

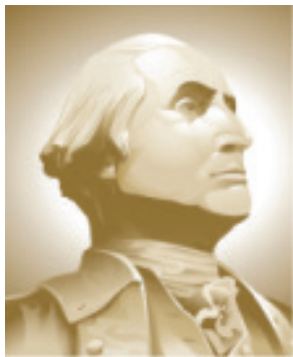
VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

TANK FOCUS VESSELS 1998 - 2012

TANK FV HIGH - LOW SCENARIO DESIGN

Dr. J. Rene van Dorp and Dr. Jason R.W Merrick

February 2014



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TANK FOCUS VESSELS ARRIVAL DATA

ARRIVALS INTO PUGET SOUND (DISTINCT ARRIVALS, NO SHIFTS)

TOTAL TANK SECTOR	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
PETROL TANKER	487	497	543	487	493	494	451	455	471	517	476	505	427	462	441
CHEM TANKER	50	60	46	47	40	24	16	14	30	34	23	17	15	16	12
PETRO/CHEM	537	557	589	534	533	518	467	469	501	551	499	522	442	478	453
ITB/ATB	4	9	32	47	65	130	167	145	183	179	179	172	148	130	142
TOTAL TANK SECTOR	541	566	621	581	598	648	634	614	684	730	678	694	590	608	595

LOW

HIGH

2010

ARRIVALS TO EACH OF THE NORTH SOUND REFINERY AREAS

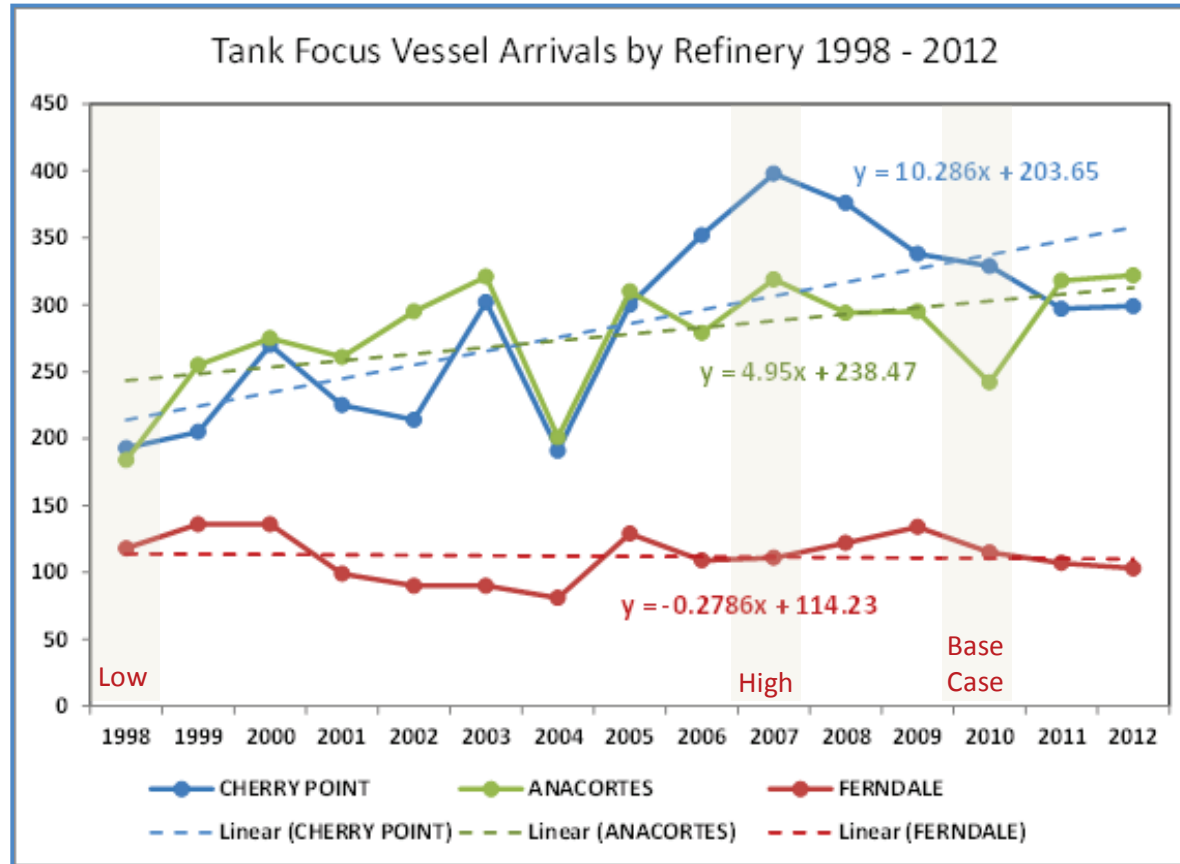
FERNDALE REFINERY	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
PETROL TANKER	118	136	136	99	88	86	69	113	92	92	103	108	86	88	81
CHEM TANKER	0	0	0	0	2	0	0	0	0	0	4	2	3	2	1
PETRO/CHEM	118	136	136	99	90	86	69	113	92	92	107	110	89	90	82
ITB/ATB	0	0	0	0	0	4	12	16	17	19	15	24	26	17	21
TOTAL	118	136	136	99	90	90	81	129	109	111	122	134	115	107	103

CHERRY POINT REFINERY	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
PETROL TANKER	189	189	224	167	164	213	116	196	206	243	266	205	203	197	163
CHEM TANKER	0	1	13	4	1	1	10	15	12	36	28	70	70	59	72
PETRO/CHEM	189	190	237	171	165	214	126	211	218	279	294	275	273	256	235
ITB/ATB	4	15	33	54	49	88	65	89	134	119	82	63	56	41	64
TOTAL	193	205	270	225	214	302	191	300	352	398	376	338	329	297	299

ANACORTES REFINERIES	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
PETROL TANKER	183	250	270	250	253	258	143	240	217	240	172	160	121	178	195
CHEM TANKER			1	1	24	13	19	16	22	24	29	39	33	56	42
PETRO/CHEM	183	250	271	251	277	271	162	256	239	264	201	199	154	234	237
ITB/ATB	1	5	4	10	18	50	39	54	40	55	93	96	88	84	85
TOTAL	184	255	275	261	295	321	201	310	279	319	294	295	242	318	322

SUM OF THREE AREAS	495	596	681	585	599	713	473	739	740	828	792	767	686	722	724
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VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010



TANKER CALL NUMBER HIGH-LOW ANALYSIS FROM 1998-2012

	LOW - YEAR: - #	2010	HIGH - YEAR: + #
CHERRY POINT	193 - 1998 : -136	329	398 - 2007 : +69
ANACORTES	184 - 1998 : -58	242	319 - 2007 : +77
FERNDALE	118 - 1998 : 3	115	111 - 2007 : -4
Total Change Tank FV	-191		+142

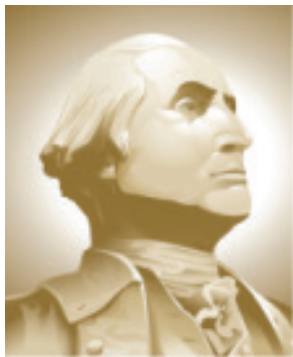
VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

**CARGO FOCUS VESSELS 2008 - 2012
AIS CROSSING DATA**

CARGO FV HIGH – LOW SCENARIO DESIGN

Dr. J. Rene van Dorp and Dr. Jason R.W Merrick

November 2013

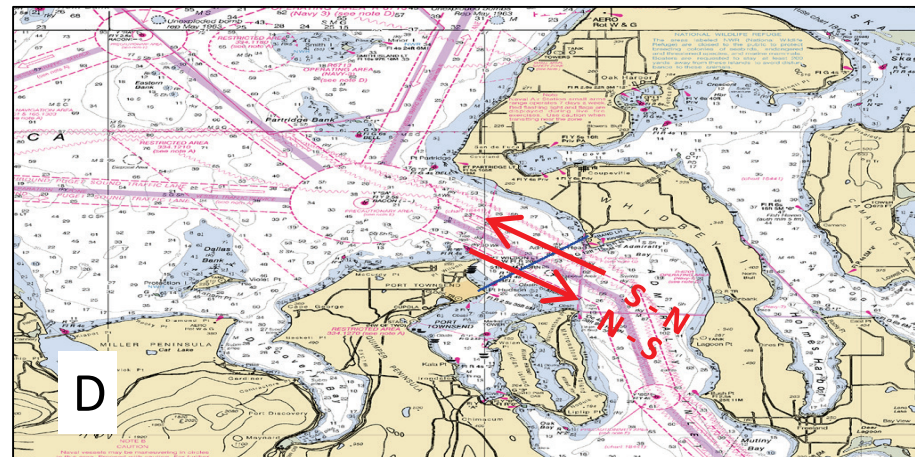
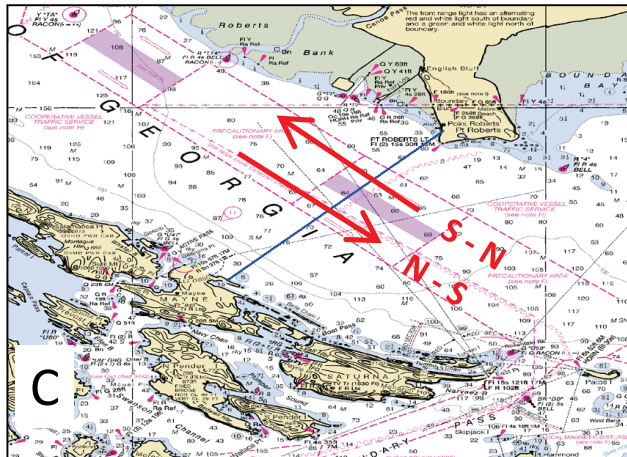
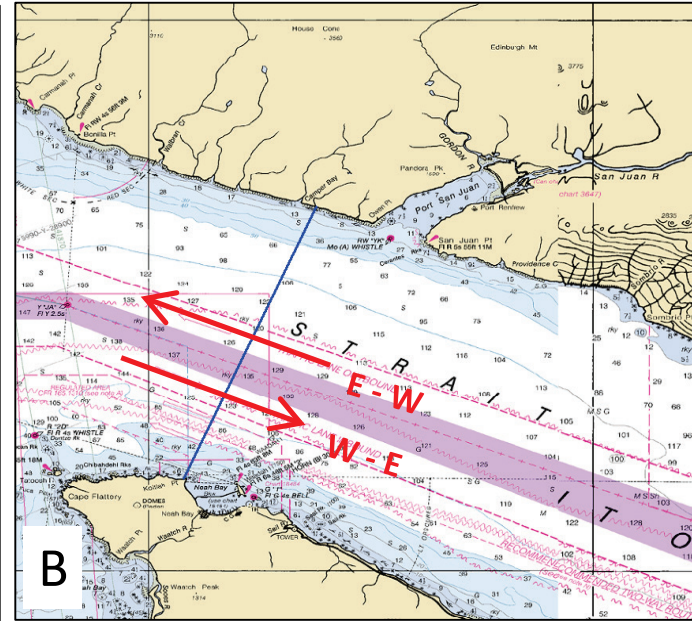
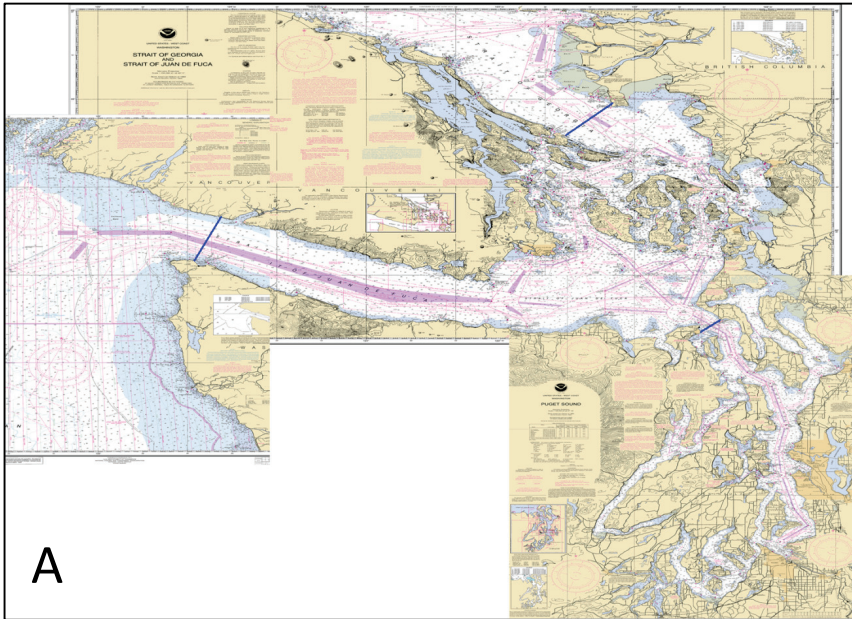


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VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010



CARGO FOCUS VESSELS AIS CROSSING DATA 2008 - 2012

Neah Bay Crossing Line				
Year	East	West	Sum	A = Sum/2
2008	3318	3285	6603	3302
2009	3092	3107	6199	3100
2010	3215	3154	6369	3185
2011	3412	3404	6816	3408
2012	3112	3000	6112	3056

Georgia Strait



X31 X32

low

high

Neah Bay Crossing Line

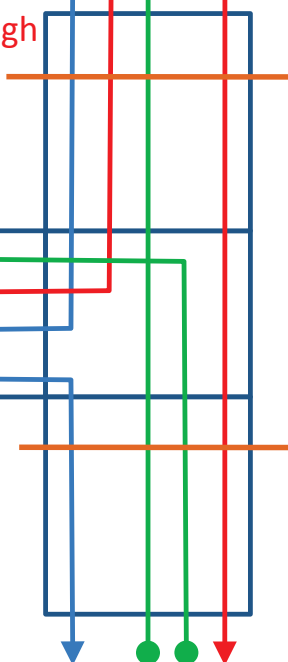
Buoy J



X13
X12

$$X12 + x13 = X31 + X23$$

$$X12 + x13 = A$$



X23 X21



Puget Sound

$$X31 + x32 = X13 + X23$$

$$X31 + x32 = C$$

Point Roberts Crossing Line

Point Roberts Crossing Line				
Year	North	South	Sum	C = Sum/2
2008	2377	2314	4691	2346
2009	2168	2106	4274	2137
2010	2277	2131	4408	2204
2011	2537	2451	4988	2494
2012	2405	2341	4746	2373

Admiralty Inlet Crossing Line

Admiralty Inlet Crossing Line				
Year	North	South	Sum	B = Sum/2
2008	2233	2242	4475	2238
2009	1945	1936	3881	1941
2010	1754	1765	3519	1760
2011	1903	1896	3799	1900
2012	1734	1702	3436	1718

$$X21 + x23 = X12 + X32$$

$$X21 + x23 = B$$

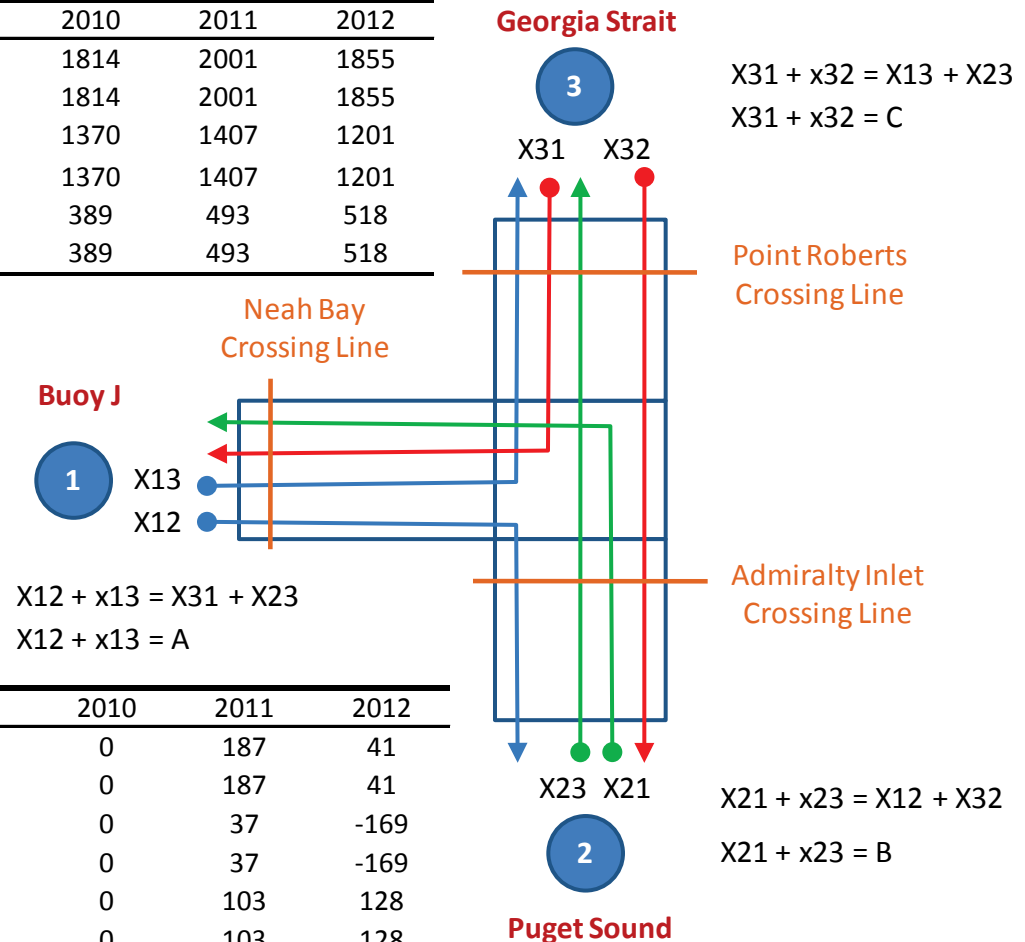
VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

CARGO FOCUS VESSELS AIS CROSSING LINE ANALYSIS

		2008	2009	2010	2011	2012
x13	Bouy J - Georgia Strait	1604	1648	1814	2001	1855
x31	Georgia Strait - Bouy J	1604	1648	1814	2001	1855
x21	Puget Sound - Bouy J	1496	1451	1370	1407	1201
x12	Bouy J - Puget Sound	1496	1451	1370	1407	1201
x23	Puget Sound - Georgia Strait	742	489	389	493	518
x32	Georgia Strait - Puget Sound	742	489	389	493	518

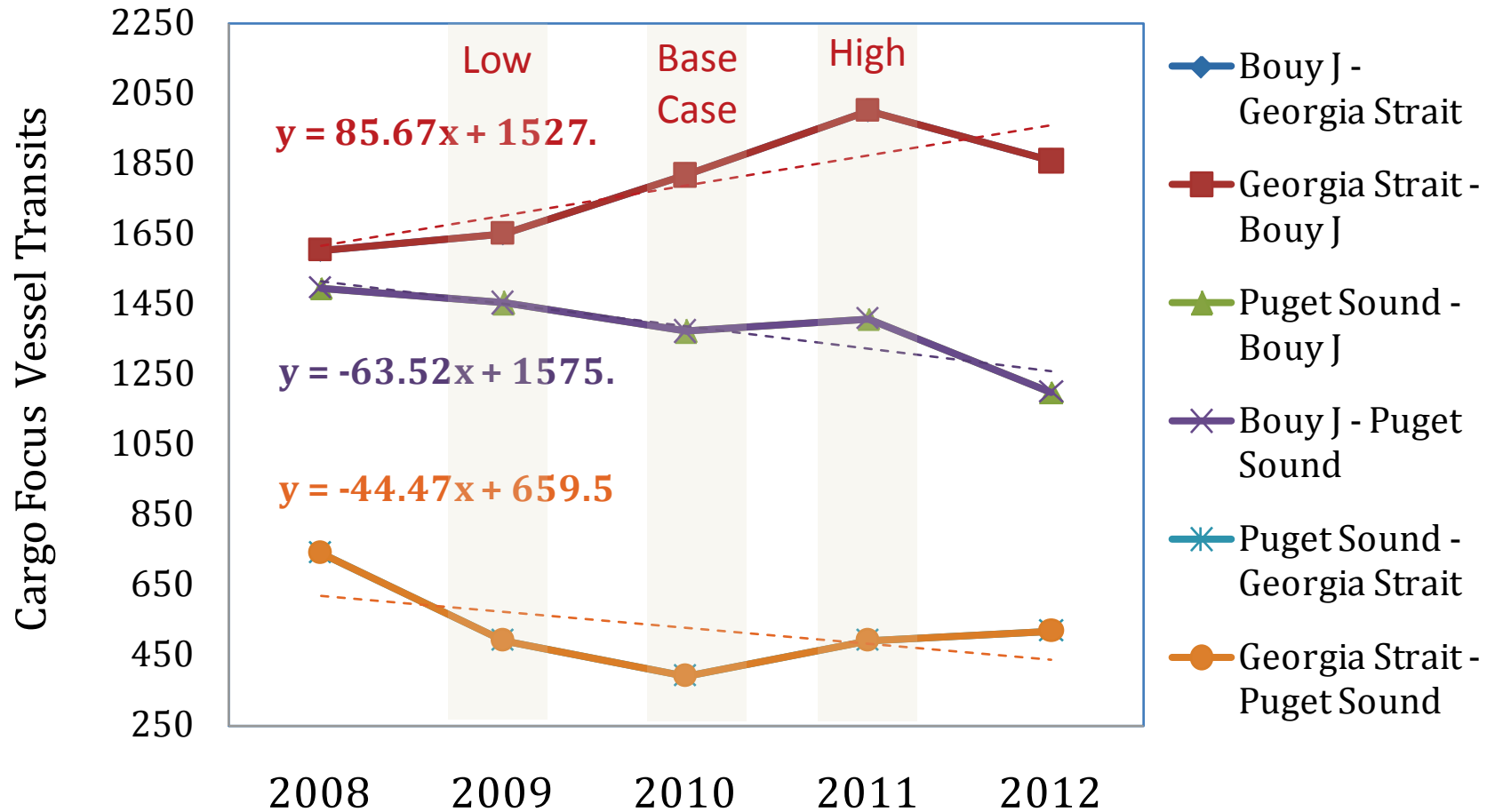
	2008	2009	2010	2011	2012
A	3099	3099	3184	3408	3056
B	2237	1940	1759	1899	1718
C	2346	2137	2204	2494	2373

		2008	2009	2010	2011	2012
x13	Bouy J - Georgia Strait	-211	-166	0	187	41
x31	Georgia Strait - Bouy J	-211	-166	0	187	41
x21	Puget Sound - Bouy J	126	81	0	37	-169
x12	Bouy J - Puget Sound	126	81	0	37	-169
x23	Puget Sound - Georgia Strait	352	100	0	103	128
x32	Georgia Strait - Puget Sound	352	100	0	103	128



VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

AIS CARGO FV ANALYSIS FROM AIS DATA



VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010



BULK TRANSIT NUMBER HIGH-LOW ANALYSIS FROM 2008-2012

	LOW - YEAR: - #	2010	HIGH - YEAR: + #
Bouy J - Georgia Strait	1095 - 2009 : -63	1159	1268 - 2011 : +109
Bouy J - Puget Sound	344 - 2009 : 22	322	325 - 2011 : +3
Puget Sound - Georgia Strait	0 - 2009 : +0	0	0 - 2011 : +0
Total Change Bulk FV	-41		+112

CONTAINER TRANSIT NUMBER HIGH-LOW ANALYSIS FROM 2008-2012

	LOW - YEAR: - #	2010	HIGH - YEAR: + #
Bouy J - Georgia Strait	223 - 2009 : -85	308	332 - 2011 : +25
Bouy J - Puget Sound	812 - 2009 : +46	766	807 - 2011 : +41
Puget Sound - Georgia Strait	274 - 2009 : +52	222	258 - 2011 : +36
Total Change Container FV	+13		+102

OTHER CARGO TRANSIT NUMBER HIGH-LOW ANALYSIS FROM 2008-2012

	LOW - YEAR: - #	2010	HIGH - YEAR: + #
Bouy J - Georgia Strait	336 - 2009 : -50	386	421 - 2011 : +36
Bouy J - Puget Sound	280 - 2009 : +28	252	255 - 2011 : +3
Puget Sound - Georgia Strait	246 - 2009 : +20	226	260 - 2011 : +34
Total Change Other Cargo FV	-2		+73

-30

+287

VESSEL TRAFFIC RISK ASSESSMENT (VTRA) 2010

