



Ministry of
Transportation
and Infrastructure

British Columbia Smart Infrastructure
Monitoring System (BCSIMS)

Earthquake Report

Magnitude 4.79
19km NNE of Victoria, Canada

Issued on March 5, 2021 12:32:24 (PST)

Revision No: 1

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Acronyms

BCSIMS - British Columbia Smart Infrastructure Monitoring System

MOTI - Ministry of Transportation and Infrastructure

GSC - Geological Survey of Canada

SA - Service Area

PGA - Peak Ground Acceleration

PGV - Peak Ground Velocity

PGD - Peak Ground Displacement

KSI - Katayama Spectral Intensity

1.0 Summary of the Earthquake

An earthquake with a magnitude of 4.79 occurred at 19km NNE of Victoria, Canada on December 30, 2015 07:39:28 (UTC). The figure below shows the shakemap generated for the affected region of 400 km radius around the earthquake epicenter. The Ministry bridges are depicted as a layer on the shakemap. The peak ground accelerations recorded during the earthquake are indicated as triangles on the shakemap. The size of the triangle indicates the recorded acceleration whereas the color of triangles the Spectral Intensity, which may be correlated with structural damage. This report is generated automatically by the BCSIMS network immediately following the earthquake; therefore, please visit BCSIMS website (www.bcsims.ca) for the most updated information about the earthquake.

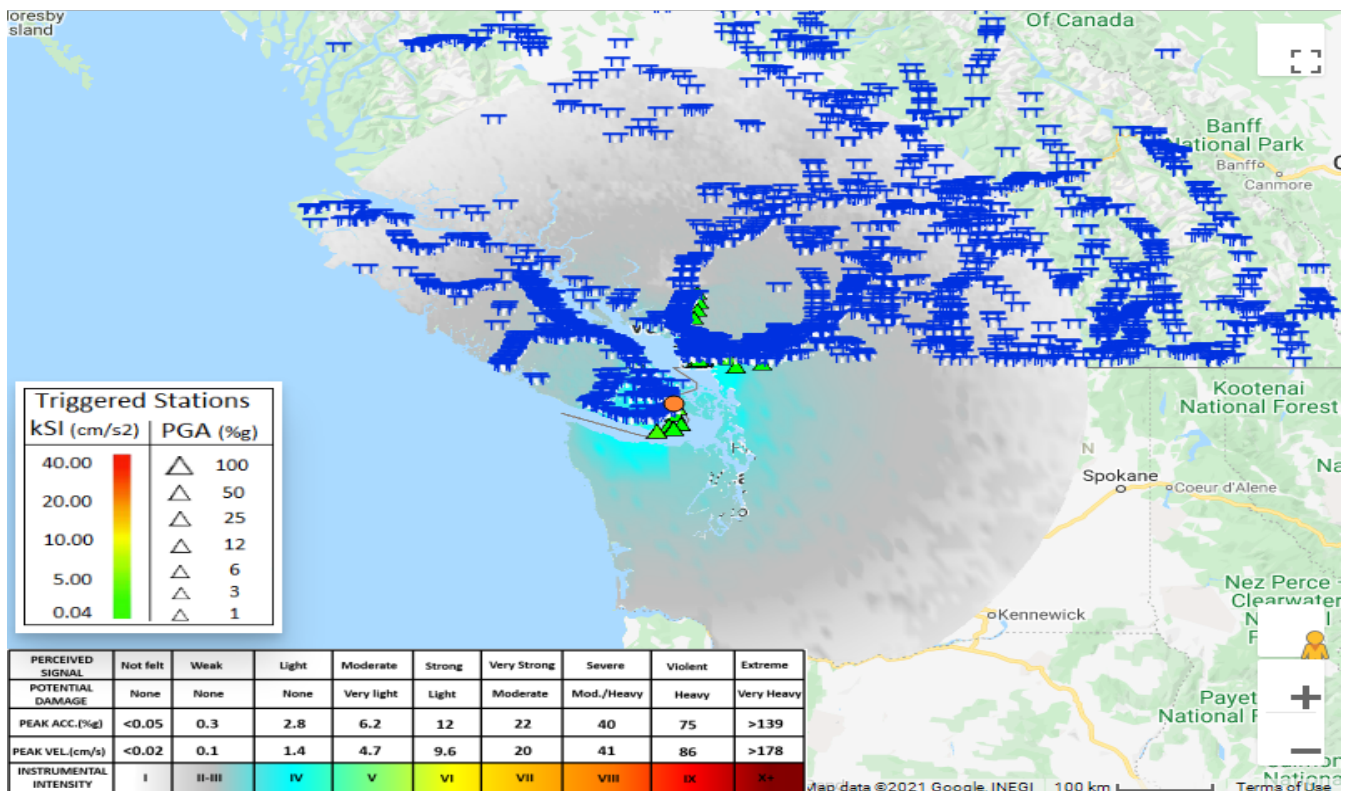


Figure 1: Shakemap with bridge layer

1.1 Meta data of the earthquake

Table1 below shows the earthquake parameters obtained from USGS. Please visit BCSIMS website (www.bcsims.ca) for the most updated information about the earthquake.

Table 1: Earthquake Parameters (USGS)

Magnitude (Mw)	4.79
Epicenter Location	-123.3068 / 48.6038
Event Date &Time (UTC)	2015-Dec-30 07:39:28
Event Date &Time (PST)	2015-Dec-29 23:39:28
Region	19km NNE of Victoria, Canada
Depth (km)	52.5

1.2 Population count of structures

Table2 below shows the population count of the structures in the BCSIMS network with various range of areas around the earthquake epicenter. Additional information for each structure type is provided on the BCSIMS website (www.bcsims.ca).

Table 2: Population count for structures

Structure Type	Population count around the epicenter				
	10km	20km	50km	100km	400km
Bridges	5	45	120	638	1825
Tunnels	0	6	9	32	138
Schools	5	48	101	686	818
Marine	0	0	0	1	1
Sign	0	6	7	158	193
Retaining Wall	0	7	31	289	769

2.0 Structures affected by the earthquake

Table 3-4-5 below shows the list of bridges, tunnels and schools in the earthquake affected area and their distance from the earthquake epicenter. A comparison between the different GSC acceleration hazard levels at different return periods and the acceleration level obtained from the calculated shakemap is presented for each structure. Additional information for each structure is provided in the BCSIMS website (www.bcsims.ca).

2.1 List of Bridges affected by the earthquake

Table 3: MOTI bridges in the earthquake effected area.

No	Bridge ID	Bridge Name	Year Built	Longitude Latitude	SA	Distance (km)	Horizontal Peak Ground Accelerations(g)				
							Shakemap	100 years Hazard	475 years Hazard	1000 years Hazard	2475 years Hazard
1	03150	MT NEWTON PED O/P	1995	-123.3986 48.5934	1	6.847	0.0251	0.1306	0.2974	0.4047	0.5590
2	02454	AMITY DRIVE PED O/P	1971	-123.4040 48.6158	1	7.267	0.0267	0.1298	0.2951	0.4012	0.5537
3	07814	MCTAVISH RD PED O/P	2011	-123.4119 48.6292	1	8.223	0.0290	0.1291	0.2930	0.3981	0.5491
4	02457	MCTAVISH RD U/P	2011	-123.4120 48.6307	1	8.288	0.0291	0.1290	0.2927	0.3976	0.5485
5	02453	WEILER AVE PED O/P	1971	-123.4069 48.6408	1	8.426	0.0290	0.1284	0.2905	0.3943	0.5437
6	03021	MCDON PK RD PED O/P	1997	-123.4164 48.6619	1	10.321	0.0320	0.1269	0.2863	0.3880	0.5345
7	03004	LANDS END U/P	1992	-123.4124 48.6837	1	11.791	0.0329	0.1256	0.2818	0.3810	0.5243
8	02674	WAIN ROAD PED O/P	1986	-123.4260 48.6766	1	11.922	0.0341	0.1260	0.2834	0.3836	0.5280
9	03100	WAIN ROAD U/P	1994	-123.4277 48.6757	1	11.947	0.0345	0.1260	0.2836	0.3839	0.5285
10	02434	ROYAL OAK AVE U/P	1970	-123.3853 48.4990	1	13.009	0.0155	0.1330	0.3048	0.4162	0.5758
11	02435	QUADRA STREET U/P	1972	-123.3848 48.4870	1	14.203	0.0170	0.1330	0.3053	0.4170	0.5771
12	02458	ROGERS AVE PED O/P	1993	-123.3838 48.4749	1	15.416	0.0126	0.1332	0.3057	0.4178	0.5783
13	03001	MCKENZIE AVE O/P	1993	-123.3818 48.4677	1	16.112	0.0135	0.1333	0.3060	0.4182	0.5788
14	02747	CAREY ROAD PED O/P	1983	-123.3918 48.4665	1	16.502	0.0108	0.1331	0.3062	0.4190	0.5800
15	02728	Portage Creek bridge	1983	-123.3951 48.4663	-	16.612	0.0119	0.1331	0.3063	0.4192	0.5804

No	Bridge ID	Bridge Name	Year Built	Longitude Latitude	SA	Distance (km)	Horizontal Peak Ground Accelerations(g)				
							Shakemap	100 years Hazard	475 years Hazard	1000 years Hazard	2475 years Hazard
16	02728	PORTAGE CREEK	1983	-123.3950 48.4663	1	16.614	0.0118	0.1331	0.3063	0.4192	0.5803
17	02734	SWAN CREEK	1983	-123.3950 48.4663	1	16.614	0.0118	0.1331	0.3063	0.4192	0.5803
18	02657	VERNON AVE / GALLOPING GOOSE	1979	-123.3760 48.4585	1	16.944	0.0095	0.1334	0.3062	0.4186	0.5791
19	01521	BAMBERTON O/P	1957	-123.5381 48.6097	1	17.016	0.0323	0.1283	0.2974	0.4066	0.5624
20	01370	DOUGLAS ST O/H	1955	-123.3776 48.4567	1	17.170	0.0090	0.1334	0.3063	0.4188	0.5795
21	03120	SWITCH PED O/P	1996	-123.3772 48.4550	1	17.342	0.0089	0.1335	0.3064	0.4189	0.5796
22	10000	INTERURBAN BRIDGE	0	-123.3947 48.4586	1	17.397	0.0130	0.1331	0.3066	0.4197	0.5811
23	03129	INTERURBAN R PED O/P	1997	-123.3947 48.4586	1	17.397	0.0130	0.1331	0.3066	0.4197	0.5811
24	01378	COLQUITZ RIVER NO1	1954	-123.3948 48.4584	1	17.420	0.0129	0.1331	0.3066	0.4197	0.5811
25	10001	WILKINSON BRIDGE	0	-123.4166 48.4646	1	17.465	0.0157	0.1327	0.3069	0.4206	0.5828
26	03128	WILKINSON RD PED O/P	1997	-123.4166 48.4646	1	17.465	0.0157	0.1327	0.3069	0.4206	0.5828
27	02655	COLQUITZ RIVER NO2	1978	-123.3951 48.4580	1	17.470	0.0126	0.1331	0.3067	0.4198	0.5812
28	01178	PORTAGE RD PED O/P	1978	-123.4077 48.4603	1	17.604	0.0165	0.1329	0.3069	0.4204	0.5823
29	03025	HELMCKEN RD U/P	1996	-123.4306 48.4639	1	18.032	0.0222	0.1325	0.3073	0.4214	0.5842
30	06880	CANAL	1955	-123.2573 48.7649	1	18.275	0.0151	0.1199	0.2638	0.3550	0.4881
31	02705	HELMCKEN RD PED O/P	1979	-123.4367 48.4578	1	18.845	0.0220	0.1325	0.3076	0.4223	0.5855
32	03026	WEST BURNSIDE F/O	1996	-123.4490 48.4629	1	18.846	0.0215	0.1323	0.3078	0.4225	0.5858
33	03034	WATKISS WAY	1996	-123.4531 48.4623	1	19.070	0.0189	0.1323	0.3079	0.4228	0.5862
34	03035	W.BURNSIDE RD @ C.CR	1996	-123.4527 48.4621	1	19.072	0.0192	0.1323	0.3079	0.4227	0.5862
35	02702	GLENTANA RD PED O/P	1979	-123.4294 48.4527	1	19.076	0.0178	0.1326	0.3077	0.4222	0.5854
36	08490	SELKIRK TRESTLE	1916	-123.3823 48.4397	1	19.078	0.0103	0.1334	0.3069	0.4201	0.5816
37	01403N	COLWOOD O/P NORTH	1997	-123.4527 48.4617	1	19.109	0.0193	0.1323	0.3079	0.4228	0.5863
38	01403S	COLWOOD O/P SOUTH	1997	-123.4529 48.4615	1	19.135	0.0192	0.1323	0.3079	0.4228	0.5863
39	00423W	WILKINSON/MILL BAY W	1990	-123.5608 48.6561	1	19.548	0.0348	0.1254	0.2882	0.3928	0.5422
40	00423E	WILKINSON/MILL BAY E	1990	-123.5611 48.6558	1	19.560	0.0346	0.1254	0.2883	0.3928	0.5424
41	03031	THETIS PK.ACCESS O/P	1996	-123.4658 48.4611	1	19.721	0.0192	0.1320	0.3080	0.4234	0.5875

No	Bridge ID	Bridge Name	Year Built	Longitude Latitude	SA	Distance (km)	Horizontal Peak Ground Accelerations(g)				
							Shakemap	100 years Hazard	475 years Hazard	1000 years Hazard	2475 years Hazard
42	00684W	PARSONS WEST	1927	-123.4589 48.4561	1	19.881	0.0159	0.1322	0.3082	0.4235	0.5875
43	03003	SIX MILE PED O/P	1996	-123.4638 48.4582	1	19.895	0.0181	0.1320	0.3081	0.4236	0.5877
44	10004	SIX MILE BRIDGE	0	-123.4640 48.4582	1	19.904	0.0181	0.1320	0.3081	0.4236	0.5878
45	00684E	PARSONS EAST	1972	-123.4589 48.4558	1	19.908	0.0159	0.1322	0.3082	0.4236	0.5876
46	01018	MILLSTREAM	1974	-123.5706 48.6576	1	20.285	0.0373	0.1252	0.2879	0.3924	0.5417
47	08081	COUL FTBR	1990	-123.5773 48.6626	1	20.922	0.0395	0.1248	0.2869	0.3908	0.5394
48	10005	MILLSTREAM CK. BRIDGE	2005	-123.4734 48.4475	1	21.276	0.0175	0.1317	0.3085	0.4248	0.5901
49	03032	MILLSTREAM RD U/P	1997	-123.4974 48.4567	1	21.554	0.0179	0.1309	0.3081	0.4250	0.5912
50	03268	GARNET	2003	-123.5567 48.7100	1	21.822	0.0355	0.1227	0.2778	0.3761	0.5173

2.2 List of Tunnels affected by the earthquake

Table 4: MOTI tunnels in the earthquake effected area.

No	Tunnel ID	Tunnel Name	Year Built	Longitude Latitude	SA	Distance (km)	Horizontal Peak Ground Accelerations(g)				
							Shakemap	100 years Hazard	475 years Hazard	1000 years Hazard	2475 years Hazard
1	7482	ROYAL OAK PED TUNNEL	-	-123.3865 48.4943	-	13.516	0.0126	0.1330	0.3050	0.4166	0.5765
2	2676	SEYMOUR AVE TUNNEL	-	-123.3758 48.4570	-	17.098	0.0089	0.1335	0.3062	0.4186	0.5793
3	2639	SEATON RD PED TUN	-	-123.3865 48.4572	-	17.330	0.0125	0.1333	0.3065	0.4193	0.5804
4	3119	HELMCKEN G GOOSE TUN	-	-123.4309 48.4644	-	17.992	0.0221	0.1325	0.3072	0.4214	0.5841
5	3127	HOSP G GOOSE PED TUN	-	-123.4314 48.4644	-	18.012	0.0222	0.1325	0.3073	0.4214	0.5842
6	3126	MILLSTRM PED TUN (E)	-	-123.4320 48.4638	-	18.090	0.0226	0.1325	0.3073	0.4215	0.5843
7	3125	MILLSTRM PED TUN (W)	-	-123.5042 48.4547	-	22.047	0.0160	0.1307	0.3082	0.4254	0.5921
8	7165	SPROTT PED TUN	-	-123.7180 48.8234	-	38.811	0.0293	0.1165	0.2684	0.3649	0.5028
9	7669	BINGS CR CATTLE U/P TUN	-	-123.7615 48.8010	-	39.928	0.0311	0.1169	0.2713	0.3697	0.5102
10	3323	LADYSMITH PED TUN	-	-123.8104 48.9900	-	56.605	0.0206	0.1095	0.2543	0.3464	0.4792
11	8732	BENSON ROAD TUN	-	-123.0241 49.0949	-	58.391	0.0308	0.0907	0.2026	0.2771	0.3877
12	8731	HWY 99 FARM X TUN	-	-123.0478 49.1041	-	58.768	0.0254	0.0908	0.2031	0.2780	0.3889
13	00760	DIAMOND O/H TUN	-	-123.8343 49.0062	-	59.110	0.0166	0.1085	0.2528	0.3450	0.4780
14	01509	George Massey Tunnel	1958	-123.0758 49.1219	-	60.032	0.0244	0.0904	0.2027	0.2777	0.3889
15	7131	91A KNIGHT RAMP TUN	-	-123.0732 49.1776	-	66.050	0.0330	0.0861	0.1948	0.2676	0.3765
16	8161	NANAIMO RIVER U/P	-	-123.8816 49.0748	-	67.172	0.0156	0.1046	0.2455	0.3359	0.4671
17	3123	BIGGS PARK PED TUN	-	-123.8876 49.1493	-	74.047	0.0101	0.1001	0.2354	0.3231	0.4506
18	2950	ADANAC TUNNEL EAST	-	-123.0313 49.2774	-	77.557	0.0048	0.0774	0.1774	0.2455	0.3486
19	2951	WALL ST. WB TUNNEL	-	-123.0314 49.2858	-	78.452	0.0057	0.0768	0.1762	0.2439	0.3467
20	2952	WALL ST. SB TUNNEL	-	-123.0321 49.2864	-	78.510	0.0058	0.0768	0.1762	0.2438	0.3467

2.3 List of Schools affected by the earthquake

Table 5: Schools in the earthquake effected area.

No	School ID	School Name	Longitude Latitude	Distance (km)	Horizontal Peak Ground Accelerations(g)				
					Shakemap	100 years Hazard	475 years Hazard	1000 years Hazard	2475 years Hazard
1	6363007	Keating Elementary	-123.4035 48.5677	8.169	0.0241	0.1314	0.3002	0.4090	0.5652
2	6363014	Sidney Elementary	-123.4062 48.6532	9.136	0.0300	0.1276	0.2880	0.3904	0.5380
3	6363020	Stelly's Secondary School	-123.4315 48.5797	9.554	0.0448	0.1307	0.2995	0.4082	0.5640
4	6363003	Cordova Bay Elementary	-123.3687 48.5272	9.664	0.0139	0.1331	0.3033	0.4129	0.5706
5	6363003	Cordova Bay Elementary	-123.3687 48.5272	9.664	0.0139	0.1331	0.3033	0.4129	0.5706
6	6363026	North Saanich Middle School	-123.4168 48.6660	10.636	0.0272	0.1267	0.2854	0.3868	0.5326
7	6363002	Brentwood Elementary	-123.4464 48.5744	10.776	0.0453	0.1308	0.3003	0.4096	0.5660
8	6363021	Claremont Secondary School	-123.3741 48.5155	10.998	0.0151	0.1331	0.3039	0.4142	0.5727
9	6363022	Parkland Secondary School	-123.4208 48.6711	11.226	0.0317	0.1263	0.2845	0.3852	0.5304
10	6363022	Parkland Secondary School	-123.4208 48.6711	11.226	0.0317	0.1263	0.2845	0.3852	0.5304
11	6363008	Lochside Elementary	-123.3618 48.5014	12.088	0.0098	0.1333	0.3042	0.4146	0.5732
12	6363010	Prospect Lake Elementary	-123.4333 48.5236	12.893	0.0252	0.1324	0.3051	0.4166	0.5764
13	6161065	Torquay Elementary	-123.3241 48.4874	13.008	0.0139	0.1340	0.3038	0.4133	0.5707
14	6161052	Hillcrest Elementary	-123.3146 48.4851	13.211	0.0139	0.1341	0.3036	0.4129	0.5702
15	6363004	Deep Cove Elementary	-123.4577 48.6790	13.883	0.0351	0.1256	0.2833	0.3836	0.5278
16	6161064	Lambrick Park Secondary	-123.3320 48.4792	13.978	0.0130	0.1340	0.3044	0.4144	0.5724
17	6161042	Lake Hill Elementary	-123.3666 48.4792	14.538	0.0105	0.1334	0.3052	0.4165	0.5760
18	6161049	Mount Douglas Secondary	-123.3172 48.4713	14.751	0.0136	0.1342	0.3042	0.4140	0.5717
19	6161062	Arbutus Middle	-123.3050 48.4693	14.962	0.0129	0.1342	0.3038	0.4134	0.5710
20	6161051	Braefoot Elementary	-123.3439 48.4695	15.185	0.0085	0.1339	0.3050	0.4158	0.5746

3.0 Triggered Strong Motion Stations

Table-6 below contains the earthquake stations triggered during the earthquake, and the table is sorted by the epicentral distance. Station ID is the name of the earthquake sensor, and Epicentral Distance is the distance between the epicenter of the earthquake and the location of the earthquake sensor. Maximum acceleration, velocity, and displacement are given as the vector modulus of three component signal recorded. Maximum acceleration reported in the Table-6 is recorded/measured by earthquake sensor; however, the maximum velocity and displacement are calculated from integrated acceleration recorded. Katayama Spectral Intensity (kSI) is calculated as the area underneath the spectral velocity spectrum between 0.1 and 2.5 seconds, and it may be correlated with structural damage.

Table 6 Earthquake sensors that are triggered during the earthquake.

No	Station ID	Lat / Long	Distance (km)	Max. Acc. (g)	Max. Vel. (cm/s)	Max. Disp. (cm)	Ksi (cm/s)
1	SOK01NA	-123.6960 48.3880	37.394	0.0411	0.0129	0.0001	0.0025
2	RMD15NA	-123.1850 49.1710	63.692	0.0444	0.0190	0.0001	0.0037
3	RMD03E7	-123.0900 49.1850	66.538	0.0327	0.0127	0.0004	0.0025
4	RMD04B9	-123.1270 49.1640	63.661	0.0220	0.0087	0.0005	0.0016
5	ABT02NA	-122.2980 49.1200	93.489	0.0095	0.0069	0.0005	0.0008
6	VCT12NA	-123.5250 48.4510	23.386	0.0069	0.0047	0.0004	0.0007
7	VNC09A6	-123.1500 49.1910	66.289	0.0519	0.0188	0.0004	0.0038
8	RMD05C9	-123.1130 49.1660	64.097	0.0172	0.0066	0.0004	0.0013
9	VNC26NA	-123.1120 49.2760	76.084	0.0088	0.0057	0.0004	0.0008
10	PMB13C5	-122.7350 49.1820	76.686	0.0038	0.1060	0.0008	0.0039
11	PMB17D3	-122.9740 49.2510	75.959	0.0088	0.2840	0.0012	0.0098
12	PMB07B3	-122.9860 49.2440	74.943	0.0026	0.0931	0.0011	0.0062
13	PMB19D5	-122.7770 49.1920	76.009	0.0013	0.0433	0.0004	0.0034
14	PMB08B4	-122.9860 49.2440	74.943	0.0031	0.1157	0.0006	0.0052

No	Station ID	Lat / Long	Distance (km)	Max. Acc. (g)	Max. Vel. (cm/s)	Max. Disp. (cm)	Ksi (cm/s)
15	PMB09C1	-122.9150 49.2430	76.621	0.0029	0.1064	0.0008	0.0052
16	PMB18D4	-122.9740 49.2500	75.853	0.0029	0.0978	0.0006	0.0036
17	PMB15D1	-123.0280 49.2690	76.716	0.0028	0.0729	0.0005	0.0030
18	PMB11C3	-122.8340 49.2280	77.529	0.0101	0.0446	0.0005	0.0048
19	PMB16D2	-122.9830 49.2570	76.384	0.0040	0.1397	0.0006	0.0047
20	PMB12C4	-122.8340 49.2280	77.529	0.0065	0.0218	0.0002	0.0020
21	PMB10C2	-122.8340 49.2280	77.529	0.0024	0.0840	0.0006	0.0054
22	SQM01NA	-123.1500 49.7050	122.974	0.0075	0.0038	0.0001	0.0007
23	PGC01NA	-123.4510 48.6510	11.823	0.0306	0.0127	0.0001	0.0026
24	RMD01C6	-123.1160 49.1830	65.894	0.0345	0.0137	0.0004	0.0026
25	VCT14NA	-123.4840 48.4140	24.817	0.0357	0.0117	0.0004	0.0021
26	VCT17NA	-123.3740 48.4650	16.210	0.0112	0.0053	0.0004	0.0006
27	BRN01NA	-123.4570 48.5760	11.470	0.0393	0.0116	0.0005	0.0017
28	VCT16NA	-123.4940 48.4210	24.564	0.0160	0.0062	0.0004	0.0006
29	STS03NA	-123.2440 49.4530	94.534	0.0086	0.0027	6.8878e-05	0.0004
30	STS01NA	-123.2700 49.3610	84.236	0.0345	0.0097	0.0006	0.0016
31	RMD11B8	-123.1270 49.1740	64.749	0.0188	0.0077	0.0004	0.0012
32	VNC24NA	-123.0710 49.2210	70.757	0.0180	0.0076	0.0004	0.0016
33	VNC01G2	-123.0540 49.2300	72.036	0.0102	0.0045	0.0004	0.0009
34	VNC22F2	-123.0680 49.2320	71.996	0.0182	0.0089	0.0004	0.0014
35	VNC06E4	-123.0840 49.2150	69.883	0.0358	0.0175	0.0004	0.0026
36	VNC04G1	-123.0590 49.2370	72.696	0.0132	0.0069	0.0004	0.0011
37	RMD02C7	-123.1080 49.1950	67.322	0.0252	0.0117	0.0004	0.0022
38	VNC14A4	-123.1360 49.2100	68.549	0.0261	0.0104	0.0004	0.0021
39	LNG01NA	-122.6590 49.1020	72.904	0.0259	0.0121	0.0004	0.0019
40	NMO03NA	-123.9690 49.1570	78.281	0.0079	0.0045	0.0004	0.0006
41	UBC01NA	-123.2500 49.2630	73.414	0.0067	0.0057	0.0005	0.0007

No	Station ID	Lat / Long	Distance (km)	Max. Acc. (g)	Max. Vel. (cm/s)	Max. Disp. (cm)	Ksi (cm/s)
42	BWN01NA	-123.3430 49.3810	86.457	0.0104	0.0054	0.0005	0.0007
43	HNY01NA	-122.5730 49.2670	91.164	0.0061	0.0048	0.0004	0.0006
44	SNB01NA	-123.0260 49.3010	80.188	0.0058	0.0035	0.0002	0.0008
45	STS02NA	-123.2330 49.4080	89.581	0.0127	0.0066	0.0005	0.0010
46	STS04NA	-123.2080 49.6180	113.000	0.0055	0.0022	5.8409e-05	0.0004
47	STS07NA	-123.1330 49.7920	132.720	0.0088	0.0020	0.0001	0.0003
48	STS08NA	-123.1590 49.8920	143.639	0.0017	0.0009	8.201e-05	0.0001