber)	(ksi) Dead Load Stress (neutr. axis) (fpc)	Stress Variable 'K'	(k-ft) Torsional Moment (Tcr)	Ultimate Corresp. Live Load Moment	Ultimate Max Live Load Shear	Ultimate Corresp. Live Load Torsion	TOTAL Ultimate Moment (Mu)	TOTAL Ultimate Shear (Vu)	TOTAL Ultimate Torsion (Tu)	Investigate Torsional Effects? (Y/N)	Shear from Primary Post Tensioning Effect (Vp)	(in) Depth to Tensile Reinforcement d_e	(in) Effective Shear Depth d_v	(kip) Concrete Shear Resistance per web (Vc)	(kip) Required Steel Resistance per web (Vs-req'd)	(in^2/ft) Required Steel Area per web (Av)	(in^2/ft) Additional Steel Required for Torsion (At)	(in^2/ft) Additional Steel Req'd from Transverse A_v (trans)	(in^2/ft) Total Steel Required per leg (As_req'd)	(in^2/ft) Steel Provided per leg As_prov'd)	(kip) Provided Steel Resistance per web (Vs_prov)	(kip) Nominal Shear Resistance per web (ϕVn)	(kip) Ultimate Shear per web (Vu)	Shear Rating Factor, RF	Total Long. Mild Steel Required for Torsion (Al) in^2	Equivalent PT Steel Req'd for Torsion (based on fpe) (Al) in^2
				Permanent Loads + Maximum LL Shear @ t=00																									
1	1	-0.005	-0.005	-0.005	1.019	7064	0	14	89	0	2543	750	N	0	0.00	102.02	61	880	2.54	Not Reqd	0.00	1.27	0.37	258				0.00	0.00
1	2	-0.673	-0.753	-0.706	2.000	14431	-715	328	-885	-22907	3482	-164	N	-2829	99.17	105.89	1556	0	0.12	Not Reqd	0.00	0.06	0.37	753	2078	1161	9.38	0.00	0.00
2	2	-0.673	-0.753	-0.706	2.000	14431	-715	328	-884	-22907	3482	-164	N	-2854	99.17	105.89	1565	0	0.12	Not Reqd	0.00	0.06	0.37	753	2086	1161	9.46	0.00	0.00
2	3	-0.652	-0.739	-0.690	2.000	14973	-3097	435	-1201	-50780	3808	-422	N	-2498	118.41	110.07	1443	0	0.12	Not Reqd	0.00	0.06	0.37	778	1999	1269	6.04	0.00	0.00
3	3	-0.652	-0.739	-0.690	2.000	14973	-3097	435	-1201	-50780	3808	-421	N	-2523	118.41	110.07	1451	0	0.12	Not Reqd	0.00	0.06	0.37	778	2007	1269	6.09	0.00	0.00
3	4	-0.595	-0.778	-0.677	2.000	15555	-3576	458	-1286	-78501	4059	-448	N	-2082	134.90	121.41	1316	187	0.16	Not Reqd	0.00	0.08	0.37	849	1948	1353	4.90	0.00	0.00
4	4	-0.595	-0.778	-0.677	2.000	15555	-3576	458	-1286	-78501	4059	-447	N	-2109	134.90	121.41	1326	177	0.16	Not Reqd	0.00	0.08	0.37	849	1957	1353	4.96	0.00	0.00
4	5	-0.507	-0.850	-0.664	2.000	16176	-5580	529	-1509	-109557	4366	-611	N	-1729	148.91	134.02	1221	396	0.32	Not Reqd	0.00	0.16	0.37	927	1933	1455	3.71	0.00	0.00
5	5	-0.507	-0.850	-0.664	2.000	16176	-5580	529	-1509	-109557	4365	-610	N	-1762	148.91	134.02	1232	384	0.31	Not Reqd	0.00	0.15	0.37	927	1944	1455	3.77	0.00	0.00
5	6	-0.396	-0.943	-0.652	2.000	16843	-6437	553	-1594	-141344	4633	-637	N	-1416	160.79	144.71	1133	583	0.44	Not Reqd	0.00	0.22	0.37	992	1913	1544	3.00	0.00	0.00
6	6	-0.394	-0.941	-0.651	2.000	16843	-6437	553	-1595	-141344	4637	-625	N	-1171	160.79	144.71	1048	670	0.50	Not Reqd	0.00	0.25	0.37	992	1835	1546	2.57	0.00	0.00
6	7	-0.262	-1.103	-0.657	2.000	17619	-7486	577	-1680	-175252	4910	-651	N	-676	170.42	153.38	888	930	0.66	Not Reqd	0.00	0.33	0.37	1042				0.00	0.00
7	7	-0.257	-1.097	-0.652	2.000	17619	-7486	577	-1681	-175252	4914	-642	N	-111	170.42	153.38	693	1127	0.81	Not Reqd	0.00	0.40	0.37	1040				0.00	0.00
7	8	-0.193	-1.181	-0.657	2.000	17619	-7863	585	-1708	-186571	5002	-650	N	103	170.43	153.39	680	1173	0.84	Not Reqd	0.00	0.42	0.37	1037				0.00	0.00
8	8	-0.302	-1.022	-0.640	2.000	17619	5224	80	69	-168553	-3341	-1071	N	103	170.43	153.39	715	523	0.37	Not Reqd	0.00	0.19	0.37	1047				0.00	0.00
8	9	-0.356	-0.961	-0.640	2.000	17619	5032	80	68	-160294	-3261	-1053	N	269	170.16	153.15	779	428	0.30	Not Reqd	0.00	0.15	0.31	873				0.00	0.00
9	9	-0.359	-0.964	-0.643	2.000	17619	4978	76	66	-160348	-3264	-1045	N	838	170.16	153.15	977	232	0.16	Not Reqd	0.00	0.08	0.31	875				0.00	0.00
9	10	-0.463	-0.865	-0.652	2.000	16843	4479	77	63	-135744	-3013	-989	N	1257	159.91	143.92	1099	17	0.12	Not Reqd	0.00	0.06	0.31	827	1734	1004	29.45	0.00	0.00
10	10	-0.464	-0.865	-0.653	2.000	16843	4479	75	62	-135744	-3013	-975	N	1509	159.91	143.92	1186	0	0.12	Not Reqd	0.00	0.06	0.31	828	1813	1004	33.15	0.00	0.00
10	11	-0.388	-0.862	-0.605	2.000	16176	4096	77	58	-112946	-2768	-921	N	1650	146.86	132.17	1171	0	0.12	Not Reqd	0.00	0.06	0.31	759	1738	923	32.87	0.00	0.00
11	11	-0.388	-0.862	-0.605	2.000	16176	4096	77	58	-112946	-2768	-920	N	1620	146.86	132.17	1161	0	0.12	Not Reqd	0.00	0.06	0.31	759	1728	923	32.41	0.00	0.00
11	12	-0.439	-0.854	-0.624	2.000	15555	3802	79	53	-91936	-2530	-866	N	1669	133.56	120.20	1140	0	0.12	Not Reqd	0.00	0.06	0.31	694	1651	843	31.74	0.00	0.00
12	12	-0.439	-0.854	-0.624	2.000	15555	3802	79	53	-91936	-2530	-866	N	1644	133.56	120.20	1132	0	0.12	Not Reqd	0.00	0.06	0.31	694	1643	843	31.38	0.00	0.00
12	13	-0.439	-0.859	-0.621	2.000	14973	8486	88	-84	-67761	-2293	-944	N	1515	119.91	110.07	1057	0	0.12	Not Reqd	0.00	0.06	0.31	639	1527	764	27.01	0.00	0.00
13	13	-0.439	-0.859	-0.621	2.000	14973	8486	88	-84	-67761	-2293	-944	N	1493	119.91	110.07	1050	0	0.12	Not Reqd	0.00	0.06	0.31	639	1520	764	26.78	0.00	0.00
13	14	-0.488	-0.855	-0.642	2.000	14431	10240	105	-111	-48267	-2056	-911	N	1394	108.10	105.89	1027	0	0.12	Not Reqd	0.00	0.06	0.31	620	1483	685	23.84	0.00	0.00
14	14	-0.488	-0.855	-0.642	2.000	14431	10240	105	-111	-48267	-2057	-911	N	1370	108.10	105.89	1019	0	0.12	Not Reqd	0.00	0.06	0.31	620	1475	686	23.64	0.00	0.00
14	15	-0.384	-0.878	-0.584	2.000	13934	11877	122	-140	-30578	-1827	-882	N	1216	92.27	102.02	949	0	0.12	Not Reqd	0.00	0.06	0.31	598	1393	609	20.22	0.00	0.00
15	15	-0.384	-0.878	-0.584	2.000	13934	11877	122	-140	-30578	-1827	-882	N	1197	92.27	102.02	943	0	0.12	Not Reqd	0.00	0.06	0.31	598	1387	609	20.09	0.00	0.00
15	16	-0.430	-0.879	-0.604	2.000	13477	13386	141	-174	-14648	-1603	-856	N	1141	81.71	98.42	942	0	0.12	Not Reqd	0.00	0.06	0.31	582	1372	534	18.83	0.00	0.00
16	16	-0.430	-0.879	-0.604	2.000	13477	13386	141	-174	-14648	-1603	-856	N	1131	81.71	98.42	938	0	0.12	Not Reqd	0.00	0.06	0.31	582	1368	534	18.77	0.00	0.00
16	17	-0.470	-0.890	-0.626	2.000	13066	14752	160	-212	-432	-1386	-836	N	1085	71.93	95.13	912	0	0.12	Not Reqd	0.00	0.06	0.21	376	1160	462	14.05	0.00	0.00
17	17	-0.470	-0.890	-0.626	2.000	13066	14752	160	-212	-432	-1387	-836	N	1072	71.93	95.13	908	0	0.12	Not Reqd	0.00	0.06	0.21	376	1156	462	13.99	0.00	0.00
17	18	-0.504	-0.913	-0.648	2.000	12695	15964	181	-256	12118	-1176	-821	N	1019	64.95	92.12	873	0	0.12	Not Reqd	0.00	0.06	0.21	364	1113	392	12.98	0.00	0.00
18	18	-0.504	-0.912	-0.647	2.000	12695	15964	178	-252	12118	-1178	-820	N	712	64.95	92.12	771	0	0.12	Not Reqd	0.00	0.06	0.21	364	1021	393	11.60	0.00	0.00
18	19	-0.547	-0.843	-0.651	2.000	12301	17036	199	-302	23045	-971	-811	N	652	69.28	89.42	728	0	0.12	Not Reqd	0.00	0.06	0.21	353	973	324	10.79	0.00	0.00
19	19	-0.547	-0.843	-0.651	2.000	12301	17036	199	-302	23045	-971	-811	N	632	69.28	89.42	721	0	0.12	Not Reqd	0.00	0.06	0.21	353	966	324	10.70	0.00	0.00
19	20	-0.586	-0.782	-0.654	2.000	11939	17939	221	-357	32358	-765	-807	N	564	73.04	86.94	667	0	0.12	Not Reqd	0.00	0.06	0.21	341	908	255	9.87	0.00	0.00
20	20	-0.586	-0.782	-0.654	2.000	11939	17939	220	-357	32358	-765	-807	N	547	73.04	86.94	661	0	0.12	Not Reqd	0.00	0.06	0.21	341	902	255	9.81	0.00	0.00
20	21	-0.618	-0.731	-0.657	2.000	11623	18661	243	-417	40058	-560	-809	N	496	76.30	84.78	619	0	0.12	Not Reqd	0.00	0.06	0.21	331	855	187	9.25	0.00	0.00
21	21	-0.618	-0.731	-0.657	2.000	11623	18661	243	-417	40058	-560	-809	N	476	76.30	84.78	612	0	0.12	Not Reqd	0.00	0.06	0.21	331	849	187	9.18	0.00	0.00
21	22	-0.479	-0.710	-0.559	2.000	11354	19191	267	-483	46143	-355	-816	N	442	91.42	82.94	608	0	0.12	Not Reqd	0.00	0.06	0.21	326	841	118	9.13	0.00	0.00
22	22	-0.481	-0.647	-0.539	2.000	11354	19191	266	-482	46143	-355	-816	N	374	91.42	82.94	587	0	0.12	Not Reqd	0.00	0.06	0.21	326	822	118	8.92	0.00	0.00
22	23	-0.498	-0.617	-0.539	2.000	11124	19517	291	-553	50611	-150	-827	N	351	72.14	81.36	558	0	0.12	Not Reqd	0.00	0.06	0.21	319	789	50	8.62	0.00	0.00
23	23	-0.822	-0.632	-0.756	2.000	11124	19517	291	-553	50611	-150	-827	N	360	72.14	81.36	561	0	0.12	Not Reqd	0.00	0.06	0.21	319	791	50	8.65	0.00	0.00
23	24	-0.826	-0.631	-0.758	2.000	10933	19627	316	-627	53458	55	-843	N	295	73.86	80.06	525	0	0.12	Not Reqd	0.00	0.06	0.21	313	754	18	7.98	0.00	0.00
24	24	-0.826	-0.631	-0.758	2.000	10933	19627	316	-627	53458	55	-843	N	272	73.86	80.06	518	0	0.12	Not Reqd	0.00	0.06	0.21	313	748	18	7.93	0.00	0.00
24	25	-0.820	-0.647	-0.760	2.000	10788	19513	342	-707	54681	260	-864	N	203	75.06	79.07	488	0	0.12	Not Reqd	0.00	0.06	0.21	309	717	87	6.53	0.00	0.00
25	25	-0.820	-0.647	-0.760	2.000	10788	19513	342	-706	54681	260	-863	N	184	75.06	79.07	482	0	0.12	Not Reqd	0.00	0.06	0.21	309	711	87	6.49	0.00	0.00
25	26	-0.804	-0.675	-0.759	2.000	10683	19167	369	-790	54277	465	-888	N	122	75.73	78.35	454	0	0.12	Not Reqd	0.00	0.06	0.21	306	684	155	5.30	0.00	0.00
26	26	-0.804	-0.675	-0.759	2.000	10683	19167	368	-790	54277	465	-888	N	103	75.73	78.35	448	0	0.12	Not Reqd	0.00	0.06	0.21	306	678	155	5.26	0.00	0.00
26	27	-0.775	-0.726	-0.758	2.000	10617	18582	396	-877	52243	670	-917	N	50	75.97	77.90	428	0	0.12	Not Reqd	0.00	0.06	0.21	304	659	223	4.30	0.00	0.00
27	27	-0.775	-0.726	-0.758	2.000	10617	18582	395	-877	52243	670	-917	N	19	75.97	77.90	417	0	0.12	Not Reqd	0.00	0.06	0.21	304	649	223	4.23	0.00	0.00
27	28	-1.195	-0.725	-1.032	2.000	10617	17927	418	-951	49395	837	-943	N	23	57.68	77.90	459	0	0.12	Not Reqd	0.00	0.06	0.21	308	690	279	3.95	0.00	0.00
28	28	-1.195	-0.725	-1.032	2.000	10617	17927	417	-950	49395	837	-942	N	-20	57.68	77.90	458	0	0.12	Not Reqd	0.00	0.06	0.21	308	689	279	3.95	0.00	0.00
28	29	-1.133	-0.833	-1.029	2.000	10683	16904	446	-1044	44407	1043	-977	N	33	57.84	78.35	465	0	0.12	Not Reqd	0.00	0.06	0.21	310	697	348	3.35	0.00	0.00
29	29	-1.133	-0.833	-1.029	2.000	10683	16904	445	-1044	44407	1043	-977	N	7	57.84	78.35	456	0	0.12	Not Reqd	0.00	0.06	0.21	310	689	348	3.30	0.00	0.00
29	30	-1.048	-0.982	-1.025	2.000	10788	15639	474	-1140	37786	1250	-1015	N	53	58.27	79.07	475	0	0.12	Not Reqd	0.00	0.06	0.21	313	709	417	2.85	0.00	0.00
30	30	-1.048	-0.982	-1.025	2.000	10788	15639	474	-1140	37786	1250	-1015	N	27	58.27	79.07	467	0	0.12	Not Reqd	0.00	0.06	0.21	313	701	417	2.80	0.00	0.00
30	31	-0.953	-1.134	-1.016	2.000	10933	14124	503	-1238	29520	1458	-1055	N	-186	58.33	80.06	526	14	0.12	Not Reqd	0.00	0.06	0.21	316	758	486	2.62	0.00	0.00
31	31	-0.953	-1.134	-1.016	2.000	10933	14124	503	-1238	29520	1458	-1055	N	-217	58.33	80.06	536	4	0.12	Not Reqd	0.00	0.06	0.21	316	767	486	2.68	0.00	0.00
31	32	-0.876	-0.974	-0.910	2.000	11124	12366	532	-1338	19608	1669	-1096	N	50	53.96	81.36	488	130	0.17	Not Reqd	0.00	0.08	0.21	322	728	556	1.97	0.00	0.00
32	32	-0.876	-0.974	-0.910	2.000	11124	12366	532	-1338	19608	1669	-1096	N	26	53.96	81.36	480	138	0.18	Not Reqd	0.00	0.09	0.21	322	721	556	1.93	0.00	0.00

URS

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Forces Worksheet: V:\Projects\Cline Avenue\Load Rating Analysis\Revised LL Long Rating\Orig Ab with increased Vc AASHTO\Segment3\EB Rating\[Forces.xls]
Props&Reinf Worksheet: V:\Projects\Cline Avenue\Load Rating Analysis\Revised LL Long Rating\Orig Ab with increased Vc AASHTO\Segment3\EB Rating\[Props&Reinf.xls]

PROJECT: **Cline Avenue Mainline Seg 3 EB** CALCS BY: TSP DATE: 01/21/09
DESCRIPTION: **Ultimate Shear Check** CHECKED BY: DATE:

Web Reinforcement Requirements **Load combination: Strength 1** ***Rating Truck:*** HL-93 ***LL Factor:*** *Inventory*

Material Properties:

Concrete
f'c = ***5.0*** ksi
ϕ_v = ***0.90***

P-T Strands
f_{pu} = ***270*** ksi
f_{pe} = ***176*** ksi

Reinforcement
fy = ***60.0*** ksi

Box Girder Properties:

Web Thickness
b_v = ***11.95*** in

Effective Width of Shear Flow Path
be= ***5.50*** in

Notes:
1. All shears are vertical unless noted otherwise.
2. Web thickness is horizontal, box depth is vertical.

Calc All RF

Calc RF

Member Number	Node Number	(ksi) Perm Load Stress (top fiber)	(ksi) Perm Load Stress (bott. fiber)	(ksi) Dead Load Stress (neutr. axis) (fpc)	Stress Variable 'K'	(k-ft) Torsional Cracking Moment (Tcr)	Ultimate Corresp. Live Load Moment	Ultimate Max Live Load Shear	Ultimate Corresp. Live Load Torsion	TOTAL Ultimate Moment (Mu)	TOTAL Ultimate Shear (Vu)	TOTAL Ultimate Torsion (Tu)	Investigate Torsional Effects? (Y/N)	Shear from Primary Post Tensioning Effect (Vp)	(in) Depth to Tensile Reinforcement d_e	(in) Effective Shear Depth d_v	(kip) Concrete Shear Resistance per web (Vc)	(kip) Required Steel Resistance per web (Vs-req'd)	(in^2/ft) Required Steel Area per web (Av)	(in^2/ft) Additional Steel Required for Torsion (At)	(in^2/ft) Additional Steel Req'd from Transverse A_v (trans)	(in^2/ft) Total Steel Required per leg (As_req'd)	(in^2/ft) Steel Provided per leg As_prov'd)	(kip) Provided Steel Resistance per web (Vs_prov)	(kip) Nominal Shear Resistance per web (φVn)	(kip) Ultimate Shear per web (Vu)	Shear Rating Factor, RF	Total Long. Mild Steel Required for Torsion (Al) in^2	Equivalent PT Steel Req'd for Torsion (based on fpe) (Al) in^2
				Permanent Loads + Maximum LL Shear @ t=00																									
32	33	-1.198	-1.133	-1.176	2.000	11354	10365	561	-1440	8032	1879	-1139	N	8	43.07	82.94	483	213	0.27	Not Reqd	0.00	0.13	0.21	328	730	626	1.55	0.00	0.00
33	33	-1.198	-1.133	-1.176	2.000	11354	10365	561	-1439	8032	1878	-1139	N	-24	43.07	82.94	488	207	0.26	Not Reqd	0.00	0.13	0.21	328	734	626	1.58	0.00	0.00
33	34	-1.051	-1.383	-1.166	2.000	11623	8125	590	-1542	-5195	2090	-1182	N	-167	74.13	84.78	547	227	0.28	Not Reqd	0.00	0.14	0.21	335	794	697	1.49	0.00	0.00
34	34	-1.051	-1.383	-1.167	2.000	11623	8125	590	-1541	-5195	2089	-1182	N	-205	74.13	84.78	559	215	0.26	Not Reqd	0.00	0.13	0.21	335	805	696	1.55	0.00	0.00
34	35	-0.927	-1.579	-1.155	2.000	11939	5653	620	-1644	-20078	2302	-1226	N	-411	77.86	86.94	640	212	0.26	Not Reqd	0.00	0.13	0.21	344	886	767	1.57	0.00	0.00
35	35	-0.927	-1.579	-1.155	2.000	11939	5653	619	-1644	-20078	2301	-1227	N	-444	77.86	86.94	651	201	0.24	Not Reqd	0.00	0.12	0.21	344	895	767	1.62	0.00	0.00
35	36	-0.781	-1.541	-1.047	2.000	12301	2953	649	-1747	-36639	2518	-1271	N	-61	85.74	89.42	538	394	0.46	Not Reqd	0.00	0.23	0.21	353	802	839	0.83	0.00	0.00
36	36	-0.783	-1.543	-1.049	2.000	12301	2953	644	-1743	-36639	2513	-1279	N	-528	85.74	89.42	694	237	0.28	Not Reqd	0.00	0.14	0.21	353	942	838	1.49	0.00	0.00
36	37	-1.098	-1.560	-1.260	2.000	12695	64	673	-1845	-54856	2730	-1322	N	-944	98.22	92.12	848	163	0.19	Not Reqd	0.00	0.09	0.21	364	1091	910	1.81	0.00	0.00
37	37	-1.098	-1.560	-1.260	2.000	12695	64	673	-1845	-54856	2730	-1321	N	-971	98.22	92.12	857	154	0.17	Not Reqd	0.00	0.09	0.21	364	1099	910	1.84	0.00	0.00
37	38	-1.020	-1.518	-1.204	2.000	13066	-3047	702	-1945	-74789	2954	-1363	N	-1713	104.67	95.13	1122	0	0.12	Not Reqd	0.00	0.06	0.21	376	1348	985	2.55	0.00	0.00
38	38	-1.020	-1.518	-1.204	2.000	13066	-3047	702	-1945	-74789	2954	-1362	N	-1752	104.67	95.13	1135	0	0.12	Not Reqd	0.00	0.06	0.21	376	1360	985	2.60	0.00	0.00
38	39	-0.924	-0.913	-0.920	2.000	13477	-6380	731	-2043	-96504	3187	-1401	N	-810	128.89	116.00	942	239	0.22	Not Reqd	0.00	0.11	0.41	917	1673	1062	3.50	0.00	0.00
39	39	-0.924	-0.913	-0.920	2.000	13477	-6380	731	-2043	-96504	3186	-1400	N	-833	128.89	116.00	949	231	0.21	Not Reqd	0.00	0.10	0.41	917	1680	1062	3.53	0.00	0.00
39	40	-0.778	-1.064	-0.894	2.000	13934	-9935	760	-2138	-120045	3424	-1437	N	-834	133.58	120.22	932	336	0.30	Not Reqd	0.00	0.15	0.41	942	1686	1141	3.15	0.00	0.00
40	40	-0.778	-1.064	-0.893	2.000	13934	-9935	760	-2138	-120045	3423	-1436	N	-872	133.58	120.22	945	323	0.28	Not Reqd	0.00	0.14	0.41	942	1698	1141	3.20	0.00	0.00
40	41	-1.066	-1.133	-1.095	2.000	14431	-13714	789	-2231	-145461	3667	-1471	N	-1161	138.48	124.63	1108	250	0.21	Not Reqd	0.00	0.10	0.41	985	1884	1222	3.52	0.00	0.00
41	41	-1.065	-1.134	-1.094	2.000	14431	-13714	789	-2231	-145461	3666	-1470	N	-1215	138.48	124.63	1127	231	0.19	Not Reqd	0.00	0.10	0.41	985	1901	1222	3.58	0.00	0.00
41	42	-0.928	-1.245	-1.066	2.000	14973	-17719	817	-2322	-172810	3917	-1503	N	-1215	144.05	129.65	1156	295	0.24	Not Reqd	0.00	0.12	0.41	1025	1963	1306	3.41	0.00	0.00
42	42	-0.927	-1.245	-1.065	2.000	14973	-17719	817	-2322	-172810	3917	-1502	N	-1266	144.05	129.65	1173	278	0.22	Not Reqd	0.00	0.11	0.41	1025	1978	1306	3.47	0.00	0.00
42	43	-0.794	-1.342	-1.039	2.000	15555	-21951	846	-2412	-202151	4175	-1533	N	-1266	150.02	135.02	1174	373	0.29	Not Reqd	0.00	0.15	0.41	1062	2012	1392	3.20	0.00	0.00
43	43	-0.793	-1.342	-1.038	2.000	15555	-21951	845	-2412	-202151	4174	-1532	N	-1319	150.02	135.02	1192	354	0.28	Not Reqd	0.00	0.14	0.41	1062	2029	1391	3.26	0.00	0.00
43	44	-0.664	-1.426	-1.013	2.000	16176	-26412	874	-2501	-233543	4440	-1562	N	-1319	156.38	140.75	1180	465	0.35	Not Reqd	0.00	0.18	0.41	1097	2049	1480	2.95	0.00	0.00
44	44	-0.663	-1.426	-1.013	2.000	16176	-26412	874	-2500	-233543	4439	-1561	N	-1383	156.38	140.75	1202	442	0.33	Not Reqd	0.00	0.17	0.41	1098	2069	1480	3.02	0.00	0.00
44	45	-0.538	-1.498	-0.989	2.000	16843	-31102	902	-2588	-267046	4712	-1590	N	-1382	163.14	146.83	1195	551	0.40	Not Reqd	0.00	0.20	0.41	1136	2098	1571	2.75	0.00	0.00
45	45	-0.536	-1.498	-0.987	2.000	16843	-31103	905	-2586	-267046	4717	-1565	N	-999	163.14	146.83	1061	686	0.50	Not Reqd	0.00	0.25	0.41	1134	1976	1572	2.34	0.00	0.00
45	46	-0.407	-1.631	-0.982	2.000	17619	-36043	933	-2673	-302723	4995	-1593	N	-998	170.46	153.42	1063	787	0.55	Not Reqd	0.00	0.28	0.41	1177				0.00	0.00
46	46	-0.402	-1.627	-0.977	2.000	17619	-36043	939	-2670	-302723	5001	-1565	N	0	170.46	153.42	717	1136	0.80	Not Reqd	0.00	0.40	0.41	1174				0.00	0.00
46	47	-0.339	-1.706	-0.981	2.000	17619	-37687	948	-2698	-314623	5091	-1574	N	0	170.46	153.42	704	1181	0.83	Not Reqd	0.00	0.42	0.41	1170				0.00	0.00
47	47	-0.501	-1.514	-0.977	2.000	17619	10947	102	74	-243567	-3967	-1197	N	0	170.46	153.42	794	676	0.47	Not Reqd	0.00	0.23	0.41	1193				0.00	0.00
47	48	-0.562	-1.437	-0.973	2.000	17619	10695	102	73	-233746	-3887	-1178	N	0	170.49	153.45	807	632	0.44	Not Reqd	0.00	0.22	0.74	2153				0.00	0.00
48	48	-0.566	-1.441	-0.977	2.000	17619	10682	99	61	-233759	-3899	-1169	N	774	170.49	153.45	1078	366	0.25	Not Reqd	0.00	0.13	0.74	2159				0.00	0.00
48	49	-0.702	-1.287	-0.976	2.000	17041	9986	100	59	-205359	-3658	-1115	N	774	165.11	148.60	1016	339	0.24	Not Reqd	0.00	0.12	0.74	2076	2346	1219	34.94	0.00	0.00
49	49	-0.489	-1.321	-0.879	2.000	17041	9987	97	53	-205357	-3665	-1093	N	1160	165.11	148.60	1151	207	0.15	Not Reqd	0.00	0.07	0.74	2078	2519	1222	41.05	0.00	0.00
49	50	-0.730	-1.144	-0.916	2.000	15844	8823	99	48	-155171	-3213	-990	N	1157	152.86	137.57	1090	100	0.12	Not Reqd	0.00	0.06	0.74	1923	2370	1071	40.48	0.00	0.00
50	50	-0.502	-1.175	-0.806	2.000	15844	8823	99	48	-155172	-3212	-989	N	921	152.86	137.57	1007	182	0.14	Not Reqd	0.00	0.07	0.74	1921	2264	1071	37.13	0.00	0.00
50	51	-0.756	-0.951	-0.840	2.000	14769	7826	102	39	-111191	-2784	-889	N	918	141.42	127.28	949	82	0.12	Not Reqd	0.00	0.06	0.74	1775	2124	928	36.22	0.00	0.00
51	51	-0.514	-0.990	-0.719	2.000	14769	7826	102	39	-111191	-2783	-888	N	697	141.42	127.28	872	158	0.13	Not Reqd	0.00	0.07	0.74	1774	2025	928	33.17	0.00	0.00
51	52	-0.783	-0.702	-0.750	2.000	13862	6964	107	27	-73088	-2378	-792	N	695	131.81	118.63	834	47	0.12	Not Reqd	0.00	0.06	0.74	1656	1908	793	32.37	0.00	0.00
52	52	-0.572	-0.733	-0.637	2.000	13862	6964	107	27	-73088	-2377	-791	N	544	131.81	118.63	781	99	0.12	Not Reqd	0.00	0.06	0.74	1655	1840	792	30.40	0.00	0.00
52	53	-0.778	-0.973	-0.852	2.000	13076	12171	127	-180	-34611	-1976	-889	N	517	97.74	95.45	723	9	0.12	Not Reqd	0.00	0.06	0.25	452	1058	659	10.39	0.00	0.00
53	53	-0.555	-1.010	-0.728	2.000	13076	12171	127	-180	-34611	-1976	-889	N	377	97.74	95.45	673	58	0.12	Not Reqd	0.00	0.06	0.25	452	1013	659	9.35	0.00	0.00
53	54	-0.741	-1.348	-0.953	2.000	12202	13721	154	-257	-5157	-1591	-857	N	390	67.70	88.74	644	0	0.12	Not Reqd	0.00	0.06	0.25	421	958	530	9.32	0.00	0.00
54	54	-0.502	-1.390	-0.813	2.000	12202	13721	153	-255	-5157	-1584	-864	N	-69	67.70	88.74	537	50	0.12	Not Reqd	0.00	0.06	0.25	421	862	528	7.55	0.00	0.00
54	55	-0.733	-1.322	-0.938	2.000	11781	15138	183	-350	18937	-1209	-851	N	-64	66.41	85.86	518	0	0.12	Not Reqd	0.00	0.06	0.21	339	772	403	7.04	0.00	0.00
55	55	-0.591	-1.339	-0.852	2.000	11781	15138	183	-350	18937	-1208	-851	N	-127	66.41	85.86	539	0	0.12	Not Reqd	0.00	0.06	0.21	339	791	403	7.36	0.00	0.00
55	56	-0.849	-0.892	-0.864	2.000	11282	16320	218	-463	37847	-836	-855	N	-61	70.40	82.44	485	0	0.12	Not Reqd	0.00	0.06	0.21	325	729	279	7.20	0.00	0.00
56	56	-0.698	-0.917	-0.775	2.000	11282	16320	218	-463	37847	-835	-855	N	-119	70.40	82.44	505	0	0.12	Not Reqd	0.00	0.06	0.21	325	747	278	7.46	0.00	0.00
56	57	-0.903	-0.560	-0.784	2.000	10920	17151	256	-591	51515	-462	-875	N	-53	76.01	79.97	418	0	0.12	Not Reqd	0.00	0.06	0.21	309	654	154	6.85	0.00	0.00
57	57	-0.753	-0.577	-0.692	2.000	10920	17151	256	-591	51515	-461	-875	N	-91	76.01	79.97	431	0	0.12	Not Reqd	0.00	0.06	0.21	309	666	154	7.00	0.00	0.00
57	58	-0.887	-0.343	-0.698	2.000	10696	17505	299	-734	59861	-86	-908	N	-24	85.00	78.44	366	0	0.12	Not Reqd	0.00	0.06	0.21	299	599	29	6.72	0.00	0.00
58	58	-0.725	-0.375	-0.604	2.000	10696	17505	299	-733	59861	-85	-908	N	-60	85.00	78.44	378	0	0.12	Not Reqd	0.00	0.06	0.21	299	610	28	6.84	0.00	0.00
58	59	-0.779	-0.281	-0.607	2.000	10598	17268	345	-888	62795	292	-954	N	7	98.26	88.43	387	0	0.12	Not Reqd	0.00	0.06	0.21	334	649	97	5.79	0.00	0.00
59	59	-0.624	-0.231	-0.487	2.000	10598	17268	345	-888	62795	293	-954	N	-13	98.26	88.43	389	0	0.12	Not Reqd	0.00	0.06	0.21	334	651	98	5.81	0.00	0.00
59	60	-0.622	-0.234	-0.487	2.000	10598	17018	364	-951	62482	439	-975	N	13	83.75	77.76	332	0	0.12	Not Reqd	0.00	0.06	0.21	292	562	146	4.42	0.00	0.00
60	60	-0.787	-0.258	-0.604	2.000	10598	17018	364	-951	62482	440	-974	N	-7	83.75	77.76	330	0	0.12	Not Reqd	0.00	0.06	0.21	292	560	147	4.41	0.00	0.00
60	61	-0.724	-0.365	-0.600	2.000	10696	15786	414	-1121	57750	821	-1035	N	60	73.91	78.44	375	0	0.12	Not Reqd	0.00	0.06	0.21	298	606	274	3.40	0.00	0.00
61	61	-0.890	-0.336	-0.698	2.000	10696	15786	414	-1121	57750	822	-1035	N	24	73.91	78.44	362	0	0.12	Not Reqd	0.00	0.06	0.21	298	594	274	3.32	0.00	0.00
61	62	-0.746	-0.583	-0.689	2.000	10920	13780	467	-1298	47423	1207	-1103	N	90	67.51	79.97	429	18	0.12	Not Reqd	0.00	0.06	0.21	309	664	402	2.68	0.00	0.00
62	62	-0.901	-0.564	-0.784	2.000	10920	13780	466	-1298	47423	1207	-1103	N	52	67.51	79.97	416	31	0.12	Not Reqd	0.00	0.06	0.21	309	652	402	2.61	0.00	0.00
62	63	-0.688	-0.931	-0.772	2.000	11282	10950	521	-1481	31427	1596	-1177	N	118	63.29	82.44	507	84	0.12	Not Reqd	0.00	0.06	0.21	325	749	532	2.25	0.00	0.00
63	63	-0.838	-0.913	-0.864	2.000	11282	10950	520	-1480	31427	1597	-1177	N	59	63.29	82.44	487	105	0.13	Not Reqd	0.00	0.07	0.21	325	731	532	2.14	0.00	0.00
63	64	-0.572	-1.368	-0.849	2.000	11781	7279	576	-1666	9699	1990	-1253	N	124	57.24	85.86	538	199	0.24	Not Reqd	0.00	0.12	0.21	339	790	663	1.66	0.00	0.00

URS

FILE: V:\Projects\Cline Avenue\Load Rating Analysis\Revised LL Long Rating\Orig Ab with increased Vc AASHTO\Segment3\EB Rating\[Shear Design.xls]Web Design (t=1)
Forces Worksheet: V:\Projects\Cline Avenue\Load Rating Analysis\Revised LL Long Rating\Orig Ab with increased Vc AASHTO\Segment3\EB Rating\[Forces.xls]
Props&Reinf Worksheet: V:\Projects\Cline Avenue\Load Rating Analysis\Revised LL Long Rating\Orig Ab with increased Vc AASHTO\Segment3\EB Rating\[Props&Reinf.xls]

PROJECT: **Cline Avenue Mainline Seg 3 EB** CALCS BY: TSP DATE: 01/21/09
DESCRIPTION: **Ultimate Shear Check** CHECKED BY: DATE:

Web Reinforcement Requirements **Load combination: Strength 1** ***Rating Truck:*** HL-93 ***LL Factor:*** *Inventory*

Material Properties:

Concrete
f'c = ***5.0*** ksi
ϕ_v = ***0.90***

P-T Strands
f_{pu} = ***270*** ksi
f_{pe} = ***176*** ksi

Reinforcement
fy = ***60.0*** ksi

Box Girder Properties:

Web Thickness
b_v = ***11.95*** in

Effective Width of Shear Flow Path
be= ***5.50*** in

Notes:
1. All shears are vertical unless noted otherwise.
2. Web thickness is horizontal, box depth is vertical.

Calc All RF

Calc RF

Member Number	Node Number	(ksi) Perm Load Stress (top fiber)	(ksi) Perm Load Stress (bott. fiber)	(ksi) Dead Load Stress (neutr. axis)	Stress Variable 'K'	(k-ft) Torsional Cracking Moment (Tcr)	Ultimate Corresp. Live Load Moment (fpc)	Ultimate Max Live Load Shear	Ultimate Corresp. Live Load Torsion	TOTAL Ultimate Moment (Mu)	TOTAL Ultimate Shear (Vu)	TOTAL Ultimate Torsion (Tu)	Investigate Torsional Effects? (Y/N)	Shear from Primary Post Tensioning Effect (Vp)	(in) Depth to Tensile Reinforcement d_e	(in) Effective Shear Depth d_v	(kip) Concrete Shear Resistance per web (Vc)	(kip) Required Steel Resistance per web (Vs-req'd)	(in^2/ft) Required Steel Area per web (Av)	(in^2/ft) Additional Steel Required for Torsion (At)	(in^2/ft) Additional Steel Req'd from Transverse A_v (trans)	(in^2/ft) Total Steel Required per leg (As_req'd)	(in^2/ft) Steel Provided per leg As_prov'd)	(kip) Provided Steel Resistance (Vs_prov)	(kip) Nominal Shear Resistance per web (ϕVn)	(kip) Ultimate Shear per web (Vu)	Shear Rating Factor, RF	Total Long. Mild Steel Required for Torsion (Al) in^2	Equivalent PT Steel Req'd for Torsion (based on fpe) (Al) in^2
		Permanent Loads + Maximum LL Shear @ t=00																											
64	64	-0.815	-1.329	-0.995	2.000	11781	7279	575	-1666	9699	1990	-1253	N	46	57.24	85.86	513	225	0.27	Not Reqd	0.00	0.14	0.21	339	767	663	1.54	0.00	0.00
64	65	-0.577	-1.419	-0.872	2.000	12412	2776	631	-1853	-17808	2391	-1331	N	51	79.17	90.18	539	346	0.40	Not Reqd	0.00	0.20	0.25	428	870	797	1.35	0.00	0.00
65	65	-0.813	-1.379	-1.011	2.000	12412	2777	624	-1847	-17807	2394	-1335	N	-582	79.17	90.18	716	171	0.20	Not Reqd	0.00	0.10	0.25	428	1030	798	2.11	0.00	0.00
65	66	-0.630	-1.000	-0.775	2.000	13030	-2460	680	-2030	-51341	2811	-1409	N	-545	103.10	95.45	706	335	0.37	Not Reqd	0.00	0.18	0.25	449	1040	937	1.46	0.00	0.00
66	66	-0.851	-0.963	-0.895	2.000	13030	-2461	680	-2030	-51341	2811	-1408	N	-685	103.10	95.45	755	286	0.32	Not Reqd	0.00	0.16	0.25	450	1084	937	1.65	0.00	0.00
66	67	-0.639	-0.719	-0.673	2.000	13776	-8522	735	-2206	-91145	3255	-1474	N	-692	131.42	118.28	810	396	0.36	Not Reqd	0.00	0.18	0.74	1641	1901	1085	4.33	0.00	0.00
67	67	-0.845	-0.690	-0.779	2.000	13776	-8522	735	-2205	-91145	3256	-1472	N	-846	131.42	118.28	863	343	0.31	Not Reqd	0.00	0.16	0.74	1642	1971	1085	4.61	0.00	0.00
67	68	-0.575	-0.930	-0.736	2.000	14657	-15424	790	-2373	-137652	3726	-1531	N	-847	141.39	127.25	893	487	0.41	Not Reqd	0.00	0.21	0.74	1760	2092	1242	4.23	0.00	0.00
68	68	-0.811	-0.893	-0.848	2.000	14657	-15424	790	-2373	-137652	3726	-1528	N	-1078	141.39	127.25	973	407	0.34	Not Reqd	0.00	0.17	0.74	1762	2196	1242	4.62	0.00	0.00
68	69	-0.552	-1.077	-0.803	2.000	15673	-23178	845	-2537	-191282	4227	-1583	N	-1078	152.35	137.11	1016	550	0.43	Not Reqd	0.00	0.22	0.74	1896	2329	1409	4.27	0.00	0.00
69	69	-0.771	-1.048	-0.903	2.000	15673	-23193	844	-2394	-191288	4227	-411	N	-1355	152.35	137.11	1111	454	0.36	Not Reqd	0.00	0.18	0.74	1897	2453	1409	4.71	0.00	0.00
69	70	-0.525	-1.185	-0.854	2.000	16967	-31801	899	-2573	-252502	4760	-481	N	-1355	164.85	148.37	1161	602	0.44	Not Reqd	0.00	0.22	0.74	2051	2604	1587	4.40	0.00	0.00
70	70	-0.731	-1.153	-0.941	2.000	16967	-31802	903	-2559	-252502	4760	-360	N	-891	164.85	148.37	1000	763	0.55	Not Reqd	0.00	0.28	0.74	2048	2396	1587	3.69	0.00	0.00
70	71	-0.593	-1.288	-0.940	2.000	17628	-36611	931	-2647	-287213	5045	-392	N	-891	170.38	153.34	1049	819	0.57	Not Reqd	0.00	0.29	0.74	2129				0.00	0.00
71	71	-0.589	-1.285	-0.936	2.000	17628	-36611	936	-2643	-287213	5040	-375	N	-40	170.38	153.34	754	1112	0.78	Not Reqd	0.00	0.39	0.74	2123				0.00	0.00
71	72	-0.527	-1.353	-0.939	2.000	17654	-38286	947	-2679	-299257	5137	-392	N	-40	168.15	151.34	728	1174	0.84	Not Reqd	0.00	0.42	0.74	2088				0.00	0.00
72	72	-0.215	-1.612	-0.912	2.000	17654	-2297	143	-528	-153626	-2106	85	N	27	168.15	151.34	885	0	0.12	Not Reqd	0.00	0.06	0.74	2154				0.00	0.00
72	73	-0.278	-1.534	-0.894	2.000	8147	-2655	143	-528	-148419	-2060	68	N	27	169.75	152.78	898	246	0.17	Not Reqd	0.00	0.08	0.62	1812				0.00	0.00
73	73	-0.270	-1.537	-0.891	2.000	8147	-2104	106	-436	-148052	-2121	1253	N	551	169.75	152.78	1160	19	0.12	Not Reqd	0.00	0.06	0.62	1812				0.00	0.00
73	74	-0.396	-1.407	-0.891	2.000	7784	-263	115	137	-129380	-1969	1772	N	550	162.43	146.19	1019	75	0.12	Not Reqd	0.00	0.06	0.62	1701	2213	985	22.37	0.00	0.00
74	74	-0.401	-1.409	-0.894	2.000	7784	3021	48	-128	-125950	-2059	1860	N	783	162.43	146.19	1144	0	0.12	Not Reqd	0.00	0.06	0.62	1704	2318	1029	54.81	0.00	0.00
74	75	-0.527	-1.348	-0.920	2.000	7484	2314	68	313	-110739	-1899	2247	Y	782	155.39	139.85	1145	0	0.12	0.104	0.00	0.11	0.62	1642	2232	1020	28.48	5.91	2.02
75	75	-0.536	-1.348	-0.924	2.000	7484	2861	36	139	-109995	-1952	1879	N	753	155.39	139.85	1130	0	0.12	Not Reqd	0.00	0.06	0.62	1642	2219	976	69.52	0.00	0.00
75	76	-0.668	-1.275	-0.951	2.000	7205	2916	67	638	-94929	-1787	2324	Y	752	148.79	133.91	1140	0	0.12	0.111	0.00	0.12	0.62	1585	2139	967	22.93	6.25	2.14
76	76	-0.671	-1.275	-0.952	2.000	7205	3179	47	224	-94585	-1821	1672	N	729	148.79	133.91	1127	0	0.12	Not Reqd	0.00	0.06	0.62	1584	2128	911	52.64	0.00	0.00
76	77	-0.808	-1.188	-0.980	2.000	6946	3122	73	683	-80548	-1666	2077	N	728	142.57	128.32	1107	0	0.12	Not Reqd	0.00	0.06	0.62	1522	2053	833	34.44	0.00	0.00
77	77	-0.811	-1.188	-0.981	2.000	6946	3476	55	259	-80140	-1692	1368	N	708	142.57	128.32	1097	0	0.12	Not Reqd	0.00	0.06	0.62	1522	2043	846	44.22	0.00	0.00
77	78	-0.951	-1.085	-1.010	2.000	6704	3405	78	714	-67041	-1545	1769	N	707	136.74	123.07	1066	0	0.12	Not Reqd	0.00	0.06	0.62	1460	1973	773	31.66	0.00	0.00
78	78	-0.953	-1.085	-1.011	2.000	6704	3926	62	229	-66474	-1563	1006	N	685	136.74	123.07	1055	0	0.12	Not Reqd	0.00	0.06	0.62	1460	1963	782	39.06	0.00	0.00
78	79	-0.702	-1.034	-0.841	2.000	6484	3668	83	745	-54503	-1423	1467	N	518	131.57	118.41	929	0	0.12	Not Reqd	0.00	0.06	0.62	1400	1825	711	27.85	0.00	0.00
79	79	-0.702	-1.034	-0.842	2.000	6484	4300	68	199	-53843	-1439	794	N	504	131.57	118.41	923	0	0.12	Not Reqd	0.00	0.06	0.62	1400	1819	720	33.41	0.00	0.00
79	80	-0.850	-0.884	-0.864	2.000	6283	3944	87	765	-42875	-1306	1305	N	504	126.59	113.93	912	0	0.12	Not Reqd	0.00	0.06	0.62	1351	1758	653	26.44	0.00	0.00
80	80	-0.852	-0.883	-0.864	2.000	6283	4668	72	147	-42113	-1320	475	N	499	126.59	113.93	909	0	0.12	Not Reqd	0.00	0.06	0.62	1351	1756	660	31.27	0.00	0.00
80	81	-0.963	-1.310	-1.096	2.000	6103	4237	91	777	-32101	-1190	1051	N	889	106.03	95.43	997	0	0.12	Not Reqd	0.00	0.06	0.31	566	1407	595	18.93	0.00	0.00
81	81	-0.965	-1.310	-1.097	2.000	6103	5040	76	78	-31256	-1202	268	N	880	106.03	95.43	993	0	0.12	Not Reqd	0.00	0.06	0.31	566	1403	601	21.99	0.00	0.00
81	82	-1.058	-1.309	-1.148	2.000	5941	4547	94	784	-22178	-1079	920	N	584	99.67	92.12	825	0	0.12	Not Reqd	0.00	0.06	0.31	546	1234	539	15.80	0.00	0.00
82	82	-1.077	-1.306	-1.159	2.000	5941	5422	81	-26	-20951	-1094	-356	N	203	99.67	92.12	635	0	0.12	Not Reqd	0.00	0.06	0.31	546	1063	547	13.66	0.00	0.00
82	83	-0.804	-1.109	-0.913	2.000	5756	5392	99	60	-12206	-974	-324	N	73	89.75	89.42	554	0	0.12	Not Reqd	0.00	0.06	0.31	530	976	487	10.88	0.00	0.00
83	83	-0.824	-1.108	-0.925	2.000	5756	5829	87	-105	-11492	-982	-372	N	55	89.75	89.42	545	1	0.12	Not Reqd	0.00	0.06	0.31	530	968	491	11.91	0.00	0.00
83	84	-0.961	-1.402	-1.119	2.000	5587	5861	106	-44	-3512	-861	-365	N	428	76.16	86.94	718	0	0.12	Not Reqd	0.00	0.06	0.21	344	955	430	10.95	0.00	0.00
84	84	-0.962	-1.402	-1.119	2.000	5587	6363	94	-260	-2985	-870	-485	N	410	76.16	86.94	708	0	0.12	Not Reqd	0.00	0.06	0.21	344	947	435	11.88	0.00	0.00
84	85	-1.057	-1.245	-1.124	2.000	5440	6323	113	-153	4105	-750	-431	N	192	46.76	84.78	587	0	0.12	Not Reqd	0.00	0.06	0.21	335	830	375	9.05	0.00	0.00
85	85	-1.057	-1.245	-1.124	2.000	5440	7933	102	-161	5725	-763	-463	N	171	46.76	84.78	577	0	0.12	Not Reqd	0.00	0.06	0.21	335	820	381	9.60	0.00	0.00
85	86	-1.204	-0.976	-1.123	2.000	5313	6771	121	-273	10920	-644	-629	N	16	46.43	82.94	488	0	0.12	Not Reqd	0.00	0.06	0.29	465	858	322	9.88	0.00	0.00
86	86	-1.204	-0.975	-1.123	2.000	5313	8500	111	-246	12664	-653	-800	N	-2	46.43	82.94	481	0	0.12	Not Reqd	0.00	0.06	0.29	465	852	327	10.46	0.00	0.00
86	87	-0.963	-0.818	-0.912	2.000	5206	7200	129	-405	16939	-536	-1013	N	-11	57.03	81.36	477	0	0.12	Not Reqd	0.00	0.06	0.29	457	840	268	9.87	0.00	0.00
87	87	-0.963	-0.817	-0.911	2.000	5206	9046	120	-341	18794	-541	-766	N	-25	57.03	81.36	483	0	0.12	Not Reqd	0.00	0.06	0.29	457	846	270	10.55	0.00	0.00
87	88	-1.005	-1.251	-1.092	2.000	5116	8757	138	-261	23266	-423	-740	N	230	64.47	80.06	578	0	0.12	Not Reqd	0.00	0.06	0.29	449	925	211	11.36	0.00	0.00
88	88	-1.004	-1.251	-1.091	2.000	5116	9565	130	-447	24071	-429	-525	N	211	64.47	80.06	569	0	0.12	Not Reqd	0.00	0.06	0.29	449	916	215	11.76	0.00	0.00
88	89	-1.093	-1.098	-1.095	2.000	5018	9216	148	-372	27702	-313	-505	N	-17	64.46	78.62	464	0	0.12	Not Reqd	0.00	0.06	0.29	441	814	156	9.90	0.00	0.00
89	89	-1.093	-1.098	-1.095	2.000	5018	10043	141	-561	28529	-320	-521	N	-33	64.46	78.62	472	0	0.12	Not Reqd	0.00	0.06	0.29	441	821	160	10.40	0.00	0.00
89	90	-1.182	-0.927	-1.092	2.000	5000	9628	159	-493	31322	-203	-507	N	-1	64.22	78.35	454	0	0.12	Not Reqd	0.00	0.06	0.29	440	804	102	9.86	0.00	0.00
90	90	-1.180	-0.927	-1.091	2.000	5000	10473	152	-687	32148	-209	-793	N	-17	64.22	78.35	462	0	0.12	Not Reqd	0.00	0.06	0.29	440	812	105	10.32	0.00	0.00
90	91	-1.242	-0.798	-1.086	2.000	4969	9985	170	-625	34092	-93	-784	N	20	64.05	77.90	461	0	0.12	Not Reqd	0.00	0.06	0.29	437	808	46	9.97	0.00	0.00
91	91	-1.219	-0.798	-1.071	2.000	4969	10846	163	-826	34705	-97	-1075	N	1	64.05	77.90	452	0	0.12	Not Reqd	0.00	0.06	0.29	437	800	48	10.24	0.00	0.00
91	92	-0.853	-0.820	-0.841	2.000	4960	10280	181	-767	35777	21	-1070	N	-14	82.00	77.76	415	0	0.12	Not Reqd	0.00	0.06	0.29	430	761	10	9.28	0.00	0.00
92	92	-0.835	-0.819	-0.829	2.000	4960	11104	183	-880	36446	22	-1023	N	-20	82.00	77.76	415	0	0.12	Not Reqd	0.00	0.06	0.29	430	760	11	9.21	0.00	0.00
92	93	-0.851	-0.780	-0.826	2.000	4960	10685	194	-852	36644	93	-1029	N	-43	81.79	77.76	441	0	0.12	Not Reqd	0.00	0.06	0.29	432	786	47	8.64	0.00	0.00
93	93	-0.847	-0.780	-0.824	2.000	4960	11351	183	-1049	37272	84	-1062	N	-49	81.79	77.76	442	0	0.12	Not Reqd	0.00	0.06	0.29	432	786	42	9.13	0.00	0.00
93	94	-0.866	-0.735	-0.820	2.000	4969	10636	202	-1000	36944	202	-1067	N	-90	81.08	77.90	463	0	0.12	Not Reqd	0.00	0.06	0.29	432	806	101	7.97	0.00	0.00
94	94	-0.865	-0.735	-0.820	2.000	4969	11522	197	-1184	37820	198	-1090	N	-104	81.08	77.90	467	0	0.12	Not Reqd	0.00	0.06	0.29	432	809	99	8.19	0.00	0.00
94	95	-0.876	-0.706	-0.816	2.000	5000	10695	217	-1142	36600	317	-1102	N	-149	79.84	78.35	495	0	0.12	Not Reqd	0.00	0.06	0.29	435	837	158	7.26	0.00	0.00
95	95	-0.874	-0.706	-0.815	2.000	5000	11491	211	-1341	37377	312	-1180	N	-161	79.84	78.35	499	0	0.12	Not Reqd	0.00	0.06	0.29	434	840	156	7.47	0.00	0.00

URS

FILE: V:\Projects\Cline Avenue\Load Rating Analysis\Revised LL Long Rating\Orig Ab with increased Vc AASHTO\Segment3\EB Rating\[Shear Design.xls]Web Design (t=1)
Forces Worksheet: V:\Projects\Cline Avenue\Load Rating Analysis\Revised LL Long Rating\Orig Ab with increased Vc AASHTO\Segment3\EB Rating\[Forces.xls]
Props&Reinf Worksheet: V:\Projects\Cline Avenue\Load Rating Analysis\Revised LL Long Rating\Orig Ab with increased Vc AASHTO\Segment3\EB Rating\[Props&Reinf.xls]

PROJECT: **Cline Avenue Mainline Seg 3 EB** CALCS BY: TSP DATE: 01/21/09
DESCRIPTION: **Ultimate Shear Check** CHECKED BY: DATE:

Web Reinforcement Requirements **Load combination: Strength 1** ***Rating Truck:*** HL-93 ***LL Factor:*** *Inventory*

Material Properties:

Concrete
f'c = ***5.0*** ksi
ϕ_v = ***0.90***

P-T Strands
f_{pu} = ***270*** ksi
f_{pe} = ***176*** ksi

Reinforcement
fy = ***60.0*** ksi

Box Girder Properties:

Web Thickness
b_v = ***11.95*** in

Effective Width of Shear Flow Path
be= ***5.50*** in

Notes:
1. All shears are vertical unless noted otherwise.
2. Web thickness is horizontal, box depth is vertical.

Calc All RF

Calc RF

Member Number	Node Number	(ksi) Perm Load Stress (top fiber)	(ksi) Perm Load Stress (bott. fiber)	(ksi) Dead Load Stress (neutr. axis)	Stress Variable 'K'	(k-ft) Torsional Moment (Tcr)	Ultimate Corresp. Live Load Moment	Ultimate Max Live Load Shear	Ultimate Corresp. Live Load Torsion	TOTAL Ultimate Moment (Mu)	TOTAL Ultimate Shear (Vu)	TOTAL Ultimate Torsion (Tu)	Investigate Torsional Effects? (Y/N)	Shear from Primary Post Tensioning Effect (Vp)	(in) Depth to Tensile Reinforcement d_e	(in) Effective Shear Depth d_v	(kip) Concrete Shear Resistance per web (Vc)	(kip) Required Steel Resistance per web (Vs-req'd)	(in^2/ft) Required Steel Area per web (Av)	(in^2/ft) Additional Steel Required for Torsion (At)	(in^2/ft) Additional Steel Req'd from Transverse A_v (trans)	(in^2/ft) Total Steel Required per leg (As_req'd)	(in^2/ft) Steel Provided per leg As_prov'd)	(kip) Provided Steel Resistance per web (Vs_prov)	(kip) Nominal Shear Resistance per web (ϕVn)	(kip) Ultimate Shear per web (Vu)	Shear Rating Factor, RF	Total Long. Mild Steel Required for Torsion (Al) in^2	Equivalent PT Steel Req'd for Torsion (based on fpe) (Al) in^2
				(fpc)		(Tcr)				(Mu)	(Vu)	(Tu)		(Vp)	d_e	d_v	(Vc)	(Vs-req'd)	(Av)	(At)	A_v (trans)	(As_req'd)	As_prov'd)	(Vs_prov)	(ϕVn)	(Vu)			
		Permanent Loads + Maximum LL Shear @ t=00																											
95	96	-0.876	-0.695	-0.813	2.000	5049	10554	231	-1305	35262	431	-1199	N	-207	78.04	79.07	532	0	0.12	Not Reqd	0.00	0.06	0.29	439	874	216	6.71	0.00	0.00
96	96	-0.863	-0.695	-0.804	2.000	5049	11437	226	-1497	36009	427	-1180	N	-219	78.04	79.07	535	0	0.12	Not Reqd	0.00	0.06	0.29	439	876	213	6.86	0.00	0.00
96	97	-0.857	-0.704	-0.803	2.000	5116	10379	246	-1467	32994	547	-1204	N	-247	92.25	83.03	533	0	0.12	Not Reqd	0.00	0.06	0.29	455	889	273	6.01	0.00	0.00
97	97	-0.613	-0.684	-0.638	2.000	5116	11259	242	-1655	34016	542	-861	N	-251	92.25	83.03	533	0	0.12	Not Reqd	0.00	0.06	0.29	454	889	271	6.11	0.00	0.00
97	98	-0.569	-0.742	-0.630	2.000	5206	10072	262	-1630	30095	662	-891	N	-260	77.47	81.36	569	0	0.12	Not Reqd	0.00	0.06	0.29	452	919	331	5.49	0.00	0.00
98	98	-0.786	-0.620	-0.728	2.000	5206	10945	258	-1814	30974	659	-2102	Y	-315	77.47	81.36	595	0	0.12	0.139	0.00	0.13	0.29	452	942	396	3.93	-6.87	-2.35
98	99	-0.756	-0.670	-0.726	2.000	5313	9619	278	-1794	26127	780	-2137	Y	-335	74.15	82.94	629	0	0.12	0.139	0.00	0.13	0.29	463	983	458	3.68	-6.90	-2.36
99	99	-0.754	-0.670	-0.725	2.000	5313	10484	275	-1975	26977	779	-2381	Y	-347	74.15	82.94	632	0	0.12	0.155	0.00	0.14	0.29	462	985	465	3.60	-7.69	-2.63
99	100	-0.715	-0.730	-0.720	2.000	5440	9014	295	-1961	21174	902	-2421	Y	-391	70.40	84.78	685	0	0.12	0.154	0.00	0.14	0.29	475	1044	527	3.47	-7.70	-2.63
100	100	-0.714	-0.730	-0.719	2.000	5440	10017	291	-2156	22167	900	-2391	Y	-405	70.40	84.78	688	0	0.12	0.152	0.00	0.14	0.29	475	1047	526	3.44	-7.61	-2.60
100	101	-0.671	-0.801	-0.716	2.000	5587	8409	311	-2149	15401	1024	-2438	Y	-445	66.15	86.94	726	0	0.12	0.151	0.00	0.14	0.29	488	1092	589	3.25	-7.63	-2.61
101	101	-0.670	-0.801	-0.716	2.000	5587	9219	303	-2389	16209	1017	-2266	Y	-618	66.15	86.94	813	0	0.12	0.140	0.00	0.13	0.29	488	1170	580	3.60	-7.09	-2.42
101	102	-0.637	-0.802	-0.698	2.000	5721	7945	330	-2486	8949	1149	-2417	Y	-655	61.45	89.42	845	0	0.12	0.146	0.00	0.13	0.29	502	1212	651	3.31	-7.45	-2.55
102	102	-0.637	-0.802	-0.698	2.000	5721	8006	318	-2592	9009	1142	-2344	Y	-663	61.45	89.42	849	0	0.12	0.142	0.00	0.13	0.29	502	1216	645	3.37	-7.22	-2.47
102	103	-0.599	-0.808	-0.679	2.000	5870	6595	345	-2683	738	1278	-2490	Y	-695	56.28	92.12	881	0	0.12	0.147	0.00	0.13	0.53	930	1551	718	4.24	-7.55	-2.58
103	103	-0.599	-0.808	-0.679	2.000	5870	6979	335	-2766	1122	1273	-2461	Y	-703	56.28	92.12	885	0	0.12	0.145	0.00	0.13	0.53	930	1555	714	4.30	-7.46	-2.55
103	104	-0.555	-0.819	-0.661	2.000	6041	5403	363	-2852	-8220	1414	-2601	Y	-741	81.42	95.13	921	0	0.12	0.149	0.00	0.13	0.53	961	1612	789	4.03	-7.75	-2.65
104	104	-0.555	-0.819	-0.661	2.000	6041	5779	356	-2891	-7841	1412	-2567	Y	-752	81.42	95.13	927	0	0.12	0.147	0.00	0.13	0.53	961	1617	787	4.08	-7.65	-2.62
104	105	-0.508	-0.832	-0.642	2.000	6230	4001	384	-2971	-18322	1558	-2702	Y	-802	92.13	98.42	949	0	0.12	0.150	0.00	0.13	0.53	988	1684	864	3.87	-7.90	-2.70
105	105	-0.509	-0.832	-0.643	2.000	6230	4369	383	-2963	-17945	1560	-2639	Y	-811	92.13	98.42	955	0	0.12	0.146	0.00	0.13	0.53	989	1688	863	3.89	-7.72	-2.64
105	106	-0.460	-0.845	-0.624	2.000	6441	2343	411	-3038	-29641	1710	-2769	Y	-874	103.93	102.02	966	0	0.12	0.148	0.00	0.13	0.53	1014	1765	943	3.73	-7.94	-2.71
106	106	-0.461	-0.845	-0.625	2.000	6441	2631	415	-2935	-29340	1716	-2600	Y	-888	103.93	102.02	974	0	0.12	0.139	0.00	0.13	0.53	1014	1771	940	3.77	-7.46	-2.55
106	107	-0.413	-0.854	-0.607	2.000	6670	302	444	-3001	-42325	1872	-2722	Y	-953	116.99	105.89	992	48	0.12	0.141	0.00	0.13	0.53	1042	1830	1022	3.55	-7.65	-2.61
107	107	-0.414	-0.854	-0.607	2.000	6670	727	453	-2832	-41891	1881	-2500	Y	-968	116.99	105.89	1001	44	0.12	0.129	0.00	0.12	0.53	1042	1839	1019	3.59	-7.02	-2.40
107	108	-0.362	-0.869	-0.590	2.000	6921	-1962	483	-2887	-56239	2041	-2610	Y	-945	130.80	117.72	1019	115	0.12	0.130	0.00	0.12	0.53	1149	1952	1103	3.55	-7.18	-2.45
108	108	-0.362	-0.869	-0.589	2.000	6921	-1623	498	-2635	-55914	2051	-2385	Y	-959	130.80	117.72	1027	112	0.12	0.119	0.00	0.12	0.53	1150	1959	1101	3.58	-6.56	-2.24
108	109	-0.293	-0.904	-0.573	2.000	7190	-4736	529	-2675	-71688	2217	-2480	Y	-814	143.82	129.44	982	250	0.21	0.119	0.00	0.16	0.53	1254	2012	1187	3.37	-6.67	-2.28
109	109	-0.293	-0.903	-0.573	2.000	7190	-4360	550	-2378	-71312	2230	-2700	Y	-712	143.82	129.44	929	309	0.26	0.130	0.00	0.20	0.53	1253	1964	1200	3.18	-7.27	-2.48
109	110	-0.180	-1.022	-0.567	2.000	7513	-8004	582	-2420	-88607	2400	-2798	Y	-381	154.24	138.82	776	557	0.44	0.129	0.00	0.29	0.53	1332				-7.35	-2.51
110	110	-0.177	-1.019	-0.564	2.000	7513	-8036	604	-2226	-88682	2410	-3411	Y	-137	154.24	138.82	649	690	0.55	0.157	0.00	0.35	0.53	1330				-8.95	-3.06
110	111	-0.116	-1.092	-0.564	2.000	7513	-9321	614	-2244	-94539	2465	-3446	Y	6	154.54	139.08	573	796	0.63	0.158	0.00	0.40	0.53	1327				-9.05	-3.09
111	111	-0.076	-1.153	-0.571	2.000	7513	3288	156	1622	-77581	-2149	7094	Y	6	154.54	139.08	603	591	0.47	0.326	0.00	0.40	0.53	1340				18.63	6.37
111	112	-0.141	-1.062	-0.564	2.000	7513	2669	159	2345	-72494	-2101	7799	Y	110	154.38	138.94	665	503	0.40	0.359	0.00	0.38	0.29	746				20.48	7.00
112	112	-0.144	-1.066	-0.568	2.000	7513	2934	134	1295	-72252	-2140	5963	Y	348	154.38	138.94	789	400	0.31	0.274	0.00	0.29	0.29	747				15.66	5.35
112	113	-0.284	-0.882	-0.558	2.000	7042	1838	143	2229	-56141	-1991	6841	Y	648	143.12	128.80	924	183	0.15	0.336	0.00	0.24	0.29	699	1460	1212	2.75	18.63	6.37
113	113	-0.282	-0.884	-0.558	2.000	7042	1994	106	1527	-56072	-2042	6025	Y	747	143.12	128.80	975	160	0.13	0.296	0.00	0.21	0.29	699	1506	1211	3.91	16.40	5.61
113	114	-0.392	-0.775	-0.564	2.000	6921	1287	119	1979	-40526	-1894	6422	Y	1024	131.40	118.26	1097	0	0.12	0.321	0.00	0.22	0.29	648	1571	1150	4.46	17.66	6.04
114	114	-0.391	-0.776	-0.563	2.000	6921	1429	88	1354	-40432	-1936	6046	Y	1010	131.40	118.26	1089	0	0.12	0.302	0.00	0.21	0.29	648	1563	1159	5.66	16.63	5.69
114	115	-0.468	-0.705	-0.572	2.000	6522	858	101	1828	-25710	-1791	6465	Y	1297	112.96	103.73	1199	0	0.12	0.342	0.00	0.23	0.29	575	1596	1100	5.58	18.41	6.29
115	115	-0.467	-0.706	-0.571	2.000	6522	986	79	1272	-25636	-1821	5717	Y	1282	112.96	103.73	1190	0	0.12	0.303	0.00	0.21	0.29	575	1588	1091	7.27	16.27	5.56
115	116	-0.499	-0.692	-0.581	2.000	6441	516	95	1761	-11771	-1677	6151	Y	1560	93.75	102.02	1371	0	0.12	0.330	0.00	0.22	0.29	572	1749	1033	7.95	17.64	6.03
116	116	-0.498	-0.694	-0.581	2.000	6441	639	84	1562	-11687	-1691	4430	Y	1546	93.75	102.02	1364	0	0.12	0.238	0.00	0.18	0.29	572	1742	985	9.31	12.71	4.34
116	117	-0.006	0.002	-0.003	1.010	3129	9	108	2014	152	-1310	4827	Y	0	0.00	98.42	38	690	4.51	0.269	0.00	2.39	0.29	90				14.17	4.84

0.83

PROJECT: **Cline Avenue Mainline Seg 3 EB** CALCS BY: TSP DATE: 01/21/09

DESCRIPTION: **Ultimate Shear Check** CHECKED BY: DATE:

Web Reinforcement Requirements **Load combination: Strength 1**

Material Properties:

Concrete

f'c = ***5.0*** ksi

ϕ_v = ***0.90***

P-T Strands

f_{pu} = ***270*** ksi

f_{pe} = ***176*** ksi

Box Girder Properties:

Web Thickness

b_v = ***14.00*** in

Effective Width of Shear Flow Path

be= ***5.50*** in

Reinforcement

fy = ***60.0*** ksi

Notes:

1. All shears are vertical unless noted otherwise.
2. Web thickness is horizontal, box depth is vertical.

Calc RF

		Permanent Loads + Minimum LL Shear @ t=00														(kip)	(kip)	(in^2/ft)	(in^2/ft)	(in^2/ft)	(in^2/ft)	(in^2/ft)	(kip)	(kip)	(kip)		Total Long.	Equivalent
		(ksi)	(ksi)	(ksi)		(k-ft)	Ultimate	Ultimate	Ultimate				Investigate	Shear from	(in)	(in)	Concrete	Required	Required	Additional	Additional	Total		Provided	Nominal			Mild Steel	PT Steel Req'd
		Perm Load	Perm Load	Dead Load	Stress	Torsional	Corresp.	Max	Corresp.	TOTAL	TOTAL	TOTAL	Torsional	Primary	Depth	Effective	Shear	Steel	Steel	Steel	Steel	Steel	Steel	Steel	Shear	Ultimate	Shear	Required	for Torsion
		Stress	Stress	Stress	Variable	Cracking	Live Load	Live Load	Live Load	Ultimate	Ultimate	Ultimate	Effects?	Post Tensioning	to Tensile	Shear	Resistance	Resistance	Area	Required	Req'd from	Required	Provided	Resistance	Resistance	Shear	Rating	for Torsion	(based on fpe)
Member	Node	(top fiber)	(bott. fiber)	(neutr. axis)	'K'	Moment	Moment	Shear	Torsion	Moment	Shear	Torsion	(Y/N)	Effect	Reinforcement	Depth	per web	per web	per web	for Torsion	Transverse	per leg	per leg	Steel	per web	per web	per web	Factor, RF	(Al)	(Al)
Number	Number			(fpc)		(Tcr)				(Mu)	(Vu)	(Tu)		(Vp)	d_e	d_v	(Vc)	(Vs-req'd)	(Av)	(At)	A_v (trans)	(As_req'd)	As_prov'd)	(Vs_prov)	(ϕVn)	(Vu)			in^2	in^2
1	1	-0.005	-0.005	-0.005	1.019	7064	0	-8	-177	0	2521	484	N	0	0.00	102.02	62	872	2.49	Not Reqd	0.00	1.25	0.37	260					0.00	0.00
1	2	-0.673	-0.753	-0.706	2.000	14431	51	-6	-150	-22141	3147	570	N	-2829	99.17	105.89	1556	0	0.12	Not Reqd	0.00	0.06	0.37	753	2078	1049	479.23		0.00	0.00
2	2	-0.673	-0.753	-0.706	2.000	14431	51	-6	-150	-22141	3147	571	N	-2854	99.17	105.89	1565	0	0.12	Not Reqd	0.00	0.06	0.37	753	2086	1049	482.88		0.00	0.00
2	3	-0.652	-0.739	-0.690	2.000	14973	80	-5	-111	-47603	3368	668	N	-2498	118.41	110.07	1455	0	0.12	Not Reqd	0.00	0.06	0.37	781	2012	1123	521.10		0.00	0.00
3	3	-0.652	-0.739	-0.690	2.000	14973	80	-5	-111	-47603	3368	669	N	-2523	118.41	110.07	1463	0	0.12	Not Reqd	0.00	0.06	0.37	781	2019	1123	525.70		0.00	0.00
3	4	-0.595	-0.778	-0.677	2.000	15555	99	-4	-92	-74825	3597	746	N	-2082	134.90	121.41	1328	4	0.12	Not Reqd	0.00	0.06	0.37	851	1961	1199	540.76		0.00	0.00
4	4	-0.595	-0.778	-0.677	2.000	15555	99	-4	-92	-74825	3596	747	N	-2109	134.90	121.41	1337	0	0.12	Not Reqd	0.00	0.06	0.37	851	1969	1199	546.85		0.00	0.00
4	5	-0.507	-0.850	-0.664	2.000	16176	112	-4	-13	-103865	3833	885	N	-1729	148.91	134.02	1234	185	0.15	Not Reqd	0.00	0.07	0.37	930	1948	1278	564.46		0.00	0.00
5	5	-0.507	-0.850	-0.664	2.000	16176	112	-4	-13	-103865	3833	886	N	-1762	148.91	134.02	1246	174	0.14	Not Reqd	0.00	0.07	0.37	930	1959	1278	573.51		0.00	0.00
5	6	-0.396	-0.943	-0.652	2.000	16843	136	-3	-8	-134770	4077	949	N	-1416	160.79	144.71	1146	364	0.27	Not Reqd	0.00	0.14	0.37	996	1928	1359	490.94		0.00	0.00
6	6	-0.394	-0.941	-0.651	2.000	16843	136	-3	-8	-134770	4080	963	N	-1171	160.79	144.71	1061	450	0.34	Not Reqd	0.00	0.17	0.37	995	1850	1360	423.23		0.00	0.00
6	7	-0.262	-1.103	-0.657	2.000	17619	161	-3	-4	-167604	4330	1025	N	-676	170.42	153.38	902	702	0.50	Not Reqd	0.00	0.25	0.37	1046					0.00	0.00
7	7	-0.257	-1.097	-0.652	2.000	17619	161	-3	-4	-167604	4333	1035	N	-111	170.42	153.38	706	899	0.64	Not Reqd	0.00	0.32	0.37	1044					0.00	0.00
7	8	-0.193	-1.181	-0.657	2.000	17619	170	-3	-3	-178538	4414	1055	N	103	170.43	153.39	693	942	0.67	Not Reqd	0.00	0.34	0.37	1041					0.00	0.00
8	8	-0.302	-1.022	-0.640	2.000	17619	-15612	-801	-2647	-189389	-4222	-3787	N	103	170.43	153.39	686	877	0.63	Not Reqd	0.00	0.31	0.37	1039					0.00	0.00
8	9	-0.356	-0.961	-0.640	2.000	17619	-13935	-790	-2620	-179261	-4130	-3741	N	269	170.16	153.15	752	778	0.56	Not Reqd	0.00	0.28	0.31	867					0.00	0.00
9	9	-0.359	-0.964	-0.643	2.000	17619	-13935	-782	-2619	-179261	-4122	-3729	N	838	170.16	153.15	949	578	0.41	Not Reqd	0.00	0.21	0.31	869					0.00	0.00
9	10	-0.463	-0.865	-0.652	2.000	16843	-9055	-746	-2532	-149278	-3836	-3583	N	1257	159.91	143.92	1075	346	0.26	Not Reqd	0.00	0.13	0.31	822	1708	1279	2.72		0.00	0.00
10	10	-0.464	-0.865	-0.653	2.000	16843	-9056	-742	-2529	-149278	-3831	-3567	N	1509	159.91	143.92	1162	257	0.19	Not Reqd	0.00	0.10	0.31	823	1787	1277	3.06		0.00	0.00
10	11	-0.388	-0.862	-0.605	2.000	16176	-4646	-707	-2441	-121687	-3552	-3420	N	1650	146.86	132.17	1153	162	0.13	Not Reqd	0.00	0.07	0.31	755	1717	1184	3.26		0.00	0.00
11	11	-0.388	-0.862	-0.605	2.000	16176	-4646	-708	-2441	-121687	-3553	-3419	N	1620	146.86	132.17	1142	173	0.14	Not Reqd	0.00	0.07	0.31	755	1708	1184	3.22		0.00	0.00
11	12	-0.439	-0.854	-0.624	2.000	15555	-660	-673	-2351	-96398	-3282	-3271	N	1669	133.56	120.20	1126	89	0.12	Not Reqd	0.00	0.06	0.31	691	1636	1094	3.41		0.00	0.00
12	12	-0.439	-0.854	-0.624	2.000	15555	-660	-674	-2352	-96398	-3283	-3270	N	1644	133.56	120.20	1118	98	0.12	Not Reqd	0.00	0.06	0.31	691	1628	1094	3.38		0.00	0.00
12	13	-0.439	-0.859	-0.621	2.000	14973	2915	-640	-2260	-73332	-3021	-3120	N	1515	119.91	110.07	1041	78	0.12	Not Reqd	0.00	0.06	0.31	636	1509	1007	3.36		0.00	0.00
13	13	-0.439	-0.859	-0.621	2.000	14973	2915	-640	-2260	-73332	-3021	-3119	N	1493	119.91	110.07	1034	85	0.12	Not Reqd	0.00	0.06	0.31	636	1503	1007	3.32		0.00	0.00
13	14	-0.488	-0.855	-0.642	2.000	14431	6097	-607	-2166	-52409	-2768	-2966	N	1394	108.10	105.89	1011	14	0.12	Not Reqd	0.00	0.06	0.31	617	1466	923	3.69		0.00	0.00
14	14	-0.488	-0.855	-0.642	2.000	14431	6097	-607	-2166	-52410	-2768	-2966	N	1370	108.10	105.89	1003	22	0.12	Not Reqd	0.00	0.06	0.31	617	1458	923	3.65		0.00	0.00
14	15	-0.384	-0.878	-0.584	2.000	13934	8902	-574	-2069	-33553	-2523	-2810	N	1216	92.27	102.02	935	0	0.12	Not Reqd	0.00	0.06	0.31	595	1378	841	3.80		0.00	0.00
15	15	-0.384	-0.878	-0.584	2.000	13934	8902	-575	-2069	-33553	-2524	-2810	N	1197	92.27	102.02	929	6	0.12	Not Reqd	0.00	0.06	0.31	595	1372	841	3.77		0.00	0.00
15	16	-0.430	-0.879	-0.604	2.000	13477	11347	-542	-1969	-16687	-2286	-2652	N	1141	81.71	98.42	927	0	0.12	Not Reqd	0.00	0.06	0.31	580	1356	762	4.29		0.00	0.00
16	16	-0.430	-0.879	-0.604	2.000	13477	11347	-543	-1970	-16687	-2287	-2652	N	1131	81.71	98.42	924	0	0.12	Not Reqd	0.00	0.06	0.31	580	1353	762	4.27		0.00	0.00
16	17	-0.470	-0.890	-0.626	2.000	13066	13445	-511	-1868	-1738	-2058	-2491	N	1085	71.93	95.13	912	0	0.12	Not Reqd	0.00	0.06	0.21	376	1160	686	3.78		0.00	0.00
17	17	-0.470	-0.890	-0.626	2.000	13066	13445	-511	-1868	-1738	-2058	-2491	N	1072	71.93	95.13	908	0	0.12	Not Reqd	0.00	0.06	0.21	376	1156	686	3.76		0.00	0.00
17	18	-0.504	-0.913	-0.648	2.000	12695	15213	-480	-1765	11366	-1836	-2329	N	1019	64.95	92.12	873	0	0.12	Not Reqd	0.00	0.06	0.21	364	1113	612	4.13		0.00	0.00
18	18	-0.504	-0.912	-0.647	2.000	12695	15213	-487	-1764	11367	-1843	-2332	N	712	64.95	92.12	771	0	0.12	Not Reqd	0.00	0.06	0.21	364	1021	614	3.51		0.00	0.00
18	19	-0.547	-0.843	-0.651	2.000	12301	16719	-457	-1661	22728	-1627	-2170	N	652	69.28	89.42	718	0	0.12	Not Reqd	0.00	0.06	0.21	352	963	542	3.76		0.00	0.00
19	19	-0.547	-0.843	-0.651	2.000	12301	16719	-457	-1660	22728	-1627	-2170	N	632	69.28	89.42	711	0	0.12	Not Reqd	0.00	0.06	0.21	352	957	542	3.72		0.00	0.00
19	20	-0.586	-0.782	-0.654	2.000	11939	17926	-427	-1557	32345	-1413	-2008	N	564	73.04	86.94	658	0	0.12	Not Reqd	0.00	0.06	0.21	340	898	471	4.00		0.00	0.00
20	20	-0.586	-0.782	-0.654	2.000	11939	17926	-428	-1557	32345	-1414	-2008	N	547	73.04	86.94	652	0	0.12	Not Reqd	0.00	0.06	0.21	340	893	471	3.96		0.00	0.00
20	21	-0.618	-0.731	-0.657	2.000	11623	18847	-399	-1454	40244	-1202	-1846	N	496	76.30	84.78	610	0	0.12	Not Reqd	0.00	0.06	0.21	330	846	401	4.35		0.00	0.00
21	21	-0.618	-0.731	-0.657	2.000	11623	18847	-399	-1454	40244	-1202	-1846	N	476	76.30	84.78	603	0	0.12	Not Reqd	0.00	0.06	0.21	330	840	401	4.30		0.00	0.00
21	22	-0.479	-0.710	-0.559	2.000	11354	19499	-371	-1352	46452	-992	-1685	N	442	91.42	82.94	601	0	0.12	Not Reqd	0.00	0.06	0.21	325	834	331	5.07		0.00	0.00
22	22	-0.481	-0.647	-0.539	2.000	11354	19499	-371	-1352	46452	-992	-1685	N	374	91.42	82.94	578	0	0.12	Not Reqd	0.00	0.06	0.21	325	813	331	4.89		0.00	0.00
22	23	-0.498	-0.617	-0.539	2.000	11124	19900	-344	-1251	50994	-784	-1525	N	351	72.14	81.36	554	0	0.12	Not Reqd	0.00	0.06	0.21	318	785	261	5.57		0.00	0.00
23	23	-0.822	-0.632	-0.756	2.000	11124	19900	-344	-1251	50994	-784	-1525	N	360	72.14	81.36	557	0	0.12	Not Reqd	0.00	0.06	0.21	318	788	261	5.59		0.00	0.00
23	24	-0.826	-0.631	-0.758	2.000	10933	20064	-317	-1151	53895	-578	-1367	N	295	73.86	80.06	524	0	0.12	Not Reqd	0.00	0.06	0.21	313	753	193	6.29		0.00	0.00
24	24	-0.826	-0.631	-0.758	2.000	10933	20064	-318	-1151	53895	-579	-1367	N	272	73.86	80.06	516	0	0.12	Not Reqd	0.00	0.06	0.21	313	746	193	6.22		0.00	0.00
24	25	-0.820	-0.647	-0.760	2.000	10788	20018	-292	-1054	55186	-374	-1211	N	203	75.06	79.07	486	0	0.12	Not Reqd	0.00	0.06	0.21	308	715	125	7.06		0.00	0.00
25	25	-0.820	-0.647	-0.760	2.000	10788	20018	-292	-1054	55186	-374	-1211	N	184	75.06	79.07	479	0	0.12	Not Reqd	0.00	0.06	0.21	308	709	125	6.99		0.00	0.00
25	26	-0.804	-0.675	-0.759	2.000	10683	19774	-268	-959	54885	-171	-1058	N	122	75.73	78.35	457	0	0.12	Not Reqd	0.00	0.06	0.21	306	686	57	8.05		0.00	0.00
26	26	-0.804	-0.675	-0.759	2.000	10683	19774	-268	-959	54885	-171	-1058	N	103	75.73	78.35	450	0	0.12	Not Reqd	0.00	0.06	0.21	306	680	57	7.97		0.00	0.00
26	27	-0.775	-0.726	-0.758	2.000	10617	19360	-245	-868	53022	30	-907	N	50	75.97	77.90	434	0	0.12	Not Reqd	0.00	0.06	0.21	304	665	10	9.03		0.00	0.00
27	27	-0.775	-0.726	-0.758	2.000	10617	19360	-245	-868	53022	30	-907	N	19	75.97	77.90	424	0	0.12	Not Reqd	0.00	0.06	0.21	305	655	10	8.90		0.00	0.00
27	28	-1.195	-0.725	-1.032	2.000	10617	18919	-227	-796	50387	192	-788	N	23	57.68	77.90	459	0	0.12	Not Reqd	0.00	0.06	0.21	308	690	64	9.27		0.00	0.00
28	28	-1.195	-0.725	-1.032	2.000	10617	18919	-227	-796	50387	192	-788	N	-20	57.68	77.90	458	0	0.12	Not Reqd	0.00	0.06	0.21	308	689	64	9.25		0.00	0.00
28	29	-1.133	-0.833	-1.029	2.000	10683	18247	-206	-712	45750	391	-645	N	33	57.84	78.35	465	0	0.12	Not Reqd	0.00	0.06	0.21	310	697	130	9.25		0.00	0.00
29	29	-1.133	-0.833	-1.029	2.000	10683	18247	-206	-712	45750	391	-645	N	7	57.84	78.35	456	0	0.12	Not Reqd	0.00	0.06	0.21	310	689	130	9.13		0.00	0.00
29	30	-1.048	-0.982	-1.025	2.000	10788	17461	-186	-632	39607	590	-506	N	53	58.27	79.07	475	0	0.12	Not Reqd	0.00	0.06	0.21	313	709	197	9.26		0.00	0.00
30	30	-1.048	-0.982	-1.025	2.000	10788	17461	-186	-632	39607	589	-506	N	27	58.27	79.07	467	0	0.12	Not Reqd	0.00	0.06	0.21	313	701	196	9.13		0.00	0.00
30	31	-0.953	-1.134	-1.016	2.000	10933	16580	-167	-556	31976	787	-372	N	-186	58.33	80.06	526	0	0.12	Not Reqd	0.00	0.06	0.21	316	758	262	9.88		0.00	0.00
31	31	-0.953	-1.134	-1.016	2.000	10933	16580	-168	-556	31976	787	-372	N	-217	58.33	80.06	536	0	0.12	Not Reqd	0.00	0.06	0.21	316	767	262	10.03		0.00	0.00
31	32	-0.876	-0.974	-0.910	2.000	11124	15625	-150	-485	22868	987	-243	N	50	53.96	81.36	488	0	0.12	Not Reqd	0.00	0.06	0.21	322	728	329	8.99		0.00	0.00
32	32	-0.876	-0.974	-0.910	2.000	11124	15625	-150	-485	22868	987	-243	N	26	53.96	81.36	480	0	0.12	Not Reqd	0.00	0.06	0.21	322	721	329	8.84		0.00	0.00

PROJECT: **Cline Avenue Mainline Seg 3 EB** CALCS BY: TSP DATE: 01/21/09

DESCRIPTION: **Ultimate Shear Check** CHECKED BY: DATE:

Web Reinforcement Requirements **Load combination: Strength 1**

Material Properties:

Concrete

f'c = ***5.0*** ksi

ϕ_v = ***0.90***

P-T Strands

f_{pu} = ***270*** ksi

f_{pe} = ***176*** ksi

Reinforcement

fy = ***60.0*** ksi

Box Girder Properties:

Web Thickness

b_v = ***14.00*** in

Effective Width of Shear Flow Path

be= ***5.50*** in

Notes:

1. All shears are vertical unless noted otherwise.
2. Web thickness is horizontal, box depth is vertical.

Calc RF

Member Number	Node Number	(ksi) Perm Load Stress (top fiber)	(ksi) Perm Load Stress (bott. fiber)	(ksi) Dead Load Stress (neutr. axis) (fpc)	Stress Variable 'K'	(k-ft) Torsional Moment (Tcr)	Ultimate Corresp. Live Load Moment	Ultimate Max Live Load Shear	Ultimate Corresp. Live Load Torsion	TOTAL Ultimate Moment (Mu)	TOTAL Ultimate Shear (Vu)	TOTAL Ultimate Torsion (Tu)	Investigate Torsional Effects? (Y/N)	Shear from Primary Post Tensioning Effect (Vp)	(in) Depth to Tensile Reinforcement d_e	(in) Effective Shear Depth d_v	(kip) Concrete Shear Resistance per web (Vc)	(kip) Required Steel Resistance per web (Vs-req'd)	(in^2/ft) Required Steel Area per web (Av)	(in^2/ft) Additional Steel Required for Torsion (At)	(in^2/ft) Additional Steel Req'd from Transverse A_v (trans)	(in^2/ft) Total Steel Required per leg (As_req'd)	(in^2/ft) Steel Provided per leg As_prov'd)	(kip) Provided Steel Resistance per web (Vs_prov)	(kip) Nominal Shear Resistance per web (ϕVn)	(kip) Ultimate Shear per web (Vu)	Shear Rating Factor, RF	Total Long. Mild Steel Required for Torsion (Al) in^2	Equivalent PT Steel Req'd for Torsion (based on fpe) (Al) in^2
				Permanent Loads + Minimum LL Shear @ t=00																									
32	33	-1.198	-1.133	-1.176	2.000	11354	14616	-134	-419	12283	1184	-119	N	8	43.07	82.94	483	0	0.12	Not Reqd	0.00	0.06	0.21	328	730	395	8.52	0.00	0.00
33	33	-1.198	-1.133	-1.176	2.000	11354	14616	-134	-419	12283	1184	-119	N	-24	43.07	82.94	488	0	0.12	Not Reqd	0.00	0.06	0.21	328	734	395	8.62	0.00	0.00
33	34	-1.051	-1.383	-1.166	2.000	11623	13567	-119	-360	246	1381	0	N	-167	43.62	84.78	547	0	0.12	Not Reqd	0.00	0.06	0.21	335	794	460	9.44	0.00	0.00
34	34	-1.051	-1.383	-1.167	2.000	11623	13567	-119	-359	246	1380	-1	N	-205	43.62	84.78	559	0	0.12	Not Reqd	0.00	0.06	0.21	335	805	460	9.71	0.00	0.00
34	35	-0.927	-1.579	-1.155	2.000	11939	12494	-105	-306	-13238	1577	112	N	-411	77.86	86.94	640	0	0.12	Not Reqd	0.00	0.06	0.21	344	886	526	11.32	0.00	0.00
35	35	-0.927	-1.579	-1.155	2.000	11939	12494	-105	-306	-13238	1577	111	N	-444	77.86	86.94	651	0	0.12	Not Reqd	0.00	0.06	0.21	344	895	526	11.59	0.00	0.00
35	36	-0.781	-1.541	-1.047	2.000	12301	11406	-92	-258	-28187	1777	218	N	-61	85.74	89.42	538	120	0.14	Not Reqd	0.00	0.07	0.21	353	802	592	7.87	0.00	0.00
36	36	-0.783	-1.543	-1.049	2.000	12301	11406	-93	-256	-28187	1776	209	N	-528	85.74	89.42	694	0	0.12	Not Reqd	0.00	0.06	0.21	353	942	592	12.26	0.00	0.00
36	37	-1.098	-1.560	-1.260	2.000	12695	5447	-90	4	-49473	1967	528	N	-944	98.22	92.12	848	0	0.12	Not Reqd	0.00	0.06	0.21	364	1091	656	15.51	0.00	0.00
37	37	-1.098	-1.560	-1.260	2.000	12695	5447	-90	4	-49473	1967	528	N	-971	98.22	92.12	857	0	0.12	Not Reqd	0.00	0.06	0.21	364	1099	656	15.80	0.00	0.00
37	38	-1.020	-1.518	-1.204	2.000	13066	5658	-87	16	-66084	2165	598	N	-1713	104.67	95.13	1122	0	0.12	Not Reqd	0.00	0.06	0.21	376	1348	722	22.69	0.00	0.00
38	38	-1.020	-1.518	-1.204	2.000	13066	5658	-87	15	-66084	2165	598	N	-1752	104.67	95.13	1135	0	0.12	Not Reqd	0.00	0.06	0.21	376	1360	722	23.12	0.00	0.00
38	39	-0.924	-0.913	-0.920	2.000	13477	5897	-84	25	-84228	2372	667	N	-810	128.89	116.00	942	0	0.12	Not Reqd	0.00	0.06	0.41	917	1673	791	32.60	0.00	0.00
39	39	-0.924	-0.913	-0.920	2.000	13477	5897	-84	25	-84228	2372	667	N	-833	128.89	116.00	949	0	0.12	Not Reqd	0.00	0.06	0.41	917	1680	791	32.90	0.00	0.00
39	40	-0.778	-1.064	-0.894	2.000	13934	6166	-81	34	-103943	2582	735	N	-834	133.58	120.22	974	0	0.12	Not Reqd	0.00	0.06	0.41	951	1732	861	33.14	0.00	0.00
40	40	-0.778	-1.064	-0.893	2.000	13934	6166	-81	33	-103943	2582	735	N	-872	133.58	120.22	987	0	0.12	Not Reqd	0.00	0.06	0.41	951	1743	861	33.64	0.00	0.00
40	41	-1.066	-1.133	-1.095	2.000	14431	6471	-79	41	-125276	2799	801	N	-1161	138.48	124.63	1108	0	0.12	Not Reqd	0.00	0.06	0.41	985	1884	933	37.04	0.00	0.00
41	41	-1.065	-1.134	-1.094	2.000	14431	6471	-79	40	-125276	2799	801	N	-1215	138.48	124.63	1127	0	0.12	Not Reqd	0.00	0.06	0.41	985	1901	933	37.74	0.00	0.00
41	42	-0.928	-1.245	-1.066	2.000	14973	6814	-77	46	-148278	3023	866	N	-1215	144.05	129.65	1156	0	0.12	Not Reqd	0.00	0.06	0.41	1025	1963	1008	37.99	0.00	0.00
42	42	-0.927	-1.245	-1.065	2.000	14973	6814	-77	46	-148278	3023	866	N	-1266	144.05	129.65	1173	0	0.12	Not Reqd	0.00	0.06	0.41	1025	1978	1008	38.66	0.00	0.00
42	43	-0.794	-1.342	-1.039	2.000	15555	7199	-76	51	-173001	3253	930	N	-1266	150.02	135.02	1204	1	0.12	Not Reqd	0.00	0.06	0.41	1068	2044	1084	38.83	0.00	0.00
43	43	-0.793	-1.342	-1.038	2.000	15555	7199	-76	50	-173001	3253	930	N	-1319	150.02	135.02	1221	0	0.12	Not Reqd	0.00	0.06	0.41	1068	2060	1084	39.56	0.00	0.00
43	44	-0.664	-1.426	-1.013	2.000	16176	7630	-75	54	-199501	3491	993	N	-1319	156.38	140.75	1243	50	0.12	Not Reqd	0.00	0.06	0.41	1111	2118	1164	39.15	0.00	0.00
44	44	-0.663	-1.426	-1.013	2.000	16176	7630	-75	54	-199501	3491	993	N	-1383	156.38	140.75	1265	28	0.12	Not Reqd	0.00	0.06	0.41	1111	2139	1164	40.09	0.00	0.00
44	45	-0.538	-1.498	-0.989	2.000	16843	8109	-74	57	-227835	3736	1055	N	-1382	163.14	146.83	1258	126	0.12	Not Reqd	0.00	0.06	0.41	1150	2167	1245	38.22	0.00	0.00
45	45	-0.536	-1.498	-0.987	2.000	16843	8109	-76	60	-227835	3736	1081	N	-999	163.14	146.83	1123	261	0.19	Not Reqd	0.00	0.09	0.41	1149	2045	1245	32.70	0.00	0.00
45	46	-0.407	-1.631	-0.982	2.000	17619	8650	-75	63	-258030	3986	1142	N	-998	170.46	153.42	1126	350	0.24	Not Reqd	0.00	0.12	0.41	1193				0.00	0.00
46	46	-0.402	-1.627	-0.977	2.000	17619	8650	-79	72	-258030	3983	1177	N	0	170.46	153.42	778	698	0.49	Not Reqd	0.00	0.24	0.41	1189				0.00	0.00
46	47	-0.339	-1.706	-0.981	2.000	17619	8844	-79	73	-268093	4064	1196	N	0	170.46	153.42	765	740	0.52	Not Reqd	0.00	0.26	0.41	1186				0.00	0.00
47	47	-0.501	-1.514	-0.977	2.000	17619	-39962	-932	-2776	-294476	-5002	-4046	N	0	170.46	153.42	724	1129	0.79	Not Reqd	0.00	0.40	0.41	1176				0.00	0.00
47	48	-0.562	-1.437	-0.973	2.000	17619	-38275	-923	-2748	-282716	-4912	-4000	N	0	170.49	153.45	737	1082	0.76	Not Reqd	0.00	0.38	0.74	2123				0.00	0.00
48	48	-0.566	-1.441	-0.977	2.000	17619	-38275	-918	-2749	-282716	-4916	-3980	N	774	170.49	153.45	1006	815	0.57	Not Reqd	0.00	0.28	0.74	2128				0.00	0.00
48	49	-0.702	-1.287	-0.976	2.000	17041	-33457	-889	-2666	-248801	-4647	-3840	N	774	165.11	148.60	955	766	0.56	Not Reqd	0.00	0.28	0.74	2048	2346	1549	3.69	0.00	0.00
49	49	-0.489	-1.321	-0.879	2.000	17041	-33457	-885	-2663	-248802	-4647	-3810	N	1160	165.11	148.60	1089	632	0.46	Not Reqd	0.00	0.23	0.74	2050	2519	1549	4.29	0.00	0.00
49	50	-0.730	-1.144	-0.916	2.000	15844	-24791	-829	-2498	-188786	-4141	-3535	N	1157	152.86	137.57	1037	497	0.39	Not Reqd	0.00	0.19	0.74	1899	2370	1380	4.58	0.00	0.00
50	50	-0.502	-1.175	-0.806	2.000	15844	-24791	-830	-2498	-188786	-4141	-3534	N	921	152.86	137.57	955	579	0.45	Not Reqd	0.00	0.23	0.74	1897	2264	1380	4.19	0.00	0.00
50	51	-0.756	-0.951	-0.840	2.000	14769	-16982	-774	-2328	-135998	-3660	-3255	N	918	141.42	127.28	906	449	0.38	Not Reqd	0.00	0.19	0.74	1755	2124	1220	4.51	0.00	0.00
51	51	-0.514	-0.990	-0.719	2.000	14769	-16982	-774	-2328	-135998	-3660	-3255	N	697	141.42	127.28	830	526	0.45	Not Reqd	0.00	0.22	0.74	1754	2025	1220	4.12	0.00	0.00
51	52	-0.783	-0.702	-0.750	2.000	13862	-10018	-718	-2151	-90070	-3202	-2970	N	695	131.81	118.63	799	387	0.35	Not Reqd	0.00	0.18	0.74	1640	1908	1067	4.51	0.00	0.00
52	52	-0.572	-0.733	-0.637	2.000	13862	-10018	-718	-2151	-90070	-3202	-2969	N	544	131.81	118.63	747	439	0.40	Not Reqd	0.00	0.20	0.74	1639	1840	1067	4.23	0.00	0.00
52	53	-0.778	-0.973	-0.852	2.000	13076	-3892	-661	-1967	-50673	-2765	-2676	N	517	97.74	95.45	681	343	0.38	Not Reqd	0.00	0.19	0.25	447	1015	922	1.43	0.00	0.00
53	53	-0.555	-1.010	-0.728	2.000	13076	-3892	-662	-1967	-50674	-2765	-2676	N	377	97.74	95.45	632	392	0.43	Not Reqd	0.00	0.22	0.25	447	971	922	1.23	0.00	0.00
53	54	-0.741	-1.348	-0.953	2.000	12202	1391	-604	-1778	-17486	-2349	-2377	N	390	67.70	88.74	644	226	0.27	Not Reqd	0.00	0.13	0.25	421	958	783	1.87	0.00	0.00
54	54	-0.502	-1.390	-0.813	2.000	12202	1392	-610	-1779	-17485	-2347	-2389	N	-69	67.70	88.74	537	332	0.39	Not Reqd	0.00	0.20	0.25	421	862	782	1.39	0.00	0.00
54	55	-0.733	-1.322	-0.938	2.000	11781	5885	-553	-1590	9684	-1945	-2090	N	-64	66.41	85.86	518	202	0.25	Not Reqd	0.00	0.12	0.21	339	772	648	1.67	0.00	0.00
55	55	-0.591	-1.339	-0.852	2.000	11781	5885	-553	-1590	9684	-1945	-2091	N	-127	66.41	85.86	539	181	0.22	Not Reqd	0.00	0.11	0.21	339	791	648	1.77	0.00	0.00
55	56	-0.849	-0.892	-0.864	2.000	11282	9506	-497	-1403	31032	-1550	-1794	N	-61	70.40	82.44	489	85	0.12	Not Reqd	0.00	0.06	0.21	325	733	517	2.30	0.00	0.00
56	56	-0.698	-0.917	-0.775	2.000	11282	9506	-497	-1403	31032	-1550	-1795	N	-119	70.40	82.44	509	65	0.12	Not Reqd	0.00	0.06	0.21	325	751	517	2.41	0.00	0.00
56	57	-0.903	-0.560	-0.784	2.000	10920	12256	-442	-1220	46620	-1160	-1503	N	-53	76.01	79.97	418	12	0.12	Not Reqd	0.00	0.06	0.21	309	655	387	2.82	0.00	0.00
57	57	-0.753	-0.577	-0.692	2.000	10920	12256	-443	-1220	46620	-1160	-1503	N	-91	76.01	79.97	431	0	0.12	Not Reqd	0.00	0.06	0.21	309	666	387	2.90	0.00	0.00
57	58	-0.887	-0.343	-0.698	2.000	10696	14177	-390	-1043	56533	-775	-1217	N	-24	85.00	78.44	365	0	0.12	Not Reqd	0.00	0.06	0.21	299	597	258	3.61	0.00	0.00
58	58	-0.725	-0.375	-0.604	2.000	10696	14177	-390	-1043	56533	-774	-1218	N	-60	85.00	78.44	377	0	0.12	Not Reqd	0.00	0.06	0.21	299	608	258	3.69	0.00	0.00
58	59	-0.779	-0.281	-0.607	2.000	10598	15310	-340	-876	60837	-393	-941	N	7	98.26	88.43	389	0	0.12	Not Reqd	0.00	0.06	0.21	334	651	131	5.59	0.00	0.00
59	59	-0.624	-0.231	-0.487	2.000	10598	15310	-340	-876	60837	-393	-941	N	-13	98.26	88.43	391	0	0.12	Not Reqd	0.00	0.06	0.21	334	652	131	5.60	0.00	0.00
59	60	-0.622	-0.234	-0.487	2.000	10598	15513	-322	-814	60977	-246	-837	N	13	83.75	77.76	335	0	0.12	Not Reqd	0.00	0.06	0.21	293	565	82	5.51	0.00	0.00
60	60	-0.787	-0.258	-0.604	2.000	10598	15513	-322	-814	60977	-246	-837	N	-7	83.75	77.76	333	0	0.12	Not Reqd	0.00	0.06	0.21	293	563	82	5.49	0.00	0.00
60	61	-0.724	-0.365	-0.600	2.000	10696	15674	-276	-663	57638	130	-577	N	60	73.91	78.44	381	0	0.12	Not Reqd	0.00	0.06	0.21	299	612	43	7.18	0.00	0.00
61	61	-0.890	-0.336	-0.698	2.000	10696	15674	-277	-662	57638	131	-577	N	24	73.91	78.44	369	0	0.12	Not Reqd	0.00	0.06	0.21	299	601	44	7.04	0.00	0.00
61	62	-0.746	-0.583	-0.689	2.000	10920	15276	-235	-525	48919	505	-330	N	90	67.51	79.97	434	0	0.12	Not Reqd	0.00	0.06	0.21	310	670	168	7.40	0.00	0.00
62	62	-0.901	-0.564	-0.784	2.000	10920	15276	-236	-525	48919	505	-330	N	52	67.51	79.97	421	0	0.12	Not Reqd	0.00	0.06	0.21	310	658	168	7.23	0.00	0.00
62	63	-0.688	-0.931	-0.772	2.000	11282	14443	-198	-403	34920	877	-99	N	118	63.29	82.44	510	0	0.12	Not Reqd	0.00	0.06	0.21	325	752	292	7.95	0.00	0.00
63	63	-0.838	-0.913	-0.864	2.000	11282	14443	-199	-402	34920	878	-99	N	59	63.29	82.44	490	0	0.12	Not Reqd	0.00	0.06	0.21	325	734	293	7.66	0.00	0.00
63	64	-0.572	-1.368	-0.849	2.000	11781	13302	-166	-297	15722	1248	115	N	124	57.24	85.86	538	0	0.12	Not Reqd	0.00	0.06	0.21	339	790	416	7.76	0.00	0.00

PROJECT: **Cline Avenue Mainline Seg 3 EB** CALCS BY: TSP DATE: 01/21/09

DESCRIPTION: **Ultimate Shear Check** CHECKED BY: DATE:

Web Reinforcement Requirements **Load combination: Strength 1**

Material Properties:

Concrete

f'c = ***5.0*** ksi

ϕ_v = ***0.90***

P-T Strands

f_{pu} = ***270*** ksi

f_{pe} = ***176*** ksi

Reinforcement

fy = ***60.0*** ksi

Box Girder Properties:

Web Thickness

b_v = ***14.00*** in

Effective Width of Shear Flow Path

be= ***5.50*** in

Notes:

1. All shears are vertical unless noted otherwise.
2. Web thickness is horizontal, box depth is vertical.

Calc RF

		Permanent Loads + Minimum LL Shear @ t=00															(kip)	(kip)	(in^2/ft)	(in^2/ft)	(in^2/ft)	(in^2/ft)	(in^2/ft)	(kip)	(kip)	(kip)		Total Long.	Equivalent
		(ksi)	(ksi)	(ksi)		(k-ft)	Ultimate	Ultimate	Ultimate				Investigate	Shear from	(in)	(in)	Concrete	Required	Required	Additional	Additional	Total		Provided	Nominal			Mild Steel	PT Steel Req'd
		Perm Load	Perm Load	Dead Load	Stress	Torsional	Corresp.	Max	Corresp.	TOTAL	TOTAL	TOTAL	Torsional	Primary	Depth	Effective	Shear	Steel	Steel	Steel	Steel	Steel	Steel	Steel	Shear	Ultimate	Shear	Required	for Torsion
		Stress	Stress	Stress	Variable	Cracking	Live Load	Live Load	Live Load	Ultimate	Ultimate	Ultimate	Effects?	Post Tensioning	to Tensile	Shear	Resistance	Resistance	Area	Required	Req'd from	Required	Provided	Resistance	Resistance	Shear	Rating	for Torsion	(based on fpe)
Member	Node	(top fiber)	(bott. fiber)	(neutr. axis)	'K'	Moment	Moment	Shear	Torsion	Moment	Shear	Torsion	(Y/N)	Effect	Reinforcement	Depth	per web	per web	per web	for Torsion	Transverse	per leg	per leg	Resistance	per web	per web	Factor, RF	(Al)	(Al)
Number	Number			(fpc)		(Tcr)				(Mu)	(Vu)	(Tu)		(Vp)	d_v	d_v	(Vc)	(Vs-req'd)	(Av)	(At)	A_v (trans)	(As_req'd)	As_prov'd)	(Vs_prov)	(ϕVn)	(Vu)		in^2	in^2
64	64	-0.815	-1.329	-0.995	2.000	11781	13302	-166	-297	15722	1249	115	N	46	57.24	85.86	513	0	0.12	Not Reqd	0.00	0.06	0.21	339	767	416	7.33	0.00	0.00
64	65	-0.577	-1.419	-0.872	2.000	12412	11950	-138	-213	-8634	1622	309	N	51	79.17	90.18	539	61	0.12	Not Reqd	0.00	0.06	0.25	428	870	541	8.18	0.00	0.00
65	65	-0.813	-1.379	-1.011	2.000	12412	11950	-139	-209	-8634	1631	303	N	-582	79.17	90.18	716	0	0.12	Not Reqd	0.00	0.06	0.25	428	1030	544	11.46	0.00	0.00
65	66	-0.630	-1.000	-0.775	2.000	13030	10479	-114	-143	-38401	2017	478	N	-545	103.10	95.45	734	13	0.12	Not Reqd	0.00	0.06	0.25	453	1068	672	11.40	0.00	0.00
66	66	-0.851	-0.963	-0.895	2.000	13030	10479	-114	-143	-38401	2017	479	N	-685	103.10	95.45	781	0	0.12	Not Reqd	0.00	0.06	0.25	453	1110	672	12.50	0.00	0.00
66	67	-0.639	-0.719	-0.673	2.000	13776	6854	-104	-20	-75769	2416	712	N	-692	131.42	118.28	843	52	0.12	Not Reqd	0.00	0.06	0.74	1656	1901	805	32.47	0.00	0.00
67	67	-0.845	-0.690	-0.779	2.000	13776	6854	-104	-20	-75769	2416	714	N	-846	131.42	118.28	896	0	0.12	Not Reqd	0.00	0.06	0.74	1657	1971	805	34.51	0.00	0.00
67	68	-0.575	-0.930	-0.736	2.000	14657	7688	-100	-32	-114540	2836	811	N	-847	141.39	127.25	933	117	0.12	Not Reqd	0.00	0.06	0.74	1778	2092	945	35.36	0.00	0.00
68	68	-0.811	-0.893	-0.848	2.000	14657	7688	-100	-32	-114540	2837	813	N	-1078	141.39	127.25	1014	37	0.12	Not Reqd	0.00	0.06	0.74	1780	2196	946	38.58	0.00	0.00
68	69	-0.552	-1.077	-0.803	2.000	15673	8656	-97	-40	-159448	3286	914	N	-1078	152.35	137.11	1064	153	0.12	Not Reqd	0.00	0.06	0.74	1918	2329	1095	39.16	0.00	0.00
69	69	-0.771	-1.048	-0.903	2.000	15673	8655	-97	-93	-159440	3287	1890	N	-1355	152.35	137.11	1160	57	0.12	Not Reqd	0.00	0.06	0.74	1919	2453	1096	43.18	0.00	0.00
69	70	-0.525	-1.185	-0.854	2.000	16967	9789	-95	-97	-210912	3766	1995	N	-1355	164.85	148.37	1217	177	0.13	Not Reqd	0.00	0.06	0.74	2076	2604	1255	43.57	0.00	0.00
70	70	-0.731	-1.153	-0.941	2.000	16967	9762	-97	-103	-210938	3759	2095	N	-891	164.85	148.37	1056	337	0.24	Not Reqd	0.00	0.12	0.74	2073	2396	1253	36.25	0.00	0.00
70	71	-0.593	-1.288	-0.940	2.000	17628	10441	-97	-105	-240162	4016	2150	N	-891	170.38	153.34	1115	373	0.26	Not Reqd	0.00	0.13	0.74	2157				0.00	0.00
71	71	-0.589	-1.285	-0.936	2.000	17628	10461	-100	-112	-240141	4004	2156	N	-40	170.38	153.34	818	665	0.46	Not Reqd	0.00	0.23	0.74	2151				0.00	0.00
71	72	-0.527	-1.353	-0.939	2.000	17654	10707	-100	-113	-250264	4091	2174	N	-40	168.15	151.34	791	724	0.51	Not Reqd	0.00	0.25	0.74	2116				0.00	0.00
72	72	-0.215	-1.612	-0.912	2.000	17654	-25273	-763	1392	-176602	-3012	2005	N	27	168.15	151.34	885	231	0.16	Not Reqd	0.00	0.08	0.74	2154				0.00	0.00
72	73	-0.278	-1.534	-0.894	2.000	8147	-23546	-756	1376	-169310	-2959	1972	N	27	169.75	152.78	898	746	0.51	Not Reqd	0.00	0.26	0.62	1812				0.00	0.00
73	73	-0.270	-1.537	-0.891	2.000	8147	-22895	-724	1312	-168843	-2951	3001	Y	551	169.75	152.78	1160	479	0.33	0.127	0.00	0.23	0.62	1812				7.54	2.58
73	74	-0.396	-1.407	-0.891	2.000	7784	-17809	-704	1269	-146926	-2788	2903	Y	550	162.43	146.19	967	582	0.43	0.129	0.00	0.28	0.62	1681	2213	1486	2.86	7.48	2.56
74	74	-0.401	-1.409	-0.894	2.000	7784	-18787	-626	1968	-147758	-2732	3956	Y	783	162.43	146.19	1086	432	0.32	0.176	0.00	0.25	0.62	1682	2318	1491	3.20	10.19	3.48
74	75	-0.527	-1.348	-0.920	2.000	7484	-15209	-603	2091	-128262	-2571	4025	Y	782	155.39	139.85	1089	339	0.26	0.186	0.00	0.22	0.62	1622	2232	1412	3.23	10.59	3.62
75	75	-0.536	-1.348	-0.924	2.000	7484	-14908	-565	2149	-127764	-2554	3889	Y	753	155.39	139.85	1075	343	0.26	0.180	0.00	0.22	0.62	1623	2219	1400	3.34	10.23	3.50
75	76	-0.668	-1.275	-0.951	2.000	7205	-11793	-541	2302	-109638	-2395	3988	Y	752	148.79	133.91	1084	246	0.19	0.191	0.00	0.19	0.62	1567	2139	1323	3.38	10.72	3.66
76	76	-0.671	-1.275	-0.952	2.000	7205	-12228	-522	2346	-109991	-2390	3795	Y	729	148.79	133.91	1072	256	0.20	0.182	0.00	0.19	0.62	1567	2128	1315	3.43	10.20	3.49
76	77	-0.808	-1.188	-0.980	2.000	6946	-8838	-497	2380	-92508	-2236	3774	Y	728	142.57	128.32	1089	154	0.13	0.188	0.00	0.16	0.62	1516	2053	1237	3.52	10.36	3.54
77	77	-0.811	-1.188	-0.981	2.000	6946	-9843	-489	2406	-93459	-2237	3515	Y	708	142.57	128.32	1075	168	0.14	0.175	0.00	0.16	0.62	1515	2043	1230	3.54	9.65	3.30
77	78	-0.951	-1.085	-1.010	2.000	6704	-6719	-465	2438	-77165	-2088	3494	Y	707	136.74	123.07	1066	94	0.12	0.180	0.00	0.15	0.62	1460	1973	1155	3.64	9.79	3.35
78	78	-0.953	-1.085	-1.011	2.000	6704	-7689	-465	2378	-78090	-2090	3155	Y	685	136.74	123.07	1055	106	0.12	0.163	0.00	0.14	0.62	1460	1963	1145	3.66	8.84	3.02
78	79	-0.702	-1.034	-0.841	2.000	6484	-4770	-440	2411	-62941	-1946	3134	Y	518	131.57	118.41	888	193	0.17	0.167	0.00	0.17	0.62	1387	1825	1072	3.54	8.95	3.06
79	79	-0.702	-1.034	-0.842	2.000	6484	-5710	-445	2290	-63853	-1952	2885	Y	504	131.57	118.41	878	206	0.18	0.154	0.00	0.17	0.62	1386	1819	1067	3.55	8.24	2.82
79	80	-0.850	-0.884	-0.864	2.000	6283	-2955	-421	2325	-49773	-1814	2866	Y	504	126.59	113.93	903	104	0.12	0.158	0.00	0.14	0.62	1349	1758	997	3.68	8.34	2.85
80	80	-0.852	-0.883	-0.864	2.000	6283	-3879	-430	2148	-50660	-1822	2476	Y	499	126.59	113.93	897	115	0.12	0.136	0.00	0.13	0.62	1348	1756	989	3.71	7.21	2.46
80	81	-0.963	-1.310	-1.096	2.000	6103	-1252	-406	2183	-37590	-1687	2457	Y	889	106.03	95.43	997	0	0.12	0.139	0.00	0.13	0.31	566	1407	921	2.79	7.28	2.49
81	81	-0.965	-1.310	-1.097	2.000	6103	-2167	-419	1954	-38464	-1697	2145	Y	880	106.03	95.43	993	0	0.12	0.121	0.00	0.12	0.31	566	1403	916	2.79	6.35	2.17
81	82	-1.058	-1.309	-1.148	2.000	5941	364	-395	1990	-26361	-1568	2126	Y	584	99.67	92.12	825	46	0.12	0.124	0.00	0.12	0.31	546	1234	851	2.47	6.40	2.19
82	82	-1.077	-1.306	-1.159	2.000	5941	-475	-407	1805	-26848	-1582	1475	N	203	99.67	92.12	635	244	0.28	Not Reqd	0.00	0.14	0.31	546	1063	791	2.34	0.00	0.00
82	83	-0.804	-1.109	-0.913	2.000	5756	1952	-383	1845	-15647	-1456	1461	N	73	89.75	89.42	554	255	0.30	Not Reqd	0.00	0.15	0.31	530	976	728	2.30	0.00	0.00
83	83	-0.824	-1.108	-0.925	2.000	5756	1081	-387	1700	-16240	-1457	1434	N	55	89.75	89.42	545	264	0.31	Not Reqd	0.00	0.15	0.31	530	968	729	2.24	0.00	0.00
83	84	-0.961	-1.402	-1.119	2.000	5587	3352	-364	1744	-6020	-1330	1424	N	428	76.16	86.94	718	21	0.12	Not Reqd	0.00	0.06	0.21	344	955	665	2.60	0.00	0.00
84	84	-0.962	-1.402	-1.119	2.000	5587	2502	-369	1588	-6846	-1333	1364	N	410	76.16	86.94	708	32	0.12	Not Reqd	0.00	0.06	0.21	344	947	666	2.52	0.00	0.00
84	85	-1.057	-1.245	-1.124	2.000	5440	4619	-345	1634	2401	-1208	1356	N	192	46.76	84.78	587	84	0.12	Not Reqd	0.00	0.06	0.21	335	830	604	2.31	0.00	0.00
85	85	-1.057	-1.245	-1.124	2.000	5440	3789	-351	1463	1581	-1216	1160	N	171	46.76	84.78	577	99	0.12	Not Reqd	0.00	0.06	0.21	335	820	608	2.21	0.00	0.00
85	86	-1.204	-0.976	-1.123	2.000	5313	5759	-327	1511	9908	-1092	1155	N	16	46.43	82.94	488	118	0.15	Not Reqd	0.00	0.07	0.29	465	858	546	2.91	0.00	0.00
86	86	-1.204	-0.975	-1.123	2.000	5313	4953	-334	1328	9117	-1098	774	N	-2	46.43	82.94	481	129	0.16	Not Reqd	0.00	0.08	0.29	465	852	549	2.81	0.00	0.00
86	87	-0.963	-0.818	-0.912	2.000	5206	6781	-311	1379	16521	-975	771	N	-11	57.03	81.36	477	65	0.12	Not Reqd	0.00	0.06	0.29	457	840	488	3.27	0.00	0.00
87	87	-0.963	-0.817	-0.911	2.000	5206	5986	-317	1188	15733	-978	763	N	-25	57.03	81.36	483	60	0.12	Not Reqd	0.00	0.06	0.29	457	846	489	3.25	0.00	0.00
87	88	-1.005	-1.251	-1.092	2.000	5116	7674	-294	1241	22183	-854	763	N	230	64.47	80.06	578	0	0.12	Not Reqd	0.00	0.06	0.29	449	925	427	4.38	0.00	0.00
88	88	-1.004	-1.251	-1.091	2.000	5116	6884	-301	1044	21391	-860	966	N	211	64.47	80.06	569	0	0.12	Not Reqd	0.00	0.06	0.29	449	916	430	4.24	0.00	0.00
88	89	-1.093	-1.098	-1.095	2.000	5018	8437	-278	1101	26923	-738	968	N	-17	64.46	78.62	464	0	0.12	Not Reqd	0.00	0.06	0.29	441	814	369	4.20	0.00	0.00
89	89	-1.093	-1.098	-1.095	2.000	5018	7653	-284	901	26139	-745	941	N	-33	64.46	78.62	472	0	0.12	Not Reqd	0.00	0.06	0.29	441	821	372	4.16	0.00	0.00
89	90	-1.182	-0.927	-1.092	2.000	5000	9071	-262	960	30766	-624	946	N	-1	64.22	78.35	454	0	0.12	Not Reqd	0.00	0.06	0.29	440	804	312	4.76	0.00	0.00
90	90	-1.180	-0.927	-1.091	2.000	5000	8371	-268	758	30047	-629	653	N	-17	64.22	78.35	462	0	0.12	Not Reqd	0.00	0.06	0.29	440	812	315	4.71	0.00	0.00
90	91	-1.242	-0.798	-1.086	2.000	4969	9654	-246	822	33761	-508	662	N	20	64.05	77.90	461	0	0.12	Not Reqd	0.00	0.06	0.29	437	808	254	5.51	0.00	0.00
91	91	-1.219	-0.798	-1.071	2.000	4969	8878	-251	633	32736	-510	385	N	1	64.05	77.90	452	0	0.12	Not Reqd	0.00	0.06	0.29	437	800	255	5.34	0.00	0.00
91	92	-0.853	-0.820	-0.841	2.000	4960	10021	-229	701	35517	-390	398	N	-14	82.00	77.76	408	0	0.12	Not Reqd	0.00	0.06	0.29	429	753	195	5.87	0.00	0.00
92	92	-0.835	-0.819	-0.829	2.000	4960	9423	-240	500	34766	-401	357	N	-20	82.00	77.76	412	0	0.12	Not Reqd	0.00	0.06	0.29	429	758	200	5.64	0.00	0.00
92	93	-0.851	-0.780	-0.826	2.000	4960	10086	-228	538	36044	-328	362	N	-43	81.79	77.76	438	0	0.12	Not Reqd	0.00	0.06	0.29	431	782	164	6.43	0.00	0.00
93	93	-0.847	-0.780	-0.824	2.000	4960	9365	-228	398	35286	-327	385	N	-49	81.79	77.76	443	0	0.12	Not Reqd	0.00	0.06	0.29	432	788	163	6.49	0.00	0.00
93	94	-0.866	-0.735	-0.820	2.000	4969	10318	-206	472	36626	-206	405	N	-90	81.08	77.90	464	0	0.12	Not Reqd	0.00	0.06	0.29	432	807	103	7.82	0.00	0.00
94	94	-0.865	-0.735	-0.820	2.000	4969	9015	-213	301	35313	-212	395	N	-104	81.08	77.90	475	0	0.12	Not Reqd	0.00	0.06	0.29	433	818	106	7.68	0.00	0.00
94	95	-0.876	-0.706	-0.816	2.000	5000	9691	-192	315	35596	-92	355	N	-149	79.84	78.35	501	0	0.12	Not Reqd	0.00	0.06	0.29	436	843	46	9.30	0.00	0.00
95	95	-0.874	-0.706	-0.815	2.000	5000	9071	-199	190	34957	-98	351	N	-161	79.84	78.35	509	0	0.12	Not Reqd	0.00	0.06	0.29	436	851	49	9.04	0.00	0.00

PROJECT: **Cline Avenue Mainline Seg 3 EB** CALCS BY: TSP DATE: 01/21/09

DESCRIPTION: **Ultimate Shear Check** CHECKED BY: DATE:

Web Reinforcement Requirements **Load combination: Strength 1**

Material Properties:

Concrete

$f'c$ = ***5.0*** ksi

ϕ_v = ***0.90***

P-T Strands

f_{pu} = ***270*** ksi

f_{pe} = ***176*** ksi

Reinforcement

fy = ***60.0*** ksi

Box Girder Properties:

Web Thickness

b_v = ***14.00*** in

Effective Width of Shear Flow Path

be= ***5.50*** in

Notes:

1. All shears are vertical unless noted otherwise.
2. Web thickness is horizontal, box depth is vertical.

Calc RF

Member Number	Node Number	(ksi) Perm Load Stress (top fiber)	(ksi) Perm Load Stress (bott. fiber)	(ksi) Dead Load Stress (neutr. axis) (fpc)	Stress Variable 'K'	(k-ft) Torsional Cracking Moment (Tcr)	Ultimate Corresp. Live Load Moment	Ultimate Max Live Load Shear	Ultimate Corresp. Live Load Torsion	TOTAL Ultimate Moment (Mu)	TOTAL Ultimate Shear (Vu)	TOTAL Ultimate Torsion (Tu)	Investigate Torsional Effects? (Y/N)	Shear from Primary Post Tensioning Effect (Vp)	(in) Depth to Tensile Reinforcement d_e	(in) Effective Shear Depth d_v	(kip) Concrete Shear Resistance per web (Vc)	(kip) Required Steel Resistance per web (Vs-req'd)	(in^2/ft) Required Steel Area per web (Av)	(in^2/ft) Additional Steel Required for Torsion (At)	(in^2/ft) Additional Steel Req'd from Transverse A_v (trans)	(in^2/ft) Total Steel Required per leg (As_req'd)	(in^2/ft) Steel Provided per leg As_prov'd)	(kip) Provided Steel Resistance per web (Vs_prov)	(kip) Nominal Shear Resistance per web (ϕVn)	(kip) Ultimate Shear per web (Vu)	Shear Rating Factor, RF	Total Long. Mild Steel Required for Torsion (Al) in^2	Equivalent PT Steel Req'd for Torsion (based on fpe) (Al) in^2
		Permanent Loads + Minimum LL Shear @ t=00																											
95	96	-0.876	-0.695	-0.813	2.000	5049	8931	-179	190	33639	21	296	N	-207	78.04	79.07	538	0	0.12	Not Reqd	0.00	0.06	0.29	440	881	11	10.70	0.00	0.00
96	96	-0.863	-0.695	-0.804	2.000	5049	9021	-186	86	33594	15	404	N	-219	78.04	79.07	543	0	0.12	Not Reqd	0.00	0.06	0.29	440	885	7	10.43	0.00	0.00
96	97	-0.857	-0.704	-0.803	2.000	5116	8791	-167	101	31406	134	364	N	-247	92.25	83.03	542	0	0.12	Not Reqd	0.00	0.06	0.29	456	899	67	10.95	0.00	0.00
97	97	-0.613	-0.684	-0.638	2.000	5116	8211	-173	4	30968	127	797	N	-251	92.25	83.03	546	0	0.12	Not Reqd	0.00	0.06	0.29	457	902	63	10.69	0.00	0.00
97	98	-0.569	-0.742	-0.630	2.000	5206	8560	-155	18	28584	245	758	N	-260	77.47	81.36	584	0	0.12	Not Reqd	0.00	0.06	0.29	454	934	123	11.45	0.00	0.00
98	98	-0.786	-0.620	-0.728	2.000	5206	7981	-161	-77	28010	240	-365	N	-315	77.47	81.36	612	0	0.12	Not Reqd	0.00	0.06	0.29	454	960	120	11.42	0.00	0.00
98	99	-0.756	-0.670	-0.726	2.000	5313	8244	-144	-58	24751	358	-400	N	-335	74.15	82.94	646	0	0.12	Not Reqd	0.00	0.06	0.29	465	1000	179	12.41	0.00	0.00
99	99	-0.754	-0.670	-0.725	2.000	5313	7424	-150	-165	23917	354	-570	N	-347	74.15	82.94	654	0	0.12	Not Reqd	0.00	0.06	0.29	465	1007	177	12.08	0.00	0.00
99	100	-0.715	-0.730	-0.720	2.000	5440	7609	-133	-141	19769	473	-601	N	-391	70.40	84.78	687	0	0.12	Not Reqd	0.00	0.06	0.29	476	1046	237	13.17	0.00	0.00
100	100	-0.714	-0.730	-0.719	2.000	5440	7018	-140	-248	19169	470	-483	N	-405	70.40	84.78	693	0	0.12	Not Reqd	0.00	0.06	0.29	476	1052	235	12.71	0.00	0.00
100	101	-0.671	-0.801	-0.716	2.000	5587	7138	-123	-218	14131	589	-507	N	-445	66.15	86.94	726	0	0.12	Not Reqd	0.00	0.06	0.29	488	1092	295	13.95	0.00	0.00
101	101	-0.670	-0.801	-0.716	2.000	5587	5013	-132	-1075	12003	582	-952	N	-618	66.15	86.94	813	0	0.12	Not Reqd	0.00	0.06	0.29	488	1170	291	14.33	0.00	0.00
101	102	-0.637	-0.802	-0.698	2.000	5721	6601	-114	-302	7606	706	-233	N	-655	61.45	89.42	845	0	0.12	Not Reqd	0.00	0.06	0.29	502	1212	353	16.09	0.00	0.00
102	102	-0.637	-0.802	-0.698	2.000	5721	5699	-126	-227	6701	698	20	N	-663	61.45	89.42	849	0	0.12	Not Reqd	0.00	0.06	0.29	502	1216	349	14.76	0.00	0.00
102	103	-0.599	-0.808	-0.679	2.000	5870	5467	-105	-188	-390	828	5	N	-695	71.66	92.12	881	0	0.12	Not Reqd	0.00	0.06	0.53	930	1551	414	22.65	0.00	0.00
103	103	-0.599	-0.808	-0.679	2.000	5870	4419	-119	-1048	-1437	819	-743	N	-703	71.66	92.12	885	0	0.12	Not Reqd	0.00	0.06	0.53	930	1555	409	20.22	0.00	0.00
103	104	-0.555	-0.819	-0.661	2.000	6041	5051	-97	-255	-8573	954	-4	N	-741	81.42	95.13	921	0	0.12	Not Reqd	0.00	0.06	0.53	961	1612	477	24.30	0.00	0.00
104	104	-0.555	-0.819	-0.661	2.000	6041	4119	-113	-1029	-9501	943	-705	N	-752	81.42	95.13	927	0	0.12	Not Reqd	0.00	0.06	0.53	961	1617	471	21.29	0.00	0.00
104	105	-0.508	-0.832	-0.642	2.000	6230	4290	-89	-248	-18034	1085	21	N	-802	92.13	98.42	962	0	0.12	Not Reqd	0.00	0.06	0.53	992	1684	542	26.79	0.00	0.00
105	105	-0.509	-0.832	-0.643	2.000	6230	3848	-107	-1001	-18467	1071	-677	N	-811	92.13	98.42	966	0	0.12	Not Reqd	0.00	0.06	0.53	992	1688	535	22.64	0.00	0.00
105	106	-0.460	-0.845	-0.624	2.000	6441	3560	-80	-597	-28424	1220	-328	N	-874	103.93	102.02	980	0	0.12	Not Reqd	0.00	0.06	0.53	1018	1765	610	29.99	0.00	0.00
106	106	-0.461	-0.845	-0.625	2.000	6441	3494	-100	-977	-28477	1202	-642	N	-888	103.93	102.02	988	0	0.12	Not Reqd	0.00	0.06	0.53	1018	1771	601	24.48	0.00	0.00
106	107	-0.413	-0.854	-0.607	2.000	6670	3172	-74	-582	-39455	1354	-302	N	-953	116.99	105.89	1009	0	0.12	Not Reqd	0.00	0.06	0.53	1047	1851	677	32.65	0.00	0.00
107	107	-0.414	-0.854	-0.607	2.000	6670	3003	-93	-954	-39615	1335	-622	N	-968	116.99	105.89	1017	0	0.12	Not Reqd	0.00	0.06	0.53	1047	1858	667	26.70	0.00	0.00
107	108	-0.362	-0.869	-0.590	2.000	6921	1297	-70	-638	-52979	1488	-361	N	-945	130.80	117.72	1037	0	0.12	Not Reqd	0.00	0.06	0.53	1155	1973	744	35.88	0.00	0.00
108	108	-0.362	-0.869	-0.589	2.000	6921	-1051	-94	-1298	-55343	1459	-1048	N	-959	130.80	117.72	1040	0	0.12	Not Reqd	0.00	0.06	0.53	1154	1975	730	27.45	0.00	0.00
108	109	-0.293	-0.904	-0.573	2.000	7190	-855	-80	-1021	-67807	1608	-826	N	-814	143.82	129.44	1001	0	0.12	Not Reqd	0.00	0.06	0.53	1261	2035	804	31.65	0.00	0.00
109	109	-0.293	-0.903	-0.573	2.000	7190	-945	-111	-1510	-67897	1568	-1833	N	-712	143.82	129.44	948	0	0.12	Not Reqd	0.00	0.06	0.53	1260	1987	784	22.69	0.00	0.00
109	110	-0.180	-1.022	-0.567	2.000	7513	-610	-98	-1231	-81213	1720	-1608	N	-381	154.24	138.82	800	155	0.12	Not Reqd	0.00	0.06	0.53	1342				0.00	0.00
110	110	-0.177	-1.019	-0.564	2.000	7513	-661	-119	-1575	-81307	1687	-2760	Y	-137	154.24	138.82	673	264	0.21	0.127	0.00	0.17	0.53	1340				-7.25	-2.48
110	111	-0.116	-1.092	-0.564	2.000	7513	-512	-115	-1485	-85730	1735	-2687	Y	6	154.54	139.08	599	366	0.29	0.124	0.00	0.21	0.53	1338				-7.06	-2.41
111	111	-0.076	-1.153	-0.571	2.000	7513	-8945	-483	870	-89814	-2788	6343	Y	6	154.54	139.08	573	976	0.78	0.292	0.00	0.53	0.53	1328				16.65	5.69
111	112	-0.141	-1.062	-0.564	2.000	7513	-8220	-473	877	-83382	-2733	6332	Y	110	154.38	138.94	636	882	0.70	0.291	0.00	0.50	0.29	740				16.63	5.68
112	112	-0.144	-1.066	-0.568	2.000	7513	-8269	-454	1053	-83455	-2728	5721	Y	348	154.38	138.94	760	755	0.60	0.263	0.00	0.43	0.29	741				15.02	5.14
112	113	-0.284	-0.882	-0.558	2.000	7042	-6346	-423	1092	-64325	-2558	5704	Y	648	143.12	128.80	898	523	0.44	0.280	0.00	0.36	0.29	694	1432	1459	0.89	15.53	5.31
113	113	-0.282	-0.884	-0.558	2.000	7042	-5393	-399	1207	-63459	-2548	5704	Y	747	143.12	128.80	951	464	0.39	0.280	0.00	0.34	0.29	694	1481	1454	1.11	15.53	5.31
113	114	-0.392	-0.775	-0.564	2.000	6921	-2652	-367	1029	-44465	-2380	5472	Y	1024	131.40	118.26	1079	244	0.22	0.273	0.00	0.25	0.29	645	1551	1363	1.87	15.05	5.14
114	114	-0.391	-0.776	-0.563	2.000	6921	-2785	-346	1345	-44646	-2370	6038	Y	1010	131.40	118.26	1071	246	0.22	0.301	0.00	0.26	0.29	645	1544	1376	1.78	16.61	5.68
114	115	-0.468	-0.705	-0.572	2.000	6522	-1770	-316	1363	-28338	-2208	6000	Y	1297	112.96	103.73	1183	44	0.12	0.318	0.00	0.22	0.29	572	1579	1294	2.42	17.08	5.84
115	115	-0.467	-0.706	-0.571	2.000	6522	-1871	-299	1554	-28494	-2199	5999	Y	1282	112.96	103.73	1175	47	0.12	0.318	0.00	0.22	0.29	572	1572	1289	2.43	17.08	5.84
115	116	-0.499	-0.692	-0.581	2.000	6441	-335	-243	1108	-12622	-2016	5497	Y	1560	93.75	102.02	1364	0	0.12	0.295	0.00	0.21	0.29	572	1742	1181	4.58	15.77	5.39
116	116	-0.498	-0.694	-0.581	2.000	6441	-413	-234	1191	-12739	-2009	4059	Y	1546	93.75	102.02	1356	0	0.12	0.218	0.00	0.17	0.29	571	1735	1133	4.89	11.64	3.98
116	117	-0.006	0.002	-0.003	1.010	3129	-41	-109	-876	102	-1528	1938	Y	0	0.00	98.42	34	815	9.22	0.108	0.00	4.66	0.29	52				5.69	1.94
																											0.89		

PROJECT: **Cline Avenue Mainline Seg 3 EB** CALCS BY: TSP DATE: 01/21/09

DESCRIPTION: **Ultimate Shear Check** CHECKED BY: DATE:

Web Reinforcement Requirements **Load combination: Strength 1**

Material Properties:

Concrete

f'c = ***5.0*** ksi

ϕ_v = ***0.90***

P-T Strands

f_{pu} = ***270*** ksi

f_{pe} = ***176*** ksi

Reinforcement

fy = ***60.0*** ksi

Box Girder Properties:

Web Thickness

b_v = ***14.00*** in

Effective Width of Shear Flow Path

be= ***5.50*** in

Notes:

1. All shears are vertical unless noted otherwise.
2. Web thickness is horizontal, box depth is vertical.

Calc RF

Member Number	Node Number	(ksi) Perm Load Stress (top fiber)	(ksi) Perm Load Stress (bott. fiber)	(ksi) Dead Load Stress (neutr. axis) (fpc)	Stress Variable 'K'	(k-ft) Torsional Moment (Tcr)	Ultimate Corresp. Live Load Moment	Ultimate Max Live Load Shear	Ultimate Corresp. Live Load Torsion	TOTAL Ultimate Moment (Mu)	TOTAL Ultimate Shear (Vu)	TOTAL Ultimate Torsion (Tu)	Investigate Torsional Effects? (Y/N)	Shear from Primary Post Tensioning Effect (Vp)	(in) Depth to Tensile Reinforcement d_e	(in) Effective Shear Depth d_v	(kip) Concrete Shear Resistance per web (Vc)	(kip) Required Steel Resistance per web (Vs-req'd)	(in^2/ft) Required Steel Area per web (Av)	(in^2/ft) Additional Steel Required for Torsion (At)	(in^2/ft) Additional Steel Req'd from Transverse A_v (trans)	(in^2/ft) Total Steel Required per leg (As_req'd)	(in^2/ft) Steel Provided per leg As_prov'd)	(kip) Provided Steel Resistance per web (Vs_prov)	(kip) Nominal Shear Resistance per web (ϕVn)	(kip) Ultimate Shear per web (Vu)	Shear Rating Factor, RF	Total Long. Mild Steel Required for Torsion (Al) in^2	Equivalent PT Steel Req'd for Torsion (based on fpe) (Al) in^2
				Permanent Loads + Maximum LL Torsion @ t=00																									
1	1	-0.005	-0.005	-0.005	1.019	7064	0	0	825	0	2529	1486	N	0	0.00	102.02	62	875	2.51	Not Reqd	0.00	1.25	0.37	260				0.00	0.00
1	2	-0.673	-0.753	-0.706	2.000	14431	-506	247	3393	-22698	3401	4113	N	-2829	99.17	105.89	1556	0	0.12	Not Reqd	0.00	0.06	0.37	753	2078	1134	12.48	0.00	0.00
2	2	-0.673	-0.753	-0.706	2.000	14431	-506	247	3393	-22698	3400	4113	N	-2854	99.17	105.89	1565	0	0.12	Not Reqd	0.00	0.06	0.37	753	2086	1133	12.58	0.00	0.00
2	3	-0.652	-0.739	-0.690	2.000	14973	-2293	329	4538	-49977	3702	5318	Y	-2498	118.41	110.07	1446	0	0.12	0.123	0.00	0.12	0.37	779	2002	1313	4.90	11.21	3.83
3	3	-0.652	-0.739	-0.690	2.000	14973	-2293	329	4538	-49977	3702	5318	Y	-2523	118.41	110.07	1454	0	0.12	0.123	0.00	0.12	0.37	779	2010	1313	4.95	11.21	3.83
3	4	-0.595	-0.778	-0.677	2.000	15555	-2618	347	4848	-77542	3948	5687	Y	-2082	134.90	121.41	1319	143	0.13	0.126	0.00	0.13	0.37	849	1952	1400	3.95	11.66	3.99
4	4	-0.595	-0.778	-0.677	2.000	15555	-2618	347	4848	-77542	3947	5687	Y	-2109	134.90	121.41	1329	133	0.12	0.126	0.00	0.12	0.37	849	1960	1400	3.99	11.66	3.99
4	5	-0.507	-0.850	-0.664	2.000	16176	-4114	401	5656	-108091	4238	6553	Y	-1729	148.91	134.02	1224	346	0.28	0.140	0.00	0.21	0.37	928	1937	1510	2.97	13.06	4.46
5	5	-0.507	-0.850	-0.664	2.000	16176	-4114	401	5655	-108091	4237	6554	Y	-1762	148.91	134.02	1236	334	0.27	0.140	0.00	0.20	0.37	928	1947	1509	3.02	13.06	4.46
5	6	-0.396	-0.943	-0.652	2.000	16843	-4729	419	5968	-139636	4500	6925	Y	-1416	160.79	144.71	1136	531	0.40	0.142	0.00	0.27	0.37	993	1916	1602	2.38	13.40	4.58
6	6	-0.394	-0.941	-0.651	2.000	16843	-4729	420	5973	-139635	4503	6943	Y	-1171	160.79	144.71	1051	617	0.46	0.142	0.00	0.30	0.37	992	1839	1604	2.03	13.44	4.59
6	7	-0.262	-1.103	-0.657	2.000	17619	-5492	438	6282	-173257	4772	7311	Y	-676	170.42	153.38	892	875	0.62	0.143	0.00	0.38	0.37	1043				13.70	4.68
7	7	-0.257	-1.097	-0.652	2.000	17619	-5491	438	6287	-173257	4775	7326	Y	-111	170.42	153.38	696	1072	0.77	0.144	0.00	0.46	0.37	1041				13.73	4.69
7	8	-0.193	-1.181	-0.657	2.000	17619	-5767	444	6386	-184475	4861	7444	Y	103	170.43	153.39	683	1117	0.80	0.146	0.00	0.47	0.37	1038				13.95	4.77
8	8	-0.302	-1.022	-0.640	2.000	17619	-8040	-573	9827	-181817	-3994	8687	Y	103	170.43	153.39	695	784	0.56	0.170	0.00	0.37	0.37	1041				16.28	5.57
8	9	-0.356	-0.961	-0.640	2.000	17619	-6857	-565	9726	-172182	-3905	8605	Y	269	170.16	153.15	761	685	0.49	0.169	0.00	0.33	0.31	869				16.13	5.51
9	9	-0.359	-0.964	-0.643	2.000	17619	-6849	-559	9718	-172174	-3900	8607	Y	838	170.16	153.15	958	487	0.35	0.169	0.00	0.26	0.31	871				16.13	5.51
9	10	-0.463	-0.865	-0.652	2.000	16843	-3423	-532	9400	-143646	-3622	8348	Y	1257	159.91	143.92	1083	258	0.19	0.171	0.00	0.18	0.31	824	1716	1331	2.22	16.15	5.52
10	10	-0.464	-0.865	-0.653	2.000	16843	-3418	-529	9392	-143640	-3618	8354	Y	1509	159.91	143.92	1171	170	0.13	0.171	0.00	0.15	0.31	825	1796	1329	2.48	16.17	5.53
10	11	-0.388	-0.862	-0.605	2.000	16176	-351	-502	9070	-117393	-3347	8091	Y	1650	146.86	132.17	1160	80	0.12	0.173	0.00	0.15	0.31	757	1725	1235	2.62	16.12	5.51
11	11	-0.388	-0.862	-0.605	2.000	16176	-353	-503	9071	-117395	-3347	8093	Y	1620	146.86	132.17	1149	91	0.12	0.173	0.00	0.15	0.31	757	1715	1235	2.59	16.13	5.51
11	12	-0.439	-0.854	-0.624	2.000	15555	2387	-476	8744	-93351	-3085	7825	Y	1669	133.56	120.20	1132	10	0.12	0.174	0.00	0.15	0.31	693	1642	1144	2.73	16.04	5.48
12	12	-0.439	-0.854	-0.624	2.000	15555	2385	-476	8745	-93353	-3085	7826	Y	1644	133.56	120.20	1123	19	0.12	0.174	0.00	0.15	0.31	692	1634	1144	2.70	16.04	5.49
12	13	-0.439	-0.859	-0.621	2.000	14973	4809	-450	8411	-71438	-2831	7551	Y	1515	119.91	110.07	1046	3	0.12	0.174	0.00	0.15	0.31	637	1514	1055	2.67	15.92	5.44
13	13	-0.439	-0.859	-0.621	2.000	14973	4807	-451	8412	-71440	-2832	7552	Y	1493	119.91	110.07	1038	11	0.12	0.174	0.00	0.15	0.31	637	1507	1056	2.65	15.92	5.44
13	14	-0.488	-0.855	-0.642	2.000	14431	6929	-425	8068	-51578	-2586	7268	Y	1394	108.10	105.89	1015	0	0.12	0.174	0.00	0.15	0.31	618	1470	969	2.92	15.75	5.38
14	14	-0.488	-0.855	-0.642	2.000	14431	6927	-425	8069	-51580	-2586	7269	Y	1370	108.10	105.89	1007	0	0.12	0.174	0.00	0.15	0.31	618	1462	970	2.89	15.75	5.39
14	15	-0.384	-0.878	-0.584	2.000	13934	8758	-400	7716	-33697	-2349	6974	Y	1216	92.27	102.02	937	0	0.12	0.173	0.00	0.15	0.31	596	1380	886	3.00	15.52	5.30
15	15	-0.384	-0.878	-0.584	2.000	13934	8757	-400	7716	-33699	-2349	6975	Y	1197	92.27	102.02	931	0	0.12	0.173	0.00	0.15	0.31	596	1374	886	2.97	15.52	5.31
15	16	-0.430	-0.879	-0.604	2.000	13477	10311	-375	7353	-17723	-2120	6671	Y	1141	81.71	98.42	928	0	0.12	0.171	0.00	0.15	0.31	580	1357	805	3.36	15.22	5.20
16	16	-0.430	-0.879	-0.604	2.000	13477	10310	-376	7354	-17724	-2120	6672	Y	1131	81.71	98.42	924	0	0.12	0.171	0.00	0.15	0.31	580	1354	805	3.35	15.22	5.20
16	17	-0.470	-0.890	-0.626	2.000	13066	11598	-351	6984	-3585	-1898	6360	Y	1085	71.93	95.13	912	0	0.12	0.168	0.00	0.14	0.21	376	1160	727	2.97	14.86	5.08
17	17	-0.470	-0.890	-0.626	2.000	13066	11597	-351	6984	-3586	-1898	6361	Y	1072	71.93	95.13	908	0	0.12	0.168	0.00	0.14	0.21	376	1156	727	2.95	14.86	5.08
17	18	-0.504	-0.913	-0.648	2.000	12695	12631	-327	6610	8784	-1684	6046	Y	1019	64.95	92.12	873	0	0.12	0.165	0.00	0.14	0.21	364	1113	651	3.24	14.44	4.94
18	18	-0.504	-0.912	-0.647	2.000	12695	12612	-333	6622	8766	-1689	6055	Y	712	64.95	92.12	771	0	0.12	0.165	0.00	0.14	0.21	364	1021	653	2.77	14.46	4.94
18	19	-0.547	-0.843	-0.651	2.000	12301	13445	-310	6246	19454	-1480	5737	Y	652	69.28	89.42	728	0	0.12	0.161	0.00	0.14	0.21	353	972	578	3.02	14.04	4.80
19	19	-0.547	-0.843	-0.651	2.000	12301	13444	-310	6247	19453	-1480	5737	Y	632	69.28	89.42	720	0	0.12	0.161	0.00	0.14	0.21	353	966	578	2.98	14.04	4.80
19	20	-0.586	-0.782	-0.654	2.000	11939	14047	-287	5871	28466	-1273	5420	Y	564	73.04	86.94	668	0	0.12	0.157	0.00	0.14	0.21	341	908	504	3.21	13.58	4.64
20	20	-0.586	-0.782	-0.654	2.000	11939	14046	-287	5871	28465	-1273	5420	Y	547	73.04	86.94	662	0	0.12	0.157	0.00	0.14	0.21	341	903	504	3.18	13.58	4.64
20	21	-0.618	-0.731	-0.657	2.000	11623	14429	-265	5496	35826	-1068	5104	Y	496	76.30	84.78	620	0	0.12	0.152	0.00	0.14	0.21	331	856	431	3.51	13.06	4.46
21	21	-0.618	-0.731	-0.657	2.000	11623	14428	-265	5497	35825	-1068	5105	Y	476	76.30	84.78	613	0	0.12	0.152	0.00	0.14	0.21	331	850	431	3.47	13.06	4.47
21	22	-0.479	-0.710	-0.559	2.000	11354	14604	-243	5125	41557	-865	4792	Y	442	91.42	82.94	613	0	0.12	0.146	0.00	0.13	0.21	326	846	359	4.10	12.49	4.27
22	22	-0.481	-0.647	-0.539	2.000	11354	14604	-244	5125	41557	-865	4792	Y	374	91.42	82.94	590	0	0.12	0.146	0.00	0.13	0.21	326	824	359	3.96	12.49	4.27
22	23	-0.498	-0.617	-0.539	2.000	11124	14587	-223	4757	45681	-663	4483	Y	351	72.14	81.36	566	0	0.12	0.139	0.00	0.13	0.21	319	797	287	4.53	11.87	4.06
23	23	-0.822	-0.632	-0.756	2.000	11124	14587	-223	4758	45681	-663	4483	Y	360	72.14	81.36	569	0	0.12	0.139	0.00	0.13	0.21	319	800	287	4.55	11.87	4.06
23	24	-0.826	-0.631	-0.758	2.000	10933	14388	-202	4396	48219	-463	4180	Y	295	73.86	80.06	536	0	0.12	0.132	0.00	0.13	0.21	314	765	216	5.15	11.22	3.84
24	24	-0.826	-0.631	-0.758	2.000	10933	14388	-203	4396	48219	-463	4180	Y	272	73.86	80.06	529	0	0.12	0.132	0.00	0.13	0.21	314	758	216	5.09	11.23	3.84
24	25	-0.820	-0.647	-0.760	2.000	10788	14027	-183	4042	49195	-265	3885	Y	203	75.06	79.07	499	0	0.12	0.124	0.00	0.12	0.21	310	728	146	5.82	10.54	3.60
25	25	-0.820	-0.647	-0.760	2.000	10788	14028	-183	4042	49196	-265	3885	Y	184	75.06	79.07	492	0	0.12	0.124	0.00	0.12	0.21	310	722	146	5.77	10.54	3.60
25	26	-0.804	-0.675	-0.759	2.000	10683	13514	-164	3698	48625	-68	3599	Y	122	75.73	78.35	469	0	0.12	0.116	0.00	0.12	0.21	307	699	76	6.69	9.85	3.37
26	26	-0.804	-0.675	-0.759	2.000	10683	13515	-165	3698	48625	-68	3600	Y	103	75.73	78.35	463	0	0.12	0.116	0.00	0.12	0.21	307	693	76	6.64	9.85	3.37
26	27	-0.775	-0.726	-0.758	2.000	10617	18993	75	3471	52655	350	3431	Y	50	75.97	77.90	431	0	0.12	0.112	0.00	0.12	0.21	304	662	167	7.48	9.43	3.22
27	27	-0.775	-0.726	-0.758	2.000	10617	18990	75	3471	52652	349	3431	Y	19	75.97	77.90	420	0	0.12	0.112	0.00	0.12	0.21	304	652	167	7.37	9.43	3.22
27	28	-1.195	-0.725	-1.032	2.000	10617	16105	279	3670	47572	698	3678	Y	23	57.68	77.90	459	0	0.12	0.120	0.00	0.12	0.21	308	690	287	3.74	10.11	3.46
28	28	-1.195	-0.725	-1.032	2.000	10617	16098	279	3670	47566	698	3677	Y	-20	57.68	77.90	458	0	0.12	0.120	0.00	0.12	0.21	308	689	287	3.73	10.11	3.46
28	29	-1.133	-0.833	-1.029	2.000	10683	15641	301	4009	43144	898	4075	Y	33	57.84	78.35	465	0	0.12	0.132	0.00	0.13	0.21	310	697	360	3.12	11.15	3.81
29	29	-1.133	-0.833	-1.029	2.000	10683	15637	300	4008	43139	898	4075	Y	7	57.84	78.35	456	0	0.12	0.132	0.00	0.13	0.21	310	689	359	3.07	11.15	3.81
29	30	-1.048	-0.982	-1.025	2.000	10788	14993	323	4357	37140	1098	4482	Y	53	58.27	79.07	475	0	0.12	0.144	0.00	0.13	0.21	313	709	432	2.61	12.16	4.16
30	30	-1.048	-0.982	-1.025	2.000	10788	14988	322	4356	37134	1098	4482	Y	27	58.27	79.07	467	0	0.12	0.144	0.00	0.13	0.21	313	701	432	2.57	12.16	4.16
30	31	-0.953	-1.134	-1.016	2.000	10933	14152	345	4713	29547	1300	4897	Y	-186	58.33	80.06	526	0	0.12	0.155	0.00	0.14	0.21	316	758	506	2.37	13.15	4.50
31	31	-0.953	-1.134	-1.016	2.000	10933	14145	345	4712	29540	1299	4896	Y	-217	58.33	80.06	536	0	0.12	0.155	0.00	0.14	0.21	316	767	505	2.42	13.15	4.49
31	32	-0.876	-0.974	-0.910	2.000	11124	13121	367	5075	20364	1504	5317	Y	50	53.96	81.36	488	69	0.12	0.165	0.00	0.14	0.21	322	728	580	1.75	14.08	4.81
32	32	-0.876	-0.974	-0.910	2.000	11124	13121	367	5074	20364	1504	5316	Y	26	53.96	81.36	480	77	0.12	0.165	0.00	0.14	0.21	322	721	580	1.72	14.08	4.81

PROJECT: **Cline Avenue Mainline Seg 3 EB** CALCS BY: TSP DATE: 01/21/09

DESCRIPTION: **Ultimate Shear Check** CHECKED BY: DATE:

Web Reinforcement Requirements **Load combination: Strength 1**

Material Properties:

Concrete

f'c = ***5.0*** ksi

ϕ_v = ***0.90***

P-T Strands

f_{pu} = ***270*** ksi

f_{pe} = ***176*** ksi

Reinforcement

fy = ***60.0*** ksi

Box Girder Properties:

Web Thickness

b_v = ***14.00*** in

Effective Width of Shear Flow Path

be= ***5.50*** in

Notes:

1. All shears are vertical unless noted otherwise.
2. Web thickness is horizontal, box depth is vertical.

Calc RF

Member Number	Node Number	(ksi) Perm Load Stress (top fiber)	(ksi) Perm Load Stress (bott. fiber)	(ksi) Dead Load Stress (neutr. axis) (fpc)	Stress Variable 'K'	(k-ft) Torsional Moment (Tcr)	Ultimate Corresp. Live Load Moment	Ultimate Max Live Load Shear	Ultimate Corresp. Live Load Torsion	TOTAL Ultimate Moment (Mu)	TOTAL Ultimate Shear (Vu)	TOTAL Ultimate Torsion (Tu)	Investigate Torsional Effects? (Y/N)	Shear from Primary Post Tensioning Effect (Vp)	(in) Depth to Tensile Reinforcement d_e	(in) Effective Shear Depth d_v	(kip) Concrete Shear Resistance per web (Vc)	(kip) Required Steel Resistance per web (Vs-req'd)	(in^2/ft) Required Steel Area per web (Av)	(in^2/ft) Additional Steel Required for Torsion (At)	(in^2/ft) Additional Steel Req'd from Transverse A_v (trans)	(in^2/ft) Total Steel Required per leg (As_req'd)	(in^2/ft) Steel Provided per leg As_prov'd)	(kip) Provided Steel Resistance per web (Vs_prov)	(kip) Nominal Shear Resistance per web (ϕVn)	(kip) Ultimate Shear per web (Vu)	Shear Rating Factor, RF	Total Long. Mild Steel Required for Torsion (Al) in^2	Equivalent PT Steel Req'd for Torsion (based on fpe) (Al) in^2
				Permanent Loads + Maximum LL Torsion @ t=00																									
32	33	-1.198	-1.133	-1.176	2.000	11354	11911	390	5441	9579	1707	5742	Y	8	43.07	82.94	483	149	0.19	0.175	0.00	0.18	0.21	328	730	654	1.36	14.96	5.12
33	33	-1.198	-1.133	-1.176	2.000	11354	11911	389	5441	9578	1707	5741	Y	-24	43.07	82.94	488	144	0.18	0.175	0.00	0.18	0.21	328	734	654	1.38	14.96	5.12
33	34	-1.051	-1.383	-1.166	2.000	11623	10517	412	5810	-2803	1911	6170	Y	-167	74.13	84.78	547	161	0.20	0.183	0.00	0.19	0.21	335	794	728	1.29	15.78	5.40
34	34	-1.051	-1.383	-1.167	2.000	11623	10514	412	5810	-2806	1911	6169	Y	-205	74.13	84.78	559	149	0.18	0.183	0.00	0.18	0.21	335	805	728	1.34	15.78	5.40
34	35	-0.927	-1.579	-1.155	2.000	11939	8942	435	6181	-16790	2116	6599	Y	-411	77.86	86.94	640	144	0.17	0.191	0.00	0.18	0.21	344	886	803	1.35	16.53	5.65
35	35	-0.927	-1.579	-1.155	2.000	11939	8945	434	6181	-16786	2116	6598	Y	-444	77.86	86.94	651	133	0.16	0.191	0.00	0.18	0.21	344	895	803	1.39	16.53	5.65
35	36	-0.781	-1.541	-1.047	2.000	12301	7198	457	6553	-32394	2326	7029	Y	-61	85.74	89.42	538	323	0.38	0.197	0.00	0.29	0.21	353	802	879	0.69	17.20	5.88
36	36	-0.783	-1.543	-1.049	2.000	12301	7209	452	6546	-32383	2321	7010	Y	-528	85.74	89.42	694	166	0.19	0.197	0.00	0.20	0.21	353	942	877	1.26	17.16	5.87
36	37	-1.098	-1.560	-1.260	2.000	12695	5322	475	6915	-49598	2532	7439	Y	-944	98.22	92.12	848	90	0.12	0.202	0.00	0.16	0.21	364	1091	954	1.53	17.77	6.07
37	37	-1.098	-1.560	-1.260	2.000	12695	5322	475	6915	-49598	2532	7439	Y	-971	98.22	92.12	857	81	0.12	0.202	0.00	0.16	0.21	364	1099	954	1.56	17.77	6.07
37	38	-1.020	-1.518	-1.204	2.000	13066	3263	497	7278	-68479	2749	7861	Y	-1713	104.67	95.13	1122	0	0.12	0.208	0.00	0.16	0.21	376	1348	1033	2.15	18.36	6.28
38	38	-1.020	-1.518	-1.204	2.000	13066	3263	497	7277	-68479	2749	7860	Y	-1752	104.67	95.13	1135	0	0.12	0.208	0.00	0.16	0.21	376	1360	1032	2.20	18.36	6.28
38	39	-0.924	-0.913	-0.920	2.000	13477	1035	520	7632	-89090	2975	8274	Y	-810	128.89	116.00	942	160	0.14	0.212	0.00	0.18	0.41	917	1673	1114	2.95	18.88	6.45
39	39	-0.924	-0.913	-0.920	2.000	13477	1035	520	7632	-89090	2975	8274	Y	-833	128.89	116.00	949	152	0.14	0.212	0.00	0.17	0.41	917	1680	1114	2.98	18.88	6.45
39	40	-0.778	-1.064	-0.894	2.000	13934	-1365	542	7978	-111475	3205	8679	Y	-834	133.58	120.22	950	237	0.21	0.215	0.00	0.21	0.41	946	1706	1197	2.71	19.31	6.60
40	40	-0.778	-1.064	-0.893	2.000	13934	-1365	542	7977	-111475	3205	8678	Y	-872	133.58	120.22	963	224	0.20	0.215	0.00	0.21	0.41	946	1718	1197	2.75	19.31	6.60
40	41	-1.066	-1.133	-1.095	2.000	14431	-3937	564	8315	-135683	3442	9076	Y	-1161	138.48	124.63	1108	166	0.14	0.217	0.00	0.18	0.41	985	1884	1281	2.94	19.67	6.72
41	41	-1.065	-1.134	-1.094	2.000	14431	-3936	564	8315	-135683	3442	9075	Y	-1215	138.48	124.63	1127	148	0.12	0.217	0.00	0.17	0.41	985	1901	1281	2.99	19.67	6.72
41	42	-0.928	-1.245	-1.066	2.000	14973	-6681	586	8647	-161773	3686	9466	Y	-1215	144.05	129.65	1156	209	0.17	0.218	0.00	0.19	0.41	1025	1963	1368	2.84	19.96	6.82
42	42	-0.927	-1.245	-1.065	2.000	14973	-6681	585	8646	-161773	3685	9466	Y	-1266	144.05	129.65	1173	192	0.16	0.218	0.00	0.19	0.41	1025	1978	1368	2.89	19.96	6.82
42	43	-0.794	-1.342	-1.039	2.000	15555	-9600	608	8973	-189801	3937	9852	Y	-1266	150.02	135.02	1197	261	0.20	0.219	0.00	0.21	0.41	1066	2037	1458	2.73	20.20	6.90
43	43	-0.793	-1.342	-1.038	2.000	15555	-9600	607	8972	-189801	3936	9852	Y	-1319	150.02	135.02	1216	242	0.19	0.219	0.00	0.20	0.41	1066	2054	1458	2.78	20.20	6.91
43	44	-0.664	-1.426	-1.013	2.000	16176	-12695	629	9295	-219827	4195	10233	Y	-1319	156.38	140.75	1202	352	0.26	0.219	0.00	0.24	0.41	1102	2073	1550	2.51	20.39	6.97
44	44	-0.663	-1.426	-1.013	2.000	16176	-12695	629	9294	-219826	4194	10233	Y	-1383	156.38	140.75	1224	330	0.25	0.219	0.00	0.23	0.41	1102	2094	1549	2.57	20.39	6.97
44	45	-0.538	-1.498	-0.989	2.000	16843	-15967	651	9613	-251911	4461	10611	Y	-1382	163.14	146.83	1216	436	0.32	0.218	0.00	0.27	0.41	1141	2121	1644	2.33	20.53	7.02
45	45	-0.536	-1.498	-0.987	2.000	16843	-15966	653	9617	-251910	4465	10638	Y	-999	163.14	146.83	1082	572	0.41	0.218	0.00	0.32	0.41	1139	1999	1646	1.98	20.59	7.04
45	46	-0.407	-1.631	-0.982	2.000	17619	-19432	675	9932	-286112	4737	11012	Y	-998	170.46	153.42	1084	671	0.47	0.216	0.00	0.34	0.41	1183				20.64	7.06
46	46	-0.402	-1.627	-0.977	2.000	17619	-19037	678	9930	-285717	4741	11035	Y	0	170.46	153.42	737	1019	0.71	0.216	0.00	0.47	0.41	1179				20.68	7.07
46	47	-0.339	-1.706	-0.981	2.000	17619	-20191	685	10030	-297127	4828	11154	Y	0	170.46	153.42	724	1064	0.75	0.219	0.00	0.48	0.41	1176				20.90	7.15
47	47	-0.501	-1.514	-0.977	2.000	17619	-17849	-635	10353	-272364	-4705	9083	Y	0	170.46	153.42	750	992	0.69	0.178	0.00	0.44	0.41	1183				17.02	5.82
47	48	-0.562	-1.437	-0.973	2.000	17619	-16757	-627	10252	-261198	-4617	9001	Y	0	170.49	153.45	764	946	0.66	0.176	0.00	0.42	0.74	2135				16.87	5.77
48	48	-0.566	-1.441	-0.977	2.000	17619	-16757	-624	10252	-261198	-4622	9022	Y	774	170.49	153.45	1034	678	0.47	0.177	0.00	0.32	0.74	2140				16.91	5.78
48	49	-0.702	-1.287	-0.976	2.000	17041	-13667	-602	9949	-229011	-4359	8775	Y	774	165.11	148.60	979	635	0.46	0.178	0.00	0.32	0.74	2059	2346	1583	3.19	16.84	5.76
49	49	-0.489	-1.321	-0.879	2.000	17041	-13666	-599	9944	-229010	-4361	8797	Y	1160	165.11	148.60	1113	502	0.36	0.178	0.00	0.27	0.74	2062	2519	1584	3.70	16.88	5.77
49	50	-0.730	-1.144	-0.916	2.000	15844	-8188	-556	9343	-172183	-3868	8306	Y	1157	152.86	137.57	1059	373	0.29	0.181	0.00	0.24	0.74	1909	2370	1412	3.96	16.80	5.74
50	50	-0.502	-1.175	-0.806	2.000	15844	-8188	-556	9345	-172183	-3867	8308	Y	921	152.86	137.57	977	455	0.35	0.181	0.00	0.27	0.74	1908	2264	1412	3.63	16.81	5.75
50	51	-0.756	-0.951	-0.840	2.000	14769	-3370	-513	8728	-122387	-3399	7801	Y	918	141.42	127.28	926	333	0.28	0.182	0.00	0.23	0.74	1765	2124	1248	3.92	16.62	5.68
51	51	-0.514	-0.990	-0.719	2.000	14769	-3370	-514	8730	-122386	-3399	7803	Y	697	141.42	127.28	850	409	0.35	0.183	0.00	0.26	0.74	1764	2025	1248	3.59	16.62	5.68
51	52	-0.783	-0.702	-0.750	2.000	13862	798	-470	8089	-79254	-2954	7270	Y	695	131.81	118.63	817	277	0.25	0.181	0.00	0.22	0.74	1648	1908	1092	3.95	16.24	5.55
52	52	-0.572	-0.733	-0.637	2.000	13862	798	-470	8090	-79254	-2954	7272	Y	544	131.81	118.63	764	330	0.30	0.181	0.00	0.24	0.74	1647	1840	1092	3.70	16.24	5.55
52	53	-0.778	-0.973	-0.852	2.000	13076	4321	-426	7420	-42461	-2530	6711	Y	517	97.74	95.45	699	238	0.26	0.177	0.00	0.22	0.25	450	1034	943	1.36	15.67	5.36
53	53	-0.555	-1.010	-0.728	2.000	13076	4321	-427	7421	-42461	-2530	6713	Y	377	97.74	95.45	650	287	0.32	0.177	0.00	0.25	0.25	449	989	942	1.19	15.67	5.36
53	54	-0.741	-1.348	-0.953	2.000	12202	7195	-383	6734	-11682	-2128	6134	Y	390	67.70	88.74	644	144	0.17	0.174	0.00	0.17	0.25	421	958	800	1.70	15.11	5.17
54	54	-0.502	-1.390	-0.813	2.000	12202	7194	-387	6748	-11683	-2124	6139	Y	-69	67.70	88.74	537	250	0.29	0.174	0.00	0.23	0.25	421	862	799	1.28	15.12	5.17
54	55	-0.733	-1.322	-0.938	2.000	11781	9459	-343	6059	13258	-1735	5558	Y	-64	66.41	85.86	518	124	0.15	0.163	0.00	0.16	0.21	339	772	661	1.55	14.07	4.81
55	55	-0.591	-1.339	-0.852	2.000	11781	9459	-343	6060	13258	-1735	5559	Y	-127	66.41	85.86	539	103	0.13	0.163	0.00	0.14	0.21	339	791	660	1.64	14.07	4.81
55	56	-0.849	-0.892	-0.864	2.000	11282	11051	-300	5378	32578	-1353	4986	Y	-61	70.40	82.44	489	13	0.12	0.153	0.00	0.14	0.21	325	732	525	2.16	13.06	4.47
56	56	-0.698	-0.917	-0.775	2.000	11282	11051	-300	5379	32578	-1353	4987	Y	-119	70.40	82.44	509	0	0.12	0.153	0.00	0.14	0.21	325	751	525	2.26	13.06	4.47
56	57	-0.903	-0.560	-0.784	2.000	10920	11974	-258	4713	46339	-976	4429	Y	-53	76.01	79.97	421	0	0.12	0.140	0.00	0.13	0.21	310	657	391	2.71	11.91	4.07
57	57	-0.753	-0.577	-0.692	2.000	10920	11974	-258	4714	46338	-976	4430	Y	-91	76.01	79.97	434	0	0.12	0.140	0.00	0.13	0.21	310	669	391	2.79	11.91	4.07
57	58	-0.887	-0.343	-0.698	2.000	10696	12259	-217	4071	54615	-603	3897	Y	-24	85.00	78.44	369	0	0.12	0.126	0.00	0.12	0.21	299	601	258	3.59	10.65	3.64
58	58	-0.725	-0.375	-0.604	2.000	10696	12259	-218	4072	54615	-602	3898	Y	-60	85.00	78.44	381	0	0.12	0.126	0.00	0.12	0.21	299	612	258	3.67	10.65	3.64
58	59	-0.779	-0.281	-0.607	2.000	10598	16304	3	3567	61831	-51	3501	Y	7	98.26	88.43	391	0	0.12	0.114	0.00	0.12	0.21	335	653	69	11.90	9.64	3.30
59	59	-0.624	-0.231	-0.487	2.000	10598	16304	2	3567	61831	-50	3502	Y	-13	98.26	88.43	393	0	0.12	0.114	0.00	0.12	0.21	335	655	69	11.96	9.64	3.30
59	60	-0.622	-0.234	-0.487	2.000	10598	13389	198	3738	58852	273	3715	Y	13	83.75	77.76	338	0	0.12	0.121	0.00	0.12	0.21	293	568	146	4.48	10.23	3.50
60	60	-0.787	-0.258	-0.604	2.000	10598	13389	197	3738	58852	273	3715	Y	-7	83.75	77.76	336	0	0.12	0.121	0.00	0.12	0.21	293	566	146	4.47	10.23	3.50
60	61	-0.724	-0.365	-0.600	2.000	10696	13634	236	4351	55598	643	4437	Y	60	73.91	78.44	379	0	0.12	0.143	0.00	0.13	0.21	299	611	280	3.31	12.12	4.14
61	61	-0.890	-0.336	-0.698	2.000	10696	13634	236	4350	55598	644	4436	Y	24	73.91	78.44	367	0	0.12	0.143	0.00	0.13	0.21	299	599	280	3.23	12.12	4.14
61	62	-0.746	-0.583	-0.689	2.000	10920	13284	277	4991	46927	1017	5186	Y	90	67.51	79.97	432	0	0.12	0.164	0.00	0.14	0.21	310	667	416	2.52	13.94	4.77
62	62	-0.901	-0.564	-0.784	2.000	10920	13284	277	4991	46927	1017	5185	Y	52	67.51	79.97	419	0	0.12	0.164	0.00	0.14	0.21	309	655	416	2.44	13.94	4.77
62	63	-0.688	-0.931	-0.772	2.000	11282	12300	318	5651	32777	1394	5955	Y	118	63.29	82.44	507	9	0.12	0.182	0.00	0.15	0.21	325	749	553	2.04	15.60	5.33
63	63	-0.838	-0.913	-0.864	2.000	11282	12300	318	5650	32777	1394	5954	Y	59	63.29	82.44	487	30	0.12	0.182	0.00	0.15	0.21	325	731	553	1.94	15.59	5.33
63	64	-0.572	-1.368	-0.849	2.000	11781	10670	361	6322	13091	1775	6735	Y	124	57.24	85.86	538	119	0.14	0.197	0.00	0.17	0.21	339	790	691	1.46	17.05	5.83

PROJECT: **Cline Avenue Mainline Seg 3 EB** CALCS BY: TSP DATE: 01/21/09

DESCRIPTION: **Ultimate Shear Check** CHECKED BY: DATE:

Web Reinforcement Requirements **Load combination: Strength 1**

Material Properties:

Concrete

f'c = ***5.0*** ksi

ϕ_v = ***0.90***

P-T Strands

f_{pu} = ***270*** ksi

f_{pe} = ***176*** ksi

Reinforcement

fy = ***60.0*** ksi

Box Girder Properties:

Web Thickness

b_v = ***14.00*** in

Effective Width of Shear Flow Path

be= ***5.50*** in

Notes:

1. All shears are vertical unless noted otherwise.
2. Web thickness is horizontal, box depth is vertical.

Calc RF

		Permanent Loads + Maximum LL Torsion @ t=00														(kip)	(kip)	(in^2/ft)	(in^2/ft)	(in^2/ft)	(in^2/ft)	(in^2/ft)	(kip)	(kip)	(kip)		Total Long.	Equivalent
		(ksi)	(ksi)	(ksi)		(k-ft)	Ultimate	Ultimate	Ultimate				Investigate	Shear from	(in)	(in)	Concrete	Required	Required	Additional	Additional	Total		Provided	Nominal		Mild Steel	PT Steel Req'd
		Perm Load	Perm Load	Dead Load	Stress	Torsional	Corresp.	Max	Corresp.	TOTAL	TOTAL	TOTAL	Torsional	Primary	Depth	Effective	Shear	Steel	Steel	Steel	Steel	Steel	Steel	Steel	Shear	Ultimate	Shear	Required	for Torsion
		Stress	Stress	Stress	Variable	Cracking	Live Load	Live Load	Live Load	Ultimate	Ultimate	Ultimate	Effects?	Post Tensioning	to Tensile	Shear	Resistance	Resistance	Area	Required	Req'd from	Required	Provided	Resistance	Resistance	Shear	Rating	for Torsion	(based on fpe)
Member	Node	(top fiber)	(bott. fiber)	(neutr. axis)	'K'	Moment	Moment	Shear	Torsion	Moment	Shear	Torsion	(Y/N)	Effect	Reinforcement	Depth	per web	per web	per web	for Torsion	Transverse	per leg	per leg	Steel	per web	per web	per web	Factor, RF	(Al)	(Al)
Number	Number			(fpc)		(Tcr)				(Mu)	(Vu)	(Tu)		(Vp)	d_e	d_v	(Vc)	(Vs-req'd)	(Av)	(At)	A_v (trans)	(As_req'd)	As_prov'd)	(Vs_prov)	(φVn)	(Vu)			in^2	in^2
64	64	-0.815	-1.329	-0.995	2.000	11781	10670	360	6321	13090	1775	6734	Y	46	57.24	85.86	513	145	0.18	0.197	0.00	0.19	0.21	339	767	691	1.35	17.05	5.83
64	65	-0.577	-1.419	-0.872	2.000	12412	8401	403	6998	-12183	2163	7519	Y	51	79.17	90.18	539	262	0.30	0.209	0.00	0.26	0.25	428	870	832	1.16	18.28	6.25
65	65	-0.813	-1.379	-1.011	2.000	12412	8399	398	6985	-12185	2168	7497	Y	-582	79.17	90.18	716	87	0.12	0.209	0.00	0.16	0.25	428	1030	833	1.83	18.22	6.23
65	66	-0.630	-1.000	-0.775	2.000	13030	5568	441	7651	-43312	2572	8272	Y	-545	103.10	95.45	725	228	0.25	0.219	0.00	0.23	0.25	452	1059	979	1.31	19.37	6.62
66	66	-0.851	-0.963	-0.895	2.000	13030	5568	441	7651	-43312	2572	8273	Y	-685	103.10	95.45	774	179	0.20	0.219	0.00	0.21	0.25	452	1103	979	1.48	19.37	6.62
66	67	-0.639	-0.719	-0.673	2.000	13776	2103	483	8288	-80521	3003	9020	Y	-692	131.42	118.28	827	285	0.26	0.226	0.00	0.24	0.74	1649	1901	1134	3.70	20.24	6.92
67	67	-0.845	-0.690	-0.779	2.000	13776	2103	483	8288	-80520	3003	9021	Y	-846	131.42	118.28	881	231	0.21	0.226	0.00	0.22	0.74	1650	1971	1134	3.95	20.24	6.92
67	68	-0.575	-0.930	-0.736	2.000	14657	-2009	525	8898	-124237	3461	9741	Y	-847	141.39	127.25	913	369	0.31	0.230	0.00	0.27	0.74	1769	2092	1298	3.59	20.87	7.13
68	68	-0.811	-0.893	-0.848	2.000	14657	-2009	525	8897	-124237	3462	9741	Y	-1078	141.39	127.25	992	290	0.24	0.230	0.00	0.24	0.74	1771	2196	1298	3.93	20.87	7.13
68	69	-0.552	-1.077	-0.803	2.000	15673	-6775	567	9492	-174879	3950	10446	Y	-1078	152.35	137.11	1037	426	0.33	0.230	0.00	0.28	0.74	1906	2329	1471	3.60	21.30	7.28
69	69	-0.771	-1.048	-0.903	2.000	15673	-6717	567	9532	-174812	3950	11515	Y	-1355	152.35	137.11	1133	330	0.26	0.254	0.00	0.26	0.74	1907	2453	1487	3.93	23.48	8.03
69	70	-0.525	-1.185	-0.854	2.000	16967	-12159	609	10104	-232860	4470	12196	Y	-1355	164.85	148.37	1184	471	0.34	0.248	0.00	0.29	0.74	2062	2604	1669	3.67	23.56	8.05
70	70	-0.731	-1.153	-0.941	2.000	16967	-12155	612	10113	-232854	4469	12311	Y	-891	164.85	148.37	1023	632	0.46	0.251	0.00	0.35	0.74	2059	2396	1670	3.06	23.78	8.13
70	71	-0.593	-1.288	-0.940	2.000	17628	-15235	634	10404	-265838	4747	12659	Y	-891	170.38	153.34	1076	683	0.47	0.248	0.00	0.36	0.74	2140				23.84	8.15
71	71	-0.589	-1.285	-0.936	2.000	17628	-15235	638	10399	-265837	4742	12667	Y	-40	170.38	153.34	780	977	0.68	0.248	0.00	0.46	0.74	2135				23.86	8.16
71	72	-0.527	-1.353	-0.939	2.000	17654	-16318	646	10517	-277289	4837	12803	Y	-40	168.15	151.34	753	1038	0.74	0.251	0.00	0.49	0.74	2100				24.10	8.24
72	72	-0.215	-1.612	-0.912	2.000	17654	-22867	-676	2455	-174196	-2925	3068	N	27	168.15	151.34	885	198	0.14	Not Reqd	0.00	0.07	0.74	2154				0.00	0.00
72	73	-0.278	-1.534	-0.894	2.000	8147	-21421	-687	2012	-167184	-2891	2607	Y	27	169.75	152.78	898	708	0.48	0.111	0.00	0.30	0.62	1812				6.55	2.24
73	73	-0.270	-1.537	-0.891	2.000	8147	-16442	-637	2490	-162390	-2864	4179	Y	551	169.75	152.78	1160	432	0.30	0.177	0.00	0.24	0.62	1812				10.50	3.59
73	74	-0.396	-1.407	-0.891	2.000	7784	-14185	-637	2127	-143302	-2721	3762	Y	550	162.43	146.19	974	537	0.40	0.167	0.00	0.28	0.62	1684	2213	1479	2.90	9.69	3.31
74	74	-0.401	-1.409	-0.894	2.000	7784	-12765	-516	3618	-141736	-2623	5606	Y	783	162.43	146.19	1099	358	0.26	0.249	0.00	0.26	0.62	1688	2318	1488	3.23	14.43	4.93
74	75	-0.527	-1.348	-0.920	2.000	7484	-10979	-503	3440	-124031	-2470	5373	Y	782	155.39	139.85	1100	272	0.21	0.248	0.00	0.23	0.62	1626	2232	1405	3.30	14.14	4.83
75	75	-0.536	-1.348	-0.924	2.000	7484	-9976	-440	4225	-122832	-2428	5965	Y	753	155.39	139.85	1089	260	0.20	0.275	0.00	0.24	0.62	1628	2219	1403	3.31	15.70	5.37
75	76	-0.668	-1.275	-0.951	2.000	7205	-8696	-420	4095	-106542	-2274	5781	Y	752	148.79	133.91	1095	168	0.13	0.277	0.00	0.21	0.62	1571	2139	1320	3.41	15.54	5.31
76	76	-0.671	-1.275	-0.952	2.000	7205	-7379	-391	4492	-105143	-2259	5941	Y	729	148.79	133.91	1087	168	0.13	0.285	0.00	0.21	0.62	1572	2128	1317	3.40	15.97	5.46
76	77	-0.808	-1.188	-0.980	2.000	6946	-6434	-368	4376	-90104	-2107	5770	Y	728	142.57	128.32	1099	71	0.12	0.287	0.00	0.20	0.62	1520	2053	1236	3.54	15.84	5.41
77	77	-0.811	-1.188	-0.981	2.000	6946	-5334	-354	4544	-88949	-2102	5653	Y	708	142.57	128.32	1092	76	0.12	0.281	0.00	0.20	0.62	1520	2043	1229	3.54	15.52	5.30
77	78	-0.951	-1.085	-1.010	2.000	6704	-4634	-329	4428	-75080	-1953	5483	Y	707	136.74	123.07	1066	19	0.12	0.283	0.00	0.20	0.62	1460	1973	1149	3.70	15.36	5.25
78	78	-0.953	-1.085	-1.011	2.000	6704	-3562	-328	4463	-73963	-1953	5240	Y	685	136.74	123.07	1055	30	0.12	0.270	0.00	0.19	0.62	1460	1963	1142	3.69	14.68	5.02
78	79	-0.702	-1.034	-0.841	2.000	6484	-2647	-310	4356	-60818	-1816	5079	Y	518	131.57	118.41	898	111	0.12	0.271	0.00	0.20	0.62	1390	1825	1068	3.59	14.51	4.96
79	79	-0.702	-1.034	-0.842	2.000	6484	-1763	-314	4298	-59906	-1821	4893	Y	504	131.57	118.41	893	118	0.12	0.261	0.00	0.19	0.62	1391	1819	1065	3.58	13.98	4.78
79	80	-0.850	-0.884	-0.864	2.000	6283	-940	-296	4191	-47758	-1688	4732	Y	504	126.59	113.93	912	26	0.12	0.260	0.00	0.19	0.62	1351	1758	993	3.73	13.77	4.71
80	80	-0.852	-0.883	-0.864	2.000	6283	-377	-302	4060	-47158	-1694	4388	Y	499	126.59	113.93	909	32	0.12	0.241	0.00	0.18	0.62	1351	1756	986	3.76	12.77	4.37
80	81	-0.963	-1.310	-1.096	2.000	6103	375	-284	3945	-35963	-1565	4219	Y	889	106.03	95.43	997	0	0.12	0.239	0.00	0.18	0.31	566	1407	916	2.84	12.50	4.27
81	81	-0.965	-1.310	-1.097	2.000	6103	876	-296	3761	-35420	-1574	3951	Y	880	106.03	95.43	993	0	0.12	0.224	0.00	0.17	0.31	566	1403	912	2.84	11.70	4.00
81	82	-1.058	-1.309	-1.148	2.000	5941	1606	-279	3630	-25119	-1452	3767	Y	584	99.67	92.12	825	0	0.12	0.219	0.00	0.17	0.31	546	1234	845	2.53	11.34	3.88
82	82	-1.077	-1.306	-1.159	2.000	5941	1670	-292	3510	-24703	-1468	3180	Y	203	99.67	92.12	635	181	0.21	0.185	0.00	0.20	0.31	546	1063	835	1.89	9.57	3.27
82	83	-0.804	-1.109	-0.913	2.000	5756	2412	-276	3375	-15186	-1349	2991	Y	73	89.75	89.42	554	195	0.23	0.179	0.00	0.20	0.31	530	976	769	1.85	9.18	3.14
83	83	-0.824	-1.108	-0.925	2.000	5756	2808	-275	3342	-14513	-1345	3075	Y	55	89.75	89.42	545	202	0.24	0.185	0.00	0.21	0.31	530	968	770	1.82	9.44	3.23
83	84	-0.961	-1.402	-1.119	2.000	5587	3448	-258	3217	-5925	-1224	2897	Y	428	76.16	86.94	718	0	0.12	0.179	0.00	0.15	0.21	344	955	703	2.09	9.06	3.10
84	84	-0.962	-1.402	-1.119	2.000	5587	3806	-259	3167	-5542	-1223	2942	Y	410	76.16	86.94	708	0	0.12	0.182	0.00	0.15	0.21	344	947	705	2.06	9.20	3.15
84	85	-1.057	-1.245	-1.124	2.000	5440	4344	-241	3048	2126	-1104	2770	Y	192	46.76	84.78	587	26	0.12	0.176	0.00	0.15	0.21	335	830	640	1.88	8.81	3.01
85	85	-1.057	-1.245	-1.124	2.000	5440	4674	-244	2978	2466	-1109	2675	Y	171	46.76	84.78	577	40	0.12	0.170	0.00	0.14	0.21	335	820	639	1.84	8.51	2.91
85	86	-1.204	-0.976	-1.123	2.000	5313	5111	-226	2864	9260	-990	2508	Y	16	46.43	82.94	488	62	0.12	0.163	0.00	0.14	0.29	465	858	574	2.40	8.10	2.77
86	86	-1.204	-0.975	-1.123	2.000	5313	5405	-230	2780	9569	-994	2227	Y	-2	46.43	82.94	481	71	0.12	0.145	0.00	0.13	0.29	465	852	567	2.40	7.19	2.46
86	87	-0.963	-0.818	-0.912	2.000	5206	5761	-212	2671	15501	-876	2063	Y	-11	57.03	81.36	477	10	0.12	0.137	0.00	0.13	0.29	457	840	503	2.77	6.75	2.31
87	87	-0.963	-0.817	-0.911	2.000	5206	5599	-233	2581	15346	-894	2156	Y	-25	57.03	81.36	483	13	0.12	0.143	0.00	0.13	0.29	457	846	515	2.67	7.05	2.41
87	88	-1.005	-1.251	-1.092	2.000	5116	6293	-198	2473	20802	-759	1995	Y	230	64.47	80.06	578	0	0.12	0.135	0.00	0.13	0.29	449	925	442	3.72	6.60	2.26
88	88	-1.004	-1.251	-1.091	2.000	5116	6200	-221	2385	20707	-780	2306	Y	211	64.47	80.06	569	0	0.12	0.156	0.00	0.14	0.29	449	916	463	3.44	7.63	2.61
88	89	-1.093	-1.098	-1.095	2.000	5018	6830	-187	2277	25316	-648	2145	Y	-17	64.46	78.62	464	0	0.12	0.148	0.00	0.13	0.29	441	814	392	3.55	7.18	2.46
89	89	-1.093	-1.098	-1.095	2.000	5018	6648	-209	2189	25134	-670	2228	Y	-33	64.46	78.62	472	0	0.12	0.153	0.00	0.14	0.29	441	821	405	3.40	7.46	2.55
89	90	-1.182	-0.927	-1.092	2.000	5000	7295	-179	2094	28989	-540	2080	Y	-1	64.22	78.35	454	0	0.12	0.144	0.00	0.13	0.29	440	804	336	4.02	6.98	2.39
90	90	-1.180	-0.927	-1.091	2.000	5000	6944	-194	2003	28620	-555	1898	Y	-17	64.22	78.35	462	0	0.12	0.131	0.00	0.13	0.29	440	812	337	3.96	6.37	2.18
90	91	-1.242	-0.798	-1.086	2.000	4969	7509	-166	1911	31617	-428	1751	Y	20	64.05	77.90	461	0	0.12	0.122	0.00	0.12	0.29	437	808	269	4.76	5.90	2.02
91	91	-1.219	-0.798	-1.071	2.000	4969	8479	-130	1850	32337	-390	1602	Y	1	64.05	77.90	452	0	0.12	0.111	0.00	0.12	0.29	437	800	245	5.49	5.40	1.85
91	92	-0.853	-0.820	-0.841	2.000	4960	8664	-106	1782	34161	-267	1480	N	-14	82.00	77.76	415	0	0.12	Not Reqd	0.00	0.06	0.29	430	761	134	12.79	0.00	0.00
92	92	-0.835	-0.819	-0.829	2.000	4960	8739	-123	1609	34082	-283	1465	N	-20	82.00	77.76	417	0	0.12	Not Reqd	0.00	0.06	0.29	430	763	142	11.12	0.00	0.00
92	93	-0.851	-0.780	-0.826	2.000	4960	9021	-115	1557	34980	-215	1381	N	-43	81.79	77.76	444	0	0.12	Not Reqd	0.00	0.06	0.29	432	789	107	12.90	0.00	0.00
93	93	-0.847	-0.780	-0.824	2.000	4960	9001	-104	1631	34922	-203	1618	Y	-49	81.79	77.76	448	0	0.12	0.113	0.00	0.12	0.29	432	792	152	7.19	5.46	1.87
93	94	-0.866	-0.735	-0.820	2.000	4969	7559	101	1627	33867	101	1559	Y	-90	81.08	77.90	476	0	0.12	0.108	0.00	0.11	0.29	434	819	100	8.05	5.26	1.80
94	94	-0.865	-0.735	-0.820	2.000	4969	8508	-52	1519	34806	-51	1613	Y	-104	81.08	77.90	479	0	0.12	0.112	0.00	0.12	0.29	434	821	77	11.07	5.44	1.86
94	95	-0.876	-0.706	-0.816	2.000	5000	7853	109	1759	33757	209	1798	Y	-149	79.84	78.35	508	0	0.12	0.124	0.00	0.12	0.29	437	850	161	7.25	6.04	2.06
95	95	-0.874	-0.706	-0.815	2.000	5000	8838	101	1583	34723	202	1744	Y	-161	79.84	78.35	510	0	0.12	0.120	0.00	0.12	0.29	436	852	156	7.93	5.85	2.00

PROJECT: **Cline Avenue Mainline Seg 3 EB** CALCS BY: TSP DATE: 01/21/09

DESCRIPTION: **Ultimate Shear Check** CHECKED BY: DATE:

Web Reinforcement Requirements **Load combination: Strength 1**

Material Properties:

Concrete

$f'c$ = ***5.0*** ksi

ϕ_v = ***0.90***

P-T Strands

f_{pu} = ***270*** ksi

f_{pe} = ***176*** ksi

Reinforcement

fy = ***60.0*** ksi

Box Girder Properties:

Web Thickness

b_v = ***14.00*** in

Effective Width of Shear Flow Path

be= ***5.50*** in

Notes:

1. All shears are vertical unless noted otherwise.
2. Web thickness is horizontal, box depth is vertical.

Calc RF

Member Number	Node Number	(ksi) Perm Load Stress (top fiber)	(ksi) Perm Load Stress (bott. fiber)	(ksi) Dead Load Stress (neutr. axis)	Stress Variable 'K'	(k-ft) Torsional Moment (Tcr)	Ultimate Corresp. Live Load Moment	Ultimate Max Live Load Shear	Ultimate Corresp. Live Load Torsion	TOTAL Ultimate Moment (Mu)	TOTAL Ultimate Shear (Vu)	TOTAL Ultimate Torsion (Tu)	Investigate Torsional Effects? (Y/N)	Shear from Primary Post Tensioning Effect (Vp)	(in) Depth to Tensile Reinforcement d_e	(in) Effective Shear Depth d_v	(kip) Concrete Shear Resistance per web (Vc)	(kip) Required Steel Resistance per web (Vs-req'd)	(in^2/ft) Required Steel Area per web (Av)	(in^2/ft) Additional Steel Required for Torsion (At)	(in^2/ft) Additional Steel Req'd from Transverse A_v (trans)	(in^2/ft) Total Steel Required per leg (As_req'd)	(in^2/ft) Steel Provided per leg As_prov'd)	(kip) Provided Steel Resistance per web (Vs_prov)	(kip) Nominal Shear Resistance per web (ϕVn)	(kip) Ultimate Shear per web (Vu)	Shear Rating Factor, RF	Total Long. Mild Steel Required for Torsion (Al) in^2	Equivalent PT Steel Req'd for Torsion (based on fpe) (Al) in^2
		Permanent Loads + Maximum LL Torsion @ t=00																											
95	96	-0.876	-0.695	-0.813	2.000	5049	7920	117	1912	32628	317	2019	Y	-207	78.04	79.07	544	0	0.12	0.138	0.00	0.13	0.29	441	887	222	6.59	6.74	2.30
96	96	-0.863	-0.695	-0.804	2.000	5049	8998	111	1752	33571	312	2070	Y	-219	78.04	79.07	546	0	0.12	0.142	0.00	0.13	0.29	441	888	221	7.01	6.90	2.36
96	97	-0.857	-0.704	-0.803	2.000	5116	8007	126	2077	30622	427	2340	Y	-247	92.25	83.03	543	0	0.12	0.158	0.00	0.14	0.29	457	900	287	5.76	7.74	2.65
97	97	-0.613	-0.684	-0.638	2.000	5116	9047	123	1933	31804	423	2727	Y	-251	92.25	83.03	542	0	0.12	0.184	0.00	0.15	0.29	456	898	297	5.91	9.02	3.08
97	98	-0.569	-0.742	-0.630	2.000	5206	8545	144	2257	28569	545	2996	Y	-260	77.47	81.36	577	0	0.12	0.199	0.00	0.16	0.29	453	927	367	4.90	9.80	3.35
98	98	-0.786	-0.620	-0.728	2.000	5206	9354	132	2113	29384	533	1825	Y	-315	77.47	81.36	603	0	0.12	0.121	0.00	0.12	0.29	453	951	324	5.71	5.97	2.04
98	99	-0.756	-0.670	-0.726	2.000	5313	8771	154	2437	25278	656	2094	Y	-335	74.15	82.94	636	0	0.12	0.136	0.00	0.13	0.29	464	989	394	4.86	6.76	2.31
99	99	-0.754	-0.670	-0.725	2.000	5313	9009	145	2302	25502	649	1897	Y	-347	74.15	82.94	641	0	0.12	0.123	0.00	0.12	0.29	464	994	384	5.21	6.12	2.09
99	100	-0.715	-0.730	-0.720	2.000	5440	8324	166	2625	20484	773	2165	Y	-391	70.40	84.78	687	0	0.12	0.138	0.00	0.13	0.29	476	1046	455	4.56	6.89	2.35
100	100	-0.714	-0.730	-0.719	2.000	5440	8682	158	2505	20832	767	2270	Y	-405	70.40	84.78	693	0	0.12	0.144	0.00	0.13	0.29	476	1052	455	4.77	7.22	2.47
100	101	-0.671	-0.801	-0.716	2.000	5587	7886	179	2829	14879	892	2539	Y	-445	66.15	86.94	726	0	0.12	0.157	0.00	0.14	0.29	488	1092	526	4.16	7.94	2.72
101	101	-0.670	-0.801	-0.716	2.000	5587	7946	172	2693	14936	886	2816	Y	-618	66.15	86.94	813	0	0.12	0.174	0.00	0.15	0.29	488	1170	532	4.73	8.81	3.01
101	102	-0.637	-0.802	-0.698	2.000	5721	7033	193	3012	8037	1013	3081	Y	-655	61.45	89.42	845	0	0.12	0.186	0.00	0.15	0.29	502	1212	604	4.18	9.49	3.25
102	102	-0.637	-0.802	-0.698	2.000	5721	7548	189	2949	8551	1013	3196	Y	-663	61.45	89.42	849	0	0.12	0.193	0.00	0.16	0.29	502	1216	607	4.24	9.85	3.37
102	103	-0.599	-0.808	-0.679	2.000	5870	6490	210	3264	633	1143	3457	Y	-695	56.28	92.12	881	0	0.12	0.203	0.00	0.16	0.53	930	1551	681	5.18	10.49	3.58
103	103	-0.599	-0.808	-0.679	2.000	5870	6838	204	3169	981	1142	3474	Y	-703	56.28	92.12	885	0	0.12	0.204	0.00	0.16	0.53	930	1555	681	5.32	10.54	3.60
103	104	-0.555	-0.819	-0.661	2.000	6041	5655	224	3483	-7968	1276	3733	Y	-741	81.42	95.13	921	0	0.12	0.213	0.00	0.17	0.53	961	1612	756	4.86	11.13	3.80
104	104	-0.555	-0.819	-0.661	2.000	6041	5711	216	3336	-7909	1272	3660	Y	-752	81.42	95.13	927	0	0.12	0.209	0.00	0.16	0.53	961	1617	751	5.06	10.91	3.73
104	105	-0.508	-0.832	-0.642	2.000	6230	4423	236	3646	-17900	1409	3915	Y	-802	92.13	98.42	954	0	0.12	0.217	0.00	0.17	0.53	990	1684	828	4.67	11.45	3.92
105	105	-0.509	-0.832	-0.643	2.000	6230	4861	223	3435	-17454	1400	3759	Y	-811	92.13	98.42	960	0	0.12	0.208	0.00	0.16	0.53	990	1688	819	4.95	11.00	3.76
105	106	-0.460	-0.845	-0.624	2.000	6441	3506	242	3742	-28478	1541	4012	Y	-874	103.93	102.02	973	0	0.12	0.215	0.00	0.17	0.53	1016	1765	897	4.62	11.51	3.93
106	106	-0.461	-0.845	-0.625	2.000	6441	3248	223	3447	-28723	1525	3781	Y	-888	103.93	102.02	980	0	0.12	0.203	0.00	0.16	0.53	1016	1771	882	5.03	10.84	3.71
106	107	-0.413	-0.854	-0.607	2.000	6670	1871	243	3752	-40757	1670	4032	Y	-953	116.99	105.89	999	0	0.12	0.209	0.00	0.16	0.53	1044	1839	962	4.66	11.33	3.87
107	107	-0.414	-0.854	-0.607	2.000	6670	2094	220	3386	-40524	1647	3718	Y	-968	116.99	105.89	1008	0	0.12	0.193	0.00	0.16	0.53	1045	1848	941	5.18	10.45	3.57
107	108	-0.362	-0.869	-0.590	2.000	6921	728	238	3689	-53548	1797	3966	Y	-945	130.80	117.72	1029	0	0.12	0.198	0.00	0.16	0.53	1153	1964	1024	4.99	10.91	3.73
108	108	-0.362	-0.869	-0.589	2.000	6921	789	209	3238	-53502	1763	3488	Y	-959	130.80	117.72	1038	0	0.12	0.174	0.00	0.15	0.53	1153	1972	992	5.74	9.59	3.28
108	109	-0.293	-0.904	-0.573	2.000	7190	-517	228	3538	-67469	1917	3733	Y	-814	143.82	129.44	995	70	0.12	0.179	0.00	0.15	0.53	1259	2029	1076	5.22	10.05	3.43
109	109	-0.293	-0.903	-0.573	2.000	7190	-780	194	3006	-67732	1873	2684	Y	-712	143.82	129.44	942	98	0.12	0.129	0.00	0.12	0.53	1258	1981	1021	6.00	7.22	2.47
109	110	-0.180	-1.022	-0.567	2.000	7513	-1987	212	3305	-82590	2030	2928	Y	-381	154.24	138.82	792	336	0.26	0.135	0.00	0.20	0.53	1339				7.69	2.63
110	110	-0.177	-1.019	-0.564	2.000	7513	-1915	185	2882	-82561	1991	1698	N	-137	154.24	138.82	665	441	0.35	Not Reqd	0.00	0.17	0.53	1337				0.00	0.00
110	111	-0.116	-1.092	-0.564	2.000	7513	-2270	191	2984	-87487	2042	1782	N	6	154.54	139.08	590	544	0.43	Not Reqd	0.00	0.22	0.53	1335				0.00	0.00
111	111	-0.076	-1.153	-0.571	2.000	7513	-7415	-318	2733	-88284	-2623	8205	Y	6	154.54	139.08	578	879	0.70	0.377	0.00	0.54	0.53	1330				21.54	7.37
111	112	-0.141	-1.062	-0.564	2.000	7513	-6626	-313	2716	-81789	-2573	8170	Y	110	154.38	138.94	641	788	0.62	0.376	0.00	0.50	0.29	741				21.45	7.33
112	112	-0.144	-1.066	-0.568	2.000	7513	-6680	-305	2816	-81867	-2578	7483	Y	348	154.38	138.94	766	667	0.53	0.344	0.00	0.44	0.29	742				19.65	6.72
112	113	-0.284	-0.882	-0.558	2.000	7042	-4373	-289	2761	-62352	-2424	7374	Y	648	143.12	128.80	904	443	0.37	0.362	0.00	0.37	0.29	695	1439	1445	0.97	20.08	6.86
113	113	-0.282	-0.884	-0.558	2.000	7042	-4358	-282	2884	-62424	-2430	7381	Y	747	143.12	128.80	955	395	0.33	0.362	0.00	0.35	0.29	695	1485	1448	1.16	20.10	6.87
113	114	-0.392	-0.775	-0.564	2.000	6921	-2447	-235	2643	-44259	-2248	7085	Y	1024	131.40	118.26	1082	167	0.15	0.354	0.00	0.25	0.29	645	1554	1348	2.03	19.49	6.66
114	114	-0.391	-0.776	-0.563	2.000	6921	-2217	-234	2801	-44077	-2258	7494	Y	1010	131.40	118.26	1075	180	0.16	0.374	0.00	0.27	0.29	645	1548	1365	1.89	20.61	7.05
114	115	-0.468	-0.705	-0.572	2.000	6522	-984	-216	2687	-27552	-2108	7325	Y	1297	112.96	103.73	1187	0	0.12	0.388	0.00	0.25	0.29	573	1584	1285	2.55	20.85	7.13
115	115	-0.467	-0.706	-0.571	2.000	6522	-925	-214	2783	-27547	-2114	7228	Y	1282	112.96	103.73	1179	0	0.12	0.383	0.00	0.25	0.29	573	1577	1285	2.49	20.58	7.03
115	116	-0.499	-0.692	-0.581	2.000	6441	463	78	2600	-11824	-1694	6990	Y	1560	93.75	102.02	1371	0	0.12	0.375	0.00	0.25	0.29	572	1749	1068	6.63	20.05	6.85
116	116	-0.498	-0.694	-0.581	2.000	6441	-64	-116	2433	-12390	-1891	5301	Y	1546	93.75	102.02	1361	0	0.12	0.284	0.00	0.20	0.29	572	1739	1113	5.64	15.20	5.20
116	117	-0.006	0.002	-0.003	1.010	3129	17	106	2739	160	-1313	5553	Y	0	0.00	98.42	38	691	4.55	0.310	0.00	2.43	0.29	89				16.30	5.57
																											0.69		

PROJECT: **Cline Avenue Mainline Seg 3 EB** CALCS BY: TSP DATE: 01/21/09

DESCRIPTION: **Ultimate Shear Check** CHECKED BY: DATE:

Web Reinforcement Requirements **Load combination: Strength 1**

Material Properties:

Concrete

f'c = ***5.0*** ksi

ϕ_v = ***0.90***

P-T Strands

f_{pu} = ***270*** ksi

f_{pe} = ***176*** ksi

Reinforcement

fy = ***60.0*** ksi

Box Girder Properties:

Web Thickness

b_v = ***14.00*** in

Effective Width of Shear Flow Path

be= ***5.50*** in

Notes:

1. All shears are vertical unless noted otherwise.
2. Web thickness is horizontal, box depth is vertical.

Calc RF

Member Number	Node Number	(ksi) Perm Load Stress (top fiber)	(ksi) Perm Load Stress (bott. fiber)	(ksi) Dead Load Stress (neutr. axis) (fpc)	Stress Variable 'K'	(k-ft) Torsional Moment (Tcr)	Ultimate Corresp. Live Load Moment	Ultimate Max Live Load Shear	Ultimate Corresp. Live Load Torsion	TOTAL Ultimate Moment (Mu)	TOTAL Ultimate Shear (Vu)	TOTAL Ultimate Torsion (Tu)	Investigate Torsional Effects? (Y/N)	Shear from Primary Post Tensioning Effect (Vp)	(in) Depth to Tensile Reinforcement d_e	(in) Effective Shear Depth d_v	(kip) Concrete Shear Resistance per web (Vc)	(kip) Required Steel Resistance per web (Vs-req'd)	(in^2/ft) Required Steel Area per web (Av)	(in^2/ft) Additional Steel Required for Torsion (At)	(in^2/ft) Additional Steel Req'd from Transverse A_v (trans)	(in^2/ft) Total Steel Required per leg (As_req'd)	(in^2/ft) Steel Provided per leg As_prov'd)	(kip) Provided Steel Resistance per web (Vs_prov)	(kip) Nominal Shear Resistance per web (ϕVn)	(kip) Ultimate Shear per web (Vu)	Shear Rating Factor, RF	Total Long. Mild Steel Required for Torsion (Al) in^2	Equivalent PT Steel Req'd for Torsion (based on fpe) (Al) in^2
							Permanent Loads + Minimum LL Torsion @ t=00																						
1	1	-0.005	-0.005	-0.005	1.019	7064	0	0	-841	0	2529	-179	N	0	0.00	102.02	42	895	4.93	Not Reqd	0.00	2.46	0.37	135				0.00	0.00
1	2	-0.673	-0.753	-0.706	2.000	14431	-506	247	-3397	-22698	3401	-2676	N	-2829	99.17	105.89	1556	0	0.12	Not Reqd	0.00	0.06	0.37	753	2078	1134	12.48	0.00	0.00
2	2	-0.673	-0.753	-0.706	2.000	14431	-506	247	-3396	-22698	3400	-2676	N	-2854	99.17	105.89	1565	0	0.12	Not Reqd	0.00	0.06	0.37	753	2086	1133	12.57	0.00	0.00
2	3	-0.652	-0.739	-0.690	2.000	14973	-2294	329	-4543	-49978	3702	-3764	N	-2498	118.41	110.07	1446	0	0.12	Not Reqd	0.00	0.06	0.37	779	2002	1234	8.01	0.00	0.00
3	3	-0.652	-0.739	-0.690	2.000	14973	-2294	329	-4543	-49978	3702	-3763	N	-2523	118.41	110.07	1454	0	0.12	Not Reqd	0.00	0.06	0.37	779	2010	1234	8.08	0.00	0.00
3	4	-0.595	-0.778	-0.677	2.000	15555	-2619	347	-4852	-77543	3948	-4014	N	-2082	134.90	121.41	1319	143	0.13	Not Reqd	0.00	0.06	0.37	849	1952	1316	6.50	0.00	0.00
4	4	-0.595	-0.778	-0.677	2.000	15555	-2619	347	-4852	-77543	3947	-4013	N	-2109	134.90	121.41	1329	133	0.12	Not Reqd	0.00	0.06	0.37	849	1960	1316	6.57	0.00	0.00
4	5	-0.507	-0.850	-0.664	2.000	16176	-4116	401	-5660	-108093	4238	-4762	N	-1729	148.91	134.02	1224	346	0.28	Not Reqd	0.00	0.14	0.37	928	1937	1413	4.92	0.00	0.00
5	5	-0.507	-0.850	-0.664	2.000	16176	-4116	401	-5659	-108093	4238	-4761	N	-1762	148.91	134.02	1236	334	0.27	Not Reqd	0.00	0.13	0.37	928	1947	1413	5.00	0.00	0.00
5	6	-0.396	-0.943	-0.652	2.000	16843	-4732	419	-5972	-139638	4500	-5014	N	-1416	160.79	144.71	1136	531	0.40	Not Reqd	0.00	0.20	0.37	993	1916	1500	3.98	0.00	0.00
6	6	-0.394	-0.941	-0.651	2.000	16843	-4732	420	-5976	-139639	4503	-5005	N	-1171	160.79	144.71	1051	617	0.46	Not Reqd	0.00	0.23	0.37	992	1839	1501	3.41	0.00	0.00
6	7	-0.262	-1.103	-0.657	2.000	17619	-5495	438	-6285	-173261	4772	-5256	N	-676	170.42	153.38	892	875	0.62	Not Reqd	0.00	0.31	0.37	1043				0.00	0.00
7	7	-0.257	-1.097	-0.652	2.000	17619	-5495	438	-6290	-173261	4775	-5250	N	-111	170.42	153.38	696	1072	0.77	Not Reqd	0.00	0.38	0.37	1041				0.00	0.00
7	8	-0.193	-1.181	-0.657	2.000	17619	-5770	444	-6388	-184479	4861	-5330	Y	103	170.43	153.39	683	1117	0.80	0.105	0.00	0.45	0.37	1038				-9.99	-3.42
8	8	-0.302	-1.022	-0.640	2.000	17619	-7930	-572	-9838	-181707	-3993	-10978	Y	103	170.43	153.39	695	783	0.56	0.215	0.00	0.39	0.37	1041				-20.57	-7.03
8	9	-0.356	-0.961	-0.640	2.000	17619	-6750	-564	-9737	-172076	-3904	-10859	Y	269	170.16	153.15	761	685	0.49	0.213	0.00	0.35	0.31	869				-20.35	-6.96
9	9	-0.359	-0.964	-0.643	2.000	17619	-6751	-558	-9730	-172076	-3898	-10841	Y	838	170.16	153.15	958	486	0.35	0.213	0.00	0.28	0.31	871				-20.32	-6.95
9	10	-0.463	-0.865	-0.652	2.000	16843	-3334	-531	-9413	-143557	-3621	-10465	Y	1257	159.91	143.92	1083	258	0.19	0.215	0.00	0.20	0.31	824	1717	1362	2.12	-20.25	-6.92
10	10	-0.464	-0.865	-0.653	2.000	16843	-3329	-528	-9405	-143551	-3617	-10443	Y	1509	159.91	143.92	1171	169	0.13	0.214	0.00	0.17	0.31	825	1796	1360	2.38	-20.21	-6.91
10	11	-0.388	-0.862	-0.605	2.000	16176	-271	-501	-9084	-117313	-3346	-10063	Y	1650	146.86	132.17	1160	79	0.12	0.215	0.00	0.17	0.31	757	1725	1264	2.53	-20.05	-6.85
11	11	-0.388	-0.862	-0.605	2.000	16176	-272	-502	-9085	-117314	-3346	-10063	Y	1620	146.86	132.17	1149	90	0.12	0.215	0.00	0.17	0.31	757	1715	1264	2.50	-20.05	-6.85
11	12	-0.439	-0.854	-0.624	2.000	15555	2459	-475	-8758	-93279	-3084	-9678	Y	1669	133.56	120.20	1132	10	0.12	0.215	0.00	0.17	0.31	693	1642	1171	2.64	-19.84	-6.78
12	12	-0.439	-0.854	-0.624	2.000	15555	2457	-475	-8759	-93280	-3084	-9678	Y	1644	133.56	120.20	1124	19	0.12	0.215	0.00	0.17	0.31	693	1634	1171	2.61	-19.84	-6.78
12	13	-0.439	-0.859	-0.621	2.000	14973	4873	-449	-8426	-71374	-2830	-9286	Y	1515	119.91	110.07	1046	2	0.12	0.214	0.00	0.17	0.31	637	1515	1081	2.58	-19.58	-6.69
13	13	-0.439	-0.859	-0.621	2.000	14973	4872	-449	-8427	-71375	-2831	-9286	Y	1493	119.91	110.07	1038	10	0.12	0.214	0.00	0.17	0.31	637	1508	1081	2.56	-19.58	-6.69
13	14	-0.488	-0.855	-0.642	2.000	14431	6984	-424	-8084	-51523	-2585	-8884	Y	1394	108.10	105.89	1015	0	0.12	0.213	0.00	0.17	0.31	618	1470	993	2.83	-19.25	-6.58
14	14	-0.488	-0.855	-0.642	2.000	14431	6982	-424	-8085	-51524	-2585	-8885	Y	1370	108.10	105.89	1007	0	0.12	0.213	0.00	0.17	0.31	618	1462	993	2.80	-19.25	-6.58
14	15	-0.384	-0.878	-0.584	2.000	13934	8805	-399	-7731	-33651	-2348	-8473	Y	1216	92.27	102.02	937	0	0.12	0.210	0.00	0.16	0.31	596	1380	908	2.91	-18.85	-6.44
15	15	-0.384	-0.878	-0.584	2.000	13934	8804	-399	-7732	-33652	-2348	-8473	Y	1197	92.27	102.02	931	0	0.12	0.210	0.00	0.16	0.31	596	1374	908	2.89	-18.85	-6.45
15	16	-0.430	-0.879	-0.604	2.000	13477	10348	-374	-7370	-17686	-2118	-8052	Y	1141	81.71	98.42	928	0	0.12	0.206	0.00	0.16	0.31	580	1357	825	3.28	-18.37	-6.28
16	16	-0.430	-0.879	-0.604	2.000	13477	10348	-374	-7370	-17686	-2119	-8052	Y	1131	81.71	98.42	924	0	0.12	0.206	0.00	0.16	0.31	580	1354	825	3.26	-18.37	-6.28
16	17	-0.470	-0.890	-0.626	2.000	13066	11626	-350	-7000	-3557	-1897	-7624	Y	1085	71.93	95.13	912	0	0.12	0.202	0.00	0.16	0.21	376	1160	745	2.88	-17.81	-6.09
17	17	-0.470	-0.890	-0.626	2.000	13066	11626	-350	-7001	-3558	-1897	-7624	Y	1072	71.93	95.13	908	0	0.12	0.202	0.00	0.16	0.21	376	1156	745	2.87	-17.81	-6.09
17	18	-0.504	-0.913	-0.648	2.000	12695	12650	-326	-6627	8803	-1683	-7191	Y	1019	64.95	92.12	873	0	0.12	0.196	0.00	0.16	0.21	364	1113	667	3.16	-17.18	-5.87
18	18	-0.504	-0.912	-0.647	2.000	12695	12636	-332	-6633	8789	-1688	-7201	Y	712	64.95	92.12	771	0	0.12	0.196	0.00	0.16	0.21	364	1021	669	2.69	-17.20	-5.88
18	19	-0.547	-0.843	-0.651	2.000	12301	13461	-309	-6257	19469	-1479	-6766	Y	652	69.28	89.42	728	0	0.12	0.190	0.00	0.15	0.21	353	972	593	2.94	-16.56	-5.66
19	19	-0.547	-0.843	-0.651	2.000	12301	13460	-309	-6257	19468	-1479	-6767	Y	632	69.28	89.42	720	0	0.12	0.190	0.00	0.15	0.21	353	966	593	2.91	-16.56	-5.66
19	20	-0.586	-0.782	-0.654	2.000	11939	14054	-286	-5882	28473	-1272	-6332	Y	564	73.04	86.94	668	0	0.12	0.183	0.00	0.15	0.21	341	908	518	3.14	-15.86	-5.42
20	20	-0.586	-0.782	-0.654	2.000	11939	14054	-286	-5882	28473	-1272	-6333	Y	547	73.04	86.94	662	0	0.12	0.183	0.00	0.15	0.21	341	903	518	3.11	-15.87	-5.42
20	21	-0.618	-0.731	-0.657	2.000	11623	14429	-264	-5508	35826	-1067	-5900	Y	496	76.30	84.78	620	0	0.12	0.175	0.00	0.15	0.21	331	856	443	3.44	-15.09	-5.16
21	21	-0.618	-0.731	-0.657	2.000	11623	14429	-264	-5508	35826	-1067	-5900	Y	476	76.30	84.78	613	0	0.12	0.175	0.00	0.15	0.21	331	850	443	3.40	-15.09	-5.16
21	22	-0.479	-0.710	-0.559	2.000	11354	14598	-243	-5136	41551	-864	-5470	Y	442	91.42	82.94	613	0	0.12	0.166	0.00	0.14	0.21	326	846	369	4.04	-14.25	-4.87
22	22	-0.481	-0.647	-0.539	2.000	11354	14599	-243	-5137	41551	-864	-5470	Y	374	91.42	82.94	590	0	0.12	0.166	0.00	0.14	0.21	326	824	369	3.90	-14.26	-4.87
22	23	-0.498	-0.617	-0.539	2.000	11124	14574	-222	-4769	45669	-662	-5044	Y	351	72.14	81.36	566	0	0.12	0.157	0.00	0.14	0.21	319	797	295	4.48	-13.36	-4.57
23	23	-0.822	-0.632	-0.756	2.000	11124	14575	-222	-4769	45670	-663	-5044	Y	360	72.14	81.36	570	0	0.12	0.157	0.00	0.14	0.21	319	800	295	4.49	-13.36	-4.57
23	24	-0.826	-0.631	-0.758	2.000	10933	14369	-201	-4408	48200	-462	-4624	Y	295	73.86	80.06	536	0	0.12	0.146	0.00	0.13	0.21	314	765	222	5.10	-12.42	-4.24
24	24	-0.826	-0.631	-0.758	2.000	10933	14371	-202	-4408	48202	-463	-4624	Y	272	73.86	80.06	529	0	0.12	0.146	0.00	0.13	0.21	314	758	223	5.05	-12.42	-4.24
24	25	-0.820	-0.647	-0.760	2.000	10788	14004	-182	-4054	49172	-264	-4211	Y	203	75.06	79.07	499	0	0.12	0.135	0.00	0.13	0.21	310	728	150	5.79	-11.43	-3.91
25	25	-0.820	-0.647	-0.760	2.000	10788	14006	-182	-4054	49174	-264	-4211	Y	184	75.06	79.07	493	0	0.12	0.135	0.00	0.13	0.21	310	722	150	5.74	-11.43	-3.91
25	26	-0.804	-0.675	-0.759	2.000	10683	13486	-164	-3710	48597	-67	-3808	Y	122	75.73	78.35	469	0	0.12	0.123	0.00	0.12	0.21	307	699	79	6.67	-10.42	-3.56
26	26	-0.804	-0.675	-0.759	2.000	10683	13489	-164	-3710	48599	-67	-3808	Y	103	75.73	78.35	463	0	0.12	0.123	0.00	0.12	0.21	307	693	79	6.62	-10.42	-3.56
26	27	-0.775	-0.726	-0.758	2.000	10617	18884	77	-3475	52546	352	-3515	Y	50	75.97	77.90	431	0	0.12	0.114	0.00	0.12	0.21	304	662	169	7.39	-9.66	-3.30
27	27	-0.775	-0.726	-0.758	2.000	10617	18888	77	-3474	52549	352	-3514	Y	19	75.97	77.90	420	0	0.12	0.114	0.00	0.12	0.21	304	652	169	7.28	-9.66	-3.30
27	28	-1.195	-0.725	-1.032	2.000	10617	16075	280	-3664	47543	699	-3656	Y	23	57.68	77.90	459	0	0.12	0.119	0.00	0.12	0.21	308	690	287	3.73	-10.05	-3.44
28	28	-1.195	-0.725	-1.032	2.000	10617	16073	279	-3663	47541	699	-3655	Y	-20	57.68	77.90	458	0	0.12	0.119	0.00	0.12	0.21	308	689	287	3.73	-10.05	-3.44
28	29	-1.133	-0.833	-1.029	2.000	10683	15612	301	-4003	43115	898	-3936	Y	33	57.84	78.35	465	0	0.12	0.127	0.00	0.12	0.21	310	697	358	3.13	-10.77	-3.68
29	29	-1.133	-0.833	-1.029	2.000	10683	15611	301	-4002	43113	898	-3935	Y	7	57.84	78.35	456	0	0.12	0.127	0.00	0.12	0.21	310	689	358	3.08	-10.77	-3.68
29	30	-1.048	-0.982	-1.025	2.000	10788	14963	323	-4351	37110	1099	-4226	Y	53	58.27	79.07	475	0	0.12	0.135	0.00	0.13	0.21	313	709	429	2.63	-11.47	-3.92
30	30	-1.048	-0.982	-1.025	2.000	10788	14962	323	-4350	37109	1099	-4225	Y	27	58.27	79.07	467	0	0.12	0.135	0.00	0.13	0.21	313	701	429	2.59	-11.47	-3.92
30	31	-0.953	-1.134	-1.016	2.000	10933	14122	345	-4707	29518	1300	-4523	Y	-186	58.33	80.06	526	0	0.12	0.143	0.00	0.13	0.21	316	758	500	2.40	-12.15	-4.15
31	31	-0.953	-1.134	-1.016	2.000	10933	14121	345	-4706	29516	1300	-4523	Y	-217	58.33	80.06	536	0	0.12	0.143	0.00	0.13	0.21	316	767	500	2.45	-12.15	-4.15
31	32	-0.876	-0.974	-0.910	2.000	11124	13094	368	-5069	20337	1504	-4827	Y	50	53.96	81.36	488	70	0.12	0.150	0.00	0.13	0.21	322	728	573	1.79	-12.79	-4.37
32	32	-0.876	-0.974	-0.910	2.000	11124	13093	367	-5069	20335	1504	-4826	Y	26	53.96	81.36	480	77	0.12	0.150	0.00	0.13	0.21	322	721	573	1.75	-12.78	-4.37

PROJECT: **Cline Avenue Mainline Seg 3 EB** CALCS BY: TSP DATE: 01/21/09

DESCRIPTION: **Ultimate Shear Check** CHECKED BY: DATE:

Web Reinforcement Requirements **Load combination: Strength 1**

Material Properties:

Concrete

f'c = ***5.0*** ksi

ϕ_v = ***0.90***

P-T Strands

f_{pu} = ***270*** ksi

f_{pe} = ***176*** ksi

Reinforcement

fy = ***60.0*** ksi

Box Girder Properties:

Web Thickness

b_v = ***14.00*** in

Effective Width of Shear Flow Path

be= ***5.50*** in

Notes:

1. All shears are vertical unless noted otherwise.
2. Web thickness is horizontal, box depth is vertical.

Calc RF

Member Number	Node Number	(ksi) Perm Load Stress (top fiber)	(ksi) Perm Load Stress (bott. fiber)	(ksi) Dead Load Stress (neutr. axis) (fpc)	Stress Variable 'K'	(k-ft) Torsional Moment (Tcr)	Ultimate Corresp. Live Load Moment	Ultimate Max Live Load Shear	Ultimate Corresp. Live Load Torsion	TOTAL Ultimate Moment (Mu)	TOTAL Ultimate Shear (Vu)	TOTAL Ultimate Torsion (Tu)	Investigate Torsional Effects? (Y/N)	Shear from Primary Post Tensioning Effect (Vp)	(in) Depth to Tensile Reinforcement d_e	(in) Effective Shear Depth d_v	(kip) Concrete Shear Resistance per web (Vc)	(kip) Required Steel Resistance per web (Vs-req'd)	(in^2/ft) Required Steel Area per web (Av)	(in^2/ft) Additional Steel Required for Torsion (At)	(in^2/ft) Additional Steel Req'd from Transverse A_v (trans)	(in^2/ft) Total Steel Required per leg (As_req'd)	(in^2/ft) Steel Provided per leg As_prov'd)	(kip) Provided Steel Resistance per web (Vs_prov)	(kip) Nominal Shear Resistance per web (ϕVn)	(kip) Ultimate Shear per web (Vu)	Shear Rating Factor, RF	Total Long. Mild Steel Required for Torsion (Al) in^2	Equivalent PT Steel Req'd for Torsion (based on fpe) (Al) in^2
				Permanent Loads + Minimum LL Torsion @ t=00																									
32	33	-1.198	-1.133	-1.176	2.000	11354	11879	390	-5436	9547	1707	-5135	Y	8	43.07	82.94	483	149	0.19	0.156	0.00	0.17	0.21	328	730	645	1.40	-13.38	-4.58
33	33	-1.198	-1.133	-1.176	2.000	11354	11878	390	-5435	9546	1707	-5135	Y	-24	43.07	82.94	488	144	0.18	0.156	0.00	0.17	0.21	328	734	645	1.43	-13.38	-4.57
33	34	-1.051	-1.383	-1.166	2.000	11623	10482	412	-5805	-2839	1912	-5446	Y	-167	74.13	84.78	547	161	0.20	0.162	0.00	0.18	0.21	335	794	718	1.34	-13.93	-4.76
34	34	-1.051	-1.383	-1.167	2.000	11623	10480	412	-5804	-2840	1911	-5446	Y	-205	74.13	84.78	559	149	0.18	0.162	0.00	0.17	0.21	335	805	718	1.39	-13.93	-4.76
34	35	-0.927	-1.579	-1.155	2.000	11939	8905	435	-6176	-16827	2117	-5759	Y	-411	77.86	86.94	640	144	0.17	0.167	0.00	0.17	0.21	344	886	791	1.40	-14.43	-4.93
35	35	-0.927	-1.579	-1.155	2.000	11939	8904	435	-6176	-16827	2117	-5759	Y	-444	77.86	86.94	651	133	0.16	0.167	0.00	0.16	0.21	344	895	791	1.44	-14.43	-4.93
35	36	-0.781	-1.541	-1.047	2.000	12301	7153	457	-6548	-32439	2326	-6072	Y	-61	85.74	89.42	538	323	0.38	0.171	0.00	0.27	0.21	353	802	865	0.75	-14.86	-5.08
36	36	-0.783	-1.543	-1.049	2.000	12301	7211	452	-6537	-32382	2321	-6072	Y	-528	85.74	89.42	694	166	0.19	0.171	0.00	0.18	0.21	353	942	864	1.32	-14.86	-5.08
36	37	-1.098	-1.560	-1.260	2.000	12695	5323	475	-6906	-49597	2532	-6383	Y	-944	98.22	92.12	848	90	0.12	0.174	0.00	0.15	0.21	364	1091	938	1.59	-15.25	-5.21
37	37	-1.098	-1.560	-1.260	2.000	12695	5323	475	-6906	-49597	2532	-6382	Y	-971	98.22	92.12	857	81	0.12	0.174	0.00	0.15	0.21	364	1099	938	1.62	-15.24	-5.21
37	38	-1.020	-1.518	-1.204	2.000	13066	3264	497	-7269	-68478	2749	-6686	Y	-1713	104.67	95.13	1122	0	0.12	0.177	0.00	0.15	0.21	376	1348	1015	2.22	-15.62	-5.34
38	38	-1.020	-1.518	-1.204	2.000	13066	3264	497	-7268	-68478	2749	-6685	Y	-1752	104.67	95.13	1135	0	0.12	0.177	0.00	0.15	0.21	376	1360	1015	2.26	-15.62	-5.34
38	39	-0.924	-0.913	-0.920	2.000	13477	1036	520	-7623	-89089	2975	-6982	Y	-810	128.89	116.00	942	160	0.14	0.179	0.00	0.16	0.41	917	1673	1095	3.02	-15.93	-5.45
39	39	-0.924	-0.913	-0.920	2.000	13477	1035	520	-7623	-89089	2975	-6981	Y	-833	128.89	116.00	949	152	0.14	0.179	0.00	0.16	0.41	917	1680	1095	3.05	-15.93	-5.45
39	40	-0.778	-1.064	-0.894	2.000	13934	-1364	542	-7969	-111474	3205	-7268	Y	-834	133.58	120.22	950	237	0.21	0.180	0.00	0.19	0.41	946	1706	1176	2.78	-16.17	-5.53
40	40	-0.778	-1.064	-0.893	2.000	13934	-1364	542	-7968	-111474	3205	-7267	Y	-872	133.58	120.22	963	224	0.20	0.180	0.00	0.19	0.41	946	1718	1176	2.82	-16.17	-5.53
40	41	-1.066	-1.133	-1.095	2.000	14431	-3936	564	-8306	-135683	3442	-7546	Y	-1161	138.48	124.63	1108	166	0.14	0.181	0.00	0.16	0.41	985	1884	1259	3.01	-16.35	-5.59
41	41	-1.065	-1.134	-1.094	2.000	14431	-3936	564	-8305	-135683	3442	-7545	Y	-1215	138.48	124.63	1127	148	0.12	0.181	0.00	0.15	0.41	985	1901	1259	3.07	-16.35	-5.59
41	42	-0.928	-1.245	-1.066	2.000	14973	-6681	586	-8637	-161772	3686	-7818	Y	-1215	144.05	129.65	1156	209	0.17	0.180	0.00	0.17	0.41	1025	1963	1344	2.92	-16.48	-5.64
42	42	-0.927	-1.245	-1.065	2.000	14973	-6681	585	-8636	-161772	3685	-7816	Y	-1266	144.05	129.65	1173	192	0.16	0.180	0.00	0.17	0.41	1025	1978	1344	2.96	-16.48	-5.63
42	43	-0.794	-1.342	-1.039	2.000	15555	-9600	608	-8963	-189800	3937	-8084	Y	-1266	150.02	135.02	1197	261	0.20	0.180	0.00	0.19	0.41	1066	2037	1432	2.81	-16.57	-5.67
43	43	-0.793	-1.342	-1.038	2.000	15555	-9600	607	-8962	-189800	3936	-8083	Y	-1319	150.02	135.02	1216	242	0.19	0.180	0.00	0.18	0.41	1066	2054	1432	2.86	-16.57	-5.67
43	44	-0.664	-1.426	-1.013	2.000	16176	-12695	629	-9285	-219826	4195	-8347	Y	-1319	156.38	140.75	1202	352	0.26	0.178	0.00	0.22	0.41	1102	2073	1522	2.59	-16.63	-5.69
44	44	-0.663	-1.426	-1.013	2.000	16176	-12695	629	-9284	-219826	4194	-8345	Y	-1383	156.38	140.75	1224	330	0.25	0.178	0.00	0.21	0.41	1102	2094	1521	2.65	-16.63	-5.68
44	45	-0.538	-1.498	-0.989	2.000	16843	-15967	651	-9603	-251911	4461	-8605	Y	-1382	163.14	146.83	1216	436	0.32	0.176	0.00	0.25	0.41	1141	2121	1614	2.41	-16.65	-5.69
45	45	-0.536	-1.498	-0.987	2.000	16843	-15968	653	-9605	-251911	4465	-8584	Y	-999	163.14	146.83	1082	572	0.41	0.176	0.00	0.30	0.41	1139	1999	1615	2.07	-16.61	-5.68
45	46	-0.407	-1.631	-0.982	2.000	17619	-19433	675	-9921	-286113	4737	-8841	Y	-998	170.46	153.42	1084	671	0.47	0.173	0.00	0.32	0.41	1183				-16.57	-5.66
46	46	-0.402	-1.627	-0.977	2.000	17619	-19312	680	-9918	-285992	4742	-8813	Y	0	170.46	153.42	737	1020	0.71	0.173	0.00	0.44	0.41	1179				-16.52	-5.65
46	47	-0.339	-1.706	-0.981	2.000	17619	-20469	687	-10018	-297405	4829	-8894	Y	0	170.46	153.42	724	1065	0.75	0.174	0.00	0.46	0.41	1176				-16.67	-5.70
47	47	-0.501	-1.514	-0.977	2.000	17619	-17873	-635	-10387	-272387	-4705	-11657	Y	0	170.46	153.42	750	992	0.69	0.229	0.00	0.46	0.41	1183				-21.85	-7.47
47	48	-0.562	-1.437	-0.973	2.000	17619	-16780	-628	-10286	-261221	-4617	-11537	Y	0	170.49	153.45	764	946	0.66	0.226	0.00	0.44	0.74	2135				-21.62	-7.39
48	48	-0.566	-1.441	-0.977	2.000	17619	-16728	-624	-10285	-261169	-4622	-11516	Y	774	170.49	153.45	1034	678	0.47	0.226	0.00	0.35	0.74	2140				-21.58	-7.38
48	49	-0.702	-1.287	-0.976	2.000	17041	-13640	-602	-9982	-228985	-4359	-11157	Y	774	165.11	148.60	979	635	0.46	0.226	0.00	0.34	0.74	2059	2346	1618	3.09	-21.41	-7.32
49	49	-0.489	-1.321	-0.879	2.000	17041	-13610	-598	-9975	-228954	-4360	-11122	Y	1160	165.11	148.60	1113	501	0.36	0.225	0.00	0.29	0.74	2062	2519	1618	3.60	-21.34	-7.30
49	50	-0.730	-1.144	-0.916	2.000	15844	-8144	-555	-9375	-172139	-3867	-10412	Y	1157	152.86	137.57	1059	373	0.29	0.227	0.00	0.26	0.74	1909	2370	1443	3.87	-21.06	-7.20
50	50	-0.502	-1.175	-0.806	2.000	15844	-8147	-556	-9376	-172142	-3867	-10413	Y	921	152.86	137.57	977	455	0.35	0.227	0.00	0.29	0.74	1908	2264	1443	3.54	-21.06	-7.20
50	51	-0.756	-0.951	-0.840	2.000	14769	-3340	-512	-8760	-122356	-3398	-9687	Y	918	141.42	127.28	926	332	0.28	0.227	0.00	0.25	0.74	1765	2124	1276	3.83	-20.63	-7.05
51	51	-0.514	-0.990	-0.719	2.000	14769	-3344	-513	-8762	-122361	-3398	-9689	Y	697	141.42	127.28	850	409	0.35	0.227	0.00	0.29	0.74	1764	2025	1276	3.49	-20.64	-7.06
51	52	-0.783	-0.702	-0.750	2.000	13862	814	-469	-8120	-79238	-2954	-8939	Y	695	131.81	118.63	817	277	0.25	0.223	0.00	0.24	0.74	1648	1908	1117	3.86	-19.97	-6.83
52	52	-0.572	-0.733	-0.637	2.000	13862	812	-470	-8122	-79241	-2954	-8940	Y	544	131.81	118.63	764	330	0.30	0.223	0.00	0.26	0.74	1647	1840	1117	3.61	-19.97	-6.83
52	53	-0.778	-0.973	-0.852	2.000	13076	4325	-426	-7452	-42456	-2530	-8161	Y	517	97.74	95.45	699	238	0.26	0.216	0.00	0.24	0.25	450	1034	964	1.28	-19.05	-6.51
53	53	-0.555	-1.010	-0.728	2.000	13076	4323	-426	-7453	-42458	-2529	-8162	Y	377	97.74	95.45	650	287	0.32	0.216	0.00	0.27	0.25	449	989	964	1.10	-19.06	-6.52
53	54	-0.741	-1.348	-0.953	2.000	12202	7190	-382	-6766	-11687	-2127	-7365	Y	390	67.70	88.74	644	144	0.17	0.209	0.00	0.19	0.25	421	958	818	1.62	-18.14	-6.20
54	54	-0.502	-1.390	-0.813	2.000	12202	7186	-387	-6778	-11691	-2124	-7387	Y	-69	67.70	88.74	537	250	0.29	0.209	0.00	0.25	0.25	421	862	817	1.20	-18.20	-6.22
54	55	-0.733	-1.322	-0.938	2.000	11781	9453	-343	-6089	13252	-1735	-6590	Y	-64	66.41	85.86	518	124	0.15	0.193	0.00	0.17	0.21	339	772	676	1.47	-16.68	-5.70
55	55	-0.591	-1.339	-0.852	2.000	11781	9453	-344	-6091	13252	-1735	-6592	Y	-127	66.41	85.86	539	103	0.13	0.193	0.00	0.16	0.21	339	791	676	1.56	-16.69	-5.70
55	56	-0.849	-0.892	-0.864	2.000	11282	11050	-300	-5410	32576	-1354	-5801	Y	-61	70.40	82.44	489	13	0.12	0.178	0.00	0.15	0.21	325	732	537	2.09	-15.20	-5.20
56	56	-0.698	-0.917	-0.775	2.000	11282	11050	-301	-5411	32576	-1353	-5803	Y	-119	70.40	82.44	509	0	0.12	0.178	0.00	0.15	0.21	325	751	537	2.19	-15.20	-5.20
56	57	-0.903	-0.560	-0.784	2.000	10920	11976	-258	-4745	46340	-976	-5028	Y	-53	76.01	79.97	421	0	0.12	0.159	0.00	0.14	0.21	310	657	400	2.65	-13.51	-4.62
57	57	-0.753	-0.577	-0.692	2.000	10920	11976	-258	-4746	46340	-976	-5029	Y	-91	76.01	79.97	434	0	0.12	0.159	0.00	0.14	0.21	310	669	400	2.72	-13.52	-4.62
57	58	-0.887	-0.343	-0.698	2.000	10696	12264	-218	-4104	54620	-603	-4278	Y	-24	85.00	78.44	369	0	0.12	0.138	0.00	0.13	0.21	299	601	264	3.53	-11.69	-4.00
58	58	-0.725	-0.375	-0.604	2.000	10696	12264	-218	-4105	54620	-602	-4279	Y	-60	85.00	78.44	381	0	0.12	0.138	0.00	0.13	0.21	299	612	264	3.61	-11.69	-4.00
58	59	-0.779	-0.281	-0.607	2.000	10598	16075	7	-3584	61602	-46	-3649	Y	7	98.26	88.43	391	0	0.12	0.119	0.00	0.12	0.21	335	653	69	11.57	-10.05	-3.43
59	59	-0.624	-0.231	-0.487	2.000	10598	16073	7	-3584	61600	-46	-3649	Y	-13	98.26	88.43	393	0	0.12	0.119	0.00	0.12	0.21	335	655	69	11.62	-10.05	-3.43
59	60	-0.622	-0.234	-0.487	2.000	10598	13387	198	-3731	58851	273	-3755	Y	13	83.75	77.76	338	0	0.12	0.122	0.00	0.12	0.21	293	568	146	4.48	-10.34	-3.53
60	60	-0.787	-0.258	-0.604	2.000	10598	13387	198	-3731	58851	273	-3754	Y	-7	83.75	77.76	336	0	0.12	0.122	0.00	0.12	0.21	293	566	147	4.47	-10.33	-3.53
60	61	-0.724	-0.365	-0.600	2.000	10696	13631	237	-4345	55595	643	-4259	Y	60	73.91	78.44	379	0	0.12	0.138	0.00	0.13	0.21	299	611	277	3.33	-11.64	-3.98
61	61	-0.890	-0.336	-0.698	2.000	10696	13631	236	-4343	55596	644	-4258	Y	24	73.91	78.44	367	0	0.12	0.138	0.00	0.13	0.21	299	599	278	3.25	-11.64	-3.98
61	62	-0.746	-0.583	-0.689	2.000	10920	13281	277	-4986	46924	1017	-4791	Y	90	67.51	79.97	432	0	0.12	0.152	0.00	0.14	0.21	310	667	410	2.55	-12.88	-4.40
62	62	-0.901	-0.564	-0.784	2.000	10920	13281	277	-4985	46924	1017	-4790	Y	52	67.51	79.97	419	0	0.12	0.152	0.00	0.14	0.21	309	655	410	2.48	-12.88	-4.40
62	63	-0.688	-0.931	-0.772	2.000	11282	12296	319	-5646	32773	1394	-5342	Y	118	63.29	82.44	507	9	0.12	0.164	0.00	0.14	0.21	325	749	544	2.08	-13.99	-4.78
63	63	-0.838	-0.913	-0.864	2.000	11282	12296	318	-5645	32773	1394	-5341	Y	59	63.29	82.44	487	30	0.12	0.164	0.00	0.14	0.21	325	731	544	1.99	-13.99	-4.78
63	64	-0.572	-1.368	-0.849	2.000	11781	10665	361	-6318	13085	1775	-5905	Y	124	57.24	85.86	538	119	0.14	0.173	0.00	0.16	0.21	339	790	679	1.52	-14.95	-5.11

PROJECT: **Cline Avenue Mainline Seg 3 EB** CALCS BY: TSP DATE: 01/21/09

DESCRIPTION: **Ultimate Shear Check** CHECKED BY: DATE:

Web Reinforcement Requirements **Load combination: Strength 1**

Material Properties:

Concrete

f'c = ***5.0*** ksi

ϕ_v = ***0.90***

P-T Strands

f_{pu} = ***270*** ksi

f_{pe} = ***176*** ksi

Reinforcement

fy = ***60.0*** ksi

Box Girder Properties:

Web Thickness

b_v = ***14.00*** in

Effective Width of Shear Flow Path

be= ***5.50*** in

Notes:

1. All shears are vertical unless noted otherwise.
2. Web thickness is horizontal, box depth is vertical.

Calc RF

Member Number	Node Number	(ksi) Perm Load Stress (top fiber)	(ksi) Perm Load Stress (bott. fiber)	(ksi) Dead Load Stress (neutr. axis) (fpc)	Stress Variable 'K'	(k-ft) Torsional Moment (Tcr)	Ultimate Corresp. Live Load Moment	Ultimate Max Live Load Shear	Ultimate Corresp. Live Load Torsion	TOTAL Ultimate Moment (Mu)	TOTAL Ultimate Shear (Vu)	TOTAL Ultimate Torsion (Tu)	Investigate Torsional Effects? (Y/N)	Shear from Primary Post Tensioning Effect (Vp)	(in) Depth to Tensile Reinforcement d_e	(in) Effective Shear Depth d_v	(kip) Concrete Shear Resistance per web (Vc)	(kip) Required Steel Resistance per web (Vs-req'd)	(in^2/ft) Required Steel Area per web (Av)	(in^2/ft) Additional Steel Required for Torsion (At)	(in^2/ft) Additional Steel Req'd from Transverse A_v (trans)	(in^2/ft) Total Steel Required per leg (As_req'd)	(in^2/ft) Steel Provided per leg As_prov'd)	(kip) Provided Steel Resistance per web (Vs_prov)	(kip) Nominal Shear Resistance per web (ϕVn)	(kip) Ultimate Shear per web (Vu)	Shear Rating Factor, RF	Total Long. Mild Steel Required for Torsion (Al) in^2	Equivalent PT Steel Req'd for Torsion (based on fpe) (Al) in^2
							Permanent Loads + Minimum LL Torsion @ t=00																						
64	64	-0.815	-1.329	-0.995	2.000	11781	10665	360	-6316	13085	1775	-5904	Y	46	57.24	85.86	513	145	0.18	0.173	0.00	0.17	0.21	339	767	679	1.41	-14.95	-5.11
64	65	-0.577	-1.419	-0.872	2.000	12412	8394	403	-6993	-12190	2163	-6472	Y	51	79.17	90.18	539	262	0.30	0.180	0.00	0.24	0.25	428	870	817	1.23	-15.73	-5.38
65	65	-0.813	-1.379	-1.011	2.000	12412	8395	398	-6973	-12189	2168	-6461	Y	-582	79.17	90.18	716	87	0.12	0.180	0.00	0.15	0.25	428	1030	818	1.90	-15.70	-5.37
65	66	-0.630	-1.000	-0.775	2.000	13030	5562	441	-7638	-43319	2572	-7017	Y	-545	103.10	95.45	725	228	0.25	0.186	0.00	0.22	0.25	452	1059	961	1.38	-16.43	-5.62
66	66	-0.851	-0.963	-0.895	2.000	13030	5562	441	-7638	-43319	2572	-7015	Y	-685	103.10	95.45	774	179	0.20	0.186	0.00	0.19	0.25	452	1103	961	1.55	-16.42	-5.62
66	67	-0.639	-0.719	-0.673	2.000	13776	2094	483	-8275	-80529	3003	-7543	Y	-692	131.42	118.28	827	285	0.26	0.189	0.00	0.22	0.74	1649	1901	1113	3.78	-16.93	-5.79
67	67	-0.845	-0.690	-0.779	2.000	13776	2094	483	-8274	-80529	3004	-7541	Y	-846	131.42	118.28	881	231	0.21	0.189	0.00	0.20	0.74	1650	1971	1113	4.03	-16.92	-5.79
67	68	-0.575	-0.930	-0.736	2.000	14657	-2019	526	-8885	-124247	3462	-8042	Y	-847	141.39	127.25	913	370	0.31	0.190	0.00	0.25	0.74	1769	2092	1273	3.67	-17.23	-5.89
68	68	-0.811	-0.893	-0.848	2.000	14657	-2019	525	-8883	-124247	3462	-8038	Y	-1078	141.39	127.25	992	290	0.24	0.189	0.00	0.22	0.74	1771	2196	1273	4.01	-17.22	-5.89
68	69	-0.552	-1.077	-0.803	2.000	15673	-6788	567	-9477	-174892	3950	-8523	Y	-1078	152.35	137.11	1037	426	0.33	0.188	0.00	0.26	0.74	1906	2329	1443	3.69	-17.38	-5.94
69	69	-0.771	-1.048	-0.903	2.000	15673	-6805	566	-9433	-174900	3949	-7450	Y	-1355	152.35	137.11	1133	330	0.26	0.164	0.00	0.21	0.74	1907	2453	1427	4.13	-15.19	-5.19
69	70	-0.525	-1.185	-0.854	2.000	16967	-12209	609	-10032	-232909	4470	-7939	Y	-1355	164.85	148.37	1184	471	0.34	0.162	0.00	0.25	0.74	2062	2604	1606	3.85	-15.34	-5.24
70	70	-0.731	-1.153	-0.941	2.000	16967	-12239	612	-10033	-232939	4469	-7835	Y	-891	164.85	148.37	1023	632	0.46	0.160	0.00	0.31	0.74	2059	2396	1604	3.25	-15.14	-5.17
70	71	-0.593	-1.288	-0.940	2.000	17628	-15318	634	-10334	-265921	4747	-8080	Y	-891	170.38	153.34	1075	683	0.47	0.158	0.00	0.32	0.74	2140				-15.22	-5.20
71	71	-0.589	-1.285	-0.936	2.000	17628	-15183	637	-10334	-265785	4741	-8066	Y	-40	170.38	153.34	780	976	0.68	0.158	0.00	0.42	0.74	2135				-15.19	-5.19
71	72	-0.527	-1.353	-0.939	2.000	17654	-16264	646	-10453	-277235	4836	-8166	Y	-40	168.15	151.34	753	1038	0.74	0.160	0.00	0.45	0.74	2100				-15.37	-5.26
72	72	-0.215	-1.612	-0.912	2.000	17654	-6679	-43	-1266	-158009	-2292	-654	N	27	168.15	151.34	885	0	0.12	Not Reqd	0.00	0.06	0.74	2154				0.00	0.00
72	73	-0.278	-1.534	-0.894	2.000	8147	-6735	-30	-1029	-152499	-2233	-433	N	27	169.75	152.78	898	343	0.23	Not Reqd	0.00	0.12	0.62	1812				0.00	0.00
73	73	-0.270	-1.537	-0.891	2.000	8147	-11426	-149	-1648	-157374	-2376	40	N	551	169.75	152.78	1160	160	0.12	Not Reqd	0.00	0.06	0.62	1812				0.00	0.00
73	74	-0.396	-1.407	-0.891	2.000	7784	-11069	-135	-1236	-140186	-2219	398	N	550	162.43	146.19	992	241	0.18	Not Reqd	0.00	0.09	0.62	1691	2213	1109	17.41	0.00	0.00
74	74	-0.401	-1.409	-0.894	2.000	7784	-12866	-252	-2651	-141836	-2358	-662	N	783	162.43	146.19	1105	205	0.15	Not Reqd	0.00	0.08	0.62	1690	2318	1179	10.05	0.00	0.00
74	75	-0.527	-1.348	-0.920	2.000	7484	-8860	-95	-2284	-121912	-2062	-350	N	782	155.39	139.85	1115	31	0.12	Not Reqd	0.00	0.06	0.62	1632	2232	1031	26.31	0.00	0.00
75	75	-0.536	-1.348	-0.924	2.000	7484	-11142	-299	-3160	-123998	-2287	-1420	N	753	155.39	139.85	1090	181	0.14	Not Reqd	0.00	0.07	0.62	1628	2219	1143	8.20	0.00	0.00
75	76	-0.668	-1.275	-0.951	2.000	7205	-7212	-158	-2848	-105057	-2012	-1162	N	752	148.79	133.91	1106	12	0.12	Not Reqd	0.00	0.06	0.62	1575	2139	1006	15.31	0.00	0.00
76	76	-0.671	-1.275	-0.952	2.000	7205	-9379	-322	-3412	-107142	-2190	-1964	N	729	148.79	133.91	1084	133	0.12	Not Reqd	0.00	0.06	0.62	1571	2128	1095	7.42	0.00	0.00
76	77	-0.808	-1.188	-0.980	2.000	6946	-5671	-192	-3135	-89341	-1932	-1741	N	728	142.57	128.32	1107	0	0.12	Not Reqd	0.00	0.06	0.62	1522	2053	966	12.30	0.00	0.00
77	77	-0.811	-1.188	-0.981	2.000	6946	-7657	-329	-3500	-91273	-2077	-2391	Y	708	142.57	128.32	1086	68	0.12	0.119	0.00	0.12	0.62	1519	2043	1114	4.38	-6.56	-2.24
77	78	-0.951	-1.085	-1.010	2.000	6704	-4272	-207	-3236	-74718	-1831	-2181	Y	707	136.74	123.07	1066	0	0.12	0.112	0.00	0.12	0.62	1460	1973	984	5.81	-6.11	-2.09
78	78	-0.953	-1.085	-1.011	2.000	6704	-5534	-327	-3489	-75935	-1952	-2712	Y	685	136.74	123.07	1055	30	0.12	0.140	0.00	0.13	0.62	1460	1963	1062	4.29	-7.60	-2.60
78	79	-0.702	-1.034	-0.841	2.000	6484	-2446	-211	-3220	-60617	-1717	-2497	Y	518	131.57	118.41	901	52	0.12	0.133	0.00	0.13	0.62	1391	1825	937	5.29	-7.13	-2.44
79	79	-0.702	-1.034	-0.842	2.000	6484	-3822	-318	-3396	-61965	-1825	-2801	Y	504	131.57	118.41	887	127	0.12	0.149	0.00	0.13	0.62	1389	1819	1001	4.07	-8.00	-2.74
79	80	-0.850	-0.884	-0.864	2.000	6283	-1129	-205	-3105	-47947	-1598	-2564	Y	504	126.59	113.93	912	0	0.12	0.141	0.00	0.13	0.62	1351	1758	880	5.38	-7.46	-2.55
80	80	-0.852	-0.883	-0.864	2.000	6283	-2190	-303	-3231	-48971	-1695	-2903	Y	499	126.59	113.93	907	35	0.12	0.160	0.00	0.14	0.62	1351	1756	939	4.22	-8.45	-2.89
80	81	-0.963	-1.310	-1.096	2.000	6103	82	-193	-2903	-36257	-1473	-2629	Y	889	106.03	95.43	997	0	0.12	0.149	0.00	0.13	0.31	566	1407	820	4.12	-7.79	-2.66
81	81	-0.965	-1.310	-1.097	2.000	6103	-697	-283	-3003	-36993	-1561	-2813	Y	880	106.03	95.43	993	0	0.12	0.159	0.00	0.14	0.31	566	1403	869	3.26	-8.33	-2.85
81	82	-1.058	-1.309	-1.148	2.000	5941	1124	-174	-2624	-25601	-1346	-2488	Y	584	99.67	92.12	825	0	0.12	0.145	0.00	0.13	0.31	546	1234	752	3.84	-7.49	-2.56
82	82	-1.077	-1.306	-1.159	2.000	5941	833	-270	-2844	-25540	-1446	-3175	Y	203	99.67	92.12	635	168	0.19	0.185	0.00	0.19	0.31	546	1063	823	2.07	-9.56	-3.27
82	83	-0.804	-1.109	-0.913	2.000	5756	2640	-247	-2426	-14959	-1320	-2810	Y	73	89.75	89.42	554	179	0.21	0.169	0.00	0.19	0.31	530	976	749	2.13	-8.63	-2.95
83	83	-0.824	-1.108	-0.925	2.000	5756	2017	-260	-2734	-15304	-1330	-3001	Y	55	89.75	89.42	545	194	0.23	0.180	0.00	0.20	0.31	530	968	760	1.96	-9.21	-3.15
83	84	-0.961	-1.402	-1.119	2.000	5587	3800	-237	-2317	-5572	-1204	-2637	Y	428	76.16	86.94	718	0	0.12	0.163	0.00	0.14	0.21	344	955	685	2.41	-8.25	-2.82
84	84	-0.962	-1.402	-1.119	2.000	5587	3277	-250	-2616	-6071	-1214	-2840	Y	410	76.16	86.94	708	0	0.12	0.176	0.00	0.15	0.21	344	947	697	2.20	-8.88	-3.04
84	85	-1.057	-1.245	-1.124	2.000	5440	4619	-220	-2200	2402	-1083	-2478	Y	192	46.76	84.78	587	15	0.12	0.157	0.00	0.14	0.21	335	830	620	2.17	-7.88	-2.69
85	85	-1.057	-1.245	-1.124	2.000	5440	4265	-238	-2481	2057	-1103	-2783	Y	171	46.76	84.78	577	36	0.12	0.177	0.00	0.15	0.21	335	820	639	1.92	-8.85	-3.03
85	86	-1.204	-0.976	-1.123	2.000	5313	5514	-208	-2068	9663	-973	-2425	Y	16	46.43	82.94	488	52	0.12	0.158	0.00	0.14	0.29	465	858	563	2.74	-7.83	-2.68
86	86	-1.204	-0.975	-1.123	2.000	5313	5145	-226	-2337	9309	-990	-2891	Y	-2	46.43	82.94	481	69	0.12	0.188	0.00	0.15	0.29	465	852	586	2.42	-9.33	-3.19
86	87	-0.963	-0.818	-0.912	2.000	5206	6295	-196	-1928	16035	-861	-2536	Y	-11	57.03	81.36	477	1	0.12	0.168	0.00	0.14	0.29	457	840	510	3.07	-8.29	-2.84
87	87	-0.963	-0.817	-0.911	2.000	5206	5952	-213	-2194	15699	-874	-2618	Y	-25	57.03	81.36	483	2	0.12	0.174	0.00	0.15	0.29	457	846	520	2.86	-8.56	-2.93
87	88	-1.005	-1.251	-1.092	2.000	5116	6997	-183	-1788	21506	-744	-2266	Y	230	64.47	80.06	578	0	0.12	0.153	0.00	0.14	0.29	449	925	443	4.25	-7.49	-2.56
88	88	-1.004	-1.251	-1.091	2.000	5116	6580	-199	-2049	21087	-759	-2128	Y	211	64.47	80.06	569	0	0.12	0.144	0.00	0.13	0.29	449	916	447	3.86	-7.04	-2.41
88	89	-1.093	-1.098	-1.095	2.000	5018	7520	-170	-1646	26006	-631	-1779	Y	-17	64.46	78.62	464	0	0.12	0.122	0.00	0.12	0.29	441	814	372	4.23	-5.96	-2.04
89	89	-1.093	-1.098	-1.095	2.000	5018	6972	-186	-1905	25458	-647	-1865	Y	-33	64.46	78.62	472	0	0.12	0.128	0.00	0.12	0.29	441	821	382	3.87	-6.25	-2.14
89	90	-1.182	-0.927	-1.092	2.000	5000	8133	-20	-1602	29828	-382	-1616	Y	-1	64.22	78.35	454	0	0.12	0.112	0.00	0.12	0.29	440	804	242	10.25	-5.43	-1.85
90	90	-1.180	-0.927	-1.091	2.000	5000	7333	-173	-1772	29008	-534	-1877	Y	-17	64.22	78.35	462	0	0.12	0.130	0.00	0.12	0.29	440	812	326	4.40	-6.30	-2.15
90	91	-1.242	-0.798	-1.086	2.000	4969	8438	33	-1716	32545	-229	-1875	Y	20	64.05	77.90	461	0	0.12	0.130	0.00	0.12	0.29	437	808	174	9.98	-6.32	-2.16
91	91	-1.219	-0.798	-1.071	2.000	4969	8403	31	-1682	32261	-229	-1931	Y	1	64.05	77.90	452	0	0.12	0.134	0.00	0.13	0.29	437	800	175	10.12	-6.51	-2.23
91	92	-0.853	-0.820	-0.841	2.000	4960	8820	46	-1855	34317	-115	-2158	Y	-14	82.00	77.76	418	0	0.12	0.150	0.00	0.13	0.29	431	764	125	8.82	-7.28	-2.49
92	92	-0.835	-0.819	-0.829	2.000	4960	9224	62	-1703	34566	-98	-1847	Y	-20	82.00	77.76	420	0	0.12	0.129	0.00	0.12	0.29	430	765	107	8.75	-6.23	-2.13
92	93	-0.851	-0.780	-0.826	2.000	4960	9136	64	-1840	35095	-36	-2016	Y	-43	81.79	77.76	448	0	0.12	0.140	0.00	0.13	0.29	433	793	82	8.87	-6.81	-2.33
93	93	-0.847	-0.780	-0.824	2.000	4960	9534	63	-1917	35455	-36	-1930	Y	-49	81.79	77.76	449	0	0.12	0.134	0.00	0.13	0.29	433	794	79	8.75	-6.52	-2.23
93	94	-0.866	-0.735	-0.820	2.000	4969	9378	71	-2097	35687	71	-2164	Y	-90	81.08	77.90	469	0	0.12	0.150	0.00	0.13	0.29	433	812	104	7.97	-7.30	-2.49
94	94	-0.865	-0.735	-0.820	2.000	4969	9784	78	-2052	36082	78	-1957	Y	-104	81.08	77.90	475	0	0.12	0.136	0.00	0.13	0.29	433	817	101	7.91	-6.60	-2.26
94	95	-0.876	-0.706	-0.816	2.000	5000	9547	86	-2231	35451	186	-2191	Y	-149	79.84	78.35	502	0	0.12	0.151	0.00	0.14	0.29	436	844	162	7.01	-7.36	-2.52
95	95	-0.874	-0.706	-0.815	2.000	5000	9910	91	-2206	35796	192	-2045	Y	-161	79.84	78.35	507	0	0.12	0.141	0.00	0.13	0.29	436	848	161	6.96	-6.87	-2.35

PROJECT: **Cline Avenue Mainline Seg 3 EB** CALCS BY: TSP DATE: 01/21/09

DESCRIPTION: **Ultimate Shear Check** CHECKED BY: DATE:

Web Reinforcement Requirements **Load combination: Strength 1**

Material Properties:

Concrete

$f'c$ = ***5.0*** ksi

ϕ_v = ***0.90***

P-T Strands

f_{pu} = ***270*** ksi

f_{pe} = ***176*** ksi

Reinforcement

fy = ***60.0*** ksi

Box Girder Properties:

Web Thickness

b_v = ***14.00*** in

Effective Width of Shear Flow Path

be= ***5.50*** in

Notes:

1. All shears are vertical unless noted otherwise.
2. Web thickness is horizontal, box depth is vertical.

Calc RF

Member Number	Node Number	(ksi) Perm Load Stress (top fiber)	(ksi) Perm Load Stress (bott. fiber)	(ksi) Dead Load Stress (neutr. axis) (fpc)	Stress Variable 'K'	(k-ft) Torsional Moment (Tcr)	Ultimate Corresp. Live Load Moment	Ultimate Max Live Load Shear	Ultimate Corresp. Live Load Torsion	TOTAL Ultimate Moment (Mu)	TOTAL Ultimate Shear (Vu)	TOTAL Ultimate Torsion (Tu)	Investigate Torsional Effects? (Y/N)	Shear from Primary Post Tensioning Effect (Vp)	(in) Depth to Tensile Reinforcement d_e	(in) Effective Shear Depth d_v	(kip) Concrete Shear Resistance per web (Vc)	(kip) Required Steel Resistance per web (Vs-req'd)	(in^2/ft) Required Steel Area per web (Av)	(in^2/ft) Additional Steel Required for Torsion (At)	(in^2/ft) Additional Steel Req'd from Transverse A_v (trans)	(in^2/ft) Total Steel Required per leg (As_req'd)	(in^2/ft) Steel Provided per leg As_prov'd)	(kip) Provided Steel Resistance per web (Vs_prov)	(kip) Nominal Shear Resistance per web (ϕVn)	(kip) Ultimate Shear per web (Vu)	Shear Rating Factor, RF	Total Long. Mild Steel Required for Torsion (Al) in^2	Equivalent PT Steel Req'd for Torsion (based on fpe) (Al) in^2
				Permanent Loads + Minimum LL Torsion @ t=00																									
95	96	-0.876	-0.695	-0.813	2.000	5049	9598	101	-2385	34306	302	-2279	Y	-207	78.04	79.07	538	0	0.12	0.156	0.00	0.14	0.29	440	881	223	6.22	-7.60	-2.60
96	96	-0.863	-0.695	-0.804	2.000	5049	7886	148	-2383	32459	349	-2065	Y	-219	78.04	79.07	549	0	0.12	0.141	0.00	0.13	0.29	441	891	239	5.37	-6.89	-2.36
96	97	-0.857	-0.704	-0.803	2.000	5116	7396	166	-2596	30011	467	-2333	Y	-247	92.25	83.03	544	0	0.12	0.157	0.00	0.14	0.29	457	901	307	4.60	-7.72	-2.64
97	97	-0.613	-0.684	-0.638	2.000	5116	7871	161	-2605	30628	460	-1812	Y	-251	92.25	83.03	545	0	0.12	0.122	0.00	0.12	0.29	457	901	287	4.78	-5.99	-2.05
97	98	-0.569	-0.742	-0.630	2.000	5206	7273	179	-2816	27297	580	-2077	Y	-260	77.47	81.36	581	0	0.12	0.138	0.00	0.13	0.29	454	931	356	4.22	-6.79	-2.32
98	98	-0.786	-0.620	-0.728	2.000	5206	7788	174	-2831	27817	574	-3119	Y	-315	77.47	81.36	608	0	0.12	0.207	0.00	0.16	0.29	454	955	386	4.23	-10.20	-3.49
98	99	-0.756	-0.670	-0.726	2.000	5313	7079	193	-3041	23586	695	-3383	Y	-335	74.15	82.94	641	0	0.12	0.220	0.00	0.17	0.29	464	995	454	3.81	-10.92	-3.73
99	99	-0.754	-0.670	-0.725	2.000	5313	7823	192	-3062	24316	696	-3468	Y	-347	74.15	82.94	644	0	0.12	0.225	0.00	0.17	0.29	464	997	458	3.80	-11.20	-3.83
99	100	-0.715	-0.730	-0.720	2.000	5440	6909	210	-3270	19069	817	-3730	Y	-391	70.40	84.78	687	0	0.12	0.237	0.00	0.18	0.29	476	1046	526	3.49	-11.87	-4.06
100	100	-0.714	-0.730	-0.719	2.000	5440	7497	205	-3312	19648	815	-3547	Y	-405	70.40	84.78	693	0	0.12	0.225	0.00	0.17	0.29	476	1052	519	3.57	-11.28	-3.86
100	101	-0.671	-0.801	-0.716	2.000	5587	6473	224	-3520	13465	937	-3810	Y	-445	66.15	86.94	726	0	0.12	0.236	0.00	0.18	0.29	488	1092	589	3.26	-11.91	-4.07
101	101	-0.670	-0.801	-0.716	2.000	5587	7203	213	-3621	14192	926	-3498	Y	-618	66.15	86.94	813	0	0.12	0.216	0.00	0.17	0.29	488	1170	574	3.70	-10.94	-3.74
101	102	-0.637	-0.802	-0.698	2.000	5721	6003	228	-3824	7008	1048	-3756	Y	-655	61.45	89.42	845	0	0.12	0.227	0.00	0.17	0.29	502	1212	643	3.42	-11.57	-3.96
102	102	-0.637	-0.802	-0.698	2.000	5721	6604	223	-3931	7607	1047	-3684	Y	-663	61.45	89.42	849	0	0.12	0.222	0.00	0.17	0.29	502	1216	640	3.44	-11.35	-3.88
102	103	-0.599	-0.808	-0.679	2.000	5870	5309	240	-4128	-548	1173	-3936	Y	-695	71.66	92.12	881	0	0.12	0.232	0.00	0.18	0.53	930	1551	711	4.36	-11.94	-4.08
103	103	-0.599	-0.808	-0.679	2.000	5870	5364	227	-4208	-493	1165	-3903	Y	-703	71.66	92.12	885	0	0.12	0.230	0.00	0.17	0.53	930	1555	706	4.45	-11.84	-4.05
103	104	-0.555	-0.819	-0.661	2.000	6041	4024	244	-4401	-9600	1296	-4151	Y	-741	81.42	95.13	921	0	0.12	0.237	0.00	0.18	0.53	961	1612	779	4.19	-12.37	-4.23
104	104	-0.555	-0.819	-0.661	2.000	6041	4608	243	-4432	-9011	1299	-4108	Y	-752	81.42	95.13	927	0	0.12	0.235	0.00	0.18	0.53	961	1617	779	4.21	-12.24	-4.19
104	105	-0.508	-0.832	-0.642	2.000	6230	3122	261	-4621	-19202	1434	-4352	Y	-802	92.13	98.42	949	0	0.12	0.241	0.00	0.18	0.53	989	1684	854	4.00	-12.73	-4.35
105	105	-0.509	-0.832	-0.643	2.000	6230	2997	257	-4592	-19317	1434	-4268	Y	-811	92.13	98.42	953	0	0.12	0.237	0.00	0.18	0.53	988	1688	852	4.06	-12.49	-4.27
105	106	-0.460	-0.845	-0.624	2.000	6441	1942	291	-4762	-30042	1590	-4493	Y	-874	103.93	102.02	968	0	0.12	0.241	0.00	0.18	0.53	1014	1765	937	3.80	-12.89	-4.41
106	106	-0.461	-0.845	-0.625	2.000	6441	1611	291	-4650	-30360	1592	-4316	Y	-888	103.93	102.02	974	0	0.12	0.231	0.00	0.18	0.53	1014	1771	932	3.87	-12.38	-4.23
106	107	-0.413	-0.854	-0.607	2.000	6670	250	325	-4804	-42377	1753	-4524	Y	-953	116.99	105.89	994	0	0.12	0.234	0.00	0.18	0.53	1043	1833	1019	3.59	-12.71	-4.35
107	107	-0.414	-0.854	-0.607	2.000	6670	-792	303	-4616	-43410	1730	-4285	Y	-968	116.99	105.89	1000	0	0.12	0.222	0.00	0.17	0.53	1042	1838	1000	3.82	-12.04	-4.12
107	108	-0.362	-0.869	-0.590	2.000	6921	-1892	354	-4747	-56169	1913	-4471	Y	-945	130.80	117.72	1022	41	0.12	0.223	0.00	0.17	0.53	1150	1955	1097	3.62	-12.29	-4.20
108	108	-0.362	-0.869	-0.589	2.000	6921	-2260	360	-4499	-56551	1913	-4249	Y	-959	130.80	117.72	1028	34	0.12	0.212	0.00	0.17	0.53	1150	1961	1091	3.70	-11.68	-3.99
108	109	-0.293	-0.904	-0.573	2.000	7190	-4040	406	-4586	-70992	2095	-4391	Y	-814	143.82	129.44	986	178	0.15	0.211	0.00	0.18	0.53	1255	2017	1186	3.39	-11.82	-4.04
109	109	-0.293	-0.903	-0.573	2.000	7190	-4937	410	-4306	-71889	2089	-4628	Y	-712	143.82	129.44	931	230	0.19	0.222	0.00	0.21	0.53	1254	1966	1191	3.28	-12.45	-4.26
109	110	-0.180	-1.022	-0.567	2.000	7513	-8184	428	-4383	-88787	2246	-4761	Y	-381	154.24	138.82	779	469	0.37	0.219	0.00	0.30	0.53	1333				-12.50	-4.27
110	110	-0.177	-1.019	-0.564	2.000	7513	-8171	455	-4157	-88817	2261	-5341	Y	-137	154.24	138.82	651	605	0.48	0.246	0.00	0.36	0.53	1331				-14.02	-4.79
110	111	-0.116	-1.092	-0.564	2.000	7513	-9319	461	-4181	-94536	2312	-5383	Y	6	154.54	139.08	575	709	0.56	0.247	0.00	0.41	0.53	1329				-14.13	-4.83
111	111	-0.076	-1.153	-0.571	2.000	7513	-3552	-162	-2471	-84421	-2467	3001	Y	6	154.54	139.08	586	784	0.62	0.138	0.00	0.38	0.53	1333				7.88	2.69
111	112	-0.141	-1.062	-0.564	2.000	7513	-3150	-162	-2484	-78312	-2422	2971	Y	110	154.38	138.94	650	696	0.55	0.137	0.00	0.34	0.29	743				7.80	2.67
112	112	-0.144	-1.066	-0.568	2.000	7513	-3126	-139	-2268	-78312	-2413	2400	Y	348	154.38	138.94	774	566	0.45	0.110	0.00	0.28	0.29	744				6.30	2.15
112	113	-0.284	-0.882	-0.558	2.000	7042	-2034	-139	-2305	-60013	-2274	2308	Y	648	143.12	128.80	911	352	0.30	0.113	0.00	0.21	0.29	696	1447	1210	2.66	6.28	2.15
113	113	-0.282	-0.884	-0.558	2.000	7042	-2635	-163	-2265	-60701	-2312	2233	Y	747	143.12	128.80	961	324	0.27	0.110	0.00	0.19	0.29	696	1491	1226	2.73	6.08	2.08
113	114	-0.392	-0.775	-0.564	2.000	6921	-2010	-147	-1980	-43823	-2160	2463	Y	1024	131.40	118.26	1084	116	0.12	0.123	0.00	0.12	0.29	646	1557	1158	3.94	6.77	2.32
114	114	-0.391	-0.776	-0.563	2.000	6921	-1875	-162	-2274	-43735	-2186	2419	Y	1010	131.40	118.26	1077	138	0.13	0.121	0.00	0.12	0.29	646	1550	1169	3.49	6.65	2.27
114	115	-0.468	-0.705	-0.572	2.000	6522	-1271	-145	-1982	-27838	-2038	2656	Y	1297	112.96	103.73	1188	0	0.12	0.141	0.00	0.13	0.29	573	1585	1103	4.56	7.56	2.59
115	115	-0.467	-0.706	-0.571	2.000	6522	-1188	-157	-2166	-27810	-2057	2279	Y	1282	112.96	103.73	1180	0	0.12	0.121	0.00	0.12	0.29	573	1577	1100	4.24	6.49	2.22
115	116	-0.499	-0.692	-0.581	2.000	6441	-873	-87	-1896	-13160	-1859	2494	Y	1560	93.75	102.02	1367	0	0.12	0.134	0.00	0.13	0.29	572	1745	1008	8.14	7.15	2.44
116	116	-0.498	-0.694	-0.581	2.000	6441	-638	-148	-1920	-12964	-1922	949	N	1546	93.75	102.02	1358	0	0.12	Not Reqd	0.00	0.06	0.29	572	1737	961	11.50	0.00	0.00
116	117	-0.006	0.002	-0.003	1.010	3129	-161	-89	-1711	-18	-1508	1102	Y	0	0.00	98.42	57	781	2.45	0.061	0.00	1.25	0.29	187				3.24	1.11

0.75