URS

FILE: V:\Projects\Cline Avenue\Load Rating Analysis\Revised LL Long Rating\Orig Ab with increased Vc AASHTO\Segment4\Rating EB\[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\Segment4\Rating EB\[Forces.xls]
Props&Reinf Worksheet: V:\Projects\Cline Avenue\Load Rating Analysis\Revised LL Long Rating\Orig Ab with increased Vc AASHTO\Segment4\Rating EB\[Props&Reinf.xls]

PROJECT: **Cline Avenue Mainline Seg 4 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 Rating Tr HS-20
fy = ***60.0*** ksi

Box Girder Properties:

Web Thickness
b_v = ***12.95*** 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	-0.633	-0.779	-0.690	2.000	6252	2	40	-185	-374	-1330	2812	Y	937	79.10	98.42	479	14	0.13	0.155	0.00	0.14	0.37	496				8.21	2.81
1	2	-0.680	-0.775	-0.715	2.000	6067	792	52	188	9645	-969	3130	Y	925	64.75	95.13	905	0	0.13	0.178	0.00	0.15	0.37	677	1424	422	44.10	9.30	3.18
2	2	-0.677	-0.775	-0.714	2.000	6067	751	49	-2	9558	-977	2195	Y	914	64.75	95.13	902	0	0.13	0.125	0.00	0.13	0.37	677	1421	395	63.74	6.52	2.23
2	3	-0.697	-0.809	-0.738	2.000	5876	2579	80	394	18863	-833	2536	Y	873	72.90	92.12	869	0	0.13	0.149	0.00	0.14	0.21	364	1110	358	20.17	7.69	2.63
3	3	-0.694	-0.810	-0.737	2.000	5876	1685	71	185	17924	-849	2264	Y	948	72.90	92.12	894	0	0.13	0.133	0.00	0.13	0.21	364	1132	354	27.52	6.86	2.35
3	4	-0.700	-0.874	-0.759	2.000	5756	3465	98	510	25073	-735	2547	Y	896	76.35	89.42	860	0	0.13	0.153	0.00	0.14	0.21	353	1092	325	16.72	7.82	2.67
4	4	-0.700	-0.874	-0.759	2.000	5756	3457	88	324	25060	-750	2448	Y	630	76.35	89.42	771	0	0.13	0.147	0.00	0.14	0.21	353	1012	327	18.32	7.51	2.57
4	5	-0.723	-0.843	-0.763	2.000	5587	4321	117	535	30796	-637	2616	Y	574	80.63	86.94	737	0	0.13	0.162	0.00	0.15	0.21	344	972	295	13.16	8.18	2.80
5	5	-0.721	-0.844	-0.762	2.000	5587	4323	101	287	30771	-655	2455	Y	533	80.63	86.94	723	0	0.13	0.152	0.00	0.14	0.21	344	960	296	16.55	7.68	2.62
5	6	-0.755	-0.793	-0.768	2.000	5440	5613	142	598	37480	-509	2711	Y	464	85.29	84.78	669	0	0.13	0.172	0.00	0.15	0.21	334	903	255	10.80	8.62	2.95
6	6	-0.752	-0.794	-0.766	2.000	5440	5618	120	262	37437	-533	2366	Y	449	85.29	84.78	663	0	0.13	0.150	0.00	0.14	0.21	333	897	252	14.32	7.52	2.57
6	7	-0.786	-0.745	-0.772	2.000	5313	6739	159	556	43189	-389	2606	Y	384	89.15	82.94	610	0	0.13	0.169	0.00	0.15	0.21	324	841	212	9.91	8.41	2.88
7	7	-0.783	-0.747	-0.771	2.000	5313	6746	137	189	43148	-415	2140	Y	372	89.15	82.94	605	0	0.13	0.139	0.00	0.13	0.21	324	836	206	13.24	6.91	2.36
7	8	-0.814	-0.702	-0.777	2.000	5206	7710	175	451	47954	-272	2348	Y	308	92.23	83.01	569	0	0.13	0.156	0.00	0.14	0.21	323	802	165	9.80	7.68	2.63
8	8	-0.811	-0.703	-0.775	2.000	5206	7719	152	69	47915	-297	1791	Y	296	92.23	83.01	565	0	0.13	0.119	0.00	0.12	0.21	323	799	156	13.21	5.86	2.00
8	9	-0.839	-0.664	-0.781	2.000	5116	8536	190	308	51787	-155	1976	Y	232	94.55	85.10	546	0	0.13	0.133	0.00	0.13	0.21	330	789	114	10.25	6.54	2.23
9	9	-0.836	-0.666	-0.780	2.000	5116	8548	167	-82	51756	-179	1375	N	218	94.55	85.10	542	0	0.13	Not Reqd	0.00	0.06	0.21	330	785	60	14.04	0.00	0.00
9	10	-0.861	-0.633	-0.786	2.000	5049	9217	205	139	54690	-37	1542	Y	155	96.14	86.52	521	0	0.13	0.106	0.00	0.12	0.21	335	770	61	10.76	5.15	1.76
10	10	-0.858	-0.634	-0.784	2.000	5049	9229	182	-272	54663	-61	795	N	145	96.14	86.52	519	0	0.13	Not Reqd	0.00	0.06	0.21	335	768	20	13.29	0.00	0.00
10	11	-0.876	-0.609	-0.788	2.000	5000	9746	221	-70	56657	81	942	N	80	97.00	87.30	498	0	0.13	Not Reqd	0.00	0.06	0.21	338	752	27	10.86	0.00	0.00
11	11	-0.873	-0.610	-0.787	2.000	5000	9760	199	-450	56631	58	363	N	66	97.00	87.30	494	0	0.13	Not Reqd	0.00	0.06	0.21	338	748	19	11.99	0.00	0.00
11	12	-0.889	-0.591	-0.791	2.000	5000	10107	237	-262	57664	200	496	N	-11	97.26	87.53	470	0	0.13	Not Reqd	0.00	0.06	0.21	338	727	67	9.35	0.00	0.00
12	12	-0.886	-0.592	-0.789	2.000	5000	10125	216	-651	57644	178	-156	N	-25	97.26	87.53	475	0	0.13	Not Reqd	0.00	0.06	0.21	338	732	59	10.34	0.00	0.00
12	13	-0.897	-0.579	-0.793	2.000	4960	10299	255	-478	57710	321	-37	N	-79	96.31	86.68	485	0	0.13	Not Reqd	0.00	0.06	0.21	334	737	107	8.43	0.00	0.00
13	13	-0.896	-0.579	-0.793	2.000	4960	10286	242	-707	57686	308	-426	N	-85	96.31	86.68	487	0	0.13	Not Reqd	0.00	0.06	0.21	334	739	103	8.89	0.00	0.00
13	14	-0.898	-0.578	-0.793	2.000	4960	10307	252	-666	57556	343	-398	N	-100	96.03	86.43	490	0	0.13	Not Reqd	0.00	0.06	0.21	333	741	114	8.47	0.00	0.00
14	14	-0.897	-0.578	-0.793	2.000	4960	10328	239	-912	57566	330	-805	N	-100	96.03	86.43	491	0	0.13	Not Reqd	0.00	0.06	0.21	333	741	110	8.94	0.00	0.00
14	15	-0.900	-0.580	-0.796	2.000	4960	10282	277	-757	56412	473	-705	N	-167	94.46	85.01	504	0	0.13	Not Reqd	0.00	0.06	0.21	327	749	158	7.40	0.00	0.00
15	15	-0.898	-0.580	-0.794	2.000	4960	10303	258	-1125	56406	454	-1312	N	-167	94.46	85.01	505	0	0.13	Not Reqd	0.00	0.06	0.21	327	749	151	7.96	0.00	0.00
15	16	-0.897	-0.590	-0.797	2.000	4960	10064	296	-985	54252	597	-1226	N	-240	92.08	82.87	518	0	0.13	Not Reqd	0.00	0.06	0.21	319	754	199	6.62	0.00	0.00
16	16	-0.895	-0.590	-0.796	2.000	4960	10087	278	-1335	54255	580	-1786	Y	-240	92.08	82.87	519	0	0.13	0.124	0.00	0.13	0.21	319	754	250	4.74	-6.03	-2.06
16	17	-0.889	-0.610	-0.798	2.000	4960	9654	316	-1206	51091	724	-1711	Y	-311	88.90	80.01	529	0	0.13	0.119	0.00	0.12	0.21	309	754	295	4.20	-5.77	-1.97
17	17	-0.887	-0.610	-0.797	2.000	4960	10582	300	-412	52008	709	-1091	N	-311	88.90	80.01	527	0	0.13	Not Reqd	0.00	0.06	0.21	308	752	236	6.15	0.00	0.00
17	18	-0.876	-0.639	-0.799	2.000	4960	9042	338	-1415	46908	853	-2148	Y	-379	84.95	77.76	546	0	0.13	0.150	0.00	0.14	0.21	301	762	352	3.61	-7.25	-2.48
18	18	-0.876	-0.639	-0.799	2.000	4960	9850	325	-463	47714	844	-1326	N	-379	84.95	77.76	544	0	0.13	Not Reqd	0.00	0.06	0.21	300	760	281	5.42	0.00	0.00
18	19	-0.859	-0.680	-0.801	2.000	4960	8222	361	-1605	41685	985	-2523	Y	-447	80.26	77.76	584	0	0.13	0.176	0.00	0.15	0.21	302	797	408	3.27	-8.52	-2.91
19	19	-0.859	-0.680	-0.801	2.000	4960	8806	351	-488	42278	981	-1489	Y	-447	80.26	77.76	582	0	0.13	0.104	0.00	0.12	0.21	302	795	374	4.18	-5.03	-1.72
19	20	-0.836	-0.733	-0.802	2.000	4960	7186	386	-1768	35399	1122	-2824	Y	-514	74.89	77.76	625	0	0.13	0.197	0.00	0.16	0.21	304	836	463	3.02	-9.53	-3.26
20	20	-0.836	-0.732	-0.803	2.000	4960	7603	379	-507	35836	1125	-1573	Y	-684	74.89	77.76	684	0	0.13	0.110	0.00	0.12	0.21	304	890	425	4.27	-5.31	-1.82
20	21	-0.819	-0.722	-0.786	2.000	4923	5911	415	-1884	27987	1268	-3005	Y	-753	68.70	77.76	729	0	0.13	0.211	0.00	0.17	0.21	306	932	517	3.09	-10.19	-3.48
21	21	-0.821	-0.721	-0.787	2.000	4923	6063	408	-470	28179	1271	-1532	Y	-740	68.70	77.76	723	0	0.13	0.108	0.00	0.12	0.21	306	927	472	4.01	-5.20	-1.78
21	22	-0.798	-0.720	-0.770	2.000	4886	4394	445	-1953	19443	1418	-3070	Y	-812	61.76	77.76	759	0	0.13	0.217	0.00	0.17	0.21	307	960	569	2.86	-10.46	-3.58
22	22	-0.801	-0.719	-0.771	2.000	4886	4462	439	-2083	19569	1423	-3060	Y	-800	61.76	77.76	755	0	0.13	0.216	0.00	0.17	0.21	307	956	571	2.82	-10.43	-3.57
22	23	-0.770	-0.727	-0.754	2.000	4849	2606	479	-1950	9692	1576	-2983	Y	-877	54.03	77.76	780	0	0.13	0.212	0.00	0.17	0.37	553	1200	620	3.62	-10.22	-3.49
23	23	-0.774	-0.726	-0.756	2.000	4849	2685	475	-2018	9848	1587	-2828	Y	-865	54.03	77.76	776	0	0.13	0.201	0.00	0.17	0.37	553	1197	618	3.60	-9.69	-3.31
23	24	-0.737	-0.744	-0.739	2.000	4812	506	516	-1868	-1344	1744	-2733	Y	-942	62.53	77.76	802	0	0.13	0.196	0.00	0.16	0.37	553	1220	668	3.39	-9.41	-3.22
24	24	-0.741	-0.742	-0.742	2.000	4812	599	515	-1884	-1160	1760	-2460	Y	-935	62.53	77.76	799	0	0.13	0.177	0.00	0.15	0.37	553	1218	664	3.39	-8.47	-2.90
24	25	-0.939	-0.858	-0.907	2.000	4775	-1938	557	-1710	-13818	1939	-2341	Y	-1637	73.37	77.76	1034	0	0.13	0.169	0.00	0.15	0.37	553	1428	720	3.96	-8.10	-2.77
25	25	-0.943	-0.856	-0.909	2.000	4775	-1842	558	-1669	-13635	1961	-1900	Y	-1625	73.37	77.76	1029	0	0.13	0.137	0.00	0.13	0.37	553	1424	714	3.98	-6.57	-2.25
25	26	-0.976	-0.806	-0.907	2.000	4738	-4766	601	-1471	-27915	2147	-1758	Y	-1050	84.36	77.76	838	0	0.13	0.128	0.00	0.13	0.37	553	1252	771	2.95	-6.11	-2.09
26	26	-0.980	-0.805	-0.909	2.000	4738	-4670	605	-1374	-27735	2174	-1164	N	-1038	84.36	77.76	834	0	0.13	Not Reqd	0.00	0.06	0.37	553	1249	725	3.60	0.00	0.00
26	27	-0.853	-0.953	-0.895	2.000	4701	-8011	648	-1156	-43717	2362	-1001	N	-645	90.16	81.14	717	158	0.20	Not Reqd	0.00	0.10	0.37	576	1164	787	2.74	0.00	0.00
27	27	-0.855	-0.951	-0.895	2.000	4701	-7928	655	-1007	-43561	2395	-281	N	-505	90.16	81.14	667	220	0.28	Not Reqd	0.00	0.14	0.37	576	1119	798	2.47	0.00	0.00
27	28	-0.628	-1.290	-0.904	2.000	4701	-11705	698	-772	-61303	2585	-100	N	-122	92.83	83.55	498	459	0.59	Not Reqd	0.00	0.29	0.37	583				0.00	0.00
28	28	-0.629	-1.289	-0.904	2.000	4701	-11683	704	-654	-61240	2608	418	N	-123	92.83	83.55	498	468	0.60	Not Reqd	0.00	0.30	0.37	583				0.00	0.00
28	29	-0.536	-1.428	-0.907	2.000	4701	-12976	717	-579	-67283	2662	476	N	4	93.00	83.70	442	544	0.70	Not Reqd	0.00	0.35	0.37	580				0.00	0.00
29	29	-0.536	-1.428	-0.907	2.000	4701	1127	66	362	-53183	-1688	-1468	Y	3	93.00	83.70	495	130	0.16	0.108	0.00	0.14	0.37	590				-5.13	-1.76
29	30	-0.622	-1.301	-0.905	2.000	4701	968	66	362	-49064	-1648	-1486	Y	116	92.85	83.56	547	63	0.13	0.109	0.00	0.12	0.37	592				-5.20	-1.78
30	30	-0.622	-1.301	-0.905	2.000	4701	1134	63	302	-48921	-1633	-1142	N	117	92.85	83.56	548	57	0.13	Not Reqd	0.00	0.06	0.37	592				0.00	0.00
30	31	-0.834	-0.990	-0.899	2.000	4701	830	64	388	-36729	-1485	-1111	N	435	90.55	81.49	656	0	0.13	Not Reqd	0.00	0.06	0.37	580	1113	495	30.09	0.00	0.00
31	31	-0.835	-0.991	-0.899	2.000	4701	678	59	231	-36891	-1466	-701	N	575	90.55	81.49	703	0	0.13	Not Reqd	0.00	0.06	0.37	580	1155	489	34.64	0.00	0.00
31	32	-0.913	-0.887	-0.903	2.000	4738	1169	67	366	-25210	-1313	-621	N	1458	84.68	77.76	974	0	0.13	Not Reqd	0.00	0.06	0.37	553	1375	438	42.97	0.00	0.00
32	32	-0.912	-0.888	-0.902	2.000	4738	2517	63	182	-23884	-1297	-330	N	1470	84.68	77.76	978	0	0.13	Not Reqd	0.00	0.06	0.37	553	1378	432	45.77	0.00	0.00

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 Rating Tr HS-20
fy = ***60.0*** ksi

Box Girder Properties:

Web Thickness
b_v = ***12.95*** 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	-0.745	-1.147	-0.903	2.000	4775	3073	78	315	-13400	-1139	-252	N	2083	68.68	77.76	1182	0	0.13	Not Reqd	0.00	0.06	0.37	553	1562	380	46.23	0.00	0.00
33	33	-0.744	-1.147	-0.903	2.000	4775	3184	75	236	-13312	-1127	47	N	2096	68.68	77.76	1186	0	0.13	Not Reqd	0.00	0.06	0.37	553	1566	376	48.37	0.00	0.00
33	34	-0.381	-0.760	-0.525	2.000	4812	3902	95	370	-3870	-968	127	N	671	58.16	77.76	712	0	0.13	Not Reqd	0.00	0.06	0.37	553	1138	323	26.71	0.00	0.00
34	34	-0.376	-0.754	-0.519	2.000	4812	3989	91	266	-3810	-961	315	N	678	58.16	77.76	714	0	0.13	Not Reqd	0.00	0.06	0.37	553	1141	320	28.09	0.00	0.00
34	35	-0.433	-0.715	-0.536	2.000	4849	6133	116	574	5985	-819	568	N	619	58.59	77.76	694	0	0.13	Not Reqd	0.00	0.06	0.21	307	901	273	17.27	0.00	0.00
35	35	-0.432	-0.715	-0.535	2.000	4849	6119	109	418	5939	-816	628	N	627	58.59	77.76	697	0	0.13	Not Reqd	0.00	0.06	0.21	307	904	272	18.43	0.00	0.00
35	36	-0.476	-0.693	-0.552	2.000	4886	7118	138	601	13619	-673	756	N	574	66.43	77.76	668	0	0.13	Not Reqd	0.00	0.06	0.21	306	877	224	15.21	0.00	0.00
36	36	-0.475	-0.693	-0.552	2.000	4886	7110	129	407	13584	-674	689	N	582	66.43	77.76	671	0	0.13	Not Reqd	0.00	0.06	0.21	306	880	225	16.26	0.00	0.00
36	37	-0.509	-0.689	-0.569	2.000	4923	7975	159	568	20201	-532	795	N	525	73.37	77.76	635	0	0.13	Not Reqd	0.00	0.06	0.21	305	846	177	13.62	0.00	0.00
37	37	-0.508	-0.689	-0.569	2.000	4923	7973	148	340	20178	-537	618	N	535	73.37	77.76	638	0	0.13	Not Reqd	0.00	0.06	0.21	305	849	179	14.54	0.00	0.00
37	38	-0.532	-0.702	-0.586	2.000	4960	8703	179	479	25767	-397	702	N	473	79.25	77.76	601	0	0.13	Not Reqd	0.00	0.06	0.21	303	814	132	12.40	0.00	0.00
38	38	-0.532	-0.702	-0.586	2.000	4960	8708	169	241	25758	-403	397	N	352	79.25	77.76	561	0	0.13	Not Reqd	0.00	0.06	0.21	303	778	134	12.43	0.00	0.00
38	39	-0.559	-0.653	-0.588	2.000	4960	9291	201	360	30332	-264	461	N	288	84.18	77.76	526	0	0.13	Not Reqd	0.00	0.06	0.21	302	745	88	10.80	0.00	0.00
39	39	-0.559	-0.653	-0.589	2.000	4960	9301	188	87	30335	-273	127	N	288	84.18	77.76	526	0	0.13	Not Reqd	0.00	0.06	0.21	302	745	91	11.41	0.00	0.00
39	40	-0.579	-0.617	-0.591	2.000	4960	9735	221	187	33909	-133	173	N	224	88.09	79.28	502	0	0.13	Not Reqd	0.00	0.06	0.21	306	728	44	10.27	0.00	0.00
40	40	-0.579	-0.617	-0.591	2.000	4960	9751	208	-97	33923	-144	-211	N	224	88.09	79.28	502	0	0.13	Not Reqd	0.00	0.06	0.21	306	728	48	10.80	0.00	0.00
40	41	-0.593	-0.593	-0.593	2.000	4960	10025	242	-11	36494	-2	-180	N	160	91.00	81.90	489	0	0.13	Not Reqd	0.00	0.06	0.21	316	725	1	9.97	0.00	0.00
41	41	-0.594	-0.593	-0.593	2.000	4960	10047	229	-299	36519	-14	-594	N	159	91.00	81.90	490	0	0.13	Not Reqd	0.00	0.06	0.21	316	725	5	10.43	0.00	0.00
41	42	-0.601	-0.582	-0.595	2.000	4960	10142	264	-224	38073	129	-574	N	95	92.92	83.63	477	0	0.13	Not Reqd	0.00	0.06	0.21	323	720	43	8.69	0.00	0.00
42	42	-0.601	-0.582	-0.595	2.000	4960	10170	252	-507	38107	117	-1006	N	96	92.92	83.63	478	0	0.13	Not Reqd	0.00	0.06	0.21	323	720	39	9.13	0.00	0.00
42	43	-0.602	-0.583	-0.596	2.000	4960	10065	288	-439	38624	261	-993	N	31	93.86	84.47	456	0	0.13	Not Reqd	0.00	0.06	0.21	325	703	87	7.43	0.00	0.00
43	43	-0.603	-0.583	-0.597	2.000	4960	10093	276	-698	38663	250	-1404	N	31	93.86	84.47	456	0	0.13	Not Reqd	0.00	0.06	0.21	325	703	83	7.74	0.00	0.00
43	44	-0.598	-0.595	-0.597	2.000	4960	9797	310	-637	38204	383	-1393	N	-28	93.86	84.47	454	0	0.13	Not Reqd	0.00	0.06	0.21	325	701	128	6.54	0.00	0.00
44	44	-0.600	-0.594	-0.598	2.000	4960	9834	300	-878	38253	373	-1787	Y	-28	93.86	84.47	454	0	0.13	0.124	0.00	0.13	0.21	325	701	181	5.08	-6.03	-2.06
44	45	-0.588	-0.619	-0.598	2.000	4960	9276	338	-808	36717	519	-1772	Y	-93	92.92	83.62	473	0	0.13	0.123	0.00	0.13	0.21	322	715	229	4.52	-5.98	-2.04
45	45	-0.590	-0.619	-0.599	2.000	4960	9321	328	-1033	36778	510	-2150	Y	-93	92.92	83.62	473	0	0.13	0.150	0.00	0.14	0.21	322	715	238	4.36	-7.26	-2.48
45	46	-0.573	-0.656	-0.599	2.000	4960	8493	368	-954	34135	658	-2127	Y	-159	91.00	81.90	489	0	0.13	0.148	0.00	0.14	0.21	316	725	286	3.87	-7.18	-2.45
46	46	-0.574	-0.655	-0.600	2.000	4960	8542	360	-1146	34203	650	-2458	Y	-159	91.00	81.90	489	0	0.13	0.171	0.00	0.15	0.21	316	725	294	3.76	-8.30	-2.84
46	47	-0.551	-0.706	-0.599	2.000	4960	7416	400	-1056	30423	799	-2422	Y	-226	88.10	79.29	504	0	0.13	0.169	0.00	0.15	0.21	307	729	343	3.32	-8.18	-2.80
47	47	-0.552	-0.706	-0.600	2.000	4960	7469	394	-1213	30497	793	-2685	Y	-226	88.10	79.29	504	0	0.13	0.187	0.00	0.16	0.21	307	729	349	3.24	-9.06	-3.10
47	48	-0.523	-0.770	-0.601	2.000	4960	6032	435	-1108	25566	943	-2635	Y	-296	84.19	77.76	530	0	0.13	0.184	0.00	0.16	0.21	302	749	398	2.95	-8.89	-3.04
48	48	-0.525	-0.770	-0.602	2.000	4960	6087	430	-1223	25641	939	-2795	Y	-296	84.19	77.76	530	0	0.13	0.195	0.00	0.16	0.21	302	749	401	2.91	-9.44	-3.23
48	49	-0.490	-0.849	-0.602	2.000	4960	4333	472	-1104	19552	1089	-2732	Y	-368	79.31	77.76	572	0	0.13	0.190	0.00	0.16	0.21	304	788	449	2.76	-9.22	-3.15
49	49	-0.492	-0.848	-0.604	2.000	4960	4385	469	-1190	19624	1086	-2838	Y	-494	79.31	77.76	617	0	0.13	0.198	0.00	0.16	0.21	304	829	452	2.95	-9.58	-3.27
49	50	-0.463	-0.853	-0.592	2.000	4923	2331	510	-1058	12393	1237	-2762	Y	-551	73.46	77.76	655	0	0.13	0.194	0.00	0.16	0.21	306	865	500	2.79	-9.37	-3.20
50	50	-0.465	-0.853	-0.594	2.000	4923	2381	508	-1101	12465	1236	-2635	Y	-541	73.46	77.76	651	0	0.13	0.185	0.00	0.16	0.21	306	861	495	2.79	-8.94	-3.06
50	51	-0.431	-0.869	-0.583	2.000	4886	56	549	-968	4099	1390	-2558	Y	-623	66.64	77.76	695	0	0.13	0.181	0.00	0.16	0.21	307	903	544	2.68	-8.72	-2.98
51	51	-0.433	-0.869	-0.584	2.000	4886	96	548	-977	4159	1390	-2220	Y	-614	66.64	77.76	693	0	0.13	0.157	0.00	0.14	0.21	307	900	533	2.72	-7.57	-2.59
51	52	-0.400	-0.893	-0.578	2.000	4849	-2439	587	-857	-5301	1544	-2155	Y	-700	49.49	77.76	716	0	0.13	0.154	0.00	0.14	0.37	552	1141	583	3.51	-7.38	-2.52
52	52	-0.402	-0.892	-0.579	2.000	4849	-2417	587	-840	-5263	1544	-1596	Y	-692	49.49	77.76	713	0	0.13	0.114	0.00	0.12	0.37	552	1139	565	3.58	-5.47	-1.87
52	53	-0.366	-0.935	-0.563	2.000	4886	-5044	623	-752	-15719	1699	-1563	Y	-752	69.67	77.76	700	0	0.13	0.111	0.00	0.12	0.37	547	1122	616	3.19	-5.33	-1.82
53	53	-0.472	-0.441	-0.461	2.000	4886	3077	745	-1465	-4672	2097	-3855	Y	-762	69.67	77.76	742	35	0.13	0.273	0.00	0.20	0.37	553	1166	821	2.17	-13.14	-4.49
53	54	-0.816	-0.705	-0.764	2.000	10203	-2219	777	-1508	-21163	2347	-3979	Y	-2410	68.69	77.76	1291	0	0.13	0.135	0.00	0.13	0.37	553	1660	841	3.91	-11.29	-3.86
54	54	-0.812	-0.705	-0.762	2.000	10203	-1301	717	-2833	-20208	2288	-4736	Y	-2388	68.69	77.76	1284	0	0.13	0.160	0.00	0.14	0.37	553	1654	833	3.92	-13.44	-4.60
54	55	-0.937	-0.561	-0.757	2.000	10124	-6393	747	-2850	-38199	2544	-4834	Y	-1724	84.54	77.76	1063	0	0.13	0.165	0.00	0.15	0.47	692	1579	920	3.26	-13.81	-4.72
55	55	-0.941	-0.560	-0.759	2.000	10124	-4677	738	-3351	-36384	2488	-6324	Y	-1704	84.54	77.76	1056	0	0.13	0.216	0.00	0.17	0.47	692	1573	923	3.20	-18.06	-6.18
55	56	-0.863	-0.636	-0.752	2.000	10046	-9931	769	-3350	-55934	2752	-6405	Y	-697	90.42	81.37	700	319	0.42	0.220	0.00	0.32	0.47	715	1273	1012	1.85	-18.41	-6.29
56	56	-0.870	-0.634	-0.755	2.000	10046	-8294	792	-3101	-54022	2869	-4230	Y	-511	90.42	81.37	638	424	0.55	0.145	0.00	0.35	0.47	715	1217	1019	1.64	-12.16	-4.16
56	57	-0.665	-0.861	-0.761	2.000	10046	-14014	824	-3099	-76550	3137	-4309	Y	-131	92.79	83.51	483	679	0.87	0.148	0.00	0.51	0.47	723				-12.39	-4.23
57	57	-0.674	-0.858	-0.764	2.000	10046	-13295	842	-2956	-75560	3242	-2278	N	-130	92.79	83.51	483	718	0.92	Not Reqd	0.00	0.46	0.47	723				0.00	0.00
57	58	-0.589	-0.953	-0.767	2.000	10046	-15222	852	-2947	-83455	3316	-2295	N	9	92.98	83.68	430	798	1.03	Not Reqd	0.00	0.51	0.47	721				0.00	0.00
58	58	-0.661	-0.857	-0.757	2.000	10046	5034	103	-181	-58185	-2417	1287	N	9	92.98	83.68	478	417	0.53	Not Reqd	0.00	0.26	0.47	734				0.00	0.00
58	59	-0.751	-0.762	-0.756	2.000	10046	4783	103	-170	-52330	-2353	1272	N	199	92.76	83.49	553	318	0.40	Not Reqd	0.00	0.20	0.47	735				0.00	0.00
59	59	-0.741	-0.764	-0.752	2.000	10046	4535	100	-182	-52857	-2275	2858	N	198	92.76	83.49	553	290	0.37	Not Reqd	0.00	0.18	0.47	735				0.00	0.00
59	60	-0.944	-0.549	-0.751	2.000	10046	3611	110	476	-36456	-2040	3435	Y	731	89.50	80.55	749	6	0.13	0.118	0.00	0.12	0.47	716	1319	731	14.46	9.87	3.38
60	60	-0.927	-0.552	-0.744	2.000	10046	4654	91	-415	-35907	-1965	4330	Y	920	89.50	80.55	812	0	0.13	0.149	0.00	0.14	0.47	716	1376	719	18.96	12.45	4.26
60	61	-1.003	-0.500	-0.763	2.000	10124	4221	106	600	-21440	-1728	5263	Y	1773	82.21	77.76	1079	0	0.13	0.180	0.00	0.15	0.37	553	1469	654	19.40	15.03	5.14
61	61	-0.981	-0.502	-0.753	2.000	10124	5192	90	-640	-21129	-1672	5621	Y	1794	82.21	77.76	1086	0	0.13	0.192	0.00	0.16	0.37	553	1475	640	22.22	16.05	5.49
61	62	-0.899	-0.628	-0.774	2.000	10203	5769	110	503	-7891	-1435	6682	Y	2179	68.33	77.76	1214	0	0.13	0.226	0.00	0.18	0.37	553	1591	577	24.02	18.97	6.48
62	62	-0.862	-0.632	-0.756	2.000	10203	6069	98	-201	-8512	-1462	5630	Y	2202	68.33	77.76	1222	0	0.13	0.191	0.00	0.16	0.37	553	1598	571	29.83	15.98	5.46
62	63	-0.677	-0.552	-0.626	2.000	10440	6677	124	591	3247	-1227	6342	Y	1155	46.11	77.76	873	0	0.13	0.210	0.00	0.17	0.37	553	1284	503	16.55	17.67	6.04
63	63	-0.606	-0.552	-0.584	2.000	10440	7149	112	147	2016	-1302	5037	Y	1174	46.11	77.76	879	0	0.13	0.167	0.00	0.15	0.37	553	1289	508	20.72	14.04	4.80
63	64	-0.631	-0.572	-0.605	2.000	10361	7502	141	592	12518	-1095	5400	Y	1075	58.66	77.76	846	0	0.13	0.180	0.00	0.15	0.21	307	1038	445	11.66	15.14	5.18

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 Rating Tr HS-20
fy = ***60.0*** ksi

Box Girder Properties:

Web Thickness
b_v = ***12.95*** 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																									
64	64	-0.615	-0.573	-0.597	2.000	10361	8063	128	133	12778	-1125	4634	Y	1095	58.66	77.76	853	0	0.13	0.155	0.00	0.14	0.21	307	1044	444	14.46	12.99	4.44
64	65	-0.631	-0.607	-0.621	2.000	10440	8242	157	551	21895	-923	4972	Y	1008	66.51	77.76	824	0	0.13	0.165	0.00	0.15	0.21	307	1018	381	11.54	13.85	4.74
65	65	-0.622	-0.609	-0.616	2.000	10440	8896	144	67	22348	-950	4194	Y	1031	66.51	77.76	832	0	0.13	0.139	0.00	0.13	0.21	307	1025	379	14.18	11.69	4.00
65	66	-0.628	-0.660	-0.641	2.000	10519	9167	173	446	30359	-753	4493	Y	936	73.45	77.76	788	0	0.13	0.148	0.00	0.14	0.21	306	985	317	11.37	12.44	4.25
66	66	-0.621	-0.662	-0.637	2.000	10519	9942	160	13	30978	-777	3784	Y	962	73.45	77.76	794	0	0.13	0.124	0.00	0.13	0.21	306	991	315	13.63	10.48	3.58
66	67	-0.619	-0.734	-0.661	2.000	10598	10133	189	375	37727	-585	4065	Y	859	79.32	77.76	749	0	0.13	0.133	0.00	0.13	0.21	305	948	255	11.09	11.19	3.83
67	67	-0.616	-0.734	-0.659	2.000	10598	10811	178	-184	38333	-603	3123	N	595	79.32	77.76	663	0	0.13	Not Reqd	0.00	0.06	0.21	305	871	201	12.28	0.00	0.00
67	68	-0.623	-0.724	-0.660	2.000	10598	10920	209	146	43819	-413	3372	Y	487	84.25	77.76	613	0	0.13	0.110	0.00	0.12	0.21	304	825	188	9.88	9.28	3.17
68	68	-0.618	-0.726	-0.657	2.000	10598	11605	196	-396	44403	-430	2596	N	487	84.25	77.76	612	0	0.13	Not Reqd	0.00	0.06	0.21	304	824	143	11.41	0.00	0.00
68	69	-0.621	-0.722	-0.658	2.000	10598	11578	227	-87	48560	-240	2824	N	380	88.17	79.35	576	0	0.13	Not Reqd	0.00	0.06	0.21	309	797	80	10.48	0.00	0.00
69	69	-0.617	-0.723	-0.656	2.000	10598	12278	215	-627	49164	-258	1955	N	380	88.17	79.35	575	0	0.13	Not Reqd	0.00	0.06	0.21	309	796	86	10.90	0.00	0.00
69	70	-0.616	-0.726	-0.656	2.000	10598	12126	246	-340	52024	-67	2161	N	273	91.08	81.97	550	0	0.13	Not Reqd	0.00	0.06	0.21	319	782	22	10.25	0.00	0.00
70	70	-0.612	-0.727	-0.654	2.000	10598	12822	236	-864	52628	-88	1190	N	273	91.08	81.97	549	0	0.13	Not Reqd	0.00	0.06	0.21	319	781	29	10.56	0.00	0.00
70	71	-0.608	-0.734	-0.654	2.000	10598	12517	268	-601	54193	104	1371	N	165	93.00	83.70	524	0	0.13	Not Reqd	0.00	0.06	0.21	325	764	35	9.18	0.00	0.00
71	71	-0.605	-0.735	-0.652	2.000	10598	14478	262	-1044	56064	82	365	N	165	93.00	83.70	519	0	0.13	Not Reqd	0.00	0.06	0.21	325	760	27	9.38	0.00	0.00
71	72	-0.598	-0.747	-0.652	2.000	10598	14337	297	-951	56685	278	376	N	58	93.93	84.54	486	0	0.13	Not Reqd	0.00	0.06	0.21	328	732	93	7.45	0.00	0.00
72	72	-0.595	-0.748	-0.650	2.000	10598	15106	294	-1127	57367	255	-447	N	58	93.93	84.54	484	0	0.13	Not Reqd	0.00	0.06	0.21	328	731	85	7.60	0.00	0.00
72	73	-0.588	-0.762	-0.650	2.000	10598	14745	326	-1062	56763	435	-457	N	-41	93.93	84.53	477	0	0.13	Not Reqd	0.00	0.06	0.21	328	724	145	6.33	0.00	0.00
73	73	-0.584	-0.763	-0.649	2.000	10598	15213	325	-1170	57148	410	-1293	N	-41	93.93	84.53	476	0	0.13	Not Reqd	0.00	0.06	0.21	327	723	137	6.41	0.00	0.00
73	74	-0.575	-0.780	-0.649	2.000	10598	14556	362	-1119	55224	608	-1324	N	-150	93.00	83.70	510	0	0.13	Not Reqd	0.00	0.06	0.21	324	751	203	5.55	0.00	0.00
74	74	-0.571	-0.780	-0.646	2.000	10598	15089	363	-517	55672	580	242	N	-206	93.00	83.70	528	0	0.13	Not Reqd	0.00	0.06	0.21	324	767	193	5.75	0.00	0.00
74	75	-0.579	-0.798	-0.658	2.000	10598	14138	400	-405	52439	778	272	N	-317	90.59	81.53	555	0	0.13	Not Reqd	0.00	0.06	0.21	316	784	259	4.94	0.00	0.00
75	75	-0.576	-0.802	-0.657	2.000	10598	14661	403	-1708	52789	747	-5428	Y	-206	90.59	81.53	517	0	0.13	0.177	0.00	0.15	0.21	316	749	329	3.63	-14.94	-5.11
75	76	-0.550	-0.823	-0.648	2.000	10598	13474	443	-1786	48342	948	-5588	Y	-319	88.17	79.35	547	0	0.13	0.182	0.00	0.16	0.21	308	769	399	3.13	-15.38	-5.26
76	76	-0.554	-0.822	-0.650	2.000	10598	14102	451	-1086	49147	926	-4215	Y	-374	88.17	79.35	565	0	0.13	0.137	0.00	0.13	0.21	308	785	371	3.49	-11.60	-3.97
76	77	-0.546	-0.841	-0.652	2.000	10598	12352	488	-1099	43142	1125	-4310	Y	-489	84.26	77.76	603	0	0.13	0.140	0.00	0.13	0.21	303	816	439	3.11	-11.87	-4.06
77	77	-0.552	-0.841	-0.656	2.000	10598	12781	495	-1005	43715	1103	-5019	Y	-489	84.26	77.76	603	0	0.13	0.164	0.00	0.15	0.21	303	815	442	3.07	-13.82	-4.72
77	78	-0.545	-0.860	-0.658	2.000	10598	10639	531	-1026	36301	1301	-5122	Y	-607	79.42	77.76	657	0	0.13	0.167	0.00	0.15	0.21	304	865	509	2.85	-14.10	-4.82
78	78	-0.556	-0.859	-0.664	2.000	10598	10888	538	-965	36831	1281	-5941	Y	-881	79.42	77.76	752	0	0.13	0.194	0.00	0.16	0.21	305	951	515	3.25	-16.36	-5.59
78	79	-0.565	-0.776	-0.645	2.000	10519	8425	575	-995	28043	1484	-6053	Y	-998	73.46	77.76	803	0	0.13	0.199	0.00	0.16	0.21	306	998	584	3.01	-16.76	-5.73
79	79	-0.577	-0.775	-0.652	2.000	10519	8524	582	-872	28373	1471	-6462	Y	-970	73.46	77.76	794	0	0.13	0.212	0.00	0.17	0.21	306	990	586	2.95	-17.90	-6.12
79	80	-0.582	-0.708	-0.632	2.000	10440	5678	620	-898	18059	1681	-6571	Y	-1081	66.53	77.76	846	0	0.13	0.217	0.00	0.17	0.21	307	1038	658	2.73	-18.31	-6.26
80	80	-0.589	-0.707	-0.636	2.000	10440	5785	627	-766	18324	1675	-6837	Y	-1056	66.53	77.76	837	0	0.13	0.226	0.00	0.18	0.21	307	1030	660	2.68	-19.05	-6.51
80	81	-0.589	-0.656	-0.617	2.000	10361	2569	665	-780	6395	1893	-6934	Y	-1160	58.69	77.76	874	0	0.13	0.231	0.00	0.18	0.37	553	1285	733	3.36	-19.44	-6.65
81	81	-0.590	-0.656	-0.617	2.000	10361	2716	671	-671	6578	1892	-7136	Y	-1137	58.69	77.76	867	0	0.13	0.238	0.00	0.18	0.37	553	1278	736	3.32	-20.00	-6.84
81	82	-0.583	-0.618	-0.597	2.000	10440	-888	711	-665	-7079	2116	-7213	Y	-1256	61.82	77.76	907	0	0.13	0.239	0.00	0.18	0.37	553	1314	812	3.03	-20.10	-6.87
82	82	-0.577	-0.619	-0.594	2.000	10440	-819	714	-563	-7207	2118	-7455	Y	-1236	61.82	77.76	900	0	0.13	0.247	0.00	0.19	0.37	553	1308	816	3.00	-20.77	-7.10
82	83	-0.729	-0.683	-0.708	2.000	10203	-4812	755	-532	-22935	2417	-7507	Y	-2119	68.27	77.76	1194	0	0.13	0.254	0.00	0.19	0.37	553	1573	917	3.53	-21.31	-7.28
83	83	-0.720	-0.684	-0.704	2.000	10203	-4670	758	-436	-23142	2421	-7613	Y	-2096	68.27	77.76	1187	0	0.13	0.258	0.00	0.19	0.37	553	1566	920	3.50	-21.61	-7.39
83	84	-0.783	-0.578	-0.689	2.000	10124	-9060	799	-380	-41307	2735	-7640	Y	-1817	81.49	77.76	1072	0	0.13	0.261	0.00	0.20	0.47	687	1583	1024	3.06	-21.82	-7.46
84	84	-0.774	-0.579	-0.685	2.000	10124	-9194	800	-300	-41848	2739	-7482	Y	-1796	81.49	77.76	1063	0	0.13	0.255	0.00	0.19	0.47	687	1575	1023	3.04	-21.37	-7.31
84	85	-0.715	-0.629	-0.674	2.000	10046	-13977	842	-220	-62535	3059	-7485	Y	-996	89.10	80.19	763	370	0.49	0.257	0.00	0.38	0.47	697	1314	1130	1.65	-21.51	-7.36
85	85	-0.709	-0.629	-0.671	2.000	10046	-14018	842	-173	-62857	3061	-7116	Y	-799	89.10	80.19	694	439	0.59	0.245	0.00	0.42	0.47	696	1252	1125	**1.45**	-20.45	-6.99
85	86	-0.542	-0.837	-0.680	2.000	10046	-19188	884	-88	-86087	3385	-7115	Y	-200	92.64	83.37	476	778	1.01	0.245	0.00	0.63	0.47	714				-20.45	-6.99
86	86	-0.541	-0.837	-0.680	2.000	10046	-19077	882	-29	-86048	3385	-6284	Y	-198	92.64	83.37	475	779	1.01	0.216	0.00	0.62	0.47	714				-18.06	-6.18
86	87	-0.467	-0.929	-0.683	2.000	10046	-20795	895	-2	-93986	3465	-6285	Y	21	92.65	83.39	405	879	1.15	0.216	0.00	0.68	0.47	710				-18.06	-6.18
87	87	-0.386	-1.038	-0.690	2.000	10046	6460	96	24	-73363	-2834	237	N	0	92.65	83.39	429	621	0.80	Not Reqd	0.00	0.40	0.47	720				0.00	0.00
87	88	-0.476	-0.932	-0.689	2.000	10046	6230	96	24	-66495	-2765	255	N	208	92.48	83.23	509	515	0.66	Not Reqd	0.00	0.33	0.47	721				0.00	0.00
88	88	-0.476	-0.932	-0.689	2.000	10046	6230	96	2	-66494	-2765	494	N	208	92.48	83.23	509	515	0.66	Not Reqd	0.00	0.33	0.47	721				0.00	0.00
88	89	-0.692	-0.681	-0.687	2.000	10046	5557	96	0	-46390	-2474	548	N	792	89.45	80.50	724	192	0.25	Not Reqd	0.00	0.13	0.47	706	1288	825	15.43	0.00	0.00
89	89	-0.693	-0.681	-0.687	2.000	10046	5557	96	-27	-46386	-2474	833	N	994	89.45	80.50	794	122	0.16	Not Reqd	0.00	0.08	0.47	707	1351	825	17.41	0.00	0.00
89	90	-0.815	-0.583	-0.710	2.000	10124	4950	97	-28	-28424	-2186	889	N	1509	82.62	77.76	991	0	0.13	Not Reqd	0.00	0.06	0.47	692	1514	729	25.27	0.00	0.00
90	90	-0.815	-0.583	-0.710	2.000	10124	4950	97	-54	-28419	-2186	1046	N	1530	82.62	77.76	998	0	0.13	Not Reqd	0.00	0.06	0.47	692	1520	729	25.46	0.00	0.00
90	91	-0.795	-0.625	-0.721	2.000	10203	4407	99	-55	-12568	-1903	1102	N	2268	70.58	77.76	1244	0	0.13	Not Reqd	0.00	0.06	0.37	553	1617	634	30.92	0.00	0.00
91	91	-0.794	-0.626	-0.721	2.000	10203	4406	99	-78	-12562	-1903	1173	N	2290	70.58	77.76	1251	0	0.13	Not Reqd	0.00	0.06	0.37	553	1624	634	31.12	0.00	0.00
91	92	-0.613	-0.545	-0.586	2.000	10440	3922	101	-79	1244	-1633	1229	N	1258	46.10	77.76	907	0	0.13	Not Reqd	0.00	0.06	0.37	553	1314	544	23.95	0.00	0.00
92	92	-0.608	-0.539	-0.581	2.000	10440	3921	101	-100	1250	-1633	1225	N	1277	46.10	77.76	914	0	0.13	Not Reqd	0.00	0.06	0.37	553	1320	544	24.13	0.00	0.00
92	93	-0.650	-0.534	-0.603	2.000	10361	3489	103	-101	13335	-1435	1279	N	1168	58.59	77.76	872	0	0.13	Not Reqd	0.00	0.06	0.21	307	1061	478	17.91	0.00	0.00
93	93	-0.650	-0.534	-0.603	2.000	10361	3488	103	-119	13341	-1435	1209	N	1189	58.59	77.76	880	0	0.13	Not Reqd	0.00	0.06	0.21	307	1068	478	18.10	0.00	0.00
93	94	-0.682	-0.542	-0.628	2.000	10440	9471	117	-89	30372	-1232	1296	N	1093	66.44	77.76	819	0	0.13	Not Reqd	0.00	0.06	0.21	304	1011	411	16.38	0.00	0.00
94	94	-0.682	-0.542	-0.628	2.000	10440	9470	117	-141	30378	-1232	1132	N	1117	66.44	77.76	827	0	0.13	Not Reqd	0.00	0.06	0.21	304	1018	411	16.58	0.00	0.00
94	95	-0.705	-0.566	-0.654	2.000	10519	10642	136	-144	41174	-1030	1184	N	1013	73.38	77.76	777	0	0.13	Not Reqd	0.00	0.06	0.21	303	971	343	14.88	0.00	0.00
95	95	-0.705	-0.565	-0.654	2.000	10519	10642	136	-203	41180	-1030	962	N	1039	73.38	77.76	786	0	0.13	Not Reqd	0.00	0.06	0.21	303	980	343	15.06	0.00	0.00

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 Rating Tr HS-20
fy = ***60.0*** ksi

Box Girder Properties:

Web Thickness
b_v = ***12.95*** 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)	Permanent Loads + Maximum LL Shear @ t=00 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
95	96	-0.720	-0.605	-0.680	2.000	10598	11745	156	-217	50528	-832	1004	N	926	79.25	77.76	733	0	0.13	Not Reqd	0.00	0.06	0.21	301	930	277	13.54	0.00	0.00
96	96	-0.720	-0.605	-0.680	2.000	10598	11744	156	-271	50532	-833	718	N	644	79.25	77.76	637	0	0.13	Not Reqd	0.00	0.06	0.21	301	844	278	11.88	0.00	0.00
96	97	-0.741	-0.576	-0.684	2.000	10598	12746	179	-293	58433	-636	751	N	525	84.18	77.76	584	0	0.13	Not Reqd	0.00	0.06	0.21	299	795	212	10.80	0.00	0.00
97	97	-0.741	-0.576	-0.684	2.000	10598	12744	179	-363	58436	-636	433	N	525	84.18	77.76	584	0	0.13	Not Reqd	0.00	0.06	0.21	299	795	212	10.80	0.00	0.00
97	98	-0.757	-0.556	-0.687	2.000	10598	13613	203	-395	64871	-438	456	N	407	88.09	79.28	545	0	0.13	Not Reqd	0.00	0.06	0.21	304	764	146	10.15	0.00	0.00
98	98	-0.757	-0.555	-0.687	2.000	10598	13611	203	-469	64872	-438	103	N	407	88.09	79.28	545	0	0.13	Not Reqd	0.00	0.06	0.21	304	764	146	10.15	0.00	0.00
98	99	-0.769	-0.542	-0.691	2.000	10598	14313	228	-512	69805	-238	116	N	290	91.00	81.90	514	0	0.13	Not Reqd	0.00	0.06	0.21	314	745	79	9.75	0.00	0.00
99	99	-0.769	-0.542	-0.691	2.000	10598	14310	228	-590	69805	-238	-264	N	290	91.00	81.90	514	0	0.13	Not Reqd	0.00	0.06	0.21	314	745	79	9.75	0.00	0.00
99	100	-0.777	-0.536	-0.693	2.000	10598	14812	256	-640	73204	-36	-259	N	172	92.92	83.63	480	0	0.13	Not Reqd	0.00	0.06	0.21	320	720	12	9.31	0.00	0.00
100	100	-0.777	-0.536	-0.693	2.000	10598	14808	256	-721	73202	-36	-657	N	172	92.92	83.63	480	0	0.13	Not Reqd	0.00	0.06	0.21	320	720	12	9.31	0.00	0.00
100	101	-0.780	-0.538	-0.696	2.000	10598	15078	284	-779	75035	167	-660	N	54	93.86	84.47	443	0	0.13	Not Reqd	0.00	0.06	0.21	323	689	56	7.69	0.00	0.00
101	101	-0.780	-0.538	-0.696	2.000	10598	15074	284	-858	75031	167	-1051	N	54	93.86	84.47	443	0	0.13	Not Reqd	0.00	0.06	0.21	323	689	56	7.69	0.00	0.00
101	102	-0.779	-0.545	-0.698	2.000	10598	15093	312	-917	75311	354	-1060	N	-54	93.86	84.47	441	0	0.13	Not Reqd	0.00	0.06	0.21	322	687	118	6.47	0.00	0.00
102	102	-0.779	-0.545	-0.698	2.000	10598	15088	312	-996	75305	354	-1453	N	-54	93.86	84.47	441	0	0.13	Not Reqd	0.00	0.06	0.21	322	687	118	6.47	0.00	0.00
102	103	-0.775	-0.561	-0.701	2.000	10598	14839	343	-1067	74063	560	-1468	N	-174	92.92	83.63	476	0	0.13	Not Reqd	0.00	0.06	0.21	319	716	187	5.63	0.00	0.00
103	103	-0.775	-0.561	-0.701	2.000	10598	14833	343	-1148	74054	560	-1871	N	-174	92.92	83.63	476	0	0.13	Not Reqd	0.00	0.06	0.21	319	716	187	5.63	0.00	0.00
103	104	-0.766	-0.583	-0.703	2.000	10598	14282	375	-1224	71177	766	-1892	N	-296	91.00	81.90	510	0	0.13	Not Reqd	0.00	0.06	0.21	313	740	255	4.88	0.00	0.00
104	104	-0.766	-0.583	-0.703	2.000	10598	14275	375	-1302	71165	766	-2280	N	-296	91.00	81.90	510	0	0.13	Not Reqd	0.00	0.06	0.21	313	740	255	4.88	0.00	0.00
104	105	-0.754	-0.612	-0.705	2.000	10598	13402	408	-1383	66632	974	-2305	N	-420	88.09	79.28	541	0	0.13	Not Reqd	0.00	0.06	0.21	303	759	325	4.19	0.00	0.00
105	105	-0.754	-0.612	-0.705	2.000	10598	13395	408	-1456	66619	974	-2668	N	-420	88.09	79.28	541	0	0.13	Not Reqd	0.00	0.06	0.21	303	759	325	4.19	0.00	0.00
105	106	-0.739	-0.648	-0.707	2.000	10598	12191	442	-1541	60421	1182	-2697	N	-547	84.18	77.76	582	0	0.13	Not Reqd	0.00	0.06	0.21	298	793	394	3.70	0.00	0.00
106	106	-0.739	-0.648	-0.707	2.000	10598	12182	442	-1608	60405	1182	-3027	N	-547	84.18	77.76	582	0	0.13	Not Reqd	0.00	0.06	0.21	298	793	394	3.70	0.00	0.00
106	107	-0.721	-0.689	-0.710	2.000	10598	10639	477	-1695	52533	1391	-3058	N	-676	79.33	77.76	638	0	0.13	Not Reqd	0.00	0.06	0.21	300	844	464	3.40	0.00	0.00
107	107	-0.720	-0.689	-0.710	2.000	10598	10630	477	-1745	52517	1391	-3340	Y	-973	79.33	77.76	741	0	0.13	0.109	0.00	0.12	0.21	300	937	513	3.30	-9.19	-3.14
107	108	-0.712	-0.651	-0.689	2.000	10519	8744	512	-1833	42957	1603	-3372	Y	-1103	73.37	77.76	797	0	0.13	0.111	0.00	0.12	0.21	302	989	584	3.05	-9.34	-3.19
108	108	-0.712	-0.651	-0.689	2.000	10519	8733	512	-1881	42938	1603	-3606	Y	-1074	73.37	77.76	787	0	0.13	0.118	0.00	0.12	0.21	302	980	588	2.98	-9.99	-3.41
108	109	-0.699	-0.623	-0.670	2.000	10440	6505	547	-1967	31657	1821	-3636	Y	-1195	66.43	77.76	844	0	0.13	0.120	0.00	0.12	0.21	303	1033	661	2.76	-10.13	-3.46
109	109	-0.699	-0.624	-0.670	2.000	10440	6494	547	-2003	31637	1821	-3809	Y	-1170	66.43	77.76	835	0	0.13	0.126	0.00	0.13	0.21	303	1025	663	2.71	-10.61	-3.63
109	110	-0.680	-0.607	-0.650	2.000	10361	3923	582	-2086	18589	2046	-3836	Y	-1284	58.59	77.76	893	0	0.13	0.128	0.00	0.13	0.41	611	1353	739	3.73	-10.75	-3.68
110	110	-0.680	-0.607	-0.650	2.000	10361	3912	582	-2107	18568	2046	-3937	Y	-1261	58.59	77.76	885	0	0.13	0.131	0.00	0.13	0.41	611	1346	740	3.69	-11.04	-3.77
110	111	-0.654	-0.600	-0.633	2.000	10440	1002	618	-2186	3712	2277	-3959	Y	-1391	46.10	77.76	952	0	0.13	0.131	0.00	0.13	0.41	615	1410	817	3.49	-11.03	-3.77
111	111	-0.654	-0.600	-0.633	2.000	10440	990	618	-2191	3690	2277	-3979	Y	-1370	46.10	77.76	945	0	0.13	0.132	0.00	0.13	0.41	615	1403	818	3.46	-11.09	-3.79
111	112	-0.893	-0.757	-0.834	2.000	10203	-2252	653	-2264	-13122	2542	-3996	Y	-2702	68.41	77.76	1389	0	0.13	0.135	0.00	0.13	0.41	615	1803	906	4.57	-11.34	-3.88
112	112	-0.893	-0.757	-0.834	2.000	10203	-2264	653	-2252	-13144	2542	-3925	Y	-2676	68.41	77.76	1380	0	0.13	0.133	0.00	0.13	0.41	615	1795	905	4.55	-11.14	-3.81
112	113	-1.000	-0.602	-0.820	2.000	10124	-5829	689	-2321	-32069	2815	-3937	Y	-2201	82.35	77.76	1221	0	0.13	0.134	0.00	0.13	0.41	615	1653	997	3.49	-11.24	-3.84
113	113	-0.999	-0.603	-0.820	2.000	10124	-5841	689	-2289	-32090	2815	-3762	Y	-2177	82.35	77.76	1214	0	0.13	0.128	0.00	0.13	0.41	615	1646	994	3.47	-10.74	-3.67
113	114	-0.943	-0.657	-0.810	2.000	10046	-9714	724	-2352	-53169	3095	-3770	Y	-1134	89.55	80.59	841	305	0.40	0.130	0.00	0.27	0.41	629	1323	1087	1.85	-10.84	-3.70
114	114	-0.943	-0.656	-0.810	2.000	10046	-9727	724	-2298	-53190	3095	-3472	Y	-897	89.55	80.59	759	387	0.51	0.119	0.00	0.31	0.41	629	1249	1083	1.60	-9.98	-3.41
114	115	-0.759	-0.881	-0.815	2.000	10046	-13889	758	-2357	-76438	3377	-3475	Y	-238	92.78	83.51	515	735	0.95	0.120	0.00	0.53	0.41	642				-9.99	-3.42
115	115	-0.759	-0.881	-0.815	2.000	10046	-13898	758	-2307	-76450	3377	-3200	Y	-238	92.78	83.51	515	735	0.95	0.110	0.00	0.53	0.41	642				-9.20	-3.14
115	116	-0.678	-0.979	-0.818	2.000	10046	-15281	770	-2326	-84336	3457	-3201	Y	0	93.00	83.70	424	856	1.11	0.110	0.00	0.61	0.41	640				-9.20	-3.15
116	116	-0.678	-0.979	-0.818	2.000	10046	4491	28	171	-64565	-2503	-53	N	0	93.00	83.70	460	467	0.59	Not Reqd	0.00	0.30	0.41	649				0.00	0.00
116	117	-0.757	-0.889	-0.818	2.000	10046	4427	28	171	-58509	-2434	-36	N	221	92.81	83.53	545	356	0.45	Not Reqd	0.00	0.23	0.41	650				0.00	0.00
117	117	-0.757	-0.889	-0.818	2.000	10046	4427	28	155	-58508	-2434	174	N	221	92.81	83.53	545	356	0.45	Not Reqd	0.00	0.23	0.41	650				0.00	0.00
117	118	-0.922	-0.699	-0.818	2.000	10046	4285	29	153	-40758	-2186	228	N	1060	89.38	80.44	847	0	0.13	Not Reqd	0.00	0.06	0.41	634	1333	729	63.61	0.00	0.00
118	118	-0.923	-0.699	-0.819	2.000	10046	4285	29	129	-40756	-2186	456	N	1299	89.38	80.44	929	0	0.13	Not Reqd	0.00	0.06	0.41	635	1408	729	71.41	0.00	0.00
118	119	-0.915	-0.725	-0.829	2.000	10124	5145	37	72	-23883	-1934	455	N	2459	80.57	77.76	1308	0	0.13	Not Reqd	0.00	0.06	0.41	615	1730	645	90.07	0.00	0.00
119	119	-0.915	-0.724	-0.829	2.000	10124	5145	37	44	-23880	-1934	585	N	2483	80.57	77.76	1316	0	0.13	Not Reqd	0.00	0.06	0.41	615	1737	645	90.66	0.00	0.00
119	120	-0.744	-0.964	-0.840	2.000	10203	6374	48	57	-8485	-1684	654	N	3044	64.59	77.76	1503	0	0.13	Not Reqd	0.00	0.06	0.21	307	1629	561	67.89	0.00	0.00
120	120	-0.744	-0.964	-0.840	2.000	10203	6374	48	22	-8481	-1684	700	N	3070	64.59	77.76	1511	0	0.13	Not Reqd	0.00	0.06	0.21	307	1637	561	68.38	0.00	0.00
120	121	-0.398	-0.788	-0.550	2.000	10440	8001	64	11	5524	-1439	745	N	1282	53.27	77.76	901	0	0.13	Not Reqd	0.00	0.06	0.21	306	1086	480	29.52	0.00	0.00
121	121	-0.398	-0.788	-0.550	2.000	10440	8001	64	-32	5528	-1439	715	N	1300	53.27	77.76	907	0	0.13	Not Reqd	0.00	0.06	0.21	306	1092	480	29.79	0.00	0.00
121	122	-0.404	-0.840	-0.581	2.000	10361	9653	82	-31	17933	-1226	772	N	1173	66.63	77.76	835	0	0.13	Not Reqd	0.00	0.06	0.21	303	1024	409	23.54	0.00	0.00
122	122	-0.404	-0.840	-0.581	2.000	10361	9653	82	-84	17937	-1226	674	N	1193	66.63	77.76	842	0	0.13	Not Reqd	0.00	0.06	0.21	303	1031	409	23.77	0.00	0.00
122	123	-0.407	-0.902	-0.599	2.000	10440	11238	102	-91	28806	-1017	723	N	1026	74.89	77.76	770	0	0.13	Not Reqd	0.00	0.06	0.21	302	965	339	19.40	0.00	0.00
123	123	-0.407	-0.903	-0.599	2.000	10440	11237	102	-152	28809	-1017	565	N	1048	74.89	77.76	777	0	0.13	Not Reqd	0.00	0.06	0.21	302	971	339	19.59	0.00	0.00
123	124	-0.409	-0.976	-0.618	2.000	10519	12714	124	-169	38146	-811	604	N	898	81.60	77.76	713	0	0.13	Not Reqd	0.00	0.06	0.21	300	912	270	16.52	0.00	0.00
124	124	-0.409	-0.976	-0.618	2.000	10519	12713	124	-239	38149	-811	396	N	923	81.60	77.76	721	0	0.13	Not Reqd	0.00	0.06	0.21	300	919	270	16.69	0.00	0.00
124	125	-0.405	-1.075	-0.637	2.000	10598	14042	148	-268	45958	-610	422	N	826	87.08	78.37	681	0	0.13	Not Reqd	0.00	0.06	0.21	301	884	203	14.78	0.00	0.00
125	125	-0.411	-0.968	-0.603	2.000	10598	14040	148	-342	45959	-610	182	N	494	87.08	78.37	571	0	0.13	Not Reqd	0.00	0.06	0.21	301	785	203	12.78	0.00	0.00
125	126	-0.430	-0.926	-0.602	2.000	10598	15178	174	-383	52232	-410	196	N	395	91.08	81.97	551	0	0.13	Not Reqd	0.00	0.06	0.21	314	779	137	12.06	0.00	0.00
126	126	-0.430	-0.926	-0.602	2.000	10598	15175	174	-465	52232	-410	-88	N	395	91.08	81.97	551	0	0.13	Not Reqd	0.00	0.06	0.21	314	779	137	12.06	0.00	0.00
126	127	-0.445	-0.897	-0.602	2.000	10598	16078	202	-518	56936	-207	-85	N	240	93.93	84.53	507	0	0.13	Not Reqd	0.00	0.06	0.21	323	747	69	11.05	0.00	0.00

URS

FILE: V:\Projects\Cline Avenue\Load Rating Analysis\Revised LL Long Rating\Orig Ab with increased Vc AASHTO\Segment4\Rating EB\[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\Segment4\Rating EB\[Forces.xls]
Props&Reinf Worksheet: V:\Projects\Cline Avenue\Load Rating Analysis\Revised LL Long Rating\Orig Ab with increased Vc AASHTO\Segment4\Rating EB\[Props&Reinf.xls]

PROJECT: **Cline Avenue Mainline Seg 4 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 Rating Tr HS-20
fy = ***60.0*** ksi

Box Girder Properties:

Web Thickness
b_v = ***12.95*** 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

Permanent Loads + Maximum 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			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	per web	per web	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
127	127	-0.445	-0.897	-0.602	2.000	10598	16075	202	-605	56935	-207	-395	N	240	93.93	84.53	507	0	0.13	Not Reqd	0.00	0.06	0.21	323	747	69	11.05	0.00	0.00
127	128	-0.462	-0.863	-0.601	2.000	10598	16694	233	-668	60021	-3	-402	N	71	95.27	85.74	453	0	0.13	Not Reqd	0.00	0.06	0.21	327	702	1	10.04	0.00	0.00
128	128	-0.462	-0.863	-0.601	2.000	10598	16690	233	-759	60018	-3	-729	N	71	95.27	85.74	453	0	0.13	Not Reqd	0.00	0.06	0.21	327	702	1	10.04	0.00	0.00
128	129	-0.477	-0.827	-0.598	2.000	10598	16976	265	-829	61437	204	-744	N	-53	95.32	85.79	444	0	0.13	Not Reqd	0.00	0.06	0.21	327	694	68	8.09	0.00	0.00
129	129	-0.477	-0.827	-0.598	2.000	10598	16973	265	-892	61434	204	-970	N	-53	95.32	85.79	444	0	0.13	Not Reqd	0.00	0.06	0.21	327	694	68	8.09	0.00	0.00
129	130	-0.482	-0.816	-0.597	2.000	10598	16993	277	-919	61535	277	-977	N	-118	95.06	85.55	464	0	0.13	Not Reqd	0.00	0.06	0.21	326	711	92	7.70	0.00	0.00
130	130	-0.482	-0.816	-0.597	2.000	10598	16989	277	-981	61531	277	-1204	N	-118	95.06	85.55	464	0	0.13	Not Reqd	0.00	0.06	0.21	326	711	92	7.70	0.00	0.00
130	131	-0.496	-0.786	-0.596	2.000	10598	16745	312	-1060	60616	487	-1227	N	-289	93.23	83.91	512	0	0.13	Not Reqd	0.00	0.06	0.21	320	748	162	6.64	0.00	0.00
131	131	-0.495	-0.786	-0.596	2.000	10598	16739	312	-1152	60609	487	-1557	N	-289	93.23	83.91	512	0	0.13	Not Reqd	0.00	0.06	0.21	320	748	162	6.64	0.00	0.00
131	132	-0.509	-0.763	-0.597	2.000	10598	16049	348	-1235	57914	698	-1585	N	-441	89.95	80.95	548	0	0.13	Not Reqd	0.00	0.06	0.21	309	771	233	5.64	0.00	0.00
132	132	-0.509	-0.763	-0.597	2.000	10598	16042	348	-1323	57905	698	-1901	N	-441	89.95	80.95	548	0	0.13	Not Reqd	0.00	0.06	0.21	309	771	233	5.64	0.00	0.00
132	133	-0.521	-0.746	-0.599	2.000	10598	14862	387	-1409	53386	911	-1931	N	-584	85.33	77.76	583	0	0.13	Not Reqd	0.00	0.06	0.21	297	791	304	4.78	0.00	0.00
133	133	-0.521	-0.746	-0.599	2.000	10598	14854	387	-1490	53374	911	-2222	N	-584	85.33	77.76	583	0	0.13	Not Reqd	0.00	0.06	0.21	297	791	304	4.78	0.00	0.00
133	134	-0.531	-0.735	-0.601	2.000	10598	13135	428	-1576	46983	1126	-2253	N	-721	79.41	77.76	638	0	0.13	Not Reqd	0.00	0.06	0.37	536	1057	375	5.78	0.00	0.00
134	134	-0.531	-0.735	-0.601	2.000	10598	13126	428	-1648	46970	1126	-2509	N	-721	79.41	77.76	638	0	0.13	Not Reqd	0.00	0.06	0.37	536	1057	375	5.78	0.00	0.00
134	135	-0.541	-0.724	-0.604	2.000	10598	10826	470	-1732	38663	1342	-2537	N	-869	72.26	77.76	701	0	0.13	Not Reqd	0.00	0.06	0.37	539	1116	447	5.27	0.00	0.00
135	135	-0.540	-0.724	-0.604	2.000	10598	10817	470	-1788	38649	1342	-2738	N	-1130	72.26	77.76	791	0	0.13	Not Reqd	0.00	0.06	0.37	540	1198	447	5.79	0.00	0.00
135	136	-0.564	-0.627	-0.587	2.000	10519	7894	514	-1865	28375	1563	-2760	N	-1293	63.51	77.76	861	0	0.13	Not Reqd	0.00	0.06	0.37	543	1263	521	5.33	0.00	0.00
136	136	-0.564	-0.628	-0.588	2.000	10519	7884	514	-1908	28359	1563	-2915	N	-1268	63.51	77.76	852	0	0.13	Not Reqd	0.00	0.06	0.37	543	1256	521	5.29	0.00	0.00
136	137	-0.586	-0.542	-0.569	2.000	10440	4300	560	-1974	16043	1792	-2925	N	-1403	53.21	77.76	916	0	0.13	Not Reqd	0.00	0.06	0.37	547	1316	597	4.85	0.00	0.00
137	137	-0.586	-0.542	-0.569	2.000	10440	4289	560	-1998	16027	1792	-3013	N	-1381	53.21	77.76	908	0	0.13	Not Reqd	0.00	0.06	0.37	546	1309	597	4.81	0.00	0.00
137	138	-0.575	-0.513	-0.550	2.000	10361	6	607	-2048	9	2441	-3007	N	-1426	41.99	77.76	550	354	0.93	Not Reqd	0.00	0.47	0.37	282				0.00	0.00

1.45

PROJECT: **Cline Avenue Mainline Seg 4 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 = ***15.00*** 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	per web	per web	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
1	1	-0.633	-0.779	-0.690	2.000	6252	-352	-484	2114	-728	-1854	5111	Y	937	79.10	98.42	401	286	0.63	0.282	0.00	0.45	0.37	340					14.92	5.10
1	2	-0.680	-0.775	-0.715	2.000	6067	3218	-429	479	12071	-1449	3421	Y	925	64.75	95.13	905	0	0.13	0.195	0.00	0.16	0.37	677	1424	591	6.27		10.17	3.48
2	2	-0.677	-0.775	-0.714	2.000	6067	3141	-437	351	11948	-1463	2547	Y	914	64.75	95.13	902	0	0.13	0.145	0.00	0.14	0.37	677	1421	568	6.44		7.57	2.59
2	3	-0.697	-0.809	-0.738	2.000	5876	5767	-391	643	22052	-1304	2785	Y	873	72.90	92.12	869	0	0.13	0.164	0.00	0.15	0.21	364	1110	523	4.90		8.44	2.89
3	3	-0.694	-0.810	-0.737	2.000	5876	5683	-401	474	21923	-1321	2554	Y	948	72.90	92.12	894	0	0.13	0.150	0.00	0.14	0.21	364	1132	521	5.11		7.74	2.65
3	4	-0.700	-0.874	-0.759	2.000	5756	7557	-367	697	29165	-1199	2734	Y	896	76.35	89.42	860	0	0.13	0.164	0.00	0.15	0.21	353	1092	486	5.20		8.39	2.87
4	4	-0.700	-0.874	-0.759	2.000	5756	7467	-376	493	29070	-1214	2617	Y	630	76.35	89.42	771	0	0.13	0.157	0.00	0.14	0.21	353	1012	487	4.72		8.03	2.75
4	5	-0.723	-0.843	-0.763	2.000	5587	9096	-344	678	35571	-1097	2759	Y	574	80.63	86.94	715	0	0.13	0.171	0.00	0.15	0.21	342	951	453	4.67		8.63	2.95
5	5	-0.721	-0.844	-0.762	2.000	5587	7832	-359	2092	34279	-1115	4259	Y	533	80.63	86.94	705	0	0.13	0.263	0.00	0.20	0.21	342	942	506	3.35		13.32	4.55
5	6	-0.755	-0.793	-0.768	2.000	5440	10730	-318	658	42597	-968	2772	Y	464	85.29	84.78	640	0	0.13	0.176	0.00	0.15	0.21	331	874	410	4.66		8.82	3.01
6	6	-0.752	-0.794	-0.766	2.000	5440	8837	-340	1990	40656	-993	4094	Y	449	85.29	84.78	640	0	0.13	0.260	0.00	0.19	0.21	331	874	460	3.35		13.02	4.45
6	7	-0.786	-0.745	-0.772	2.000	5313	12038	-295	573	48488	-844	2623	Y	384	89.15	82.94	583	0	0.13	0.171	0.00	0.15	0.21	321	813	364	4.86		8.47	2.89
7	7	-0.783	-0.747	-0.771	2.000	5313	9934	-322	1724	46336	-873	3674	Y	372	89.15	82.94	584	0	0.13	0.239	0.00	0.18	0.21	322	815	407	3.52		11.86	4.06
7	8	-0.814	-0.702	-0.777	2.000	5206	11346	-276	1833	51590	-722	3729	Y	308	92.23	83.01	549	0	0.13	0.247	0.00	0.19	0.21	321	783	358	3.84		12.20	4.17
8	8	-0.811	-0.703	-0.775	2.000	5206	10797	-305	1448	50993	-754	3170	Y	296	92.23	83.01	546	0	0.13	0.210	0.00	0.17	0.21	321	780	351	3.91		10.37	3.55
8	9	-0.839	-0.664	-0.781	2.000	5116	11512	-260	1696	54762	-604	3364	Y	232	94.55	85.10	531	0	0.13	0.227	0.00	0.18	0.21	328	773	308	4.32		11.13	3.80
9	9	-0.836	-0.666	-0.780	2.000	5116	11443	-289	1171	54651	-635	2628	Y	218	94.55	85.10	526	0	0.13	0.177	0.00	0.15	0.21	328	768	295	4.56		8.69	2.97
9	10	-0.861	-0.633	-0.786	2.000	5049	11945	-244	1414	57419	-486	2817	Y	155	96.14	86.52	509	0	0.13	0.193	0.00	0.16	0.21	333	758	251	5.02		9.40	3.21
10	10	-0.858	-0.634	-0.784	2.000	5049	11881	-272	870	57316	-516	1936	Y	145	96.14	86.52	505	0	0.13	0.132	0.00	0.13	0.21	333	754	233	5.40		6.46	2.21
10	11	-0.876	-0.609	-0.788	2.000	5000	12188	-229	1112	59099	-369	2124	Y	80	97.00	87.30	485	0	0.13	0.147	0.00	0.14	0.21	336	739	190	5.92		7.13	2.44
11	11	-0.873	-0.610	-0.787	2.000	5000	12122	-257	612	58993	-398	1424	N	66	97.00	87.30	480	0	0.13	Not Reqd	0.00	0.06	0.21	336	734	133	8.03		0.00	0.00
11	12	-0.889	-0.591	-0.791	2.000	5000	12251	-215	849	59808	-252	1608	Y	-11	97.26	87.53	463	0	0.13	0.111	0.00	0.12	0.21	337	720	135	6.95		5.40	1.85
12	12	-0.886	-0.592	-0.789	2.000	5000	12187	-241	339	59707	-279	835	N	-25	97.26	87.53	467	0	0.13	Not Reqd	0.00	0.06	0.21	337	723	93	8.84		0.00	0.00
12	13	-0.897	-0.579	-0.793	2.000	4960	12146	-201	577	59556	-134	1017	N	-79	96.31	86.68	484	0	0.13	Not Reqd	0.00	0.06	0.21	334	736	45	11.33		0.00	0.00
13	13	-0.896	-0.579	-0.793	2.000	4960	12096	-218	252	59496	-152	533	N	-85	96.31	86.68	485	0	0.13	Not Reqd	0.00	0.06	0.21	334	737	51	10.47		0.00	0.00
13	14	-0.898	-0.578	-0.793	2.000	4960	12059	-208	313	59308	-116	581	N	-100	96.03	86.43	490	0	0.13	Not Reqd	0.00	0.06	0.21	333	741	39	11.15		0.00	0.00
14	14	-0.897	-0.578	-0.793	2.000	4960	12054	-223	11	59293	-131	117	N	-100	96.03	86.43	490	0	0.13	Not Reqd	0.00	0.06	0.21	333	740	44	10.38		0.00	0.00
14	15	-0.900	-0.580	-0.796	2.000	4960	10569	-184	355	56699	12	407	N	-167	94.46	85.01	507	0	0.13	Not Reqd	0.00	0.06	0.21	328	751	4	13.16		0.00	0.00
15	15	-0.898	-0.580	-0.794	2.000	4960	11779	-209	-238	57882	-12	-424	N	-167	94.46	85.01	503	0	0.13	Not Reqd	0.00	0.06	0.21	327	747	4	11.69		0.00	0.00
15	16	-0.897	-0.590	-0.797	2.000	4960	10131	-173	20	54318	128	-221	N	-240	92.08	82.87	523	0	0.13	Not Reqd	0.00	0.06	0.21	320	759	43	13.44		0.00	0.00
16	16	-0.895	-0.590	-0.796	2.000	4960	10737	-195	-361	54905	108	-812	N	-240	92.08	82.87	521	0	0.13	Not Reqd	0.00	0.06	0.21	320	756	36	12.11		0.00	0.00
16	17	-0.889	-0.610	-0.798	2.000	4960	9680	-161	-190	51116	246	-695	N	-311	88.90	80.01	536	0	0.13	Not Reqd	0.00	0.06	0.21	309	761	82	13.62		0.00	0.00
17	17	-0.887	-0.610	-0.797	2.000	4960	9626	-181	-523	51052	229	-1202	N	-311	88.90	80.01	536	0	0.13	Not Reqd	0.00	0.06	0.21	309	760	76	12.35		0.00	0.00
17	18	-0.876	-0.639	-0.799	2.000	4960	9150	-150	-373	47015	365	-1107	N	-379	84.95	77.76	555	0	0.13	Not Reqd	0.00	0.06	0.21	302	771	122	14.00		0.00	0.00
18	18	-0.876	-0.639	-0.799	2.000	4960	9057	-167	-691	46921	352	-1554	Y	-379	84.95	77.76	555	0	0.13	0.108	0.00	0.12	0.21	302	771	166	8.80		-5.24	-1.79
18	19	-0.859	-0.680	-0.801	2.000	4960	8549	-138	-521	42012	486	-1438	N	-447	80.26	77.76	593	0	0.13	Not Reqd	0.00	0.06	0.21	303	807	162	15.00		0.00	0.00
19	19	-0.859	-0.680	-0.801	2.000	4960	8523	-153	-848	41995	476	-1849	Y	-447	80.26	77.76	593	0	0.13	0.129	0.00	0.13	0.21	303	807	217	8.56		-6.24	-2.13
19	20	-0.836	-0.733	-0.802	2.000	4960	8022	-126	-660	36235	609	-1716	Y	-514	74.89	77.76	634	0	0.13	0.120	0.00	0.12	0.21	305	845	257	10.34		-5.79	-1.98
20	20	-0.836	-0.732	-0.803	2.000	4960	8010	-137	-905	36244	608	-1972	Y	-684	74.89	77.76	691	0	0.13	0.137	0.00	0.13	0.21	305	896	265	9.49		-6.65	-2.28
20	21	-0.819	-0.722	-0.786	2.000	4923	7344	-113	-708	29421	740	-1829	Y	-753	68.70	77.76	736	0	0.13	0.128	0.00	0.13	0.21	307	938	304	11.58		-6.20	-2.12
21	21	-0.821	-0.721	-0.787	2.000	4923	7342	-123	-918	29458	739	-1980	Y	-740	68.70	77.76	731	0	0.13	0.139	0.00	0.13	0.21	307	935	309	9.94		-6.72	-2.30
21	22	-0.798	-0.720	-0.770	2.000	4886	6610	-99	-715	21658	873	-1831	Y	-812	61.76	77.76	759	0	0.13	0.129	0.00	0.13	0.21	307	960	349	11.97		-6.24	-2.13
22	22	-0.801	-0.719	-0.771	2.000	4886	6615	-107	-884	21722	877	-1862	Y	-800	61.76	77.76	755	0	0.13	0.132	0.00	0.13	0.21	307	956	351	10.48		-6.35	-2.17
22	23	-0.770	-0.727	-0.754	2.000	4849	5811	-85	-675	12897	1013	-1707	Y	-877	54.03	77.76	780	0	0.13	0.122	0.00	0.13	0.37	553	1200	392	17.33		-5.85	-2.00
23	23	-0.774	-0.726	-0.756	2.000	4849	5823	-91	-803	12985	1021	-1613	Y	-865	54.03	77.76	776	0	0.13	0.115	0.00	0.12	0.37	553	1197	391	15.48		-5.53	-1.89
23	24	-0.737	-0.744	-0.739	2.000	4812	4943	-69	-591	3093	1159	-1455	Y	-942	45.47	77.76	802	0	0.13	0.104	0.00	0.12	0.37	553	1220	432	19.89		-5.01	-1.71
24	24	-0.741	-0.742	-0.742	2.000	4812	4964	-73	-675	3205	1172	-1251	N	-935	45.47	77.76	799	0	0.13	Not Reqd	0.00	0.06	0.37	553	1218	391	34.86		0.00	0.00
24	25	-0.939	-0.858	-0.907	2.000	4775	2733	-54	-648	-9147	1329	-1279	N	-1637	73.37	77.76	1034	0	0.13	Not Reqd	0.00	0.06	0.37	553	1428	443	56.18		0.00	0.00
25	25	-0.943	-0.856	-0.909	2.000	4775	2714	-59	-771	-9078	1344	-1002	N	-1625	73.37	77.76	1029	0	0.13	Not Reqd	0.00	0.06	0.37	553	1424	448	51.04		0.00	0.00
25	26	-0.976	-0.806	-0.907	2.000	4738	2060	-43	-549	-21088	1503	-836	N	-1050	84.36	77.76	838	0	0.13	Not Reqd	0.00	0.06	0.37	553	1252	501	53.09		0.00	0.00
26	26	-0.980	-0.805	-0.909	2.000	4738	944	-47	-573	-22121	1521	-362	N	-1038	84.36	77.76	834	0	0.13	Not Reqd	0.00	0.06	0.37	553	1249	507	47.87		0.00	0.00
26	27	-0.853	-0.953	-0.895	2.000	4701	-734	-39	-512	-36440	1675	-356	N	-645	90.16	81.14	724	0	0.13	Not Reqd	0.00	0.06	0.37	577	1171	558	48.28		0.00	0.00
27	27	-0.855	-0.951	-0.895	2.000	4701	-744	-46	-619	-36377	1694	107	N	-505	90.16	81.14	678	0	0.13	Not Reqd	0.00	0.06	0.37	577	1129	565	38.06		0.00	0.00
27	28	-0.628	-1.290	-0.904	2.000	4701	-391	-46	-619	-49989	1841	52	N	-122	92.83	83.55	542	139	0.18	Not Reqd	0.00	0.09	0.37	591					0.00	0.00
28	28	-0.629	-1.289	-0.904	2.000	4701	-391	-49	-688	-49947	1855	384	N	-123	92.83	83.55	542	145	0.18	Not Reqd	0.00	0.09	0.37	591					0.00	0.00
28	29	-0.536	-1.428	-0.907	2.000	4701	-270	-49	-688	-54576	1896	367	N	4	93.00	83.70	487	215	0.27	Not Reqd	0.00	0.14	0.37	589					0.00	0.00
29	29	-0.536	-1.428	-0.907	2.000	4701	-14147	-678	502	-68457	-2432	-1329	N	3	93.00	83.70	443	458	0.59	Not Reqd	0.00	0.29	0.37	580					0.00	0.00
29	30	-0.622	-1.301	-0.905	2.000	4701	-12829	-664	570	-62861	-2377	-1278	N	116	92.85	83.56	496	384	0.49	Not Reqd	0.00	0.25	0.37	583					0.00	0.00
30	30	-0.622	-1.301	-0.905	2.000	4701	-12854	-659	690	-62909	-2355	-754	N	117	92.85	83.56	496	376	0.48	Not Reqd	0.00	0.24	0.37	583					0.00	0.00
30	31	-0.834	-0.990	-0.899	2.000	4701	-8575	-613	811	-46135	-2162	-688	N	435	90.55	81.49	642	159	0.20	Not Reqd	0.00	0.10	0.37	578	1097	721	2.84		0.00	0.00
31	31	-0.835	-0.991	-0.899	2.000	4701	-8664	-608	906	-46233	-2134	-26	N	575	90.55	81.49	692	99	0.13	Not Reqd	0.00	0.06	0.37	578	1143	711	3.13		0.00	0.00
31	32	-0.913	-0.887	-0.903	2.000	4738	-5323	-563	1112	-31703	-1943	125	N	1458	84.68	77.76	974	0	0.13	Not Reqd	0.00	0.06	0.37	553	1375	648	4.87		0.00	0.00
32	32	-0.912	-0.888	-0.902	2.000	4738	-5421	-562	1139	-31823	-1923	628	N	1470	84.68	77.76	978	0	0.13	Not Reqd	0.00	0.06	0.37	553	1378	641	4.93		0.00	0.00

PROJECT: **Cline Avenue Mainline Seg 4 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 = ***15.00*** 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																											
32	33	-0.745	-1.147	-0.903	2.000	4775	-2513	-518	1318	-18985	-1735	751	N	2083	68.68	77.76	1182	0	0.13	Not Reqd	0.00	0.06	0.37	553	1562	578	6.70	0.00	0.00
33	33	-0.744	-1.147	-0.903	2.000	4775	-2609	-520	1282	-19106	-1722	1094	N	2096	68.68	77.76	1186	0	0.13	Not Reqd	0.00	0.06	0.37	553	1566	574	6.73	0.00	0.00
33	34	-0.381	-0.760	-0.525	2.000	4812	-102	-477	1431	-7873	-1540	1187	N	671	58.16	77.76	694	0	0.13	Not Reqd	0.00	0.06	0.37	550	1120	513	4.82	0.00	0.00
34	34	-0.376	-0.754	-0.519	2.000	4812	-191	-481	1336	-7990	-1533	1384	N	678	58.16	77.76	696	0	0.13	Not Reqd	0.00	0.06	0.37	550	1122	511	4.81	0.00	0.00
34	35	-0.433	-0.715	-0.536	2.000	4849	1450	-439	1500	1303	-1374	1493	Y	619	58.59	77.76	694	0	0.13	0.106	0.00	0.12	0.21	307	901	505	3.04	5.12	1.75
35	35	-0.432	-0.715	-0.535	2.000	4849	1874	-446	1306	1693	-1371	1516	Y	627	58.59	77.76	697	0	0.13	0.108	0.00	0.12	0.21	307	904	505	3.10	5.19	1.78
35	36	-0.476	-0.693	-0.552	2.000	4886	3178	-406	1443	9679	-1216	1598	Y	574	66.43	77.76	670	0	0.13	0.113	0.00	0.12	0.21	307	879	456	3.34	5.45	1.86
36	36	-0.475	-0.693	-0.552	2.000	4886	3622	-415	1208	10096	-1217	1490	Y	582	66.43	77.76	671	0	0.13	0.105	0.00	0.12	0.21	306	880	453	3.42	5.08	1.74
36	37	-0.509	-0.689	-0.569	2.000	4923	4621	-375	1324	16847	-1066	1551	Y	525	73.37	77.76	635	0	0.13	0.109	0.00	0.12	0.21	305	846	404	3.64	5.26	1.80
37	37	-0.508	-0.689	-0.569	2.000	4923	5086	-386	1058	17290	-1071	1336	N	535	73.37	77.76	636	0	0.13	Not Reqd	0.00	0.06	0.21	305	847	357	4.81	0.00	0.00
37	38	-0.532	-0.702	-0.586	2.000	4960	5800	-347	1160	22865	-924	1383	N	473	79.25	77.76	603	0	0.13	Not Reqd	0.00	0.06	0.21	303	815	308	5.39	0.00	0.00
38	38	-0.532	-0.702	-0.586	2.000	4960	5754	-357	947	22804	-929	1103	N	352	79.25	77.76	560	0	0.13	Not Reqd	0.00	0.06	0.21	303	777	310	4.92	0.00	0.00
38	39	-0.559	-0.653	-0.588	2.000	4960	6729	-320	987	27770	-784	1087	N	288	84.18	77.76	524	0	0.13	Not Reqd	0.00	0.06	0.21	302	743	261	5.52	0.00	0.00
39	39	-0.559	-0.653	-0.589	2.000	4960	6688	-331	750	27722	-792	790	N	288	84.18	77.76	524	0	0.13	Not Reqd	0.00	0.06	0.21	302	743	264	5.34	0.00	0.00
39	40	-0.579	-0.617	-0.591	2.000	4960	7418	-294	792	31592	-648	777	N	224	88.09	79.28	503	0	0.13	Not Reqd	0.00	0.06	0.21	306	728	216	6.22	0.00	0.00
40	40	-0.579	-0.617	-0.591	2.000	4960	7384	-305	552	31557	-657	439	N	224	88.09	79.28	503	0	0.13	Not Reqd	0.00	0.06	0.21	306	728	219	6.00	0.00	0.00
40	41	-0.593	-0.593	-0.593	2.000	4960	7882	-270	601	34351	-514	433	N	160	91.00	81.90	492	0	0.13	Not Reqd	0.00	0.06	0.21	316	727	171	7.19	0.00	0.00
41	41	-0.594	-0.593	-0.593	2.000	4960	7856	-280	368	34328	-523	73	N	159	91.00	81.90	492	0	0.13	Not Reqd	0.00	0.06	0.21	316	727	174	6.92	0.00	0.00
41	42	-0.601	-0.582	-0.595	2.000	4960	8124	-245	429	36055	-381	79	N	95	92.92	83.63	478	0	0.13	Not Reqd	0.00	0.06	0.21	323	721	127	8.27	0.00	0.00
42	42	-0.601	-0.582	-0.595	2.000	4960	8693	-255	160	36631	-389	-338	N	96	92.92	83.63	476	0	0.13	Not Reqd	0.00	0.06	0.21	322	719	130	7.93	0.00	0.00
42	43	-0.602	-0.583	-0.596	2.000	4960	8161	-221	283	36721	-248	-271	N	31	93.86	84.47	462	0	0.13	Not Reqd	0.00	0.06	0.21	326	709	83	9.50	0.00	0.00
43	43	-0.603	-0.583	-0.597	2.000	4960	8150	-229	92	36720	-255	-613	N	31	93.86	84.47	462	0	0.13	Not Reqd	0.00	0.06	0.21	326	709	85	9.17	0.00	0.00
43	44	-0.598	-0.595	-0.597	2.000	4960	8026	-199	174	36432	-127	-582	N	-28	93.86	84.47	464	0	0.13	Not Reqd	0.00	0.06	0.21	326	711	42	11.08	0.00	0.00
44	44	-0.600	-0.594	-0.598	2.000	4960	8022	-206	7	36441	-133	-901	N	-28	93.86	84.47	464	0	0.13	Not Reqd	0.00	0.06	0.21	326	711	44	10.71	0.00	0.00
44	45	-0.588	-0.619	-0.598	2.000	4960	7861	-177	-17	35301	4	-981	N	-93	92.92	83.62	483	0	0.13	Not Reqd	0.00	0.06	0.21	323	726	1	13.26	0.00	0.00
45	45	-0.590	-0.619	-0.599	2.000	4960	7871	-183	-163	35328	-1	-1280	N	-93	92.92	83.62	483	0	0.13	Not Reqd	0.00	0.06	0.21	323	726	0	12.89	0.00	0.00
45	46	-0.573	-0.656	-0.599	2.000	4960	7528	-157	-54	33171	132	-1227	N	-159	91.00	81.90	501	0	0.13	Not Reqd	0.00	0.06	0.21	317	737	44	14.20	0.00	0.00
46	46	-0.574	-0.655	-0.600	2.000	4960	7542	-162	-178	33203	128	-1489	Y	-159	91.00	81.90	501	0	0.13	0.104	0.00	0.12	0.21	317	737	90	11.85	-5.03	-1.72
46	47	-0.551	-0.706	-0.599	2.000	4960	5379	-142	-71	28386	257	-1438	N	-226	88.10	79.29	521	0	0.13	Not Reqd	0.00	0.06	0.21	308	747	86	15.00	0.00	0.00
47	47	-0.552	-0.706	-0.600	2.000	4960	5319	-144	-151	28347	256	-1623	Y	-226	88.10	79.29	521	0	0.13	0.113	0.00	0.12	0.21	308	747	136	12.57	-5.48	-1.87
47	48	-0.523	-0.770	-0.601	2.000	4960	5154	-127	-56	24688	381	-1584	Y	-296	84.19	77.76	545	0	0.13	0.110	0.00	0.12	0.21	303	763	177	14.32	-5.34	-1.83
48	48	-0.525	-0.770	-0.602	2.000	4960	5112	-128	-119	24666	380	-1691	Y	-296	84.19	77.76	545	0	0.13	0.118	0.00	0.12	0.21	303	764	180	13.54	-5.71	-1.95
48	49	-0.490	-0.849	-0.602	2.000	4960	4890	-113	-24	20110	504	-1652	Y	-368	79.31	77.76	583	0	0.13	0.115	0.00	0.12	0.21	305	799	220	16.11	-5.58	-1.91
49	49	-0.492	-0.848	-0.604	2.000	4960	4867	-114	-73	20106	504	-1721	Y	-494	79.31	77.76	628	0	0.13	0.120	0.00	0.12	0.21	305	840	222	16.38	-5.81	-1.99
49	50	-0.463	-0.853	-0.592	2.000	4923	3720	-100	-85	13782	627	-1789	Y	-551	73.46	77.76	664	0	0.13	0.126	0.00	0.13	0.21	307	874	265	17.87	-6.07	-2.07
50	50	-0.465	-0.853	-0.594	2.000	4923	3694	-101	-156	13777	627	-1689	Y	-541	73.46	77.76	661	0	0.13	0.119	0.00	0.12	0.21	307	871	262	16.78	-5.73	-1.96
50	51	-0.431	-0.869	-0.583	2.000	4886	3038	-93	7	7080	748	-1582	Y	-623	66.64	77.76	695	0	0.13	0.112	0.00	0.12	0.21	307	903	299	20.34	-5.39	-1.84
51	51	-0.433	-0.869	-0.584	2.000	4886	3020	-93	-53	7083	748	-1296	N	-614	66.64	77.76	693	0	0.13	Not Reqd	0.00	0.06	0.21	307	900	249	21.93	0.00	0.00
51	52	-0.400	-0.893	-0.578	2.000	4849	2848	-91	152	-14	866	-1147	N	-700	49.49	77.76	721	0	0.13	Not Reqd	0.00	0.06	0.37	553	1147	289	29.33	0.00	0.00
52	52	-0.402	-0.892	-0.579	2.000	4849	2840	-91	129	-6	867	-627	N	-692	49.49	77.76	718	0	0.13	Not Reqd	0.00	0.06	0.37	553	1145	289	29.25	0.00	0.00
52	53	-0.366	-0.935	-0.563	2.000	4886	3390	-90	127	-7285	986	-684	N	-752	69.67	77.76	739	0	0.13	Not Reqd	0.00	0.06	0.37	553	1163	329	28.89	0.00	0.00
53	53	-0.472	-0.441	-0.461	2.000	4886	4458	-149	-1462	-3291	1203	-3852	Y	-762	69.67	77.76	742	0	0.13	0.272	0.00	0.20	0.37	553	1166	523	7.70	-13.13	-4.49
53	54	-0.816	-0.705	-0.764	2.000	10203	4425	-120	-88	-14519	1450	-2558	N	-2410	68.69	77.76	1291	0	0.13	Not Reqd	0.00	0.06	0.37	553	1660	483	30.46	0.00	0.00
54	54	-0.812	-0.705	-0.762	2.000	10203	3780	-143	-1372	-15127	1427	-3275	Y	-2388	68.69	77.76	1284	0	0.13	0.111	0.00	0.12	0.37	553	1654	524	17.63	-9.29	-3.18
54	55	-0.937	-0.561	-0.757	2.000	10124	4206	-119	-158	-27599	1678	-2142	N	-1724	84.54	77.76	1063	0	0.13	Not Reqd	0.00	0.06	0.47	692	1579	559	26.65	0.00	0.00
55	55	-0.941	-0.560	-0.759	2.000	10124	3518	-147	-1591	-28189	1603	-4564	Y	-1704	84.54	77.76	1056	0	0.13	0.156	0.00	0.14	0.47	692	1573	602	14.41	-13.04	-4.46
55	56	-0.863	-0.636	-0.752	2.000	10046	4515	-126	-401	-41488	1857	-3456	Y	-697	90.42	81.37	739	0	0.13	0.119	0.00	0.12	0.47	723	1315	670	14.44	-9.93	-3.40
56	56	-0.870	-0.634	-0.755	2.000	10046	3718	-155	-1805	-42011	1922	-2934	N	-511	90.42	81.37	673	39	0.13	Not Reqd	0.00	0.06	0.47	722	1255	641	12.92	0.00	0.00
56	57	-0.665	-0.861	-0.761	2.000	10046	5330	-138	-671	-57207	2174	-1882	N	-131	92.79	83.51	524	281	0.36	Not Reqd	0.00	0.18	0.47	734				0.00	0.00
57	57	-0.674	-0.858	-0.764	2.000	10046	4897	-141	-1125	-57367	2260	-447	N	-130	92.79	83.51	522	315	0.40	Not Reqd	0.00	0.20	0.47	733				0.00	0.00
57	58	-0.589	-0.953	-0.767	2.000	10046	5758	-137	-615	-62475	2327	37	N	9	92.98	83.68	472	390	0.49	Not Reqd	0.00	0.25	0.47	732				0.00	0.00
58	58	-0.661	-0.857	-0.757	2.000	10046	-18819	-808	459	-82038	-3328	1927	N	9	92.98	83.68	432	801	1.03	Not Reqd	0.00	0.52	0.47	722				0.00	0.00
58	59	-0.751	-0.762	-0.756	2.000	10046	-17421	-793	783	-74534	-3249	2225	N	199	92.76	83.49	507	696	0.89	Not Reqd	0.00	0.45	0.47	724				0.00	0.00
59	59	-0.741	-0.764	-0.752	2.000	10046	-17044	-790	489	-74436	-3165	3529	Y	198	92.76	83.49	508	664	0.85	0.121	0.00	0.49	0.47	724				10.14	3.47
59	60	-0.944	-0.549	-0.751	2.000	10046	-12421	-748	1089	-52488	-2898	4048	Y	731	89.50	80.55	710	364	0.48	0.139	0.00	0.31	0.47	708	1276	1026	1.94	11.64	3.98
60	60	-0.927	-0.552	-0.744	2.000	10046	-13142	-738	863	-53703	-2794	5608	Y	920	89.50	80.55	773	262	0.34	0.193	0.00	0.27	0.47	708	1333	1014	2.23	16.12	5.51
60	61	-1.003	-0.500	-0.763	2.000	10124	-8952	-695	1454	-34613	-2530	6118	Y	1773	82.21	77.76	1079	0	0.13	0.209	0.00	0.17	0.37	553	1469	934	3.11	17.47	5.97
61	61	-0.981	-0.502	-0.753	2.000	10124	-9440	-694	1090	-35761	-2455	7350	Y	1794	82.21	77.76	1086	0	0.13	0.251	0.00	0.19	0.37	553	1475	927	3.22	20.99	7.18
61	62	-0.899	-0.628	-0.774	2.000	10203	-5349	-652	1610	-19008	-2197	7789	Y	2179	68.33	77.76	1214	0	0.13	0.264	0.00	0.20	0.37	553	1591	847	4.08	22.11	7.56
62	62	-0.862	-0.632	-0.756	2.000	10203	-5618	-661	1146	-20199	-2222	6978	Y	2202	68.33	77.76	1222	0	0.13	0.236	0.00	0.18	0.37	553	1598	844	4.18	19.80	6.77
62	63	-0.677	-0.552	-0.626	2.000	10440	-1767	-615	1551	-5196	-1966	7302	Y	1155	61.89	77.76	873	0	0.13	0.242	0.00	0.19	0.37	553	1284	763	3.28	20.35	6.96
63	63	-0.606	-0.552	-0.584	2.000	10440	-2311	-626	1120	-7445	-2041	6010	Y	1174	61.89	77.76	879	0	0.13	0.199	0.00	0.16	0.37	553	1289	769	3.31	16.75	5.73
63	64	-0.631	-0.572	-0.605	2.000	10361	1224	-581	1502	6239	-1816	6311	Y	1075	58.66	77.76	846	0	0.13	0.210	0.00	0.17	0.21	307	1038	699	2.57	17.69	6.05

PROJECT: **Cline Avenue Mainline Seg 4 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 = ***15.00*** 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	-0.615	-0.573	-0.597	2.000	10361	674	-593	1030	5390	-1846	5532	Y	1095	58.66	77.76	853	0	0.13	0.184	0.00	0.16	0.21	307	1044	697	2.63	15.51	5.30
64	65	-0.631	-0.607	-0.621	2.000	10440	3906	-548	1393	17559	-1628	5813	Y	1008	66.51	77.76	824	0	0.13	0.192	0.00	0.16	0.21	307	1018	629	2.92	16.20	5.54
65	65	-0.622	-0.609	-0.616	2.000	10440	3258	-558	941	16710	-1652	5068	Y	1031	66.51	77.76	832	0	0.13	0.168	0.00	0.15	0.21	307	1025	626	3.00	14.12	4.83
65	66	-0.628	-0.660	-0.641	2.000	10519	6188	-515	1287	27379	-1441	5334	Y	936	73.45	77.76	790	0	0.13	0.175	0.00	0.15	0.21	306	987	559	3.24	14.77	5.05
66	66	-0.621	-0.662	-0.637	2.000	10519	5684	-527	763	26720	-1464	4534	Y	962	73.45	77.76	800	0	0.13	0.149	0.00	0.14	0.21	307	996	555	3.36	12.56	4.29
66	67	-0.619	-0.734	-0.661	2.000	10598	8323	-484	1106	35916	-1259	4796	Y	859	79.32	77.76	751	0	0.13	0.156	0.00	0.14	0.21	305	951	490	3.59	13.20	4.51
67	67	-0.616	-0.734	-0.659	2.000	10598	7667	-494	573	35190	-1275	3881	Y	595	79.32	77.76	660	0	0.13	0.126	0.00	0.13	0.21	305	868	482	3.23	10.68	3.65
67	68	-0.623	-0.724	-0.660	2.000	10598	10007	-452	913	42905	-1074	4139	Y	487	84.25	77.76	607	0	0.13	0.135	0.00	0.13	0.21	303	820	419	3.44	11.40	3.90
68	68	-0.618	-0.726	-0.657	2.000	10598	9313	-461	431	42110	-1087	3423	Y	487	84.25	77.76	609	0	0.13	0.112	0.00	0.12	0.21	303	821	413	3.55	9.42	3.22
68	69	-0.621	-0.722	-0.658	2.000	10598	11362	-420	761	48344	-887	3672	Y	380	88.17	79.35	572	0	0.13	0.120	0.00	0.12	0.21	309	792	350	3.92	10.11	3.46
69	69	-0.617	-0.723	-0.656	2.000	10598	10628	-428	289	47515	-901	2871	N	380	88.17	79.35	573	0	0.13	Not Reqd	0.00	0.06	0.21	309	794	300	4.46	0.00	0.00
69	70	-0.616	-0.726	-0.656	2.000	10598	12389	-389	612	52287	-702	3113	N	273	91.08	81.97	546	0	0.13	Not Reqd	0.00	0.06	0.21	318	778	234	5.20	0.00	0.00
70	70	-0.612	-0.727	-0.654	2.000	10598	11658	-396	158	51464	-721	2212	N	273	91.08	81.97	548	0	0.13	Not Reqd	0.00	0.06	0.21	318	780	240	5.08	0.00	0.00
70	71	-0.608	-0.734	-0.654	2.000	10598	13145	-358	475	54820	-522	2448	N	165	93.00	83.70	518	0	0.13	Not Reqd	0.00	0.06	0.21	325	758	174	5.89	0.00	0.00
71	71	-0.605	-0.735	-0.652	2.000	10598	12073	-364	50	53659	-544	1458	N	165	93.00	83.70	520	0	0.13	Not Reqd	0.00	0.06	0.21	325	760	181	5.77	0.00	0.00
71	72	-0.598	-0.747	-0.652	2.000	10598	13273	-327	359	55621	-347	1686	N	58	93.93	84.54	487	0	0.13	Not Reqd	0.00	0.06	0.21	328	733	116	6.66	0.00	0.00
72	72	-0.595	-0.748	-0.650	2.000	10598	12660	-338	30	54921	-377	709	N	58	93.93	84.54	488	0	0.13	Not Reqd	0.00	0.06	0.21	328	734	126	6.40	0.00	0.00
72	73	-0.588	-0.762	-0.650	2.000	10598	13307	-302	236	55325	-194	841	N	-41	93.93	84.53	483	0	0.13	Not Reqd	0.00	0.06	0.21	328	730	65	7.61	0.00	0.00
73	73	-0.584	-0.763	-0.649	2.000	10598	12508	-313	-82	54443	-228	-206	N	-41	93.93	84.53	484	0	0.13	Not Reqd	0.00	0.06	0.21	328	732	76	7.29	0.00	0.00
73	74	-0.575	-0.780	-0.649	2.000	10598	12410	-273	219	53077	-27	14	N	-150	93.00	83.70	519	0	0.13	Not Reqd	0.00	0.06	0.21	325	760	9	9.25	0.00	0.00
74	74	-0.571	-0.780	-0.646	2.000	10598	10957	-286	536	51541	-69	1295	N	-206	93.00	83.70	540	0	0.13	Not Reqd	0.00	0.06	0.21	326	779	23	8.92	0.00	0.00
74	75	-0.579	-0.798	-0.658	2.000	10598	10054	-248	694	48354	130	1371	N	-317	90.59	81.53	568	0	0.13	Not Reqd	0.00	0.06	0.21	318	797	43	10.11	0.00	0.00
75	75	-0.576	-0.802	-0.657	2.000	10598	10098	-264	-740	48226	81	-4460	Y	-206	90.59	81.53	532	0	0.13	0.145	0.00	0.14	0.21	318	765	93	7.79	-12.28	-4.20
75	76	-0.550	-0.823	-0.648	2.000	10598	9039	-229	-377	43907	277	-4178	Y	-319	88.17	79.35	564	0	0.13	0.136	0.00	0.13	0.21	310	787	154	8.74	-11.50	-3.93
76	76	-0.554	-0.822	-0.650	2.000	10598	8569	-244	-342	43614	231	-3470	Y	-374	88.17	79.35	582	0	0.13	0.113	0.00	0.12	0.21	310	803	128	8.82	-9.55	-3.27
76	77	-0.546	-0.841	-0.652	2.000	10598	8502	-213	-213	39292	424	-3424	Y	-489	84.26	77.76	620	0	0.13	0.112	0.00	0.12	0.21	305	832	192	9.64	-9.43	-3.22
77	77	-0.552	-0.841	-0.656	2.000	10598	8372	-227	-613	39306	380	-4627	Y	-489	84.26	77.76	619	0	0.13	0.151	0.00	0.14	0.21	304	831	195	8.51	-12.74	-4.36
77	78	-0.545	-0.860	-0.658	2.000	10598	8278	-198	-456	33940	572	-4552	Y	-607	79.42	77.76	672	0	0.13	0.148	0.00	0.14	0.21	306	880	258	9.55	-12.53	-4.28
78	78	-0.556	-0.859	-0.664	2.000	10598	8113	-207	-746	34055	536	-5721	Y	-881	79.42	77.76	759	0	0.13	0.186	0.00	0.16	0.21	305	958	263	9.69	-15.75	-5.38
78	79	-0.565	-0.776	-0.645	2.000	10519	8098	-182	-588	27715	727	-5646	Y	-998	73.46	77.76	807	0	0.13	0.185	0.00	0.16	0.21	306	1002	326	10.77	-15.64	-5.35
79	79	-0.577	-0.775	-0.652	2.000	10519	8078	-190	-813	27926	699	-6404	Y	-970	73.46	77.76	798	0	0.13	0.210	0.00	0.17	0.21	306	994	328	9.84	-17.74	-6.06
79	80	-0.582	-0.708	-0.632	2.000	10440	7793	-167	-674	20174	894	-6346	Y	-1081	66.53	77.76	848	0	0.13	0.210	0.00	0.17	0.21	307	1039	392	10.85	-17.68	-6.05
80	80	-0.589	-0.707	-0.636	2.000	10440	7791	-174	-845	20330	875	-6916	Y	-1056	66.53	77.76	839	0	0.13	0.229	0.00	0.18	0.21	307	1032	394	10.07	-19.27	-6.59
80	81	-0.589	-0.656	-0.617	2.000	10361	7426	-152	-694	11252	1075	-6848	Y	-1160	58.69	77.76	874	0	0.13	0.228	0.00	0.18	0.37	553	1285	460	14.54	-19.20	-6.56
81	81	-0.590	-0.656	-0.617	2.000	10361	7441	-156	-815	11303	1065	-7280	Y	-1137	58.69	77.76	867	0	0.13	0.243	0.00	0.19	0.37	553	1278	462	13.72	-20.41	-6.98
81	82	-0.583	-0.618	-0.597	2.000	10440	2845	-143	-1825	-3346	1263	-8373	Y	-1256	61.82	77.76	907	0	0.13	0.277	0.00	0.20	0.37	553	1314	545	11.31	-23.33	-7.98
82	82	-0.577	-0.619	-0.594	2.000	10440	2875	-151	-2025	-3514	1253	-8917	Y	-1236	61.82	77.76	900	0	0.13	0.295	0.00	0.21	0.37	553	1308	549	10.47	-24.85	-8.49
82	83	-0.729	-0.683	-0.708	2.000	10203	3239	-141	-1905	-14885	1522	-8880	Y	-2119	68.27	77.76	1194	0	0.13	0.301	0.00	0.22	0.37	553	1573	638	13.45	-25.20	-8.62
83	83	-0.720	-0.684	-0.704	2.000	10203	3315	-145	-2030	-15157	1518	-9207	Y	-2096	68.27	77.76	1187	0	0.13	0.312	0.00	0.22	0.37	553	1566	642	12.78	-26.13	-8.93
83	84	-0.783	-0.578	-0.689	2.000	10124	1598	-142	-2452	-30649	1794	-9712	Y	-1817	81.49	77.76	1094	0	0.13	0.331	0.00	0.23	0.47	692	1607	742	11.37	-27.74	-9.48
84	84	-0.774	-0.579	-0.685	2.000	10124	1769	-143	-2494	-30885	1796	-9675	Y	-1796	81.49	77.76	1087	0	0.13	0.330	0.00	0.23	0.47	692	1600	742	11.17	-27.63	-9.45
84	85	-0.715	-0.629	-0.674	2.000	10046	2863	-143	-2494	-45695	2074	-9759	Y	-996	89.10	80.19	800	0	0.13	0.336	0.00	0.23	0.47	706	1355	836	7.15	-28.05	-9.59
85	85	-0.709	-0.629	-0.671	2.000	10046	3039	-141	-2394	-45800	2078	-9337	Y	-799	89.10	80.19	731	38	0.13	0.321	0.00	0.23	0.47	705	1293	831	6.60	-26.84	-9.18
85	86	-0.542	-0.837	-0.680	2.000	10046	4120	-141	-2394	-62779	2360	-9421	Y	-200	92.64	83.37	516	358	0.46	0.324	0.00	0.39	0.47	725				-27.08	-9.26
86	86	-0.541	-0.837	-0.680	2.000	10046	4213	-137	-2326	-62758	2367	-8581	Y	-198	92.64	83.37	516	361	0.46	0.295	0.00	0.38	0.47	725				-24.67	-8.43
86	87	-0.467	-0.929	-0.683	2.000	10046	4548	-137	-2326	-68643	2433	-8608	Y	21	92.65	83.39	446	456	0.59	0.296	0.00	0.44	0.47	722				-24.74	-8.46
87	87	-0.386	-1.038	-0.690	2.000	10046	-17499	-789	284	-97322	-3719	497	N	0	92.65	83.39	392	985	1.29	Not Reqd	0.00	0.65	0.47	709				0.00	0.00
87	88	-0.476	-0.932	-0.689	2.000	10046	-20696	-773	2259	-93421	-3634	2490	N	208	92.48	83.23	467	879	1.15	Not Reqd	0.00	0.58	0.47	709				0.00	0.00
88	88	-0.476	-0.932	-0.689	2.000	10046	-20688	-773	2333	-93411	-3634	2826	N	208	92.48	83.23	467	879	1.15	Not Reqd	0.00	0.58	0.47	709				0.00	0.00
88	89	-0.692	-0.681	-0.687	2.000	10046	-16423	-739	2267	-68370	-3310	2815	N	792	89.45	80.50	683	542	0.72	Not Reqd	0.00	0.36	0.47	696	1242	1103	1.56	0.00	0.00
89	89	-0.693	-0.681	-0.687	2.000	10046	-16410	-739	2355	-68353	-3309	3215	Y	994	89.45	80.50	753	473	0.63	0.111	0.00	0.37	0.47	697	1305	1151	1.55	9.24	3.16
89	90	-0.815	-0.583	-0.710	2.000	10124	-12392	-704	2283	-45766	-2988	3200	Y	1509	82.62	77.76	952	154	0.21	0.109	0.00	0.16	0.47	683	1472	1043	2.60	9.14	3.12
90	90	-0.815	-0.583	-0.710	2.000	10124	-12379	-704	2350	-45748	-2988	3451	Y	1530	82.62	77.76	959	147	0.20	0.118	0.00	0.16	0.47	684	1479	1047	2.60	9.86	3.37
90	91	-0.795	-0.625	-0.721	2.000	10203	-8630	-669	2274	-25605	-2671	3430	Y	2268	70.58	77.76	1244	0	0.13	0.116	0.00	0.12	0.37	553	1617	941	3.63	9.74	3.33
91	91	-0.794	-0.626	-0.721	2.000	10203	-8617	-669	2320	-25586	-2671	3571	Y	2290	70.58	77.76	1251	0	0.13	0.121	0.00	0.13	0.37	553	1624	943	3.65	10.14	3.47
91	92	-0.613	-0.545	-0.586	2.000	10440	-5155	-634	2238	-7834	-2367	3545	Y	1258	61.90	77.76	907	0	0.13	0.117	0.00	0.12	0.37	553	1314	841	2.94	9.88	3.38
92	92	-0.608	-0.539	-0.581	2.000	10440	-5143	-634	2265	-7814	-2367	3589	Y	1277	61.90	77.76	914	0	0.13	0.119	0.00	0.12	0.37	553	1320	842	2.95	10.00	3.42
92	93	-0.650	-0.534	-0.603	2.000	10361	-1984	-598	2176	7862	-2136	3556	Y	1168	58.59	77.76	874	0	0.13	0.119	0.00	0.12	0.21	307	1063	765	2.29	9.97	3.41
93	93	-0.650	-0.534	-0.603	2.000	10361	-1972	-598	2186	7881	-2136	3515	Y	1189	58.59	77.76	882	0	0.13	0.117	0.00	0.12	0.21	307	1070	764	2.32	9.85	3.37
93	94	-0.682	-0.542	-0.628	2.000	10440	871	-562	2093	21772	-1911	3477	Y	1093	66.44	77.76	827	0	0.13	0.115	0.00	0.12	0.21	305	1019	689	2.51	9.69	3.31
94	94	-0.682	-0.542	-0.628	2.000	10440	883	-562	2087	21791	-1911	3360	Y	1117	66.44	77.76	836	0	0.13	0.111	0.00	0.12	0.21	305	1027	687	2.56	9.36	3.20
94	95	-0.705	-0.566	-0.654	2.000	10519	3400	-527	1991	33932	-1692	3319	Y	1013	73.38	77.76	782	0	0.13	0.109	0.00	0.12	0.21	303	977	613	2.78	9.19	3.14
95	95	-0.705	-0.565	-0.654	2.000	10519	3411	-527	1971	33949	-1692	3136	N	1039	73.38	77.76	792	0	0.13	Not Reqd	0.00	0.06	0.21	303	986	564	3.40	0.00	0.00

PROJECT: **Cline Avenue Mainline Seg 4 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 = ***15.00*** 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 + Minimum LL Shear @ t=00																						
95	96	-0.720	-0.605	-0.680	2.000	10598	5592	-491	1873	44375	-1480	3094	N	926	79.25	77.76	739	0	0.13	Not Reqd	0.00	0.06	0.21	302	937	493	3.71	0.00	0.00
96	96	-0.720	-0.605	-0.680	2.000	10598	5602	-491	1852	44390	-1480	2841	N	644	79.25	77.76	641	0	0.13	Not Reqd	0.00	0.06	0.21	301	848	493	3.17	0.00	0.00
96	97	-0.741	-0.576	-0.684	2.000	10598	7441	-456	1753	53128	-1271	2798	N	525	84.18	77.76	587	0	0.13	Not Reqd	0.00	0.06	0.21	300	798	424	3.46	0.00	0.00
97	97	-0.741	-0.576	-0.684	2.000	10598	7450	-456	1713	53143	-1271	2508	N	525	84.18	77.76	586	0	0.13	Not Reqd	0.00	0.06	0.21	300	797	424	3.46	0.00	0.00
97	98	-0.757	-0.556	-0.687	2.000	10598	8943	-421	1615	60201	-1061	2467	N	407	88.09	79.28	546	0	0.13	Not Reqd	0.00	0.06	0.21	304	765	354	3.93	0.00	0.00
98	98	-0.757	-0.555	-0.687	2.000	10598	8952	-421	1566	60213	-1061	2139	N	407	88.09	79.28	546	0	0.13	Not Reqd	0.00	0.06	0.21	304	765	354	3.93	0.00	0.00
98	99	-0.769	-0.542	-0.691	2.000	10598	10105	-387	1471	65598	-853	2099	N	290	91.00	81.90	515	0	0.13	Not Reqd	0.00	0.06	0.21	314	746	284	4.58	0.00	0.00
99	99	-0.769	-0.542	-0.691	2.000	10598	10113	-387	1416	65608	-853	1741	N	290	91.00	81.90	515	0	0.13	Not Reqd	0.00	0.06	0.21	314	746	284	4.58	0.00	0.00
99	100	-0.777	-0.536	-0.693	2.000	10598	10932	-354	1323	69324	-646	1705	N	172	92.92	83.63	482	0	0.13	Not Reqd	0.00	0.06	0.21	320	722	215	5.29	0.00	0.00
100	100	-0.777	-0.536	-0.693	2.000	10598	10939	-354	1264	69332	-646	1327	N	172	92.92	83.63	482	0	0.13	Not Reqd	0.00	0.06	0.21	320	722	215	5.29	0.00	0.00
100	101	-0.780	-0.538	-0.696	2.000	10598	11440	-322	1176	71397	-439	1295	N	54	93.86	84.47	446	0	0.13	Not Reqd	0.00	0.06	0.21	323	692	146	6.08	0.00	0.00
101	101	-0.780	-0.538	-0.696	2.000	10598	11446	-322	1116	71403	-439	922	N	54	93.86	84.47	446	0	0.13	Not Reqd	0.00	0.06	0.21	323	692	146	6.08	0.00	0.00
101	102	-0.779	-0.545	-0.698	2.000	10598	11643	-294	1040	71861	-251	897	N	-54	93.86	84.47	447	0	0.13	Not Reqd	0.00	0.06	0.21	323	694	84	7.23	0.00	0.00
102	102	-0.779	-0.545	-0.698	2.000	10598	11648	-294	979	71864	-251	522	N	-54	93.86	84.47	447	0	0.13	Not Reqd	0.00	0.06	0.21	323	694	84	7.23	0.00	0.00
102	103	-0.775	-0.561	-0.701	2.000	10598	11592	-264	901	70816	-47	500	N	-174	92.92	83.63	485	0	0.13	Not Reqd	0.00	0.06	0.21	320	724	16	9.05	0.00	0.00
103	103	-0.775	-0.561	-0.701	2.000	10598	11597	-264	838	70818	-47	114	N	-174	92.92	83.63	485	0	0.13	Not Reqd	0.00	0.06	0.21	320	724	16	9.05	0.00	0.00
103	104	-0.766	-0.583	-0.703	2.000	10598	11286	-236	768	68181	155	100	N	-296	91.00	81.90	518	0	0.13	Not Reqd	0.00	0.06	0.21	314	749	52	9.87	0.00	0.00
104	104	-0.766	-0.583	-0.703	2.000	10598	11290	-236	706	68180	155	-272	N	-296	91.00	81.90	518	0	0.13	Not Reqd	0.00	0.06	0.21	314	749	52	9.87	0.00	0.00
104	105	-0.754	-0.612	-0.705	2.000	10598	10753	-209	645	63983	356	-277	N	-420	88.09	79.28	550	0	0.13	Not Reqd	0.00	0.06	0.21	304	769	119	10.33	0.00	0.00
105	105	-0.754	-0.612	-0.705	2.000	10598	10756	-209	587	63981	356	-625	N	-420	88.09	79.28	550	0	0.13	Not Reqd	0.00	0.06	0.21	304	769	119	10.33	0.00	0.00
105	106	-0.739	-0.648	-0.707	2.000	10598	10022	-184	536	58252	556	-620	N	-547	84.18	77.76	593	0	0.13	Not Reqd	0.00	0.06	0.21	300	803	185	11.08	0.00	0.00
106	106	-0.739	-0.648	-0.707	2.000	10598	10025	-184	481	58248	556	-938	N	-547	84.18	77.76	593	0	0.13	Not Reqd	0.00	0.06	0.21	300	803	185	11.08	0.00	0.00
106	107	-0.721	-0.689	-0.710	2.000	10598	9312	-161	406	51207	753	-957	N	-676	79.33	77.76	648	0	0.13	Not Reqd	0.00	0.06	0.21	301	854	251	12.23	0.00	0.00
107	107	-0.720	-0.689	-0.710	2.000	10598	9314	-161	356	51201	753	-1238	N	-973	79.33	77.76	746	0	0.13	Not Reqd	0.00	0.06	0.21	301	942	251	13.86	0.00	0.00
107	108	-0.712	-0.651	-0.689	2.000	10519	8610	-143	335	42824	948	-1204	N	-1103	73.37	77.76	802	0	0.13	Not Reqd	0.00	0.06	0.21	302	993	316	15.20	0.00	0.00
108	108	-0.712	-0.651	-0.689	2.000	10519	8612	-143	288	42817	948	-1436	N	-1074	73.37	77.76	793	0	0.13	Not Reqd	0.00	0.06	0.21	302	985	316	15.03	0.00	0.00
108	109	-0.699	-0.623	-0.670	2.000	10440	7824	-126	276	32976	1148	-1393	N	-1195	66.43	77.76	849	0	0.13	Not Reqd	0.00	0.06	0.21	304	1037	383	16.53	0.00	0.00
109	109	-0.699	-0.624	-0.670	2.000	10440	7826	-126	234	32968	1148	-1572	N	-1170	66.43	77.76	841	0	0.13	Not Reqd	0.00	0.06	0.21	304	1030	383	16.35	0.00	0.00
109	110	-0.680	-0.607	-0.650	2.000	10361	6978	-111	229	21644	1352	-1521	N	-1284	58.59	77.76	896	0	0.13	Not Reqd	0.00	0.06	0.41	611	1356	451	25.41	0.00	0.00
110	110	-0.680	-0.607	-0.650	2.000	10361	6979	-111	191	21635	1352	-1638	N	-1261	58.59	77.76	888	0	0.13	Not Reqd	0.00	0.06	0.41	611	1349	451	25.21	0.00	0.00
110	111	-0.654	-0.600	-0.633	2.000	10440	4182	-98	-197	6892	1560	-1971	N	-1391	46.10	77.76	952	0	0.13	Not Reqd	0.00	0.06	0.41	615	1410	520	28.12	0.00	0.00
111	111	-0.654	-0.600	-0.633	2.000	10440	4181	-98	-220	6881	1560	-2008	N	-1370	46.10	77.76	945	0	0.13	Not Reqd	0.00	0.06	0.41	615	1403	520	27.93	0.00	0.00
111	112	-0.893	-0.757	-0.834	2.000	10203	2631	-94	91	-8239	1794	-1641	N	-2702	68.41	77.76	1389	0	0.13	Not Reqd	0.00	0.06	0.41	615	1803	598	39.45	0.00	0.00
112	112	-0.893	-0.757	-0.834	2.000	10203	2632	-94	77	-8248	1794	-1596	N	-2676	68.41	77.76	1380	0	0.13	Not Reqd	0.00	0.06	0.41	615	1795	598	39.20	0.00	0.00
112	113	-1.000	-0.602	-0.820	2.000	10124	3105	-92	75	-23135	2034	-1541	N	-2201	82.35	77.76	1221	0	0.13	Not Reqd	0.00	0.06	0.41	615	1653	678	32.70	0.00	0.00
113	113	-0.999	-0.603	-0.820	2.000	10124	3106	-92	59	-23143	2034	-1415	N	-2177	82.35	77.76	1214	0	0.13	Not Reqd	0.00	0.06	0.41	615	1646	678	32.46	0.00	0.00
113	114	-0.943	-0.657	-0.810	2.000	10046	3651	-91	58	-39804	2280	-1360	N	-1134	89.55	80.59	874	0	0.13	Not Reqd	0.00	0.06	0.41	635	1359	760	20.71	0.00	0.00
114	114	-0.943	-0.656	-0.810	2.000	10046	3651	-91	38	-39811	2280	-1136	N	-897	89.55	80.59	792	53	0.13	Not Reqd	0.00	0.06	0.41	635	1284	760	18.25	0.00	0.00
114	115	-0.759	-0.881	-0.815	2.000	10046	4273	-91	36	-58275	2528	-1082	N	-238	92.78	83.51	550	386	0.49	Not Reqd	0.00	0.25	0.41	650				0.00	0.00
115	115	-0.759	-0.881	-0.815	2.000	10046	4274	-91	21	-58278	2528	-872	N	-238	92.78	83.51	550	386	0.49	Not Reqd	0.00	0.25	0.41	650				0.00	0.00
115	116	-0.678	-0.979	-0.818	2.000	10046	4490	-91	20	-64565	2597	-855	N	0	93.00	83.70	459	502	0.64	Not Reqd	0.00	0.32	0.41	649				0.00	0.00
116	116	-0.678	-0.979	-0.818	2.000	10046	-16748	-723	2108	-85804	-3254	1883	N	0	93.00	83.70	424	781	1.01	Not Reqd	0.00	0.50	0.41	640				0.00	0.00
116	117	-0.757	-0.889	-0.818	2.000	10046	-15385	-711	2087	-78320	-3173	1880	N	221	92.81	83.53	509	666	0.86	Not Reqd	0.00	0.43	0.41	642				0.00	0.00
117	117	-0.757	-0.889	-0.818	2.000	10046	-15377	-711	2142	-78313	-3173	2161	N	221	92.81	83.53	509	666	0.86	Not Reqd	0.00	0.43	0.41	642				0.00	0.00
117	118	-0.922	-0.699	-0.818	2.000	10046	-11302	-675	2073	-56344	-2890	2148	N	1060	89.38	80.44	812	259	0.34	Not Reqd	0.00	0.17	0.41	627	1295	963	2.47	0.00	0.00
118	118	-0.923	-0.699	-0.819	2.000	10046	-11290	-675	2136	-56331	-2890	2463	N	1299	89.38	80.44	894	176	0.23	Not Reqd	0.00	0.12	0.41	628	1369	963	2.81	0.00	0.00
118	119	-0.915	-0.725	-0.829	2.000	10124	-7539	-638	2061	-36567	-2609	2443	N	2459	80.57	77.76	1308	0	0.13	Not Reqd	0.00	0.06	0.41	615	1730	870	5.05	0.00	0.00
119	119	-0.915	-0.724	-0.829	2.000	10124	-7528	-638	2102	-36553	-2609	2643	N	2483	80.57	77.76	1316	0	0.13	Not Reqd	0.00	0.06	0.41	615	1737	870	5.08	0.00	0.00
119	120	-0.744	-0.964	-0.840	2.000	10203	-4121	-601	2020	-18979	-2333	2616	N	3044	64.59	77.76	1503	0	0.13	Not Reqd	0.00	0.06	0.21	307	1629	778	5.25	0.00	0.00
120	120	-0.744	-0.964	-0.840	2.000	10203	-4109	-601	2042	-18964	-2333	2720	N	3070	64.59	77.76	1511	0	0.13	Not Reqd	0.00	0.06	0.21	307	1637	778	5.29	0.00	0.00
120	121	-0.398	-0.788	-0.550	2.000	10440	-1063	-563	1952	-3540	-2066	2686	N	1282	54.73	77.76	895	0	0.13	Not Reqd	0.00	0.06	0.21	306	1081	689	3.09	0.00	0.00
121	121	-0.398	-0.788	-0.550	2.000	10440	-1052	-563	1958	-3525	-2066	2705	N	1300	54.73	77.76	902	0	0.13	Not Reqd	0.00	0.06	0.21	306	1087	689	3.12	0.00	0.00
121	122	-0.404	-0.840	-0.581	2.000	10361	1620	-526	1862	9900	-1833	2665	N	1173	66.63	77.76	843	0	0.13	Not Reqd	0.00	0.06	0.21	304	1032	611	3.40	0.00	0.00
122	122	-0.404	-0.840	-0.581	2.000	10361	1630	-526	1853	9914	-1833	2610	N	1193	66.63	77.76	850	0	0.13	Not Reqd	0.00	0.06	0.21	304	1038	611	3.44	0.00	0.00
122	123	-0.407	-0.902	-0.599	2.000	10440	3914	-488	1750	21482	-1606	2564	N	1026	74.89	77.76	777	0	0.13	Not Reqd	0.00	0.06	0.21	302	971	535	3.68	0.00	0.00
123	123	-0.407	-0.903	-0.599	2.000	10440	3923	-488	1729	21495	-1606	2446	N	1048	74.89	77.76	785	0	0.13	Not Reqd	0.00	0.06	0.21	302	978	535	3.72	0.00	0.00
123	124	-0.409	-0.976	-0.618	2.000	10519	5806	-450	1623	31238	-1385	2396	N	898	81.60	77.76	721	0	0.13	Not Reqd	0.00	0.06	0.21	301	920	462	4.05	0.00	0.00
124	124	-0.409	-0.976	-0.618	2.000	10519	5815	-450	1591	31250	-1385	2225	N	923	81.60	77.76	730	0	0.13	Not Reqd	0.00	0.06	0.21	301	928	462	4.11	0.00	0.00
124	125	-0.405	-1.075	-0.637	2.000	10598	7284	-412	1484	39200	-1170	2174	N	826	87.08	78.37	691	0	0.13	Not Reqd	0.00	0.06	0.21	302	894	390	4.67	0.00	0.00
125	125	-0.411	-0.968	-0.603	2.000	10598	7292	-412	1446	39211	-1170	1969	N	494	87.08	78.37	577	0	0.13	Not Reqd	0.00	0.06	0.21	302	791	390	3.92	0.00	0.00
125	126	-0.430	-0.926	-0.602	2.000	10598	8339	-374	1339	45393	-958	1918	N	395	91.08	81.97	556	0	0.13	Not Reqd	0.00	0.06	0.21	315	784	319	4.72	0.00	0.00
126	126	-0.430	-0.926	-0.602	2.000	10598	8346	-374	1294	45403	-958	1671	N	395	91.08	81.97	556	0	0.13	Not Reqd	0.00	0.06	0.21	315	784	319	4.72	0.00	0.00
126	127	-0.445	-0.897	-0.602	2.000	10598	8963	-337	1189	49821	-747	1622	N	240	93.93	84.53	513	0	0.13	Not Reqd	0.00	0.06	0.21	324	753	249	5.49	0.00	0.00

PROJECT: **Cline Avenue Mainline Seg 4 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 = ***15.00*** 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																											
127	127	-0.445	-0.897	-0.602	2.000	10598	8969	-337	1140	49829	-747	1351	N	240	93.93	84.53	513	0	0.13	Not Reqd	0.00	0.06	0.21	324	753	249	5.49	0.00	0.00
127	128	-0.462	-0.863	-0.601	2.000	10598	9157	-300	1040	52484	-536	1306	N	71	95.27	85.74	460	0	0.13	Not Reqd	0.00	0.06	0.21	328	710	179	6.31	0.00	0.00
128	128	-0.462	-0.863	-0.601	2.000	10598	9162	-300	990	52490	-536	1020	N	71	95.27	85.74	460	0	0.13	Not Reqd	0.00	0.06	0.21	328	710	179	6.31	0.00	0.00
128	129	-0.477	-0.827	-0.598	2.000	10598	8923	-264	895	53385	-325	981	N	-53	95.32	85.79	456	0	0.13	Not Reqd	0.00	0.06	0.21	329	706	108	7.79	0.00	0.00
129	129	-0.477	-0.827	-0.598	2.000	10598	8927	-264	862	53388	-325	784	N	-53	95.32	85.79	456	0	0.13	Not Reqd	0.00	0.06	0.21	329	706	108	7.79	0.00	0.00
129	130	-0.482	-0.816	-0.597	2.000	10598	8729	-251	829	53272	-251	771	N	-118	95.06	85.55	478	0	0.13	Not Reqd	0.00	0.06	0.21	328	725	84	8.66	0.00	0.00
130	130	-0.482	-0.816	-0.597	2.000	10598	8732	-251	797	53274	-251	575	N	-118	95.06	85.55	478	0	0.13	Not Reqd	0.00	0.06	0.21	328	725	84	8.66	0.00	0.00
130	131	-0.496	-0.786	-0.596	2.000	10598	7918	-216	711	51789	-41	545	N	-289	93.23	83.91	526	0	0.13	Not Reqd	0.00	0.06	0.21	322	762	14	11.40	0.00	0.00
131	131	-0.495	-0.786	-0.596	2.000	10598	7921	-216	668	51791	-41	263	N	-289	93.23	83.91	526	0	0.13	Not Reqd	0.00	0.06	0.21	322	762	14	11.40	0.00	0.00
131	132	-0.509	-0.763	-0.597	2.000	10598	7780	-188	528	49645	162	178	N	-441	89.95	80.95	561	0	0.13	Not Reqd	0.00	0.06	0.21	310	784	54	12.68	0.00	0.00
132	132	-0.509	-0.763	-0.597	2.000	10598	7783	-188	486	49645	162	-92	N	-441	89.95	80.95	561	0	0.13	Not Reqd	0.00	0.06	0.21	310	784	54	12.68	0.00	0.00
132	133	-0.521	-0.746	-0.599	2.000	10598	6917	-162	442	45440	361	-80	N	-584	85.33	77.76	597	0	0.13	Not Reqd	0.00	0.06	0.21	299	806	120	13.66	0.00	0.00
133	133	-0.521	-0.746	-0.599	2.000	10598	6919	-162	405	45439	361	-327	N	-584	85.33	77.76	597	0	0.13	Not Reqd	0.00	0.06	0.21	299	806	120	13.66	0.00	0.00
133	134	-0.531	-0.735	-0.601	2.000	10598	5808	-138	370	39655	560	-307	N	-721	79.41	77.76	654	0	0.13	Not Reqd	0.00	0.06	0.37	540	1074	187	20.26	0.00	0.00
134	134	-0.531	-0.735	-0.601	2.000	10598	5810	-138	338	39653	560	-523	N	-721	79.41	77.76	654	0	0.13	Not Reqd	0.00	0.06	0.37	540	1074	187	20.26	0.00	0.00
134	135	-0.541	-0.724	-0.604	2.000	10598	4476	-115	312	32313	757	-493	N	-869	72.26	77.76	717	0	0.13	Not Reqd	0.00	0.06	0.37	543	1134	252	23.96	0.00	0.00
135	135	-0.540	-0.724	-0.604	2.000	10598	4477	-115	288	32310	757	-662	N	-1130	72.26	77.76	801	0	0.13	Not Reqd	0.00	0.06	0.37	542	1209	252	25.93	0.00	0.00
135	136	-0.564	-0.627	-0.587	2.000	10519	-1301	-107	178	19180	942	-716	N	-1293	63.51	77.76	878	0	0.13	Not Reqd	0.00	0.06	0.37	546	1282	314	28.07	0.00	0.00
136	136	-0.564	-0.628	-0.588	2.000	10519	-1300	-107	186	19175	942	-821	N	-1268	63.51	77.76	870	0	0.13	Not Reqd	0.00	0.06	0.37	546	1275	314	27.87	0.00	0.00
136	137	-0.586	-0.542	-0.569	2.000	10440	-717	-105	173	11027	1128	-777	N	-1403	53.21	77.76	927	0	0.13	Not Reqd	0.00	0.06	0.37	549	1328	376	28.30	0.00	0.00
137	137	-0.586	-0.542	-0.569	2.000	10440	-716	-105	177	11022	1128	-838	N	-1381	53.21	77.76	920	0	0.13	Not Reqd	0.00	0.06	0.37	549	1322	376	28.12	0.00	0.00
137	138	-0.575	-0.513	-0.550	2.000	10361	0	-103	165	2	1731	-794	N	-1426	41.99	77.76	644	0	0.13	Not Reqd	0.00	0.06	0.37	432				0.00	0.00
																											1.55		

PROJECT: **Cline Avenue Mainline Seg 4 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 = ***15.00*** 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 + Maximum LL Torsion @ t=00																									
1	1	-0.633	-0.779	-0.690	2.000	6252	-646	-228	5526	-1022	-1598	8522	Y	937	79.10	98.42	421	171	0.32	0.471	0.00	0.40	0.37	393				24.88	8.51
1	2	-0.680	-0.775	-0.715	2.000	6067	1038	-214	5442	9891	-1235	8384	Y	925	64.75	95.13	905	0	0.13	0.477	0.00	0.30	0.37	677	1424	676	4.07	24.92	8.52
2	2	-0.677	-0.775	-0.714	2.000	6067	826	-222	5354	9633	-1248	7551	Y	914	64.75	95.13	902	0	0.13	0.430	0.00	0.28	0.37	677	1421	654	4.15	22.45	7.67
2	3	-0.697	-0.809	-0.738	2.000	5876	2394	-206	5262	18678	-1119	7405	Y	873	72.90	92.12	869	0	0.13	0.435	0.00	0.28	0.21	364	1110	607	3.14	22.44	7.67
3	3	-0.694	-0.810	-0.737	2.000	5876	2295	-225	5014	18535	-1144	7093	Y	948	72.90	92.12	894	0	0.13	0.417	0.00	0.27	0.21	364	1132	605	3.26	21.50	7.35
3	4	-0.700	-0.874	-0.759	2.000	5756	3543	-212	4938	25151	-1045	6974	Y	896	76.35	89.42	860	0	0.13	0.419	0.00	0.27	0.21	353	1092	569	3.31	21.41	7.32
4	4	-0.700	-0.874	-0.759	2.000	5756	3809	-238	4711	25412	-1077	6835	Y	630	76.35	89.42	771	0	0.13	0.410	0.00	0.27	0.21	353	1012	575	2.92	20.98	7.17
4	5	-0.723	-0.843	-0.763	2.000	5587	4861	-218	4641	31336	-971	6722	Y	574	80.63	86.94	735	0	0.13	0.416	0.00	0.27	0.21	344	971	536	2.98	21.02	7.19
5	5	-0.721	-0.844	-0.762	2.000	5587	4778	-229	4426	31226	-986	6594	Y	533	80.63	86.94	720	0	0.13	0.408	0.00	0.27	0.21	343	957	537	2.94	20.62	7.05
5	6	-0.755	-0.793	-0.768	2.000	5440	5612	-193	4310	37478	-843	6423	Y	464	85.29	84.78	661	0	0.13	0.408	0.00	0.27	0.21	333	894	484	3.05	20.43	6.98
6	6	-0.752	-0.794	-0.766	2.000	5440	5726	-215	4044	37546	-869	6148	Y	449	85.29	84.78	654	0	0.13	0.390	0.00	0.26	0.21	333	888	484	3.03	19.56	6.69
6	7	-0.786	-0.745	-0.772	2.000	5313	8097	-117	3966	44547	-665	6016	Y	384	89.15	82.94	599	0	0.13	0.391	0.00	0.26	0.21	323	830	412	3.55	19.42	6.64
7	7	-0.783	-0.747	-0.771	2.000	5313	6627	-208	3670	43029	-759	5620	Y	372	89.15	82.94	597	0	0.13	0.365	0.00	0.25	0.21	323	828	431	3.15	18.14	6.20
7	8	-0.814	-0.702	-0.777	2.000	5206	9086	-105	3684	49331	-552	5580	Y	308	92.23	83.01	560	0	0.13	0.370	0.00	0.25	0.21	322	794	360	3.86	18.25	6.24
8	8	-0.811	-0.703	-0.775	2.000	5206	7138	-196	3294	47335	-644	5016	Y	296	92.23	83.01	560	0	0.13	0.333	0.00	0.23	0.21	322	794	373	3.48	16.41	5.61
8	9	-0.839	-0.664	-0.781	2.000	5116	9725	-90	3396	52976	-434	5064	Y	232	94.55	85.10	540	0	0.13	0.342	0.00	0.24	0.21	329	782	305	4.48	16.75	5.73
9	9	-0.836	-0.666	-0.780	2.000	5116	9312	-111	2974	52520	-457	4431	Y	218	94.55	85.10	536	0	0.13	0.299	0.00	0.21	0.21	329	778	292	4.71	14.66	5.01
9	10	-0.861	-0.633	-0.786	2.000	5049	10138	-76	3113	55612	-318	4516	Y	155	96.14	86.52	517	0	0.13	0.309	0.00	0.22	0.21	334	767	249	5.19	15.07	5.15
10	10	-0.858	-0.634	-0.784	2.000	5049	9655	-97	2676	55089	-341	3742	Y	145	96.14	86.52	515	0	0.13	0.256	0.00	0.19	0.21	334	764	232	5.55	12.48	4.27
10	11	-0.876	-0.609	-0.788	2.000	5000	10343	-63	2816	57254	-202	3828	Y	80	97.00	87.30	494	0	0.13	0.265	0.00	0.20	0.21	337	748	188	6.10	12.85	4.39
11	11	-0.873	-0.610	-0.787	2.000	5000	9746	-82	2416	56617	-223	3229	Y	66	97.00	87.30	490	0	0.13	0.223	0.00	0.18	0.21	337	745	176	6.49	10.84	3.71
11	12	-0.889	-0.591	-0.791	2.000	5000	10370	-49	2555	57927	-86	3313	Y	-11	97.26	87.53	472	0	0.13	0.229	0.00	0.18	0.21	338	728	133	7.12	11.12	3.80
12	12	-0.886	-0.592	-0.789	2.000	5000	9730	-65	2150	57250	-103	2645	Y	-25	97.26	87.53	478	0	0.13	0.183	0.00	0.16	0.21	338	734	118	7.89	8.88	3.04
12	13	-0.897	-0.579	-0.793	2.000	4960	10219	-37	2289	57629	29	2730	Y	-79	96.31	86.68	489	0	0.13	0.190	0.00	0.16	0.21	335	741	96	8.63	9.21	3.15
13	13	-0.896	-0.579	-0.793	2.000	4960	10382	1	2028	57782	67	2310	Y	-85	96.31	86.68	491	0	0.13	0.161	0.00	0.15	0.21	335	743	95	11.05	7.80	2.67
13	14	-0.898	-0.578	-0.793	2.000	4960	9743	-37	2058	56992	55	2326	Y	-100	96.03	86.43	496	0	0.13	0.162	0.00	0.15	0.21	334	747	92	9.49	7.85	2.68
14	14	-0.897	-0.578	-0.793	2.000	4960	10505	10	1939	57743	102	2046	Y	-100	96.03	86.43	495	0	0.13	0.142	0.00	0.14	0.21	334	746	99	11.02	6.90	2.36
14	15	-0.900	-0.580	-0.796	2.000	4960	10341	30	2047	56471	226	2099	Y	-167	94.46	85.01	509	0	0.13	0.146	0.00	0.14	0.21	328	754	142	9.21	7.08	2.42
15	15	-0.898	-0.580	-0.794	2.000	4960	9742	38	1844	55846	234	1657	Y	-167	94.46	85.01	511	0	0.13	0.115	0.00	0.12	0.21	328	755	130	9.81	5.59	1.91
15	16	-0.897	-0.590	-0.797	2.000	4960	9348	57	1952	53535	358	1711	Y	-240	92.08	82.87	525	0	0.13	0.119	0.00	0.12	0.21	320	761	173	8.27	5.78	1.97
16	16	-0.895	-0.590	-0.796	2.000	4960	9084	66	1779	53253	368	1328	N	-240	92.08	82.87	526	0	0.13	Not Reqd	0.00	0.06	0.21	320	761	123	30.08	0.00	0.00
16	17	-0.889	-0.610	-0.798	2.000	4960	9744	139	1892	51181	546	1386	N	-311	88.90	80.01	532	0	0.13	Not Reqd	0.00	0.06	0.21	309	757	182	13.39	0.00	0.00
17	17	-0.887	-0.610	-0.797	2.000	4960	8170	92	1756	49595	502	1077	N	-311	88.90	80.01	538	0	0.13	Not Reqd	0.00	0.06	0.21	310	763	167	20.32	0.00	0.00
17	18	-0.876	-0.639	-0.799	2.000	4960	8793	161	1913	46659	676	1180	N	-379	84.95	77.76	551	0	0.13	Not Reqd	0.00	0.06	0.21	301	767	225	11.09	0.00	0.00
18	18	-0.876	-0.639	-0.799	2.000	4960	6550	122	1792	44414	640	929	N	-379	84.95	77.76	558	0	0.13	Not Reqd	0.00	0.06	0.21	302	774	213	14.84	0.00	0.00
18	19	-0.859	-0.680	-0.801	2.000	4960	7440	185	1971	40904	809	1053	N	-447	80.26	77.76	590	0	0.13	Not Reqd	0.00	0.06	0.21	303	803	270	9.66	0.00	0.00
19	19	-0.859	-0.680	-0.801	2.000	4960	5606	146	1900	39078	776	899	N	-447	80.26	77.76	596	0	0.13	Not Reqd	0.00	0.06	0.21	304	810	259	12.31	0.00	0.00
19	20	-0.836	-0.733	-0.802	2.000	4960	5866	251	2139	34080	986	1083	N	-514	74.89	77.76	633	0	0.13	Not Reqd	0.00	0.06	0.21	305	844	329	7.15	0.00	0.00
20	20	-0.836	-0.732	-0.803	2.000	4960	2445	200	2074	30678	946	1008	N	-684	74.89	77.76	707	0	0.13	Not Reqd	0.00	0.06	0.21	307	912	315	9.94	0.00	0.00
20	21	-0.819	-0.722	-0.786	2.000	4923	4466	273	2321	26543	1126	1200	N	-753	68.70	77.76	738	0	0.13	Not Reqd	0.00	0.06	0.21	307	941	375	7.21	0.00	0.00
21	21	-0.821	-0.721	-0.787	2.000	4923	1328	219	2309	23444	1081	1247	N	-740	68.70	77.76	735	0	0.13	Not Reqd	0.00	0.06	0.21	307	938	360	8.92	0.00	0.00
21	22	-0.798	-0.720	-0.770	2.000	4886	3231	293	2564	18280	1265	1447	N	-812	61.76	77.76	759	0	0.13	Not Reqd	0.00	0.06	0.21	307	960	422	6.50	0.00	0.00
22	22	-0.801	-0.719	-0.771	2.000	4886	-181	240	2561	14925	1225	1584	Y	-800	61.76	77.76	755	0	0.13	0.112	0.00	0.12	0.21	307	956	458	4.09	5.40	1.85
22	23	-0.770	-0.727	-0.754	2.000	4849	1961	314	2837	9047	1411	1805	Y	-877	54.03	77.76	780	0	0.13	0.129	0.00	0.13	0.37	553	1200	527	4.47	6.18	2.11
23	23	-0.774	-0.726	-0.756	2.000	4849	-1687	259	2821	5476	1371	2011	Y	-865	54.03	77.76	776	0	0.13	0.143	0.00	0.14	0.37	553	1197	520	4.86	6.89	2.36
23	24	-0.737	-0.744	-0.739	2.000	4812	381	337	3144	-1469	1565	2279	Y	-942	62.53	77.76	802	0	0.13	0.164	0.00	0.15	0.37	553	1220	594	3.96	7.85	2.68
24	24	-0.741	-0.742	-0.742	2.000	4812	-3112	277	3089	-4871	1522	2513	Y	-935	62.53	77.76	799	0	0.13	0.180	0.00	0.15	0.37	553	1218	587	4.32	8.65	2.96
24	25	-0.939	-0.858	-0.907	2.000	4775	-1165	389	3488	-13045	1772	2857	Y	-1637	73.37	77.76	1034	0	0.13	0.207	0.00	0.17	0.37	553	1428	681	4.12	9.89	3.38
25	25	-0.943	-0.856	-0.909	2.000	4775	-1065	388	3413	-12857	1791	3181	Y	-1625	73.37	77.76	1029	0	0.13	0.230	0.00	0.18	0.37	553	1424	698	4.06	11.01	3.76
25	26	-0.976	-0.806	-0.907	2.000	4738	-3165	418	3895	-26314	1964	3609	Y	-1050	84.36	77.76	838	0	0.13	0.263	0.00	0.20	0.37	553	1252	769	2.84	12.55	4.29
26	26	-0.980	-0.805	-0.909	2.000	4738	-3154	421	3881	-26219	1990	4092	Y	-1038	84.36	77.76	834	0	0.13	0.298	0.00	0.21	0.37	553	1249	792	2.73	14.23	4.87
26	27	-0.853	-0.953	-0.895	2.000	4701	-5554	452	4382	-41260	2166	4537	Y	-645	90.16	81.14	724	78	0.13	0.333	0.00	0.23	0.37	577	1171	865	2.06	15.86	5.42
27	27	-0.855	-0.951	-0.895	2.000	4701	-5487	457	4451	-41120	2197	5178	Y	-505	90.16	81.14	678	136	0.18	0.380	0.00	0.28	0.37	577	1129	896	1.80	18.10	6.19
27	28	-0.628	-1.290	-0.904	2.000	4701	-8204	488	4981	-57802	2375	5652	Y	-122	92.83	83.55	511	369	0.47	0.415	0.00	0.44	0.37	585				19.76	6.76
28	28	-0.629	-1.289	-0.904	2.000	4701	-8311	495	5135	-57867	2399	6207	Y	-123	92.83	83.55	510	378	0.48	0.456	0.00	0.47	0.37	585				21.70	7.42
28	29	-0.536	-1.428	-0.907	2.000	4701	-9251	505	5316	-63558	2450	6371	Y	4	93.00	83.70	454	453	0.58	0.468	0.00	0.52	0.37	583				22.27	7.62
29	29	-0.536	-1.428	-0.907	2.000	4701	-6837	-394	4088	-61148	-2148	2257	Y	3	93.00	83.70	465	330	0.42	0.166	0.00	0.29	0.37	585				7.89	2.70
29	30	-0.622	-1.301	-0.905	2.000	4701	-5974	-390	4052	-56006	-2103	2204	Y	116	92.85	83.56	518	261	0.33	0.162	0.00	0.25	0.37	587				7.70	2.63
30	30	-0.622	-1.301	-0.905	2.000	4701	-6530	-401	4082	-56584	-2097	2638	Y	117	92.85	83.56	517	259	0.33	0.194	0.00	0.26	0.37	587				9.22	3.15
30	31	-0.834	-0.990	-0.899	2.000	4701	-3916	-377	3975	-41475	-1926	2476	Y	435	90.55	81.49	656	57	0.13	0.182	0.00	0.16	0.37	580	1113	720	2.56	8.66	2.96
31	31	-0.835	-0.991	-0.899	2.000	4701	-4036	-377	4012	-41605	-1903	3080	Y	575	90.55	81.49	703	2	0.13	0.226	0.00	0.18	0.37	580	1155	732	2.68	10.77	3.68
31	32	-0.913	-0.887	-0.903	2.000	4738	-1708	-351	3902	-28087	-1731	2915	Y	1458	84.68	77.76	974	0	0.13	0.213	0.00	0.17	0.37	553	1375	669	3.94	10.14	3.47
32	32	-0.912	-0.888	-0.902	2.000	4738	-1696	-360	3908	-28098	-1720	3396	Y	1470	84.68	77.76	978	0	0.13	0.248	0.00	0.19	0.37	553	1378	681	3.87	11.81	4.04

PROJECT: **Cline Avenue Mainline Seg 4 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 = ***15.00*** 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 + Maximum LL Torsion @ t=00																									
32	33	-0.745	-1.147	-0.903	2.000	4775	466	-334	3788	-16007	-1552	3221	Y	2083	68.68	77.76	1182	0	0.13	0.233	0.00	0.18	0.37	553	1562	619	5.08	11.15	3.81
33	33	-0.744	-1.147	-0.903	2.000	4775	124	-322	3761	-16373	-1525	3573	Y	2096	68.68	77.76	1186	0	0.13	0.258	0.00	0.19	0.37	553	1566	621	5.18	12.36	4.23
33	34	-0.381	-0.760	-0.525	2.000	4812	1970	-297	3629	-5802	-1361	3386	Y	671	58.16	77.76	705	0	0.13	0.243	0.00	0.19	0.37	552	1131	561	3.67	11.66	3.99
34	34	-0.376	-0.754	-0.519	2.000	4812	1909	-302	3561	-5890	-1354	3609	Y	678	58.16	77.76	707	0	0.13	0.259	0.00	0.19	0.37	552	1134	565	3.66	12.43	4.25
34	35	-0.433	-0.715	-0.536	2.000	4849	4960	-203	3528	4813	-1138	3521	Y	619	58.59	77.76	694	0	0.13	0.251	0.00	0.19	0.21	307	901	490	3.30	12.06	4.12
35	35	-0.432	-0.715	-0.535	2.000	4849	4734	-205	3326	4554	-1130	3536	Y	627	58.59	77.76	697	0	0.13	0.252	0.00	0.19	0.21	307	904	488	3.40	12.11	4.14
35	36	-0.476	-0.693	-0.552	2.000	4886	6323	-174	3379	12824	-985	3534	Y	574	66.43	77.76	664	0	0.13	0.250	0.00	0.19	0.21	306	873	440	3.63	12.05	4.12
36	36	-0.475	-0.693	-0.552	2.000	4886	6445	-191	3136	12919	-994	3418	Y	582	66.43	77.76	666	0	0.13	0.242	0.00	0.19	0.21	306	875	439	3.68	11.65	3.98
36	37	-0.509	-0.689	-0.569	2.000	4923	7913	-160	3183	20139	-851	3410	Y	525	73.37	77.76	628	0	0.13	0.239	0.00	0.18	0.21	304	839	392	3.91	11.57	3.95
37	37	-0.508	-0.689	-0.569	2.000	4923	7356	-161	2913	19561	-846	3191	Y	535	73.37	77.76	634	0	0.13	0.224	0.00	0.18	0.21	304	844	383	4.17	10.82	3.70
37	38	-0.532	-0.702	-0.586	2.000	4960	8575	-130	2961	25639	-706	3184	Y	473	79.25	77.76	598	0	0.13	0.222	0.00	0.18	0.21	303	811	336	4.47	10.75	3.67
38	38	-0.532	-0.702	-0.586	2.000	4960	7379	-146	2691	24430	-718	2847	Y	352	79.25	77.76	559	0	0.13	0.198	0.00	0.16	0.21	303	776	329	4.34	9.61	3.29
38	39	-0.559	-0.653	-0.588	2.000	4960	8475	-116	2737	29516	-580	2838	Y	288	84.18	77.76	523	0	0.13	0.198	0.00	0.16	0.21	301	742	283	4.67	9.58	3.27
39	39	-0.559	-0.653	-0.589	2.000	4960	8016	-125	2453	29050	-587	2493	Y	288	84.18	77.76	524	0	0.13	0.174	0.00	0.15	0.21	302	743	274	4.93	8.42	2.88
39	40	-0.579	-0.617	-0.591	2.000	4960	8933	-94	2504	33107	-448	2489	Y	224	88.09	79.28	502	0	0.13	0.173	0.00	0.15	0.21	306	728	228	5.52	8.40	2.87
40	40	-0.579	-0.617	-0.591	2.000	4960	7377	-110	2229	31549	-462	2115	Y	224	88.09	79.28	506	0	0.13	0.147	0.00	0.14	0.21	307	732	221	5.77	7.14	2.44
40	41	-0.593	-0.593	-0.593	2.000	4960	8164	-79	2286	34633	-324	2118	Y	160	91.00	81.90	495	0	0.13	0.148	0.00	0.14	0.21	317	730	175	6.63	7.15	2.44
41	41	-0.594	-0.593	-0.593	2.000	4960	7131	-94	2040	33604	-337	1746	Y	159	91.00	81.90	497	0	0.13	0.122	0.00	0.13	0.21	317	733	168	6.90	5.89	2.01
41	42	-0.601	-0.582	-0.595	2.000	4960	6799	133	2242	34729	-3	1892	Y	95	92.92	83.63	486	0	0.13	0.132	0.00	0.13	0.21	324	729	61	6.80	6.39	2.18
42	42	-0.601	-0.582	-0.595	2.000	4960	7280	126	2020	35218	-9	1522	Y	96	92.92	83.63	485	0	0.13	0.106	0.00	0.12	0.21	323	727	51	7.40	5.14	1.76
42	43	-0.602	-0.583	-0.596	2.000	4960	7495	151	2405	36054	124	1851	Y	31	93.86	84.47	466	0	0.13	0.129	0.00	0.13	0.21	327	713	100	5.86	6.25	2.14
43	43	-0.603	-0.583	-0.597	2.000	4960	7498	147	2198	36068	121	1492	Y	31	93.86	84.47	466	0	0.13	0.104	0.00	0.12	0.21	327	714	87	6.29	5.04	1.72
43	44	-0.598	-0.595	-0.597	2.000	4960	7528	171	2557	35934	243	1801	Y	-28	93.86	84.47	463	0	0.13	0.125	0.00	0.13	0.21	326	710	138	5.16	6.08	2.08
44	44	-0.600	-0.594	-0.598	2.000	4960	7158	171	2359	35577	244	1451	N	-28	93.86	84.47	464	0	0.13	Not Reqd	0.00	0.06	0.21	326	711	81	12.04	0.00	0.00
44	45	-0.588	-0.619	-0.598	2.000	4960	6974	198	2762	34415	379	1799	Y	-93	92.92	83.62	482	0	0.13	0.125	0.00	0.13	0.21	323	725	183	4.54	6.07	2.08
45	45	-0.590	-0.619	-0.599	2.000	4960	6549	194	2560	34007	375	1442	N	-93	92.92	83.62	483	0	0.13	Not Reqd	0.00	0.06	0.21	323	726	125	10.31	0.00	0.00
45	46	-0.573	-0.656	-0.599	2.000	4960	6163	221	2980	31805	511	1807	Y	-159	91.00	81.90	499	0	0.13	0.126	0.00	0.13	0.21	317	734	227	4.02	6.10	2.09
46	46	-0.574	-0.655	-0.600	2.000	4960	6326	214	2781	31987	504	1470	N	-159	91.00	81.90	499	0	0.13	Not Reqd	0.00	0.06	0.21	317	734	168	8.94	0.00	0.00
46	47	-0.551	-0.706	-0.599	2.000	4960	5747	242	3219	28755	641	1853	Y	-226	88.10	79.29	512	0	0.13	0.129	0.00	0.13	0.21	307	738	272	3.55	6.25	2.14
47	47	-0.552	-0.706	-0.600	2.000	4960	5838	235	3014	28866	635	1542	Y	-226	88.10	79.29	512	0	0.13	0.107	0.00	0.12	0.21	307	737	260	3.75	5.21	1.78
47	48	-0.523	-0.770	-0.601	2.000	4960	5062	264	3474	24596	772	1947	Y	-296	84.19	77.76	537	0	0.13	0.136	0.00	0.13	0.21	303	756	319	3.21	6.57	2.25
48	48	-0.525	-0.770	-0.602	2.000	4960	5071	259	3268	24625	768	1696	Y	-296	84.19	77.76	537	0	0.13	0.118	0.00	0.12	0.21	303	756	309	3.36	5.72	1.96
48	49	-0.490	-0.849	-0.602	2.000	4960	4085	288	3751	19304	905	2123	Y	-368	79.31	77.76	577	0	0.13	0.148	0.00	0.14	0.21	304	793	369	2.98	7.17	2.45
49	49	-0.492	-0.848	-0.604	2.000	4960	4092	284	3516	19331	901	1869	Y	-494	79.31	77.76	622	0	0.13	0.130	0.00	0.13	0.21	305	834	359	3.31	6.31	2.16
49	50	-0.463	-0.853	-0.592	2.000	4923	2896	313	4016	12958	1041	2313	Y	-551	73.46	77.76	657	0	0.13	0.162	0.00	0.15	0.21	306	867	420	2.93	7.84	2.68
50	50	-0.465	-0.853	-0.594	2.000	4923	2870	310	3781	12954	1038	2247	Y	-541	73.46	77.76	654	0	0.13	0.158	0.00	0.14	0.21	306	864	417	3.01	7.62	2.61
50	51	-0.431	-0.869	-0.583	2.000	4886	1476	340	4300	5519	1180	2711	Y	-623	66.64	77.76	695	0	0.13	0.192	0.00	0.16	0.21	307	903	479	2.70	9.24	3.16
51	51	-0.433	-0.869	-0.584	2.000	4886	1437	338	4069	5500	1179	2826	Y	-614	66.64	77.76	693	0	0.13	0.200	0.00	0.16	0.21	307	900	482	2.73	9.63	3.29
51	52	-0.400	-0.893	-0.578	2.000	4849	-132	367	4617	-2994	1324	3318	Y	-700	49.49	77.76	721	0	0.13	0.236	0.00	0.18	0.37	553	1147	546	3.24	11.37	3.89
52	52	-0.402	-0.892	-0.579	2.000	4849	-171	366	4448	-3017	1324	3693	Y	-692	49.49	77.76	718	0	0.13	0.263	0.00	0.20	0.37	553	1145	558	3.24	12.65	4.32
52	53	-0.366	-0.935	-0.563	2.000	4886	-1821	397	5101	-12496	1473	4290	Y	-752	69.67	77.76	715	0	0.13	0.303	0.00	0.22	0.37	549	1138	626	2.74	14.62	5.00
53	53	-0.472	-0.441	-0.461	2.000	4886	1929	40	2446	-5821	1392	57	N	-762	69.67	77.76	742	0	0.13	Not Reqd	0.00	0.06	0.37	553	1166	464	53.60	0.00	0.00
53	54	-0.816	-0.705	-0.764	2.000	10203	-3446	189	1748	-22390	1759	-723	N	-2410	68.69	77.76	1291	0	0.13	Not Reqd	0.00	0.06	0.37	553	1660	586	18.04	0.00	0.00
54	54	-0.812	-0.705	-0.762	2.000	10203	-2289	79	2885	-21196	1649	982	N	-2388	68.69	77.76	1284	0	0.13	Not Reqd	0.00	0.06	0.37	553	1654	550	43.06	0.00	0.00
54	55	-0.937	-0.561	-0.757	2.000	10124	-2893	79	2885	-34698	1876	901	N	-1724	84.54	77.76	1063	0	0.13	Not Reqd	0.00	0.06	0.47	692	1579	625	37.34	0.00	0.00
55	55	-0.941	-0.560	-0.759	2.000	10124	-2970	111	3577	-34677	1861	604	N	-1704	84.54	77.76	1056	0	0.13	Not Reqd	0.00	0.06	0.47	692	1573	620	26.74	0.00	0.00
55	56	-0.863	-0.636	-0.752	2.000	10046	-3820	111	3577	-49823	2094	523	N	-697	90.42	81.37	719	56	0.13	Not Reqd	0.00	0.06	0.47	719	1294	698	17.11	0.00	0.00
56	56	-0.870	-0.634	-0.755	2.000	10046	-7462	245	4182	-53191	2321	3053	Y	-511	90.42	81.37	646	214	0.28	0.105	0.00	0.19	0.47	717	1226	819	3.84	8.77	3.00
56	57	-0.665	-0.861	-0.761	2.000	10046	-9120	259	4332	-71657	2572	3121	Y	-131	92.79	83.51	496	457	0.58	0.107	0.00	0.35	0.47	727				8.97	3.07
57	57	-0.674	-0.858	-0.764	2.000	10046	-9941	247	4060	-72205	2648	4738	Y	-130	92.79	83.51	494	487	0.62	0.163	0.00	0.39	0.47	726				13.62	4.66
57	58	-0.589	-0.953	-0.767	2.000	10046	-11100	255	4141	-79334	2719	4794	Y	9	92.98	83.68	442	565	0.73	0.165	0.00	0.45	0.47	724				13.78	4.71
58	58	-0.661	-0.857	-0.757	2.000	10046	-7743	-547	6571	-70962	-3067	8038	Y	9	92.98	83.68	450	685	0.88	0.276	0.00	0.58	0.47	727				23.10	7.90
58	59	-0.751	-0.762	-0.756	2.000	10046	-7081	-561	6448	-64195	-3017	7890	Y	199	92.76	83.49	525	592	0.76	0.271	0.00	0.51	0.47	728				22.68	7.75
59	59	-0.741	-0.764	-0.752	2.000	10046	-7344	-517	7291	-64736	-2892	10331	Y	198	92.76	83.49	526	545	0.70	0.355	0.00	0.53	0.47	728				29.69	10.15
59	60	-0.944	-0.549	-0.751	2.000	10046	-4807	-466	7136	-44874	-2616	10095	Y	731	89.50	80.55	727	242	0.32	0.347	0.00	0.33	0.47	712	1295	1021	2.05	29.02	9.92
60	60	-0.927	-0.552	-0.744	2.000	10046	-4578	-455	7661	-45140	-2512	12406	Y	920	89.50	80.55	793	138	0.18	0.427	0.00	0.30	0.47	712	1355	1021	2.26	35.66	12.19
60	61	-1.003	-0.500	-0.763	2.000	10124	-2019	-424	7448	-27680	-2258	12111	Y	1773	82.21	77.76	1079	0	0.13	0.413	0.00	0.27	0.37	553	1469	932	3.14	34.59	11.83
61	61	-0.981	-0.502	-0.753	2.000	10124	-2052	-406	7872	-28373	-2167	14133	Y	1794	82.21	77.76	1086	0	0.13	0.482	0.00	0.31	0.37	553	1475	931	3.16	40.37	13.80
61	62	-0.899	-0.628	-0.774	2.000	10203	-241	-363	7620	-13900	-1908	13799	Y	2179	68.33	77.76	1214	0	0.13	0.467	0.00	0.30	0.37	553	1591	840	4.21	39.17	13.39
62	62	-0.862	-0.632	-0.756	2.000	10203	294	-370	7861	-14287	-1931	13693	Y	2202	68.33	77.76	1222	0	0.13	0.464	0.00	0.30	0.37	553	1598	846	4.14	38.87	13.29
62	63	-0.677	-0.552	-0.626	2.000	10440	2518	-349	7568	-911	-1700	13319	Y	1155	61.89	77.76	873	0	0.13	0.441	0.00	0.29	0.37	553	1284	764	3.28	37.11	12.69
63	63	-0.606	-0.552	-0.584	2.000	10440	2075	-337	7627	-3059	-1752	12517	Y	1174	61.89	77.76	879	0	0.13	0.414	0.00	0.27	0.37	553	1289	769	3.31	34.88	11.92
63	64	-0.631	-0.572	-0.605	2.000	10361	4144	-319	7324	9160	-1554	12133	Y	1075	58.66	77.76	846	0	0.13	0.405	0.00	0.27	0.21	307	1038	697	2.59	34.01	11.63

PROJECT: **Cline Avenue Mainline Seg 4 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 = ***15.00*** 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 + Maximum LL Torsion @ t=00																											
64	64	-0.615	-0.573	-0.597	2.000	10361	3572	-319	7240	8287	-1572	11742	Y	1095	58.66	77.76	853	0	0.13	0.391	0.00	0.26	0.21	307	1044	698	2.63	32.92	11.25
64	65	-0.631	-0.607	-0.621	2.000	10440	5347	-297	6933	19000	-1377	11354	Y	1008	66.51	77.76	824	0	0.13	0.376	0.00	0.25	0.21	307	1018	627	2.94	31.64	10.82
65	65	-0.622	-0.609	-0.616	2.000	10440	5630	-321	6751	19082	-1415	10879	Y	1031	66.51	77.76	832	0	0.13	0.360	0.00	0.24	0.21	307	1025	633	2.90	30.31	10.36
65	66	-0.628	-0.660	-0.641	2.000	10519	6307	-277	6461	27499	-1203	10508	Y	936	73.45	77.76	793	0	0.13	0.345	0.00	0.24	0.21	307	990	556	3.31	29.10	9.95
66	66	-0.621	-0.662	-0.637	2.000	10519	6447	-305	6226	27483	-1242	9997	Y	962	73.45	77.76	801	0	0.13	0.328	0.00	0.23	0.21	307	997	562	3.25	27.69	9.47
66	67	-0.619	-0.734	-0.661	2.000	10598	6871	-262	5929	34465	-1037	9620	Y	859	79.32	77.76	758	0	0.13	0.314	0.00	0.22	0.21	306	958	488	3.68	26.48	9.05
67	67	-0.616	-0.734	-0.659	2.000	10598	7447	-287	5700	34970	-1068	9008	Y	595	79.32	77.76	664	0	0.13	0.294	0.00	0.21	0.21	305	872	489	3.13	24.80	8.48
67	68	-0.623	-0.724	-0.660	2.000	10598	8265	-259	5403	41164	-881	8629	Y	487	84.25	77.76	614	0	0.13	0.281	0.00	0.21	0.21	304	826	421	3.44	23.76	8.12
68	68	-0.618	-0.726	-0.657	2.000	10598	8147	-267	5185	40945	-894	8176	Y	487	84.25	77.76	614	0	0.13	0.267	0.00	0.20	0.21	304	826	419	3.46	22.51	7.70
68	69	-0.621	-0.722	-0.658	2.000	10598	8801	-240	4901	45783	-707	7812	Y	380	88.17	79.35	580	0	0.13	0.255	0.00	0.19	0.21	309	800	351	3.95	21.51	7.35
69	69	-0.617	-0.723	-0.656	2.000	10598	7398	-264	4672	44284	-737	7253	Y	380	88.17	79.35	582	0	0.13	0.236	0.00	0.18	0.21	310	803	353	3.86	19.97	6.83
69	70	-0.616	-0.726	-0.656	2.000	10598	8014	-238	4400	47912	-551	6900	Y	273	91.08	81.97	558	0	0.13	0.225	0.00	0.18	0.21	320	790	286	4.49	19.00	6.49
70	70	-0.612	-0.727	-0.654	2.000	10598	6627	-264	4169	46434	-588	6223	Y	273	91.08	81.97	560	0	0.13	0.203	0.00	0.17	0.21	320	792	288	4.37	17.13	5.86
70	71	-0.608	-0.734	-0.654	2.000	10598	10435	-112	3926	52111	-276	5898	Y	165	93.00	83.70	527	0	0.13	0.192	0.00	0.16	0.21	326	768	179	7.16	16.24	5.55
71	71	-0.605	-0.735	-0.652	2.000	10598	7193	-252	3657	48779	-431	5065	Y	165	93.00	83.70	532	0	0.13	0.165	0.00	0.15	0.21	326	772	219	5.01	13.94	4.77
71	72	-0.598	-0.747	-0.652	2.000	10598	11934	-81	3690	54282	-100	5017	Y	58	93.93	84.54	493	0	0.13	0.164	0.00	0.15	0.21	329	740	108	8.75	13.81	4.72
72	72	-0.595	-0.748	-0.650	2.000	10598	10840	-119	3408	53101	-158	4088	Y	58	93.93	84.54	495	0	0.13	0.133	0.00	0.13	0.21	329	741	113	7.97	11.25	3.85
72	73	-0.588	-0.762	-0.650	2.000	10598	12041	-35	3517	54058	74	4122	Y	-41	93.93	84.53	488	0	0.13	0.134	0.00	0.13	0.21	329	735	85	11.21	11.35	3.88
73	73	-0.584	-0.763	-0.649	2.000	10598	11518	-91	3302	53453	-6	3179	N	-41	93.93	84.53	489	0	0.13	Not Reqd	0.00	0.06	0.21	329	736	2	25.11	0.00	0.00
73	74	-0.575	-0.780	-0.649	2.000	10598	12473	-3	3430	53141	243	3225	Y	-150	93.00	83.70	519	0	0.13	0.105	0.00	0.12	0.21	325	760	129	13.23	8.88	3.04
74	74	-0.571	-0.780	-0.646	2.000	10598	13240	-13	3778	53823	204	4537	Y	-206	93.00	83.70	537	0	0.13	0.148	0.00	0.14	0.21	325	776	135	11.63	12.49	4.27
74	75	-0.579	-0.798	-0.658	2.000	10598	12986	25	3907	51287	403	4584	Y	-317	90.59	81.53	563	0	0.13	0.149	0.00	0.14	0.21	317	792	202	9.94	12.62	4.31
75	75	-0.576	-0.802	-0.657	2.000	10598	8402	17	2771	46530	361	-948	N	-206	90.59	81.53	535	0	0.13	Not Reqd	0.00	0.06	0.21	318	768	120	117.18	0.00	0.00
75	76	-0.550	-0.823	-0.648	2.000	10598	8079	33	2879	42947	539	-923	N	-319	88.17	79.35	564	0	0.13	Not Reqd	0.00	0.06	0.21	310	786	180	56.16	0.00	0.00
76	76	-0.554	-0.822	-0.650	2.000	10598	7889	148	3430	42934	623	301	N	-374	88.17	79.35	582	0	0.13	Not Reqd	0.00	0.06	0.21	310	803	208	13.05	0.00	0.00
76	77	-0.546	-0.841	-0.652	2.000	10598	6754	148	3430	37545	785	219	N	-489	84.26	77.76	620	0	0.13	Not Reqd	0.00	0.06	0.21	305	833	262	12.56	0.00	0.00
77	77	-0.552	-0.841	-0.656	2.000	10598	7319	170	3903	38253	778	-111	N	-489	84.26	77.76	619	0	0.13	Not Reqd	0.00	0.06	0.21	304	831	259	11.08	0.00	0.00
77	78	-0.545	-0.860	-0.658	2.000	10598	6015	170	3903	31677	940	-193	N	-607	79.42	77.76	673	0	0.13	Not Reqd	0.00	0.06	0.21	306	881	313	10.99	0.00	0.00
78	78	-0.556	-0.859	-0.664	2.000	10598	6442	186	4199	32384	929	-777	N	-881	79.42	77.76	768	0	0.13	Not Reqd	0.00	0.06	0.21	306	966	310	11.59	0.00	0.00
78	79	-0.565	-0.776	-0.645	2.000	10519	5017	186	4199	24634	1095	-859	N	-998	73.46	77.76	818	0	0.13	Not Reqd	0.00	0.06	0.21	307	1012	365	11.43	0.00	0.00
79	79	-0.577	-0.775	-0.652	2.000	10519	4766	203	4555	24615	1092	-1035	N	-970	73.46	77.76	809	0	0.13	Not Reqd	0.00	0.06	0.21	307	1004	364	10.48	0.00	0.00
79	80	-0.582	-0.708	-0.632	2.000	10440	3215	203	4555	15596	1264	-1118	N	-1081	66.53	77.76	848	0	0.13	Not Reqd	0.00	0.06	0.21	307	1040	421	10.16	0.00	0.00
80	80	-0.589	-0.707	-0.636	2.000	10440	3629	214	4826	16168	1263	-1246	N	-1056	66.53	77.76	840	0	0.13	Not Reqd	0.00	0.06	0.21	307	1033	421	9.56	0.00	0.00
80	81	-0.589	-0.656	-0.617	2.000	10361	906	375	4964	4732	1602	-1190	N	-1160	58.69	77.76	874	0	0.13	Not Reqd	0.00	0.06	0.37	553	1285	534	7.02	0.00	0.00
81	81	-0.590	-0.656	-0.617	2.000	10361	-2097	278	5086	1765	1499	-1379	N	-1137	58.69	77.76	867	0	0.13	Not Reqd	0.00	0.06	0.37	553	1278	500	9.40	0.00	0.00
81	82	-0.583	-0.618	-0.597	2.000	10440	-888	401	5432	-7079	1806	-1116	N	-1256	61.82	77.76	907	0	0.13	Not Reqd	0.00	0.06	0.37	553	1314	602	6.33	0.00	0.00
82	82	-0.577	-0.619	-0.594	2.000	10440	-6713	332	5529	-13101	1736	-1363	N	-1236	61.82	77.76	900	0	0.13	Not Reqd	0.00	0.06	0.37	553	1308	579	7.58	0.00	0.00
82	83	-0.729	-0.683	-0.708	2.000	10203	-3087	427	5929	-21211	2090	-1046	N	-2119	68.27	77.76	1194	0	0.13	Not Reqd	0.00	0.06	0.37	553	1573	697	7.15	0.00	0.00
83	83	-0.720	-0.684	-0.704	2.000	10203	-2928	426	5847	-21400	2089	-1330	N	-2096	68.27	77.76	1187	0	0.13	Not Reqd	0.00	0.06	0.37	553	1566	696	7.13	0.00	0.00
83	84	-0.783	-0.578	-0.689	2.000	10124	-5287	454	6447	-37534	2390	-813	N	-1817	81.49	77.76	1084	0	0.13	Not Reqd	0.00	0.06	0.47	690	1596	797	6.28	0.00	0.00
84	84	-0.774	-0.579	-0.685	2.000	10124	-5320	452	6397	-37974	2391	-785	N	-1796	81.49	77.76	1075	0	0.13	Not Reqd	0.00	0.06	0.47	689	1588	797	6.24	0.00	0.00
84	85	-0.715	-0.629	-0.674	2.000	10046	-7932	481	7040	-56490	2698	-225	N	-996	89.10	80.19	776	224	0.30	Not Reqd	0.00	0.15	0.47	700	1328	899	3.67	0.00	0.00
85	85	-0.709	-0.629	-0.671	2.000	10046	-7969	480	7005	-56808	2699	62	N	-799	89.10	80.19	707	293	0.39	Not Reqd	0.00	0.19	0.47	699	1266	900	3.29	0.00	0.00
85	86	-0.542	-0.837	-0.680	2.000	10046	-10844	509	7693	-77743	3010	666	N	-200	92.64	83.37	490	625	0.81	Not Reqd	0.00	0.41	0.47	718				0.00	0.00
86	86	-0.541	-0.837	-0.680	2.000	10046	-10929	507	7719	-77900	3011	1464	N	-198	92.64	83.37	489	626	0.81	Not Reqd	0.00	0.41	0.47	718				0.00	0.00
86	87	-0.467	-0.929	-0.683	2.000	10046	-11881	537	8276	-85072	3107	1993	N	21	92.65	83.39	418	733	0.95	Not Reqd	0.00	0.48	0.47	714				0.00	0.00
87	87	-0.386	-1.038	-0.690	2.000	10046	-7981	-528	8630	-87804	-3458	8844	Y	0	92.65	83.39	405	875	1.14	0.304	0.00	0.72	0.47	713				25.42	8.69
87	88	-0.476	-0.932	-0.689	2.000	10046	-7089	-520	8514	-79814	-3380	8745	Y	208	92.48	83.23	486	766	1.00	0.301	0.00	0.65	0.47	715				25.14	8.59
88	88	-0.476	-0.932	-0.689	2.000	10046	-7058	-520	8540	-79782	-3380	9032	Y	208	92.48	83.23	486	766	1.00	0.311	0.00	0.65	0.47	715				25.96	8.88
88	89	-0.692	-0.681	-0.687	2.000	10046	-4364	-493	8185	-56311	-3064	8733	Y	792	89.45	80.50	703	432	0.57	0.300	0.00	0.44	0.47	701	1264	1150	1.40	25.10	8.58
89	89	-0.693	-0.681	-0.687	2.000	10046	-4420	-496	8203	-56363	-3066	9064	Y	994	89.45	80.50	772	363	0.48	0.312	0.00	0.40	0.47	702	1327	1156	1.60	26.05	8.91
89	90	-0.815	-0.583	-0.710	2.000	10124	-1896	-469	7844	-35271	-2752	8761	Y	1509	82.62	77.76	974	45	0.13	0.299	0.00	0.21	0.47	688	1496	1047	2.65	25.02	8.55
90	90	-0.815	-0.583	-0.710	2.000	10124	-1980	-472	7854	-35349	-2755	8955	Y	1530	82.62	77.76	981	40	0.13	0.306	0.00	0.22	0.47	688	1502	1051	2.65	25.58	8.74
90	91	-0.795	-0.625	-0.721	2.000	10203	362	-445	7491	-16613	-2447	8647	Y	2268	70.58	77.76	1244	0	0.13	0.293	0.00	0.21	0.37	553	1617	943	3.60	24.54	8.39
91	91	-0.794	-0.626	-0.721	2.000	10203	358	-447	7488	-16611	-2448	8739	Y	2290	70.58	77.76	1251	0	0.13	0.296	0.00	0.21	0.37	553	1624	945	3.62	24.81	8.48
91	92	-0.613	-0.545	-0.586	2.000	10440	2490	-419	7118	-188	-2152	8425	Y	1258	61.90	77.76	907	0	0.13	0.279	0.00	0.20	0.37	553	1314	842	2.93	23.48	8.03
92	92	-0.608	-0.539	-0.581	2.000	10440	2511	-420	7103	-160	-2153	8427	Y	1277	61.90	77.76	914	0	0.13	0.279	0.00	0.20	0.37	553	1320	842	2.95	23.48	8.03
92	93	-0.650	-0.534	-0.603	2.000	10361	4416	-392	6725	14261	-1931	8105	Y	1168	58.59	77.76	863	0	0.13	0.270	0.00	0.20	0.21	306	1052	763	2.26	22.72	7.77
93	93	-0.650	-0.534	-0.603	2.000	10361	4444	-393	6700	14297	-1931	8029	Y	1189	58.59	77.76	871	0	0.13	0.268	0.00	0.20	0.21	306	1059	762	2.29	22.51	7.69
93	94	-0.682	-0.542	-0.628	2.000	10440	6109	-365	6317	27010	-1714	7701	Y	1093	66.44	77.76	819	0	0.13	0.255	0.00	0.19	0.21	304	1011	685	2.52	21.46	7.34
94	94	-0.682	-0.542	-0.628	2.000	10440	6139	-365	6282	27047	-1714	7555	Y	1117	66.44	77.76	827	0	0.13	0.250	0.00	0.19	0.21	304	1019	683	2.56	21.05	7.20
94	95	-0.705	-0.566	-0.654	2.000	10519	7553	-338	5897	38085	-1504	7226	Y	1013	73.38	77.76	777	0	0.13	0.237	0.00	0.18	0.21	303	971	608	2.82	20.01	6.84
95	95	-0.705	-0.565	-0.654	2.000	10519	7580	-338	5855	38118	-1504	7019	Y	1039	73.38	77.76	786	0	0.13	0.231	0.00	0.18	0.21	303	980	605	2.88	19.44	6.65

PROJECT: **Cline Avenue Mainline Seg 4 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 = ***15.00*** 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																									
95	96	-0.720	-0.605	-0.680	2.000	10598	8735	-310	5474	47518	-1299	6695	Y	926	79.25	77.76	735	0	0.13	0.218	0.00	0.17	0.21	301	933	532	3.17	18.43	6.30
96	96	-0.720	-0.605	-0.680	2.000	10598	8762	-310	5442	47550	-1299	6431	Y	644	79.25	77.76	637	0	0.13	0.210	0.00	0.17	0.21	301	844	528	2.72	17.70	6.05
96	97	-0.741	-0.576	-0.684	2.000	10598	9653	-283	5068	55340	-1098	6113	Y	525	84.18	77.76	585	0	0.13	0.199	0.00	0.16	0.21	299	796	456	3.00	16.83	5.75
97	97	-0.741	-0.576	-0.684	2.000	10598	9660	-283	5015	55353	-1097	5811	Y	525	84.18	77.76	585	0	0.13	0.189	0.00	0.16	0.21	299	796	452	3.04	16.00	5.47
97	98	-0.757	-0.556	-0.687	2.000	10598	10282	-256	4650	61539	-896	5502	Y	407	88.09	79.28	545	0	0.13	0.179	0.00	0.15	0.21	304	765	380	3.50	15.15	5.18
98	98	-0.757	-0.555	-0.687	2.000	10598	10173	-257	4594	61435	-897	5166	Y	407	88.09	79.28	546	0	0.13	0.168	0.00	0.15	0.21	304	765	375	3.54	14.22	4.86
98	99	-0.769	-0.542	-0.691	2.000	10598	10537	-230	4238	66029	-696	4866	Y	290	91.00	81.90	517	0	0.13	0.159	0.00	0.14	0.21	314	747	304	4.18	13.40	4.58
99	99	-0.769	-0.542	-0.691	2.000	10598	10071	-235	4182	65567	-701	4508	Y	290	91.00	81.90	517	0	0.13	0.147	0.00	0.14	0.21	314	748	300	4.20	12.41	4.24
99	100	-0.777	-0.536	-0.693	2.000	10598	10208	-209	3837	68601	-501	4219	Y	172	92.92	83.63	485	0	0.13	0.138	0.00	0.13	0.21	320	725	229	4.92	11.61	3.97
100	100	-0.777	-0.536	-0.693	2.000	10598	10076	-205	3782	68469	-497	3845	Y	172	92.92	83.63	485	0	0.13	0.125	0.00	0.13	0.21	320	725	222	5.05	10.59	3.62
100	101	-0.780	-0.538	-0.696	2.000	10598	12717	-29	3627	72674	-146	3746	Y	54	93.86	84.47	447	0	0.13	0.122	0.00	0.13	0.21	323	694	104	10.34	10.31	3.53
101	101	-0.780	-0.538	-0.696	2.000	10598	12656	-28	3561	72612	-145	3368	Y	54	93.86	84.47	447	0	0.13	0.110	0.00	0.12	0.21	323	694	98	10.60	9.27	3.17
101	102	-0.779	-0.545	-0.698	2.000	10598	12814	0	3493	73032	42	3350	Y	-54	93.86	84.47	448	0	0.13	0.109	0.00	0.12	0.21	323	694	64	13.19	9.22	3.15
102	102	-0.779	-0.545	-0.698	2.000	10598	12649	-4	3426	72866	39	2970	N	-54	93.86	84.47	448	0	0.13	Not Reqd	0.00	0.06	0.21	323	694	13	539.18	0.00	0.00
102	103	-0.775	-0.561	-0.701	2.000	10598	12759	229	3705	71983	445	3304	Y	-174	92.92	83.63	481	0	0.13	0.108	0.00	0.12	0.21	320	721	197	5.00	9.10	3.11
103	103	-0.775	-0.561	-0.701	2.000	10598	12779	229	3635	72000	445	2912	N	-174	92.92	83.63	481	0	0.13	Not Reqd	0.00	0.06	0.21	320	721	148	8.51	0.00	0.00
103	104	-0.766	-0.583	-0.703	2.000	10598	12608	253	3998	69503	645	3330	Y	-296	91.00	81.90	514	0	0.13	0.109	0.00	0.12	0.21	313	744	264	4.35	9.17	3.13
104	104	-0.766	-0.583	-0.703	2.000	10598	12630	253	3929	69520	645	2952	N	-296	91.00	81.90	514	0	0.13	Not Reqd	0.00	0.06	0.21	313	744	215	7.27	0.00	0.00
104	105	-0.754	-0.612	-0.705	2.000	10598	12213	279	4301	65443	844	3379	Y	-420	88.09	79.28	544	0	0.13	0.110	0.00	0.12	0.21	304	763	331	3.76	9.30	3.18
105	105	-0.754	-0.612	-0.705	2.000	10598	12236	279	4234	65460	844	3022	N	-420	88.09	79.28	544	0	0.13	Not Reqd	0.00	0.06	0.21	304	763	281	6.18	0.00	0.00
105	106	-0.739	-0.648	-0.707	2.000	10598	11564	305	4615	59794	1045	3459	Y	-547	84.18	77.76	585	0	0.13	0.113	0.00	0.12	0.21	299	795	399	3.33	9.52	3.26
106	106	-0.739	-0.648	-0.707	2.000	10598	11589	305	4552	59812	1045	3133	N	-547	84.18	77.76	585	0	0.13	Not Reqd	0.00	0.06	0.21	299	795	348	5.40	0.00	0.00
106	107	-0.721	-0.689	-0.710	2.000	10598	10657	331	4943	52552	1246	3580	Y	-676	79.33	77.76	640	0	0.13	0.117	0.00	0.12	0.21	300	846	468	3.06	9.86	3.37
107	107	-0.720	-0.689	-0.710	2.000	10598	10683	331	4891	52570	1245	3297	Y	-973	79.33	77.76	743	0	0.13	0.107	0.00	0.12	0.21	300	939	464	3.60	9.08	3.10
107	108	-0.712	-0.651	-0.689	2.000	10519	9488	358	5288	43701	1449	3749	Y	-1103	73.37	77.76	798	0	0.13	0.123	0.00	0.13	0.21	302	989	538	3.28	10.38	3.55
108	108	-0.712	-0.651	-0.689	2.000	10519	9516	358	5236	43721	1449	3511	Y	-1074	73.37	77.76	788	0	0.13	0.115	0.00	0.12	0.21	302	981	535	3.27	9.72	3.32
108	109	-0.699	-0.623	-0.670	2.000	10440	8059	385	5634	33211	1660	3966	Y	-1195	66.43	77.76	843	0	0.13	0.131	0.00	0.13	0.21	303	1032	612	2.98	11.05	3.78
109	109	-0.699	-0.624	-0.670	2.000	10440	8089	385	5590	33232	1660	3785	Y	-1170	66.43	77.76	834	0	0.13	0.125	0.00	0.13	0.21	303	1024	609	2.96	10.55	3.61
109	110	-0.680	-0.607	-0.650	2.000	10361	6368	412	5989	21034	1876	4239	Y	-1284	58.59	77.76	890	0	0.13	0.141	0.00	0.14	0.41	610	1350	688	3.93	11.88	4.06
110	110	-0.680	-0.607	-0.650	2.000	10361	5848	417	5955	20504	1881	4126	Y	-1261	58.59	77.76	883	0	0.13	0.138	0.00	0.13	0.41	610	1344	688	3.89	11.57	3.95
110	111	-0.654	-0.600	-0.633	2.000	10440	3830	444	6353	6540	2103	4580	Y	-1391	46.10	77.76	952	0	0.13	0.152	0.00	0.14	0.41	615	1410	769	3.65	12.76	4.36
111	111	-0.654	-0.600	-0.633	2.000	10440	3357	449	6334	6057	2107	4546	Y	-1370	46.10	77.76	945	0	0.13	0.150	0.00	0.14	0.41	615	1403	770	3.61	12.67	4.33
111	112	-0.893	-0.757	-0.834	2.000	10203	1051	476	6734	-9819	2364	5002	Y	-2702	68.41	77.76	1389	0	0.13	0.169	0.00	0.15	0.41	615	1803	862	4.65	14.20	4.85
112	112	-0.893	-0.757	-0.834	2.000	10203	853	478	6729	-10026	2366	5057	Y	-2676	68.41	77.76	1380	0	0.13	0.171	0.00	0.15	0.41	615	1795	863	4.60	14.35	4.91
112	113	-1.000	-0.602	-0.820	2.000	10124	-1715	505	7134	-27955	2631	5517	Y	-2201	82.35	77.76	1221	0	0.13	0.188	0.00	0.16	0.41	615	1653	959	3.54	15.76	5.39
113	113	-0.999	-0.603	-0.820	2.000	10124	-1799	506	7143	-28048	2632	5670	Y	-2177	82.35	77.76	1214	0	0.13	0.193	0.00	0.16	0.41	615	1646	961	3.50	16.19	5.54
113	114	-0.943	-0.657	-0.810	2.000	10046	-4613	533	7554	-48068	2903	6137	Y	-1134	89.55	80.59	852	224	0.29	0.211	0.00	0.25	0.41	631	1335	1059	1.96	17.64	6.03
114	114	-0.943	-0.656	-0.810	2.000	10046	-5227	537	7581	-48690	2908	6407	Y	-897	89.55	80.59	769	308	0.40	0.220	0.00	0.31	0.41	630	1259	1064	1.67	18.42	6.30
114	115	-0.759	-0.881	-0.815	2.000	10046	-8299	564	7999	-70847	3182	6881	Y	-238	92.78	83.51	525	654	0.84	0.237	0.00	0.54	0.41	644				19.78	6.76
115	115	-0.759	-0.881	-0.815	2.000	10046	-8680	566	8030	-71232	3185	7137	Y	-238	92.78	83.51	524	655	0.84	0.245	0.00	0.54	0.41	644				20.51	7.01
115	116	-0.678	-0.979	-0.818	2.000	10046	-9709	575	8167	-78764	3262	7292	Y	0	93.00	83.70	433	775	1.00	0.251	0.00	0.62	0.41	643				20.96	7.17
116	116	-0.678	-0.979	-0.818	2.000	10046	-5612	-510	7977	-74669	-3042	7752	Y	0	93.00	83.70	441	686	0.88	0.267	0.00	0.57	0.41	644				22.28	7.62
116	117	-0.757	-0.889	-0.818	2.000	10046	-4680	-501	7858	-67615	-2964	7652	Y	221	92.81	83.53	526	572	0.73	0.263	0.00	0.50	0.41	646				21.99	7.52
117	117	-0.757	-0.889	-0.818	2.000	10046	-4653	-501	7875	-67589	-2964	7895	Y	221	92.81	83.53	526	572	0.73	0.271	0.00	0.50	0.41	646				22.69	7.76
117	118	-0.922	-0.699	-0.818	2.000	10046	-1880	-473	7509	-46922	-2688	7584	Y	1060	89.38	80.44	829	166	0.22	0.261	0.00	0.24	0.41	631	1314	1008	2.14	21.80	7.45
118	118	-0.923	-0.699	-0.819	2.000	10046	-1842	-473	7518	-46884	-2688	7845	Y	1299	89.38	80.44	912	83	0.13	0.270	0.00	0.20	0.41	631	1389	1012	2.40	22.55	7.71
118	119	-0.915	-0.725	-0.829	2.000	10124	683	-445	7148	-28345	-2416	7531	Y	2459	80.57	77.76	1308	0	0.13	0.257	0.00	0.19	0.41	615	1730	917	4.20	21.51	7.35
119	119	-0.915	-0.724	-0.829	2.000	10124	715	-445	7144	-28310	-2416	7685	Y	2483	80.57	77.76	1316	0	0.13	0.262	0.00	0.20	0.41	615	1737	919	4.22	21.95	7.50
119	120	-0.744	-0.964	-0.840	2.000	10203	2976	-416	6768	-11882	-2149	7365	Y	3044	64.59	77.76	1503	0	0.13	0.249	0.00	0.19	0.21	307	1629	825	4.37	20.90	7.15
120	120	-0.744	-0.964	-0.840	2.000	10203	3002	-416	6752	-11853	-2149	7430	Y	3070	64.59	77.76	1511	0	0.13	0.252	0.00	0.19	0.21	307	1637	826	4.40	21.09	7.21
120	121	-0.398	-0.788	-0.550	2.000	10440	4986	-388	6368	2508	-1890	7101	Y	1282	53.27	77.76	901	0	0.13	0.235	0.00	0.18	0.21	306	1086	735	2.57	19.79	6.76
121	121	-0.398	-0.788	-0.550	2.000	10440	5000	-388	6340	2527	-1890	7087	Y	1300	53.27	77.76	907	0	0.13	0.235	0.00	0.18	0.21	306	1092	735	2.60	19.75	6.75
121	122	-0.404	-0.840	-0.581	2.000	10361	6697	-359	5947	14977	-1666	6750	Y	1173	66.63	77.76	835	0	0.13	0.225	0.00	0.18	0.21	303	1024	655	2.78	18.92	6.47
122	122	-0.404	-0.840	-0.581	2.000	10361	6684	-359	5910	14968	-1667	6668	Y	1193	66.63	77.76	842	0	0.13	0.222	0.00	0.18	0.21	303	1031	654	2.82	18.69	6.39
122	123	-0.407	-0.902	-0.599	2.000	10440	8085	-330	5511	25653	-1449	6324	Y	1026	74.89	77.76	771	0	0.13	0.209	0.00	0.17	0.21	302	965	576	3.03	17.62	6.02
123	123	-0.407	-0.903	-0.599	2.000	10440	7968	-331	5467	25540	-1450	6184	Y	1048	74.89	77.76	779	0	0.13	0.205	0.00	0.17	0.21	302	973	575	3.08	17.23	5.89
123	124	-0.409	-0.976	-0.618	2.000	10519	9070	-302	5066	34502	-1237	5839	Y	898	81.60	77.76	717	0	0.13	0.192	0.00	0.16	0.21	300	916	499	3.37	16.17	5.53
124	124	-0.409	-0.976	-0.618	2.000	10519	8689	-306	5017	34125	-1241	5652	Y	923	81.60	77.76	726	0	0.13	0.186	0.00	0.16	0.21	300	924	497	3.42	15.65	5.35
124	125	-0.405	-1.075	-0.637	2.000	10598	9503	-277	4621	41419	-1035	5311	Y	826	87.08	78.37	689	0	0.13	0.173	0.00	0.15	0.21	302	892	423	3.92	14.62	5.00
125	125	-0.411	-0.968	-0.603	2.000	10598	9351	-279	4574	41270	-1037	5097	Y	494	87.08	78.37	575	0	0.13	0.166	0.00	0.15	0.21	301	788	421	3.29	14.03	4.80
125	126	-0.430	-0.926	-0.602	2.000	10598	9851	-250	4185	46906	-834	4764	Y	395	91.08	81.97	555	0	0.13	0.155	0.00	0.14	0.21	315	783	348	3.99	13.12	4.48
126	126	-0.430	-0.926	-0.602	2.000	10598	9673	-252	4132	46730	-836	4509	Y	395	91.08	81.97	555	0	0.13	0.147	0.00	0.14	0.21	315	783	345	4.02	12.41	4.24
126	127	-0.445	-0.897	-0.602	2.000	10598	9859	-223	3754	50717	-633	4186	Y	240	93.93	84.53	513	0	0.13	0.136	0.00	0.13	0.21	324	753	273	4.70	11.53	3.94

PROJECT: **Cline Avenue Mainline Seg 4 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 = ***15.00*** 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 + Maximum LL Torsion @ t=00																											
127	127	-0.445	-0.897	-0.602	2.000	10598	9875	-223	3700	50735	-633	3910	Y	240	93.93	84.53	513	0	0.13	0.127	0.00	0.13	0.21	324	753	269	4.75	10.76	3.68
127	128	-0.462	-0.863	-0.601	2.000	10598	9729	-195	3334	53056	-430	3600	Y	71	95.27	85.74	461	0	0.13	0.117	0.00	0.12	0.21	328	710	197	5.50	9.91	3.39
128	128	-0.462	-0.863	-0.601	2.000	10598	9746	-195	3280	53074	-430	3310	Y	71	95.27	85.74	461	0	0.13	0.108	0.00	0.12	0.21	328	710	192	5.57	9.11	3.12
128	129	-0.477	-0.827	-0.598	2.000	10598	9869	157	3305	54330	96	3391	Y	-53	95.32	85.79	457	0	0.13	0.111	0.00	0.12	0.21	329	707	82	7.18	9.33	3.19
129	129	-0.477	-0.827	-0.598	2.000	10598	9881	157	3269	54343	96	3191	Y	-53	95.32	85.79	457	0	0.13	0.104	0.00	0.12	0.21	329	707	79	7.24	8.78	3.00
129	130	-0.482	-0.816	-0.597	2.000	10598	10018	166	3398	54560	167	3339	Y	-118	95.06	85.55	476	0	0.13	0.109	0.00	0.12	0.21	328	724	105	6.86	9.19	3.14
130	130	-0.482	-0.816	-0.597	2.000	10598	10030	166	3361	54572	167	3138	N	-118	95.06	85.55	476	0	0.13	Not Reqd	0.00	0.06	0.21	328	724	56	13.07	0.00	0.00
130	131	-0.496	-0.786	-0.596	2.000	10598	10183	193	3728	54055	368	3561	Y	-289	93.23	83.91	524	0	0.13	0.116	0.00	0.12	0.21	321	761	175	5.90	9.80	3.35
131	131	-0.495	-0.786	-0.596	2.000	10598	10203	193	3672	54073	368	3266	Y	-289	93.23	83.91	524	0	0.13	0.106	0.00	0.12	0.21	321	761	171	5.97	8.99	3.07
131	132	-0.509	-0.763	-0.597	2.000	10598	10012	221	4049	51877	570	3699	Y	-441	89.95	80.95	559	0	0.13	0.121	0.00	0.13	0.21	310	782	245	5.03	10.18	3.48
132	132	-0.509	-0.763	-0.597	2.000	10598	10034	221	3995	51897	570	3417	Y	-441	89.95	80.95	559	0	0.13	0.111	0.00	0.12	0.21	310	782	241	5.08	9.41	3.22
132	133	-0.521	-0.746	-0.599	2.000	10598	9469	251	4384	47993	774	3862	Y	-584	85.33	77.76	593	0	0.13	0.126	0.00	0.13	0.21	298	802	315	4.28	10.63	3.63
133	133	-0.521	-0.746	-0.599	2.000	10598	9493	251	4333	48014	774	3600	Y	-584	85.33	77.76	593	0	0.13	0.117	0.00	0.12	0.21	298	802	311	4.32	9.91	3.39
133	134	-0.531	-0.735	-0.601	2.000	10598	8517	282	4735	42364	980	4059	Y	-721	79.41	77.76	648	0	0.13	0.132	0.00	0.13	0.37	538	1068	387	5.15	11.17	3.82
134	134	-0.531	-0.735	-0.601	2.000	10598	8542	282	4689	42386	980	3828	Y	-721	79.41	77.76	648	0	0.13	0.125	0.00	0.13	0.37	538	1068	383	5.19	10.54	3.60
134	135	-0.541	-0.724	-0.604	2.000	10598	7122	314	5107	34959	1187	4302	Y	-869	72.26	77.76	710	0	0.13	0.140	0.00	0.13	0.37	541	1126	459	4.70	11.84	4.05
135	135	-0.540	-0.724	-0.604	2.000	10598	7149	314	5068	34981	1186	4117	Y	-1130	72.26	77.76	800	0	0.13	0.134	0.00	0.13	0.37	542	1208	456	5.18	11.34	3.88
135	136	-0.564	-0.627	-0.587	2.000	10519	5253	348	5497	25733	1397	4603	Y	-1293	63.51	77.76	868	0	0.13	0.151	0.00	0.14	0.37	544	1271	534	4.74	12.75	4.36
136	136	-0.564	-0.628	-0.588	2.000	10519	5283	348	5469	25758	1397	4462	Y	-1268	63.51	77.76	859	0	0.13	0.147	0.00	0.14	0.37	544	1263	532	4.72	12.36	4.23
136	137	-0.586	-0.542	-0.569	2.000	10440	2883	383	5908	14626	1616	4957	Y	-1403	53.21	77.76	921	0	0.13	0.164	0.00	0.15	0.37	547	1321	612	4.30	13.81	4.72
137	137	-0.586	-0.542	-0.569	2.000	10440	2915	383	5892	14653	1616	4877	Y	-1381	53.21	77.76	913	0	0.13	0.161	0.00	0.15	0.37	547	1314	611	4.28	13.59	4.65
137	138	-0.575	-0.513	-0.550	2.000	10361	-18	419	6339	-16	2254	5380	Y	-1426	66.01	77.76	594	241	0.48	0.179	0.00	0.33	0.37	374				15.08	5.16
																											1.40		

PROJECT: **Cline Avenue Mainline Seg 4 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 = ***15.00*** 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	-0.633	-0.779	-0.690	2.000	6252	243	-285	-3061	-133	-1655	-65	N	937	79.10	98.42	427	186	0.34	Not Reqd	0.00	0.17	0.37	406				0.00	0.00
1	2	-0.680	-0.775	-0.715	2.000	6067	2087	-214	-2991	10940	-1235	-49	N	925	64.75	95.13	905	0	0.13	Not Reqd	0.00	0.06	0.37	677	1424	412	15.17	0.00	0.00
2	2	-0.677	-0.775	-0.714	2.000	6067	2149	-202	-2890	10956	-1228	-694	N	914	64.75	95.13	902	0	0.13	Not Reqd	0.00	0.06	0.37	677	1421	409	16.03	0.00	0.00
2	3	-0.697	-0.809	-0.738	2.000	5876	3706	-202	-2890	19990	-1115	-748	N	873	72.90	92.12	869	0	0.13	Not Reqd	0.00	0.06	0.21	364	1110	372	11.97	0.00	0.00
3	3	-0.694	-0.810	-0.737	2.000	5876	3625	-183	-2680	19864	-1102	-601	N	948	72.90	92.12	894	0	0.13	Not Reqd	0.00	0.06	0.21	364	1132	367	13.53	0.00	0.00
3	4	-0.700	-0.874	-0.759	2.000	5756	4748	-183	-2680	26356	-1016	-644	N	896	76.35	89.42	860	0	0.13	Not Reqd	0.00	0.06	0.21	353	1092	339	13.34	0.00	0.00
4	4	-0.700	-0.874	-0.759	2.000	5756	4675	-169	-2548	26278	-1007	-424	N	630	76.35	89.42	771	0	0.13	Not Reqd	0.00	0.06	0.21	353	1012	336	12.99	0.00	0.00
4	5	-0.723	-0.843	-0.763	2.000	5587	5711	-169	-2548	32185	-923	-467	N	574	80.63	86.94	733	0	0.13	Not Reqd	0.00	0.06	0.21	343	969	308	12.72	0.00	0.00
5	5	-0.721	-0.844	-0.762	2.000	5587	5070	-203	-2478	31517	-959	-311	N	533	80.63	86.94	720	0	0.13	Not Reqd	0.00	0.06	0.21	343	957	320	10.43	0.00	0.00
5	6	-0.755	-0.793	-0.768	2.000	5440	6680	-153	-2372	38547	-803	-259	N	464	85.29	84.78	658	0	0.13	Not Reqd	0.00	0.06	0.21	332	891	268	13.24	0.00	0.00
6	6	-0.752	-0.794	-0.766	2.000	5440	6042	-188	-2366	37861	-841	-262	N	449	85.29	84.78	654	0	0.13	Not Reqd	0.00	0.06	0.21	333	888	280	10.70	0.00	0.00
6	7	-0.786	-0.745	-0.772	2.000	5313	7408	-134	-2154	43858	-682	-104	N	384	89.15	82.94	601	0	0.13	Not Reqd	0.00	0.06	0.21	323	832	227	14.55	0.00	0.00
7	7	-0.783	-0.747	-0.771	2.000	5313	7183	-200	-2288	43585	-752	-338	N	372	89.15	82.94	595	0	0.13	Not Reqd	0.00	0.06	0.21	323	827	251	9.62	0.00	0.00
7	8	-0.814	-0.702	-0.777	2.000	5206	7681	-69	-2004	47925	-516	-108	N	308	92.23	83.01	565	0	0.13	Not Reqd	0.00	0.06	0.21	322	799	172	28.06	0.00	0.00
8	8	-0.811	-0.703	-0.775	2.000	5206	7753	-188	-2231	47950	-636	-508	N	296	92.23	83.01	558	0	0.13	Not Reqd	0.00	0.06	0.21	322	792	212	10.26	0.00	0.00
8	9	-0.839	-0.664	-0.781	2.000	5116	8687	-46	-1959	51938	-390	-290	N	232	94.55	85.10	544	0	0.13	Not Reqd	0.00	0.06	0.21	330	786	130	44.05	0.00	0.00
9	9	-0.836	-0.666	-0.780	2.000	5116	8190	-175	-2186	51399	-521	-728	N	218	94.55	85.10	538	0	0.13	Not Reqd	0.00	0.06	0.21	330	780	174	11.38	0.00	0.00
9	10	-0.861	-0.633	-0.786	2.000	5049	9768	-19	-1939	55241	-261	-535	N	155	96.14	86.52	520	0	0.13	Not Reqd	0.00	0.06	0.21	335	769	87	106.97	0.00	0.00
10	10	-0.858	-0.634	-0.784	2.000	5049	10887	-64	-2188	56322	-307	-1122	N	145	96.14	86.52	512	0	0.13	Not Reqd	0.00	0.06	0.21	334	761	102	32.04	0.00	0.00
10	11	-0.876	-0.609	-0.788	2.000	5000	10164	4	-2000	57075	-135	-988	N	80	97.00	87.30	496	0	0.13	Not Reqd	0.00	0.06	0.21	337	750	45	486.25	0.00	0.00
11	11	-0.873	-0.610	-0.787	2.000	5000	11103	-45	-2196	57974	-186	-1383	N	66	97.00	87.30	487	0	0.13	Not Reqd	0.00	0.06	0.21	337	742	62	46.35	0.00	0.00
11	12	-0.889	-0.591	-0.791	2.000	5000	10016	24	-2049	57573	-13	-1290	N	-11	97.26	87.53	474	0	0.13	Not Reqd	0.00	0.06	0.21	338	731	4	92.20	0.00	0.00
12	12	-0.886	-0.592	-0.789	2.000	5000	9167	44	-2305	56686	6	-1809	Y	-25	97.26	87.53	481	0	0.13	0.125	0.00	0.13	0.21	338	737	59	8.75	-6.08	-2.08
12	13	-0.897	-0.579	-0.793	2.000	4960	8758	76	-2159	56169	143	-1718	Y	-79	96.31	86.68	493	0	0.13	0.120	0.00	0.12	0.21	335	745	102	7.87	-5.80	-1.98
13	13	-0.896	-0.579	-0.793	2.000	4960	9549	73	-2369	56949	139	-2087	Y	-85	96.31	86.68	493	0	0.13	0.145	0.00	0.14	0.21	335	745	112	7.38	-7.05	-2.41
13	14	-0.898	-0.578	-0.793	2.000	4960	9432	82	-2333	56682	173	-2066	Y	-100	96.03	86.43	497	0	0.13	0.144	0.00	0.14	0.21	334	747	123	7.19	-6.97	-2.38
14	14	-0.897	-0.578	-0.793	2.000	4960	9387	61	-2575	56626	152	-2468	Y	-100	96.03	86.43	497	0	0.13	0.172	0.00	0.15	0.21	334	748	129	7.10	-8.33	-2.85
14	15	-0.900	-0.580	-0.796	2.000	4960	8897	94	-2444	55027	290	-2392	Y	-167	94.46	85.01	512	0	0.13	0.167	0.00	0.15	0.21	328	756	172	6.38	-8.07	-2.76
15	15	-0.898	-0.580	-0.794	2.000	4960	10452	82	-2804	56555	278	-2990	Y	-167	94.46	85.01	508	0	0.13	0.208	0.00	0.17	0.21	328	752	187	5.88	-10.09	-3.45
15	16	-0.897	-0.590	-0.797	2.000	4960	9775	115	-2683	53963	416	-2925	Y	-240	92.08	82.87	523	0	0.13	0.204	0.00	0.17	0.21	320	758	231	5.29	-9.87	-3.37
16	16	-0.895	-0.590	-0.796	2.000	4960	10693	94	-3035	54861	396	-3485	Y	-240	92.08	82.87	520	0	0.13	0.243	0.00	0.19	0.21	320	756	242	5.04	-11.76	-4.02
16	17	-0.889	-0.610	-0.798	2.000	4960	9906	127	-2923	51343	534	-3428	Y	-311	88.90	80.01	532	0	0.13	0.239	0.00	0.18	0.21	309	757	286	4.50	-11.57	-3.96
17	17	-0.887	-0.610	-0.797	2.000	4960	10715	108	-3267	52140	518	-3946	Y	-311	88.90	80.01	530	0	0.13	0.275	0.00	0.20	0.21	309	755	297	4.29	-13.32	-4.55
17	18	-0.876	-0.639	-0.799	2.000	4960	9808	140	-3164	47674	655	-3897	Y	-379	84.95	77.76	548	0	0.13	0.271	0.00	0.20	0.21	301	764	341	3.88	-13.15	-4.50
18	18	-0.876	-0.639	-0.799	2.000	4960	10093	113	-3497	47958	632	-4360	Y	-379	84.95	77.76	548	0	0.13	0.304	0.00	0.22	0.21	301	764	348	3.80	-14.72	-5.03
18	19	-0.859	-0.680	-0.801	2.000	4960	9144	145	-3403	42607	769	-4321	Y	-447	80.26	77.76	585	0	0.13	0.301	0.00	0.22	0.21	302	799	393	3.61	-14.58	-4.99
19	19	-0.859	-0.680	-0.801	2.000	4960	10197	135	-3719	43669	765	-4720	Y	-447	80.26	77.76	582	0	0.13	0.329	0.00	0.23	0.21	302	795	404	3.41	-15.93	-5.45
19	20	-0.836	-0.733	-0.802	2.000	4960	8616	162	-3633	36830	897	-4689	Y	-514	74.89	77.76	625	0	0.13	0.327	0.00	0.23	0.21	304	836	447	3.31	-15.83	-5.41
20	20	-0.836	-0.732	-0.803	2.000	4960	9347	159	-3912	37580	904	-4978	Y	-684	74.89	77.76	683	0	0.13	0.347	0.00	0.24	0.21	304	889	459	3.44	-16.80	-5.74
20	21	-0.819	-0.722	-0.786	2.000	4923	7642	185	-3835	29719	1037	-4956	Y	-753	68.70	77.76	728	0	0.13	0.348	0.00	0.24	0.21	306	931	502	3.35	-16.81	-5.75
21	21	-0.821	-0.721	-0.787	2.000	4923	8297	184	-4063	30414	1046	-5125	Y	-740	68.70	77.76	720	0	0.13	0.360	0.00	0.24	0.21	306	924	511	3.18	-17.38	-5.94
21	22	-0.798	-0.720	-0.770	2.000	4886	5146	286	-4018	20194	1258	-5135	Y	-812	61.76	77.76	759	0	0.13	0.363	0.00	0.25	0.21	307	960	582	2.70	-17.50	-5.98
22	22	-0.801	-0.719	-0.771	2.000	4886	6358	196	-4167	21464	1180	-5145	Y	-800	61.76	77.76	755	0	0.13	0.364	0.00	0.25	0.21	307	956	556	3.03	-17.54	-6.00
22	23	-0.770	-0.727	-0.754	2.000	4849	3475	299	-4219	10561	1397	-5251	Y	-877	54.03	77.76	780	0	0.13	0.374	0.00	0.25	0.37	553	1200	631	3.44	-17.99	-6.15
23	23	-0.774	-0.726	-0.756	2.000	4849	3862	309	-4228	11024	1421	-5038	Y	-865	54.03	77.76	776	0	0.13	0.359	0.00	0.24	0.37	553	1197	633	3.38	-17.26	-5.90
23	24	-0.737	-0.744	-0.739	2.000	4812	2044	333	-4367	194	1561	-5231	Y	-942	45.47	77.76	802	0	0.13	0.376	0.00	0.25	0.37	553	1220	686	3.15	-18.01	-6.16
24	24	-0.741	-0.742	-0.742	2.000	4812	1980	328	-4323	221	1573	-4899	Y	-935	45.47	77.76	799	0	0.13	0.352	0.00	0.24	0.37	553	1218	679	3.19	-16.87	-5.77
24	25	-0.939	-0.858	-0.907	2.000	4775	-1	352	-4453	-11881	1735	-5084	Y	-1637	73.37	77.76	1034	0	0.13	0.368	0.00	0.25	0.37	553	1428	739	3.67	-17.59	-6.01
25	25	-0.943	-0.856	-0.909	2.000	4775	268	365	-4378	-11525	1768	-4609	Y	-1625	73.37	77.76	1029	0	0.13	0.333	0.00	0.23	0.37	553	1424	735	3.65	-15.95	-5.45
25	26	-0.976	-0.806	-0.907	2.000	4738	-1988	390	-4501	-25137	1935	-4788	Y	-1050	84.36	77.76	838	0	0.13	0.349	0.00	0.24	0.37	553	1252	796	2.68	-16.65	-5.69
26	26	-0.980	-0.805	-0.909	2.000	4738	-2113	386	-4388	-25178	1955	-4178	Y	-1038	84.36	77.76	834	0	0.13	0.305	0.00	0.22	0.37	553	1249	783	2.74	-14.53	-4.97
26	27	-0.853	-0.953	-0.895	2.000	4701	-4955	403	-4513	-40661	2117	-4357	Y	-645	90.16	81.14	724	60	0.13	0.320	0.00	0.22	0.37	577	1171	843	2.18	-15.23	-5.21
27	27	-0.855	-0.951	-0.895	2.000	4701	-4956	408	-4383	-40590	2147	-3657	Y	-505	90.16	81.14	678	118	0.15	0.269	0.00	0.21	0.37	577	1129	831	2.09	-12.79	-4.37
27	28	-0.628	-1.290	-0.904	2.000	4701	-7637	433	-4508	-57235	2320	-3837	Y	-122	92.83	83.55	513	346	0.44	0.282	0.00	0.36	0.37	586				-13.42	-4.59
28	28	-0.629	-1.289	-0.904	2.000	4701	-7625	438	-4431	-57182	2342	-3359	Y	-123	92.83	83.55	513	355	0.45	0.247	0.00	0.35	0.37	585				-11.74	-4.01
28	29	-0.536	-1.428	-0.907	2.000	4701	-8549	442	-4474	-62855	2387	-3419	Y	4	93.00	83.70	457	427	0.54	0.251	0.00	0.40	0.37	583				-11.96	-4.09
29	29	-0.536	-1.428	-0.907	2.000	4701	-9273	-488	-5291	-63583	-2241	-7122	Y	3	93.00	83.70	458	372	0.47	0.523	0.00	0.50	0.37	583				-24.90	-8.51
29	30	-0.622	-1.301	-0.905	2.000	4701	-8306	-477	-5126	-58338	-2191	-6974	Y	116	92.85	83.56	511	301	0.38	0.512	0.00	0.45	0.37	586				-24.39	-8.34
30	30	-0.622	-1.301	-0.905	2.000	4701	-7730	-466	-4959	-57785	-2162	-6403	Y	117	92.85	83.56	513	288	0.37	0.470	0.00	0.42	0.37	586				-22.39	-7.65
30	31	-0.834	-0.990	-0.899	2.000	4701	-4976	-434	-4478	-42536	-1983	-5977	Y	435	90.55	81.49	656	78	0.13	0.439	0.00	0.28	0.37	580	1113	850	1.92	-20.90	-7.14
31	31	-0.835	-0.991	-0.899	2.000	4701	-4539	-416	-4395	-42107	-1942	-5327	Y	575	90.55	81.49	703	16	0.13	0.391	0.00	0.26	0.37	580	1155	816	2.22	-18.63	-6.37
31	32	-0.913	-0.887	-0.903	2.000	4738	-2206	-385	-3929	-28586	-1765	-4916	Y	1458	84.68	77.76	974	0	0.13	0.358	0.00	0.24	0.37	553	1375	744	3.50	-17.10	-5.85
32	32	-0.912	-0.888	-0.902	2.000	4738	-2135	-379	-3953	-28537	-1740	-4465	Y	1470	84.68	77.76	978	0	0.13	0.326	0.00	0.23	0.37	553	1378	721	3.62	-15.53	-5.31

PROJECT: **Cline Avenue Mainline Seg 4 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 = ***15.00*** 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 Torsion @ t=00																									
32	33	-0.745	-1.147	-0.903	2.000	4775	-138	-348	-3503	-16610	-1566	-4070	Y	2083	68.68	77.76	1182	0	0.13	0.294	0.00	0.21	0.37	553	1562	650	5.02	-14.08	-4.81
33	33	-0.744	-1.147	-0.903	2.000	4775	-123	-348	-3580	-16619	-1550	-3768	Y	2096	68.68	77.76	1186	0	0.13	0.273	0.00	0.20	0.37	553	1566	636	5.06	-13.04	-4.46
33	34	-0.381	-0.760	-0.525	2.000	4812	1591	-318	-3149	-6181	-1382	-3392	Y	671	58.16	77.76	703	0	0.13	0.244	0.00	0.19	0.37	552	1130	568	3.73	-11.68	-3.99
34	34	-0.376	-0.754	-0.519	2.000	4812	1433	-323	-3270	-6366	-1375	-3221	Y	678	58.16	77.76	705	0	0.13	0.231	0.00	0.18	0.37	552	1131	560	3.71	-11.09	-3.79
34	35	-0.433	-0.715	-0.536	2.000	4849	2576	-282	-2859	2429	-1217	-2866	Y	619	58.59	77.76	694	0	0.13	0.204	0.00	0.17	0.21	307	901	496	3.20	-9.82	-3.36
35	35	-0.432	-0.715	-0.535	2.000	4849	2805	-304	-2995	2624	-1229	-2785	Y	627	58.59	77.76	697	0	0.13	0.198	0.00	0.16	0.21	307	904	498	3.07	-9.54	-3.26
35	36	-0.476	-0.693	-0.552	2.000	4886	3687	-266	-2600	10188	-1076	-2445	Y	574	66.43	77.76	671	0	0.13	0.173	0.00	0.15	0.21	307	880	436	3.60	-8.33	-2.85
36	36	-0.475	-0.693	-0.552	2.000	4886	4049	-281	-2751	10522	-1084	-2469	Y	582	66.43	77.76	673	0	0.13	0.175	0.00	0.15	0.21	307	882	439	3.45	-8.42	-2.88
36	37	-0.509	-0.689	-0.569	2.000	4923	4656	-245	-2368	16882	-936	-2141	Y	525	73.37	77.76	638	0	0.13	0.150	0.00	0.14	0.21	305	849	380	4.00	-7.26	-2.48
37	37	-0.508	-0.689	-0.569	2.000	4923	5718	-252	-2539	17923	-937	-2261	Y	535	73.37	77.76	637	0	0.13	0.159	0.00	0.14	0.21	305	848	384	3.83	-7.67	-2.62
37	38	-0.532	-0.702	-0.586	2.000	4960	6013	-217	-2160	23078	-794	-1937	Y	473	79.25	77.76	605	0	0.13	0.135	0.00	0.13	0.21	304	817	326	4.50	-6.54	-2.24
38	38	-0.532	-0.702	-0.586	2.000	4960	6840	-226	-2376	23891	-798	-2220	Y	352	79.25	77.76	559	0	0.13	0.155	0.00	0.14	0.21	303	776	336	3.92	-7.49	-2.56
38	39	-0.559	-0.653	-0.588	2.000	4960	6337	-194	-2000	27378	-658	-1900	Y	288	84.18	77.76	528	0	0.13	0.132	0.00	0.13	0.21	302	747	279	4.66	-6.41	-2.19
39	39	-0.559	-0.653	-0.589	2.000	4960	8131	-195	-2205	29165	-657	-2165	Y	288	84.18	77.76	522	0	0.13	0.151	0.00	0.14	0.21	301	741	287	4.37	-7.31	-2.50
39	40	-0.579	-0.617	-0.591	2.000	4960	7323	-165	-1835	31497	-519	-1850	Y	224	88.09	79.28	505	0	0.13	0.129	0.00	0.13	0.21	307	731	231	5.43	-6.24	-2.13
40	40	-0.579	-0.617	-0.591	2.000	4960	8060	-178	-2066	32232	-530	-2179	Y	224	88.09	79.28	503	0	0.13	0.152	0.00	0.14	0.21	307	729	245	4.88	-7.36	-2.51
40	41	-0.593	-0.593	-0.593	2.000	4960	7439	38	-1774	33908	-207	-1943	Y	160	91.00	81.90	499	0	0.13	0.135	0.00	0.13	0.21	317	735	130	9.81	-6.56	-2.24
41	41	-0.594	-0.593	-0.593	2.000	4960	8814	49	-2015	35286	-194	-2310	Y	159	91.00	81.90	495	0	0.13	0.161	0.00	0.15	0.21	317	731	138	8.42	-7.80	-2.67
41	42	-0.601	-0.582	-0.595	2.000	4960	8525	78	-1959	36455	-58	-2309	Y	95	92.92	83.63	482	0	0.13	0.161	0.00	0.15	0.21	323	725	92	8.21	-7.79	-2.66
42	42	-0.601	-0.582	-0.595	2.000	4960	9123	63	-2211	37061	-72	-2709	Y	96	92.92	83.63	481	0	0.13	0.189	0.00	0.16	0.21	323	723	110	7.76	-9.15	-3.13
42	43	-0.602	-0.583	-0.596	2.000	4960	8029	95	-2165	36588	68	-2719	Y	31	93.86	84.47	466	0	0.13	0.189	0.00	0.16	0.21	326	713	108	7.05	-9.18	-3.14
43	43	-0.603	-0.583	-0.597	2.000	4960	9956	73	-2397	38526	47	-3103	Y	31	93.86	84.47	461	0	0.13	0.216	0.00	0.17	0.21	326	708	114	6.94	-10.47	-3.58
43	44	-0.598	-0.595	-0.597	2.000	4960	8839	101	-2366	37245	174	-3122	Y	-28	93.86	84.47	461	0	0.13	0.217	0.00	0.17	0.21	326	708	157	6.08	-10.54	-3.60
44	44	-0.600	-0.594	-0.598	2.000	4960	10381	98	-2581	38801	171	-3489	Y	-28	93.86	84.47	456	0	0.13	0.243	0.00	0.19	0.21	325	704	167	5.70	-11.78	-4.03
44	45	-0.588	-0.619	-0.598	2.000	4960	9026	128	-2558	36466	309	-3522	Y	-93	92.92	83.62	478	0	0.13	0.245	0.00	0.19	0.21	323	720	214	5.10	-11.89	-4.06
45	45	-0.590	-0.619	-0.599	2.000	4960	9449	125	-2749	36906	307	-3866	Y	-93	92.92	83.62	476	0	0.13	0.269	0.00	0.20	0.21	323	719	224	4.85	-13.05	-4.46
45	46	-0.573	-0.656	-0.599	2.000	4960	8459	155	-2732	34101	444	-3905	Y	-159	91.00	81.90	493	0	0.13	0.272	0.00	0.20	0.21	316	729	271	4.32	-13.18	-4.51
46	46	-0.574	-0.655	-0.600	2.000	4960	8384	142	-2890	34045	432	-4201	Y	-159	91.00	81.90	494	0	0.13	0.293	0.00	0.21	0.21	316	729	277	4.27	-14.18	-4.85
46	47	-0.551	-0.706	-0.599	2.000	4960	7255	171	-2873	30262	570	-4240	Y	-226	88.10	79.29	509	0	0.13	0.295	0.00	0.21	0.21	307	734	324	3.78	-14.31	-4.89
47	47	-0.552	-0.706	-0.600	2.000	4960	7683	179	-3000	30710	579	-4471	Y	-226	88.10	79.29	507	0	0.13	0.311	0.00	0.22	0.21	307	733	334	3.58	-15.09	-5.16
47	48	-0.523	-0.770	-0.601	2.000	4960	4818	281	-3052	24352	789	-4580	Y	-296	84.19	77.76	537	0	0.13	0.319	0.00	0.22	0.21	303	756	408	2.83	-15.46	-5.28
48	48	-0.525	-0.770	-0.602	2.000	4960	6211	199	-3064	25765	708	-4636	Y	-296	84.19	77.76	535	0	0.13	0.323	0.00	0.23	0.21	302	753	382	3.27	-15.65	-5.35
48	49	-0.490	-0.849	-0.602	2.000	4960	3246	297	-3216	18465	914	-4844	Y	-368	79.31	77.76	580	0	0.13	0.337	0.00	0.23	0.21	305	796	458	2.69	-16.35	-5.59
49	49	-0.492	-0.848	-0.604	2.000	4960	3559	311	-3180	18797	928	-4828	Y	-494	79.31	77.76	623	0	0.13	0.336	0.00	0.23	0.21	305	835	462	2.83	-16.30	-5.57
49	50	-0.463	-0.853	-0.592	2.000	4923	1765	335	-3343	11827	1062	-5046	Y	-551	73.46	77.76	661	0	0.13	0.354	0.00	0.24	0.21	306	871	513	2.64	-17.12	-5.85
50	50	-0.465	-0.853	-0.594	2.000	4923	1825	335	-3269	11908	1063	-4802	Y	-541	73.46	77.76	657	0	0.13	0.337	0.00	0.23	0.21	306	867	506	2.68	-16.29	-5.57
50	51	-0.431	-0.869	-0.583	2.000	4886	-129	358	-3438	3914	1199	-5028	Y	-623	66.64	77.76	695	0	0.13	0.355	0.00	0.24	0.21	307	903	558	2.51	-17.14	-5.86
51	51	-0.433	-0.869	-0.584	2.000	4886	-86	359	-3335	3977	1200	-4578	Y	-614	66.64	77.76	693	0	0.13	0.324	0.00	0.23	0.21	307	900	545	2.58	-15.61	-5.34
51	52	-0.400	-0.893	-0.578	2.000	4849	-2141	381	-3529	-5003	1338	-4827	Y	-700	49.49	77.76	721	0	0.13	0.344	0.00	0.24	0.37	553	1147	598	3.30	-16.54	-5.65
52	52	-0.402	-0.892	-0.579	2.000	4849	-2136	381	-3432	-4981	1339	-4187	Y	-692	49.49	77.76	718	0	0.13	0.298	0.00	0.21	0.37	553	1145	579	3.40	-14.34	-4.90
52	53	-0.366	-0.935	-0.563	2.000	4886	-4223	402	-3679	-14897	1477	-4491	Y	-752	69.67	77.76	707	0	0.13	0.318	0.00	0.22	0.37	548	1130	634	2.98	-15.31	-5.23
53	53	-0.472	-0.441	-0.461	2.000	4886	4785	390	-3086	-2965	1742	-5476	Y	-762	69.67	77.76	742	0	0.13	0.387	0.00	0.26	0.37	553	1166	754	2.81	-18.67	-6.38
53	54	-0.816	-0.705	-0.764	2.000	10203	3353	596	-3325	-15592	2166	-5796	Y	-2410	68.69	77.76	1291	0	0.13	0.196	0.00	0.16	0.37	553	1660	808	4.44	-16.45	-5.62
54	54	-0.812	-0.705	-0.762	2.000	10203	1009	414	-4436	-17898	1984	-6339	Y	-2388	68.69	77.76	1284	0	0.13	0.215	0.00	0.17	0.37	553	1654	755	5.42	-17.99	-6.15
54	55	-0.937	-0.561	-0.757	2.000	10124	440	565	-4869	-31365	2362	-6853	Y	-1724	84.54	77.76	1063	0	0.13	0.234	0.00	0.18	0.47	692	1579	889	3.65	-19.57	-6.69
55	55	-0.941	-0.560	-0.759	2.000	10124	-2254	399	-5354	-33961	2149	-8328	Y	-1704	84.54	77.76	1056	0	0.13	0.284	0.00	0.21	0.47	692	1573	839	4.46	-23.79	-8.13
55	56	-0.863	-0.636	-0.752	2.000	10046	-2669	568	-5519	-48672	2551	-8573	Y	-697	90.42	81.37	715	229	0.30	0.295	0.00	0.30	0.47	718	1290	977	2.16	-24.64	-8.42
56	56	-0.870	-0.634	-0.755	2.000	10046	-5562	404	-5912	-51290	2480	-7041	Y	-511	90.42	81.37	648	271	0.35	0.242	0.00	0.30	0.47	717	1228	931	2.34	-20.24	-6.92
56	57	-0.665	-0.861	-0.761	2.000	10046	-9149	484	-5720	-71686	2797	-6930	Y	-131	92.79	83.51	493	542	0.69	0.238	0.00	0.47	0.47	726				-19.92	-6.81
57	57	-0.674	-0.858	-0.764	2.000	10046	-7680	465	-5147	-69944	2866	-4469	Y	-130	92.79	83.51	495	567	0.73	0.154	0.00	0.44	0.47	727				-12.84	-4.39
57	58	-0.589	-0.953	-0.767	2.000	10046	-7079	630	-5256	-75313	3094	-4603	Y	9	92.98	83.68	444	702	0.90	0.158	0.00	0.53	0.47	725				-13.23	-4.52
58	58	-0.661	-0.857	-0.757	2.000	10046	-7869	-272	-5130	-71088	-2792	-3663	Y	9	92.98	83.68	453	581	0.74	0.126	0.00	0.43	0.47	727				-10.53	-3.60
58	59	-0.751	-0.762	-0.756	2.000	10046	-7201	-272	-5130	-64314	-2728	-3689	Y	199	92.76	83.49	528	482	0.62	0.127	0.00	0.37	0.47	729				-10.60	-3.62
59	59	-0.741	-0.764	-0.752	2.000	10046	-10479	-347	-5567	-67871	-2721	-2527	N	198	92.76	83.49	523	485	0.62	Not Reqd	0.00	0.31	0.47	728				0.00	0.00
59	60	-0.944	-0.549	-0.751	2.000	10046	-4697	-288	-5500	-44764	-2438	-2541	N	731	89.50	80.55	729	174	0.23	Not Reqd	0.00	0.11	0.47	712	1298	813	6.05	0.00	0.00
60	60	-0.927	-0.552	-0.744	2.000	10046	-5289	-297	-5730	-45851	-2354	-985	N	920	89.50	80.55	793	79	0.13	Not Reqd	0.00	0.06	0.47	713	1355	785	6.76	0.00	0.00
60	61	-1.003	-0.500	-0.763	2.000	10124	-3012	-297	-5730	-28673	-2132	-1066	N	1773	82.21	77.76	1079	0	0.13	Not Reqd	0.00	0.06	0.37	553	1469	711	8.65	0.00	0.00
61	61	-0.981	-0.502	-0.753	2.000	10124	-3489	-302	-5862	-29811	-2063	398	N	1794	82.21	77.76	1086	0	0.13	Not Reqd	0.00	0.06	0.37	553	1475	688	8.83	0.00	0.00
61	62	-0.899	-0.628	-0.774	2.000	10203	-1179	-302	-5862	-14838	-1846	317	N	2179	68.33	77.76	1214	0	0.13	Not Reqd	0.00	0.06	0.37	553	1591	615	10.70	0.00	0.00
62	62	-0.862	-0.632	-0.756	2.000	10203	-1688	-296	-5816	-16269	-1856	16	N	2202	68.33	77.76	1222	0	0.13	Not Reqd	0.00	0.06	0.37	553	1598	619	10.94	0.00	0.00
62	63	-0.677	-0.552	-0.626	2.000	10440	576	-296	-5816	-2854	-1647	-65	N	1155	61.89	77.76	873	0	0.13	Not Reqd	0.00	0.06	0.37	553	1284	549	8.46	0.00	0.00
63	63	-0.606	-0.552	-0.584	2.000	10440	-243	-283	-5601	-5377	-1698	-711	N	1174	61.89	77.76	879	0	0.13	Not Reqd	0.00	0.06	0.37	553	1289	566	8.66	0.00	0.00
63	64	-0.631	-0.572	-0.605	2.000	10361	1928	-283	-5601	6944	-1519	-792	N	1075	58.66	77.76	846	0	0.13	Not Reqd	0.00	0.06	0.21	307	1038	506	6.63	0.00	0.00

PROJECT: **Cline Avenue Mainline Seg 4 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 = ***15.00*** 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 Torsion @ t=00																						
64	64	-0.615	-0.573	-0.597	2.000	10361	831	-267	-5261	5547	-1520	-760	N	1095	58.66	77.76	853	0	0.13	Not Reqd	0.00	0.06	0.21	307	1044	507	7.04	0.00	0.00
64	65	-0.631	-0.607	-0.621	2.000	10440	2879	-267	-5261	16532	-1347	-841	N	1008	66.51	77.76	824	0	0.13	Not Reqd	0.00	0.06	0.21	307	1018	449	7.39	0.00	0.00
65	65	-0.622	-0.609	-0.616	2.000	10440	1245	-250	-4856	14697	-1344	-729	N	1031	66.51	77.76	832	0	0.13	Not Reqd	0.00	0.06	0.21	307	1025	448	7.93	0.00	0.00
65	66	-0.628	-0.660	-0.641	2.000	10519	3158	-250	-4856	24350	-1176	-810	N	936	73.45	77.76	800	0	0.13	Not Reqd	0.00	0.06	0.21	307	997	392	8.26	0.00	0.00
66	66	-0.621	-0.662	-0.637	2.000	10519	2271	-228	-4435	23307	-1165	-664	N	962	73.45	77.76	809	0	0.13	Not Reqd	0.00	0.06	0.21	307	1004	388	9.11	0.00	0.00
66	67	-0.619	-0.734	-0.661	2.000	10598	4018	-228	-4435	31611	-1003	-745	N	859	79.32	77.76	766	0	0.13	Not Reqd	0.00	0.06	0.21	307	965	334	9.30	0.00	0.00
67	67	-0.616	-0.734	-0.659	2.000	10598	3972	-125	-4209	31494	-906	-901	N	595	79.32	77.76	675	0	0.13	Not Reqd	0.00	0.06	0.21	306	883	302	14.98	0.00	0.00
67	68	-0.623	-0.724	-0.660	2.000	10598	6773	-83	-4091	39671	-705	-865	N	487	84.25	77.76	620	0	0.13	Not Reqd	0.00	0.06	0.21	305	832	235	22.63	0.00	0.00
68	68	-0.618	-0.726	-0.657	2.000	10598	8867	-139	-4210	41665	-766	-1219	N	487	84.25	77.76	615	0	0.13	Not Reqd	0.00	0.06	0.21	304	827	255	13.31	0.00	0.00
68	69	-0.621	-0.722	-0.658	2.000	10598	8101	-54	-4117	45083	-521	-1206	N	380	88.17	79.35	584	0	0.13	Not Reqd	0.00	0.06	0.21	310	804	174	35.85	0.00	0.00
69	69	-0.617	-0.723	-0.656	2.000	10598	12819	-76	-4272	49705	-549	-1690	N	380	88.17	79.35	573	0	0.13	Not Reqd	0.00	0.06	0.21	309	794	183	25.06	0.00	0.00
69	70	-0.616	-0.726	-0.656	2.000	10598	11424	7	-4177	51322	-306	-1676	N	273	91.08	81.97	554	0	0.13	Not Reqd	0.00	0.06	0.21	319	786	102	294.09	0.00	0.00
70	70	-0.612	-0.727	-0.654	2.000	10598	14415	-35	-4351	54221	-359	-2297	N	273	91.08	81.97	547	0	0.13	Not Reqd	0.00	0.06	0.21	318	779	120	57.94	0.00	0.00
70	71	-0.608	-0.734	-0.654	2.000	10598	12741	50	-4245	54417	-114	-2273	N	165	93.00	83.70	523	0	0.13	Not Reqd	0.00	0.06	0.21	325	764	38	44.74	0.00	0.00
71	71	-0.605	-0.735	-0.652	2.000	10598	14659	-5	-4409	56245	-185	-3000	N	165	93.00	83.70	520	0	0.13	Not Reqd	0.00	0.06	0.21	325	760	62	402.82	0.00	0.00
71	72	-0.598	-0.747	-0.652	2.000	10598	12619	77	-4293	54967	58	-2966	N	58	93.93	84.54	492	0	0.13	Not Reqd	0.00	0.06	0.21	329	739	19	29.07	0.00	0.00
72	72	-0.595	-0.748	-0.650	2.000	10598	15083	23	-4428	57344	-16	-3748	Y	58	93.93	84.54	487	0	0.13	0.122	0.00	0.13	0.21	328	733	61	10.21	-10.32	-3.53
72	73	-0.588	-0.762	-0.650	2.000	10598	14607	85	-4344	56624	194	-3739	Y	-41	93.93	84.53	481	0	0.13	0.122	0.00	0.13	0.21	328	728	120	7.56	-10.29	-3.52
73	73	-0.584	-0.763	-0.649	2.000	10598	14729	52	-4492	56664	136	-4616	Y	-41	93.93	84.53	481	0	0.13	0.150	0.00	0.14	0.21	328	728	114	8.35	-12.71	-4.34
73	74	-0.575	-0.780	-0.649	2.000	10598	14035	117	-4414	54702	363	-4619	Y	-150	93.00	83.70	514	0	0.13	0.151	0.00	0.14	0.21	325	755	189	6.42	-12.72	-4.35
74	74	-0.571	-0.780	-0.646	2.000	10598	13158	79	-3927	53741	297	-3168	N	-206	93.00	83.70	536	0	0.13	Not Reqd	0.00	0.06	0.21	325	775	99	26.68	0.00	0.00
74	75	-0.579	-0.798	-0.658	2.000	10598	8579	258	-3911	46879	636	-3234	Y	-317	90.59	81.53	569	0	0.13	0.105	0.00	0.12	0.21	318	798	260	4.74	-8.90	-3.04
75	75	-0.576	-0.802	-0.657	2.000	10598	13566	95	-5228	51693	440	-8948	Y	-206	90.59	81.53	523	0	0.13	0.292	0.00	0.21	0.21	317	756	279	5.37	-24.63	-8.42
75	76	-0.550	-0.823	-0.648	2.000	10598	9720	262	-5364	44588	768	-9165	Y	-319	88.17	79.35	557	0	0.13	0.299	0.00	0.21	0.21	309	780	391	3.33	-25.23	-8.63
76	76	-0.554	-0.822	-0.650	2.000	10598	10149	254	-5003	45194	729	-8132	Y	-374	88.17	79.35	576	0	0.13	0.265	0.00	0.20	0.21	309	796	363	3.73	-22.39	-7.65
76	77	-0.546	-0.841	-0.652	2.000	10598	9588	279	-5438	40379	916	-8649	Y	-489	84.26	77.76	612	0	0.13	0.282	0.00	0.21	0.21	304	824	433	3.25	-23.81	-8.14
77	77	-0.552	-0.841	-0.656	2.000	10598	9839	271	-5543	40773	878	-9557	Y	-489	84.26	77.76	612	0	0.13	0.312	0.00	0.22	0.21	304	824	434	3.27	-26.31	-8.99
77	78	-0.545	-0.860	-0.658	2.000	10598	9057	295	-5976	34719	1065	-10072	Y	-607	79.42	77.76	664	0	0.13	0.328	0.00	0.23	0.21	305	872	504	2.97	-27.73	-9.48
78	78	-0.556	-0.859	-0.664	2.000	10598	9053	293	-5999	34995	1036	-10975	Y	-881	79.42	77.76	760	0	0.13	0.358	0.00	0.24	0.21	305	959	507	3.42	-30.21	-10.33
78	79	-0.565	-0.776	-0.645	2.000	10519	8144	320	-6426	27762	1228	-11484	Y	-998	73.46	77.76	808	0	0.13	0.377	0.00	0.25	0.21	306	1003	579	3.10	-31.81	-10.87
79	79	-0.577	-0.775	-0.652	2.000	10519	8586	310	-6486	28434	1199	-12077	Y	-970	73.46	77.76	798	0	0.13	0.397	0.00	0.26	0.21	306	994	578	3.08	-33.45	-11.43
79	80	-0.582	-0.708	-0.632	2.000	10440	7306	340	-6896	19687	1401	-12569	Y	-1081	66.53	77.76	847	0	0.13	0.416	0.00	0.27	0.21	307	1039	653	2.79	-35.02	-11.97
80	80	-0.589	-0.707	-0.636	2.000	10440	7453	337	-6908	19992	1386	-12979	Y	-1056	66.53	77.76	838	0	0.13	0.429	0.00	0.28	0.21	307	1031	654	2.76	-36.16	-12.36
80	81	-0.589	-0.656	-0.617	2.000	10361	5957	368	-7299	9783	1595	-13453	Y	-1160	58.69	77.76	874	0	0.13	0.449	0.00	0.29	0.37	553	1285	730	3.41	-37.72	-12.89
81	81	-0.590	-0.656	-0.617	2.000	10361	6050	368	-7262	9912	1588	-13727	Y	-1137	58.69	77.76	867	0	0.13	0.458	0.00	0.29	0.37	553	1278	732	3.38	-38.48	-13.16
81	82	-0.583	-0.618	-0.597	2.000	10440	4298	399	-7626	-1893	1804	-14174	Y	-1256	61.82	77.76	907	0	0.13	0.469	0.00	0.30	0.37	553	1314	811	3.05	-39.49	-13.50
82	82	-0.577	-0.619	-0.594	2.000	10440	4273	399	-7550	-2116	1802	-14442	Y	-1236	61.82	77.76	900	0	0.13	0.478	0.00	0.30	0.37	553	1308	814	3.02	-40.24	-13.76
82	83	-0.729	-0.683	-0.708	2.000	10203	2060	426	-7891	-16064	2089	-14866	Y	-2119	68.27	77.76	1194	0	0.13	0.503	0.00	0.32	0.37	553	1573	916	3.54	-42.19	-14.43
83	83	-0.720	-0.684	-0.704	2.000	10203	1779	425	-7801	-16693	2088	-14978	Y	-2096	68.27	77.76	1187	0	0.13	0.507	0.00	0.32	0.37	553	1566	917	3.52	-42.51	-14.53
83	84	-0.783	-0.578	-0.689	2.000	10124	-857	448	-8129	-33104	2383	-15390	Y	-1817	81.49	77.76	1092	0	0.13	0.525	0.00	0.33	0.47	691	1606	1022	3.17	-43.96	-15.03
84	84	-0.774	-0.579	-0.685	2.000	10124	-802	450	-8045	-33456	2389	-15226	Y	-1796	81.49	77.76	1084	0	0.13	0.520	0.00	0.32	0.47	691	1598	1021	3.14	-43.49	-14.87
84	85	-0.715	-0.629	-0.674	2.000	10046	-3686	473	-8364	-52244	2690	-15629	Y	-996	89.10	80.19	782	214	0.28	0.537	0.00	0.41	0.47	702	1336	1128	1.74	-44.92	-15.36
85	85	-0.709	-0.629	-0.671	2.000	10046	-3665	476	-8276	-52503	2695	-15219	Y	-799	89.10	80.19	714	285	0.38	0.523	0.00	0.45	0.47	701	1273	1123	1.53	-43.74	-14.95
85	86	-0.542	-0.837	-0.680	2.000	10046	-6796	499	-8601	-73695	3000	-15628	Y	-200	92.64	83.37	495	616	0.80	0.537	0.00	0.67	0.47	719				-44.92	-15.36
86	86	-0.541	-0.837	-0.680	2.000	10046	-6825	501	-8599	-73796	3005	-14854	Y	-198	92.64	83.37	494	619	0.80	0.511	0.00	0.66	0.47	719				-42.70	-14.60
86	87	-0.467	-0.929	-0.683	2.000	10046	-7872	509	-8707	-81063	3079	-14989	Y	21	92.65	83.39	423	717	0.93	0.515	0.00	0.72	0.47	716				-43.08	-14.73
87	87	-0.386	-1.038	-0.690	2.000	10046	-8177	-532	-8086	-88000	-3462	-7873	Y	0	92.65	83.39	405	877	1.15	0.271	0.00	0.71	0.47	713				-22.63	-7.74
87	88	-0.476	-0.932	-0.689	2.000	10046	-7270	-524	-7949	-79995	-3385	-7718	Y	208	92.48	83.23	485	768	1.00	0.265	0.00	0.63	0.47	715				-22.18	-7.58
88	88	-0.476	-0.932	-0.689	2.000	10046	-7298	-524	-7923	-80022	-3385	-7430	Y	208	92.48	83.23	485	768	1.00	0.256	0.00	0.63	0.47	715				-21.36	-7.30
88	89	-0.692	-0.681	-0.687	2.000	10046	-4543	-498	-7504	-56490	-3069	-6956	Y	792	89.45	80.50	703	434	0.58	0.239	0.00	0.41	0.47	701	1263	1126	1.50	-19.99	-6.84
89	89	-0.693	-0.681	-0.687	2.000	10046	-4585	-498	-7489	-56528	-3068	-6628	Y	994	89.45	80.50	772	364	0.48	0.228	0.00	0.36	0.47	702	1326	1121	1.74	-19.05	-6.51
89	90	-0.815	-0.583	-0.710	2.000	10124	-2021	-471	-7076	-35395	-2755	-6159	Y	1509	82.62	77.76	974	47	0.13	0.210	0.00	0.17	0.47	688	1495	1009	2.86	-17.59	-6.01
90	90	-0.815	-0.583	-0.710	2.000	10124	-2059	-471	-7066	-35428	-2754	-5965	Y	1530	82.62	77.76	981	40	0.13	0.204	0.00	0.17	0.47	688	1502	1006	2.90	-17.04	-5.82
90	91	-0.795	-0.625	-0.721	2.000	10203	297	-444	-6656	-16678	-2446	-5500	Y	2268	70.58	77.76	1244	0	0.13	0.186	0.00	0.16	0.37	553	1617	897	3.92	-15.61	-5.34
91	91	-0.794	-0.626	-0.721	2.000	10203	261	-444	-6659	-16708	-2446	-5408	Y	2290	70.58	77.76	1251	0	0.13	0.183	0.00	0.16	0.37	553	1624	895	3.96	-15.35	-5.25
91	92	-0.613	-0.545	-0.586	2.000	10440	2395	-417	-6250	-284	-2150	-4943	Y	1258	61.90	77.76	907	0	0.13	0.164	0.00	0.15	0.37	553	1314	790	3.27	-13.77	-4.71
92	92	-0.608	-0.539	-0.581	2.000	10440	2361	-417	-6264	-311	-2150	-4940	Y	1277	61.90	77.76	914	0	0.13	0.163	0.00	0.15	0.37	553	1320	790	3.29	-13.77	-4.71
92	93	-0.650	-0.534	-0.603	2.000	10361	4261	-390	-5855	14107	-1928	-4475	Y	1168	58.59	77.76	864	0	0.13	0.149	0.00	0.14	0.21	306	1053	709	2.59	-12.55	-4.29
93	93	-0.650	-0.534	-0.603	2.000	10361	4229	-390	-5880	14082	-1928	-4551	Y	1189	58.59	77.76	871	0	0.13	0.152	0.00	0.14	0.21	306	1060	710	2.61	-12.76	-4.36
93	94	-0.682	-0.542	-0.628	2.000	10440	5887	-362	-5472	26788	-1711	-4088	Y	1093	66.44	77.76	820	0	0.13	0.135	0.00	0.13	0.21	304	1012	631	2.89	-11.39	-3.89
94	94	-0.682	-0.542	-0.628	2.000	10440	5857	-362	-5505	26765	-1711	-4232	Y	1117	66.44	77.76	828	0	0.13	0.140	0.00	0.13	0.21	304	1019	633	2.91	-11.79	-4.03
94	95	-0.705	-0.566	-0.654	2.000	10519	7264	-335	-5102	37796	-1501	-3773	Y	1013	73.38	77.76	777	0	0.13	0.124	0.00	0.13	0.21	303	972	556	3.22	-10.45	-3.57
95	95	-0.705	-0.565	-0.654	2.000	10519	7236	-335	-5143	37774	-1501	-3978	Y	1039	73.38	77.76	787	0	0.13	0.131	0.00	0.13	0.21	303	980	559	3.25	-11.02	-3.77

PROJECT: **Cline Avenue Mainline Seg 4 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 = ***15.00*** 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	-0.720	-0.605	-0.680	2.000	10598	8385	-308	-4749	47168	-1296	-3528	Y	926	79.25	77.76	736	0	0.13	0.115	0.00	0.12	0.21	301	933	484	3.60	-9.71	-3.32
96	96	-0.720	-0.605	-0.680	2.000	10598	8361	-308	-4782	47149	-1297	-3793	Y	644	79.25	77.76	638	0	0.13	0.124	0.00	0.13	0.21	301	845	488	3.06	-10.44	-3.57
96	97	-0.741	-0.576	-0.684	2.000	10598	9247	-281	-4399	54935	-1095	-3354	Y	525	84.18	77.76	585	0	0.13	0.109	0.00	0.12	0.21	299	796	415	3.41	-9.23	-3.16
97	97	-0.741	-0.576	-0.684	2.000	10598	9223	-281	-4449	54916	-1095	-3653	Y	525	84.18	77.76	585	0	0.13	0.119	0.00	0.12	0.21	299	796	419	3.37	-10.06	-3.44
97	98	-0.757	-0.556	-0.687	2.000	10598	9845	-254	-4077	61103	-894	-3226	Y	407	88.09	79.28	546	0	0.13	0.105	0.00	0.12	0.21	304	766	346	3.89	-8.88	-3.04
98	98	-0.757	-0.555	-0.687	2.000	10598	9823	-254	-4131	61084	-894	-3558	Y	407	88.09	79.28	546	0	0.13	0.116	0.00	0.12	0.21	304	766	351	3.85	-9.80	-3.35
98	99	-0.769	-0.542	-0.691	2.000	10598	10185	-228	-3770	65677	-694	-3142	N	290	91.00	81.90	517	0	0.13	Not Reqd	0.00	0.06	0.21	314	748	231	7.79	0.00	0.00
99	99	-0.769	-0.542	-0.691	2.000	10598	10164	-228	-3825	65659	-694	-3499	Y	290	91.00	81.90	517	0	0.13	0.114	0.00	0.12	0.21	314	748	283	4.51	-9.63	-3.29
99	100	-0.777	-0.536	-0.693	2.000	10598	10270	-203	-3474	68663	-494	-3092	N	172	92.92	83.63	485	0	0.13	Not Reqd	0.00	0.06	0.21	320	725	165	9.29	0.00	0.00
100	100	-0.777	-0.536	-0.693	2.000	10598	10251	-203	-3530	68645	-494	-3466	Y	172	92.92	83.63	485	0	0.13	0.113	0.00	0.12	0.21	320	725	216	5.25	-9.54	-3.26
100	101	-0.780	-0.538	-0.696	2.000	10598	13717	-11	-3229	73674	-128	-3110	N	54	93.86	84.47	446	0	0.13	Not Reqd	0.00	0.06	0.21	323	692	43	184.43	0.00	0.00
101	101	-0.780	-0.538	-0.696	2.000	10598	13780	-11	-3301	73736	-128	-3495	Y	54	93.86	84.47	446	0	0.13	0.114	0.00	0.12	0.21	323	692	94	12.39	-9.62	-3.29
101	102	-0.779	-0.545	-0.698	2.000	10598	11612	183	-3516	71830	225	-3659	Y	-54	93.86	84.47	448	0	0.13	0.119	0.00	0.12	0.21	323	694	129	6.01	-10.07	-3.44
102	102	-0.779	-0.545	-0.698	2.000	10598	11594	183	-3577	71810	225	-4034	Y	-54	93.86	84.47	448	0	0.13	0.131	0.00	0.13	0.21	323	694	135	5.92	-11.11	-3.80
102	103	-0.775	-0.561	-0.701	2.000	10598	11852	207	-3897	71076	424	-4299	Y	-174	92.92	83.63	483	0	0.13	0.140	0.00	0.13	0.21	320	722	205	5.09	-11.83	-4.05
103	103	-0.775	-0.561	-0.701	2.000	10598	11830	207	-3962	71051	424	-4686	Y	-174	92.92	83.63	483	0	0.13	0.153	0.00	0.14	0.21	320	723	210	5.02	-12.90	-4.41
103	104	-0.766	-0.583	-0.703	2.000	10598	11856	232	-4295	68750	623	-4962	Y	-296	91.00	81.90	515	0	0.13	0.162	0.00	0.15	0.21	314	746	281	4.31	-13.66	-4.67
104	104	-0.766	-0.583	-0.703	2.000	10598	11832	232	-4359	68722	623	-5337	Y	-296	91.00	81.90	515	0	0.13	0.174	0.00	0.15	0.21	314	746	286	4.24	-14.69	-5.02
104	105	-0.754	-0.612	-0.705	2.000	10598	11609	257	-4703	64839	823	-5625	Y	-420	88.09	79.28	545	0	0.13	0.183	0.00	0.16	0.21	304	764	357	3.62	-15.49	-5.29
105	105	-0.754	-0.612	-0.705	2.000	10598	11584	257	-4767	64808	823	-5979	Y	-420	88.09	79.28	545	0	0.13	0.195	0.00	0.16	0.21	304	764	363	3.57	-16.46	-5.63
105	106	-0.739	-0.648	-0.707	2.000	10598	11105	283	-5122	59335	1023	-6278	Y	-547	84.18	77.76	586	0	0.13	0.205	0.00	0.17	0.21	299	796	434	3.13	-17.28	-5.91
106	106	-0.739	-0.648	-0.707	2.000	10598	11077	283	-5182	59300	1023	-6601	Y	-547	84.18	77.76	586	0	0.13	0.215	0.00	0.17	0.21	299	796	439	3.09	-18.17	-6.21
106	107	-0.721	-0.689	-0.710	2.000	10598	10336	310	-5547	52231	1224	-6911	Y	-676	79.33	77.76	641	0	0.13	0.225	0.00	0.18	0.21	300	847	510	2.82	-19.03	-6.50
107	107	-0.720	-0.689	-0.710	2.000	10598	10307	310	-5599	52194	1224	-7194	Y	-973	79.33	77.76	744	0	0.13	0.234	0.00	0.18	0.21	301	940	514	3.29	-19.81	-6.77
107	108	-0.712	-0.651	-0.689	2.000	10519	9302	337	-5968	43516	1428	-7507	Y	-1103	73.37	77.76	798	0	0.13	0.247	0.00	0.19	0.21	302	990	587	3.01	-20.79	-7.11
108	108	-0.712	-0.651	-0.689	2.000	10519	9270	337	-6019	43474	1428	-7744	Y	-1074	73.37	77.76	789	0	0.13	0.254	0.00	0.19	0.21	302	981	591	2.94	-21.45	-7.33
108	109	-0.699	-0.623	-0.670	2.000	10440	8000	364	-6387	33152	1639	-8056	Y	-1195	66.43	77.76	843	0	0.13	0.267	0.00	0.20	0.21	303	1032	665	2.70	-22.45	-7.67
109	109	-0.699	-0.624	-0.670	2.000	10440	7965	364	-6431	33108	1639	-8237	Y	-1170	66.43	77.76	835	0	0.13	0.273	0.00	0.20	0.21	303	1024	668	2.65	-22.95	-7.85
109	110	-0.680	-0.607	-0.650	2.000	10361	6432	391	-6795	21098	1855	-8545	Y	-1284	58.59	77.76	890	0	0.13	0.285	0.00	0.21	0.41	610	1350	745	3.62	-23.95	-8.19
110	110	-0.680	-0.607	-0.650	2.000	10361	6395	392	-6830	21051	1855	-8660	Y	-1261	58.59	77.76	882	0	0.13	0.289	0.00	0.21	0.41	610	1343	746	3.58	-24.28	-8.30
110	111	-0.654	-0.600	-0.633	2.000	10440	4600	419	-7188	7310	2078	-8961	Y	-1391	46.10	77.76	952	0	0.13	0.297	0.00	0.21	0.41	615	1410	825	3.38	-24.97	-8.54
111	111	-0.654	-0.600	-0.633	2.000	10440	4561	419	-7213	7261	2078	-9001	Y	-1370	46.10	77.76	945	0	0.13	0.298	0.00	0.21	0.41	615	1403	826	3.35	-25.08	-8.57
111	112	-0.893	-0.757	-0.834	2.000	10203	2510	446	-7566	-8360	2335	-9298	Y	-2702	68.41	77.76	1389	0	0.13	0.315	0.00	0.22	0.41	615	1803	916	4.41	-26.39	-9.02
112	112	-0.893	-0.757	-0.834	2.000	10203	2469	446	-7580	-8411	2335	-9252	Y	-2676	68.41	77.76	1380	0	0.13	0.313	0.00	0.22	0.41	615	1795	915	4.38	-26.26	-8.98
112	113	-1.000	-0.602	-0.820	2.000	10124	169	474	-7929	-26071	2600	-9546	Y	-2201	82.35	77.76	1221	0	0.13	0.326	0.00	0.23	0.41	615	1653	1008	3.34	-27.26	-9.32
113	113	-0.999	-0.603	-0.820	2.000	10124	126	474	-7930	-26122	2600	-9403	Y	-2177	82.35	77.76	1214	0	0.13	0.321	0.00	0.23	0.41	615	1646	1006	3.33	-26.86	-9.18
113	114	-0.943	-0.657	-0.810	2.000	10046	-2410	501	-8277	-45865	2872	-9695	Y	-1134	89.55	80.59	856	208	0.27	0.333	0.00	0.30	0.41	632	1339	1100	1.83	-27.87	-9.53
114	114	-0.943	-0.656	-0.810	2.000	10046	-2457	501	-8265	-45919	2872	-9438	Y	-897	89.55	80.59	774	290	0.38	0.325	0.00	0.35	0.41	632	1265	1097	1.58	-27.13	-9.27
114	115	-0.759	-0.881	-0.815	2.000	10046	-5215	527	-8611	-67763	3146	-9729	Y	-238	92.78	83.51	530	635	0.81	0.335	0.00	0.57	0.41	645				-27.96	-9.56
115	115	-0.759	-0.881	-0.815	2.000	10046	-5246	527	-8592	-67798	3146	-9485	Y	-238	92.78	83.51	530	635	0.81	0.326	0.00	0.57	0.41	645				-27.26	-9.32
115	116	-0.678	-0.979	-0.818	2.000	10046	-6167	536	-8704	-75222	3223	-9579	Y	0	93.00	83.70	438	756	0.97	0.329	0.00	0.65	0.41	644				-27.53	-9.41
116	116	-0.678	-0.979	-0.818	2.000	10046	-10741	-543	-7455	-79797	-3074	-7679	Y	0	93.00	83.70	433	705	0.91	0.264	0.00	0.59	0.41	643				-22.07	-7.55
116	117	-0.757	-0.889	-0.818	2.000	10046	-9722	-534	-7313	-72657	-2996	-7520	Y	221	92.81	83.53	518	591	0.76	0.259	0.00	0.51	0.41	644				-21.61	-7.39
117	117	-0.757	-0.889	-0.818	2.000	10046	-9396	-532	-7279	-72332	-2994	-7259	Y	221	92.81	83.53	519	590	0.76	0.250	0.00	0.50	0.41	644				-20.86	-7.13
117	118	-0.922	-0.699	-0.818	2.000	10046	-6361	-504	-6849	-51404	-2719	-6773	Y	1060	89.38	80.44	821	186	0.24	0.233	0.00	0.24	0.41	629	1306	1006	2.11	-19.47	-6.66
118	118	-0.923	-0.699	-0.819	2.000	10046	-5112	-495	-6815	-50153	-2710	-6488	Y	1299	89.38	80.44	906	97	0.13	0.223	0.00	0.18	0.41	630	1383	999	2.44	-18.65	-6.38
118	119	-0.915	-0.725	-0.829	2.000	10124	-2394	-467	-6392	-31422	-2438	-6009	Y	2459	80.57	77.76	1308	0	0.13	0.205	0.00	0.17	0.41	615	1730	901	4.31	-17.16	-5.87
119	119	-0.915	-0.724	-0.829	2.000	10124	-2304	-466	-6379	-31330	-2437	-5838	Y	2483	80.57	77.76	1316	0	0.13	0.199	0.00	0.16	0.41	615	1737	898	4.36	-16.67	-5.70
119	120	-0.744	-0.964	-0.840	2.000	10203	140	-437	-5961	-14718	-2170	-5364	Y	3044	64.59	77.76	1503	0	0.13	0.182	0.00	0.16	0.21	307	1629	802	4.53	-15.22	-5.20
120	120	-0.744	-0.964	-0.840	2.000	10203	313	-436	-5962	-14542	-2168	-5284	Y	3070	64.59	77.76	1511	0	0.13	0.179	0.00	0.15	0.21	307	1637	801	4.58	-15.00	-5.13
120	121	-0.398	-0.788	-0.550	2.000	10440	2468	-407	-5545	-10	-1910	-4811	Y	1282	54.73	77.76	905	0	0.13	0.159	0.00	0.14	0.21	307	1091	708	2.76	-13.41	-4.58
121	121	-0.398	-0.788	-0.550	2.000	10440	2822	-404	-5559	349	-1907	-4812	Y	1300	53.27	77.76	912	0	0.13	0.159	0.00	0.14	0.21	307	1096	707	2.80	-13.41	-4.58
121	122	-0.404	-0.840	-0.581	2.000	10361	4665	-375	-5142	12945	-1683	-4339	Y	1173	66.63	77.76	839	0	0.13	0.145	0.00	0.14	0.21	304	1028	625	3.01	-12.17	-4.16
122	122	-0.404	-0.840	-0.581	2.000	10361	5815	-365	-5170	14099	-1673	-4413	Y	1193	66.63	77.76	844	0	0.13	0.147	0.00	0.14	0.21	303	1032	623	3.07	-12.37	-4.23
122	123	-0.407	-0.902	-0.599	2.000	10440	7283	-336	-4755	24851	-1455	-3942	Y	1026	74.89	77.76	772	0	0.13	0.130	0.00	0.13	0.21	302	967	543	3.33	-10.98	-3.76
123	123	-0.407	-0.903	-0.599	2.000	10440	7257	-336	-4795	24829	-1454	-4077	Y	1048	74.89	77.76	780	0	0.13	0.135	0.00	0.13	0.21	302	974	545	3.35	-11.36	-3.88
123	124	-0.409	-0.976	-0.618	2.000	10519	8416	-307	-4385	33848	-1242	-3612	Y	898	81.60	77.76	718	0	0.13	0.119	0.00	0.12	0.21	300	917	467	3.69	-10.00	-3.42
124	124	-0.409	-0.976	-0.618	2.000	10519	8392	-307	-4430	33828	-1242	-3796	Y	923	81.60	77.76	727	0	0.13	0.125	0.00	0.13	0.21	300	924	470	3.71	-10.51	-3.59
124	125	-0.405	-1.075	-0.637	2.000	10598	9235	-278	-4030	41151	-1036	-3340	Y	826	87.08	78.37	689	0	0.13	0.109	0.00	0.12	0.21	302	892	395	4.27	-9.19	-3.14
125	125	-0.411	-0.968	-0.603	2.000	10598	9214	-278	-4080	41133	-1036	-3556	Y	494	87.08	78.37	575	0	0.13	0.116	0.00	0.12	0.21	301	789	398	3.56	-9.79	-3.35
125	126	-0.430	-0.926	-0.602	2.000	10598	9735	-249	-3690	46790	-833	-3111	N	395	91.08	81.97	555	0	0.13	Not Reqd	0.00	0.06	0.21	315	783	278	7.09	0.00	0.00
126	126	-0.430	-0.926	-0.602	2.000	10598	9715	-249	-3743	46772	-833	-3366	Y	395	91.08	81.97	555	0	0.13	0.110	0.00	0.12	0.21	315	783	327	4.29	-9.27	-3.17
126	127	-0.445	-0.897	-0.602	2.000	10598	9906	-220	-3365	50764	-630	-2933	N	240	93.93	84.53	513	0	0.13	Not Reqd	0.00	0.06	0.21	324	753	210	8.40	0.00	0.00

PROJECT: **Cline Avenue Mainline Seg 4 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 = ***15.00*** 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 Torsion @ t=00																											
127	127	-0.445	-0.897	-0.602	2.000	10598	9887	-220	-3419	50747	-630	-3209	Y	240	93.93	84.53	513	0	0.13	0.105	0.00	0.12	0.21	324	753	257	5.00	-8.83	-3.02
127	128	-0.462	-0.863	-0.601	2.000	10598	9753	-192	-3052	53080	-427	-2786	N	71	95.27	85.74	461	0	0.13	Not Reqd	0.00	0.06	0.21	328	710	142	9.86	0.00	0.00
128	128	-0.462	-0.863	-0.601	2.000	10598	9736	-192	-3106	53064	-427	-3076	N	71	95.27	85.74	461	0	0.13	Not Reqd	0.00	0.06	0.21	328	710	142	9.86	0.00	0.00
128	129	-0.477	-0.827	-0.598	2.000	10598	10492	162	-3209	54954	101	-3123	N	-53	95.32	85.79	456	0	0.13	Not Reqd	0.00	0.06	0.21	329	706	34	13.48	0.00	0.00
129	129	-0.477	-0.827	-0.598	2.000	10598	10481	162	-3247	54942	101	-3325	Y	-53	95.32	85.79	456	0	0.13	0.108	0.00	0.12	0.21	329	706	83	7.12	-9.15	-3.13
129	130	-0.482	-0.816	-0.597	2.000	10598	10615	171	-3365	55158	171	-3424	Y	-118	95.06	85.55	475	0	0.13	0.112	0.00	0.12	0.21	328	723	108	6.76	-9.43	-3.22
130	130	-0.482	-0.816	-0.597	2.000	10598	10603	171	-3404	55145	171	-3627	Y	-118	95.06	85.55	475	0	0.13	0.118	0.00	0.12	0.21	328	723	111	6.71	-9.98	-3.41
130	131	-0.496	-0.786	-0.596	2.000	10598	10749	198	-3743	54620	373	-3910	Y	-289	93.23	83.91	523	0	0.13	0.127	0.00	0.13	0.21	321	760	182	5.77	-10.76	-3.68
131	131	-0.495	-0.786	-0.596	2.000	10598	10728	198	-3801	54598	373	-4207	Y	-289	93.23	83.91	523	0	0.13	0.137	0.00	0.13	0.21	321	760	186	5.70	-11.58	-3.96
131	132	-0.509	-0.763	-0.597	2.000	10598	10534	226	-4153	52399	575	-4503	Y	-441	89.95	80.95	558	0	0.13	0.147	0.00	0.14	0.21	310	781	258	4.83	-12.40	-4.24
132	132	-0.509	-0.763	-0.597	2.000	10598	10577	228	-4210	52440	577	-4788	Y	-441	89.95	80.95	558	0	0.13	0.156	0.00	0.14	0.21	310	781	263	4.75	-13.18	-4.51
132	133	-0.521	-0.746	-0.599	2.000	10598	9991	257	-4572	48515	781	-5095	Y	-584	85.33	77.76	592	0	0.13	0.166	0.00	0.15	0.21	298	801	336	4.03	-14.03	-4.80
133	133	-0.521	-0.746	-0.599	2.000	10598	10163	263	-4627	48683	786	-5360	Y	-584	85.33	77.76	592	0	0.13	0.175	0.00	0.15	0.21	298	801	341	3.95	-14.75	-5.04
133	134	-0.531	-0.735	-0.601	2.000	10598	9121	294	-4999	42968	992	-5675	Y	-721	79.41	77.76	647	0	0.13	0.185	0.00	0.16	0.37	538	1066	414	4.79	-15.62	-5.34
134	134	-0.531	-0.735	-0.601	2.000	10598	9157	296	-5048	43000	994	-5909	Y	-721	79.41	77.76	647	0	0.13	0.193	0.00	0.16	0.37	538	1066	419	4.74	-16.27	-5.56
134	135	-0.541	-0.724	-0.604	2.000	10598	7649	329	-5427	35486	1201	-6232	Y	-869	72.26	77.76	709	0	0.13	0.203	0.00	0.17	0.37	541	1125	492	4.33	-17.16	-5.87
135	135	-0.540	-0.724	-0.604	2.000	10598	7646	330	-5465	35478	1202	-6415	Y	-1130	72.26	77.76	799	0	0.13	0.209	0.00	0.17	0.37	542	1206	495	4.73	-17.66	-6.04
135	136	-0.564	-0.627	-0.587	2.000	10519	5647	364	-5842	26128	1413	-6736	Y	-1293	63.51	77.76	867	0	0.13	0.221	0.00	0.18	0.37	544	1270	571	4.37	-18.66	-6.38
136	136	-0.564	-0.628	-0.588	2.000	10519	5626	364	-5873	26101	1414	-6879	Y	-1268	63.51	77.76	858	0	0.13	0.226	0.00	0.18	0.37	544	1262	573	4.31	-19.05	-6.51
136	137	-0.586	-0.542	-0.569	2.000	10440	3110	399	-6242	14854	1632	-7192	Y	-1403	53.21	77.76	920	0	0.13	0.238	0.00	0.18	0.37	547	1321	650	3.97	-20.04	-6.85
137	137	-0.586	-0.542	-0.569	2.000	10440	3078	400	-6259	14816	1632	-7274	Y	-1381	53.21	77.76	913	0	0.13	0.241	0.00	0.19	0.37	547	1314	652	3.93	-20.27	-6.93
137	138	-0.575	-0.513	-0.550	2.000	10361	19	436	-6612	22	2271	-7572	Y	-1426	41.99	77.76	561	280	0.67	0.252	0.00	0.46	0.37	311				-21.23	-7.26

1.50