



Visualizing Freeway Traffic in the San Diego Region

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Think...

...about weekday traffic on San Diego freeways over a 24 hour span.

Volumes rise to a morning peak...

...dissipating at mid-day

...and rise again for the afternoon peak





Could you describe...

...how quickly traffic builds in the morning?
In the afternoon?

...or how rapidly it dissipates?

...how quickly bottlenecks occur?

...and where the worst ones are?





And...

how do you convey that impression to
decision-makers,
stakeholders,
and the public?





The problem is not ...

a lack of data.

Not since 1999 anyway.





PeMS ...

... Freeway **P**erformance **M**easurement
System

... Caltrans, UC Berkeley, and the
Partnership for Advanced
Technology on the Highways
(PATH)

... (<https://pems.eecs.berkeley.edu/>)





PeMS in San Diego ...

monitors 19 freeways using over 1,000
Vehicle Detector Stations ...

compiling volumes and speeds on 30
second intervals ...

for on-ramps, HOV lanes, and main
freeway lanes.





PeMS data ...

PeMS 7.3																
HOME RESOURCES HELP FEEDBACK ACCOUNT LOGOUT																
California > D11 > San Diego County > Freeways																
<ul style="list-style-type: none"> California District 11 San Diego County Cities Freeways Detectors Aggregates HICOMP Bottlenecks Modeling TMG Level of Service Detector Health Data Fidelity Inputs Incidents CHP 	Listing			HOV Facilities			Sensor Coverage									
	Detection			Mainline Facilities					HOV Facilities					Ramps		
	Freeway	# LDSs	# VDSs	# Loops	Total Miles	Detection Coverage			HOV Miles	HOV Lane Miles	Detection Coverage			Detection Coverage		
					# ML VDS	ML Miles	ML Lane Miles			# HOV VDS	HOV Miles	HOV Lane Miles	# FR	# OR	# FF	
I5-N	61	96	332	72.3	59	61.2	270.4	5.6	5.7	1	5.0	5.0	15	20	1	
I5-S	63	119	372	72.2	57	61.1	269.7	0.0	0.0	0	0.0	0.0	24	37	1	
I8-E	39	67	199	78.2	42	26.2	96.2	0.0	0.0	0	0.0	0.0	5	14	6	
I8-W	44	83	238	78.4	43	26.2	94.4	0.0	0.0	0	0.0	0.0	12	24	4	
I15-N	46	97	300	54.5	41	36.5	167.7	7.5	7.5	2	10.0	15.0	23	29	2	
I15-S	50	99	317	54.5	42	36.5	165.1	7.5	7.5	3	8.8	17.6	22	32	0	
I15S-N	0	0	0	7.0	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0	0	0	
I15S-S	0	0	0	7.0	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0	0	0	
I805-N	39	75	233	28.7	35	28.1	126.6	0.0	0.0	0	0.0	0.0	17	20	3	
I805-S	39	60	205	28.7	36	28.1	127.2	0.0	0.0	0	0.0	0.0	10	13	1	
I905-E	0	0	0	5.0	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0	0	0	
I905-W	2	6	15	5.0	2	2.5	7.5	0.0	0.0	0	0.0	0.0	2	2	0	
SR52-E	12	17	44	14.8	12	13.9	42.4	0.0	0.0	0	0.0	0.0	2	1	2	
SR52-W	11	14	37	14.8	12	13.9	39.8	0.0	0.0	0	0.0	0.0	0	1	1	
SR54-E	3	7	17	8.6	3	5.3	15.9	3.2	3.2	4	3.1	3.1	1	3	0	
SR54-W	3	8	18	8.6	3	5.2	15.7	3.2	3.2	8	5.2	5.2	2	3	0	
SR56-E	4	12	24	9.3	4	7.1	17.8	0.0	0.0	0	0.0	0.0	4	4	0	
SR56-W	6	17	35	9.3	7	8.3	17.0	0.0	0.0	0	0.0	0.0	5	5	0	
SR67-N	0	0	0	23.8	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0	0	0	
SR67-S	0	0	0	23.8	0	0.0	0.0	0.0	0.0	0	0.0	0.0	0	0	0	



PeMS data ...

Include Days
 Su Mo Tu We Th Fr Sa Holidays

Quantity
 Travel Time Index

Chart Properties
 Lines Points Grid
 Autoscale Y-Min Y-Max

Statistics
 Mean, Min, Max
 Mean, Mean+ σ , Mean- σ
 Median, %, %
 Discrete Days

Time	Minimum	Mean	Maximum	Data Quality	
				# Lane Points	% Observed
00:00	.88	0.89	.9	154,440	90.0
01:00	.89	0.91	.93	154,440	89.2
02:00	.89	0.92	.94	154,440	89.1
03:00	.91	0.93	.96	154,440	89.1
04:00	.89	0.91	.94	154,440	89.2
05:00	.87	0.89	.92	154,440	90.8
06:00	.94	0.97	1	154,440	90.8
07:00	1.02	1.07	1.12	154,440	90.8
08:00	1.02	1.07	1.12	154,440	90.9
09:00	.97	1.00	1.03	154,440	90.8
10:00	.96	0.99	1.02	154,440	90.8
11:00	.96	0.99	1.01	154,440	90.9
12:00	.96	1.00	1.03	154,440	90.9
13:00	.95	0.99	1.08	154,440	91.0
14:00	.96	1.00	1.12	154,440	90.9
15:00	1.01	1.08	1.25	154,440	91.0
16:00	1.14	1.21	1.37	128,700	91.1
17:00	1.17	1.24	1.31	128,700	91.2
18:00	1	1.06	1.09	128,700	91.2
19:00	.88	0.89	.91	128,700	91.2
20:00	.87	0.88	.89	128,700	91.1
21:00	.88	0.89	.9	128,700	90.1
22:00	.87	0.89	.91	128,700	90.3
23:00	.87	0.89	.91	128,700	90.9
Total				3,500,640	90.5



PeMS data ...

California > D11 > San Diego County > Bottlenecks ?

Top Bottlenecks

From Jul 16 2007 **To** Jul 23 2007
Min Range: 1 day Max Range: 20 years

Include Days
 Su Mo Tu We Th Fr Sa Holidays

Number of Bottlenecks to Show: 50 **Time Period:** AM PM Noon
 Normalize by # Days Active

[VIEW TABLE](#)
[EXPORT TEXT](#)
[EXPORT to XLS](#)

VDS	Name	Shift	Fwy	Abs		# Days Active	Bottleneck Characteristics		
				PM	CA PM		Avg Extent (Miles)	Total Delay (veh-hrs)	Total Duration (mins) ▼
1108471	LOMAS SANTA FE DR	AM	I5-S	37.12	R37.26	5	8.5	27,412	960
1108545	CENTER CITY PKWY	AM	I15-S	27.70	M27.455	5	3.9	12,147	795
1108577	EB CLAIREMONT MESA	AM	I805-N	22.48	22.63	5	2.8	7,084	755
1108405	UNIVERSITY AVE	AM	I805-N	15.83	15.976	4	2.2	1,693	380
1108543	VIA RANCHO PKWY	AM	I15-S	27.03	M26.785	3	4.9	6,111	365
1108676	SEG FAIRMOUNT AVE	AM	I15-N	6.38	R6.2	5	1.0	1,221	365
1113771	RNCHO SANTA FE FARMS	AM	SR56-W	2.80	2.8	4	2.9	1,016	310
1111572	NB 805 @ 15	AM	I805-N	3.05	3.2	4	0.4	262	295
1113720	CARMEL VALLEY RD	AM	SR56-W	1.80	1.8	4	0.5	190	295



PeMS data ...

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Time	Postmile		VDS	Occupancy	Data Quality	
	(Abs)	(CA)			# Lane Points	% Observed
0:00	.057	R.147	1114228	0.0136	672	69.6
0:00	1.291	1.381	1114708	0.0145	480	75.0
0:00	2.559	2.649	1114721	0.0125	384	93.8
0:00	4.06	4.15	1114234	0.0132	384	100.0
0:00	5.231	5.321	1114735	0.0179	480	93.8
0:00	6.193	6.283	1114749	0.0268	480	100.0
0:00	7.401	7.491	1114763	0.0241	480	100.0
0:00	8.763	8.853	1114777	0.0368	480	0.0
0:00	9.897	R9.987	1114240	0.0218	384	100.0
0:00	10.847	R10.95	1114247	0.0205	480	100.0
0:00	11.847	R11.95	1114254	0.0364	480	0.0
0:00	12.748	R12.851	1114261	0.0268	384	100.0
0:00	13.372	R13.475	1114268	0.0196	480	100.0
0:00	14.676	R14.779	1114310	0.0333	480	0.0
0:00	15.594	R15.703	1114318	0.0366	576	0.0
0:00	16.015	R16.124	1108417	0.0233	480	100.0
0:00	17.173	R17.282	1108605	0.0201	480	100.0
0:00	17.996	R18.105	1108609	0.0192	384	100.0
0:00	18.828	R18.937	1108615	0.0274	480	52.1
0:00	19.675	R19.784	1115355	0.0298	480	0.0
0:00	20.364	R20.473	1114792	0.0156	576	100.0
0:00	20.592	R20.701	1108457	0.0162	480	100.0
0:00	21.366	R21.475	1114806	0.0240	480	93.8
0:00	21.388	R21.497	1114818	0.0191	384	93.8
0:00	21.847	R21.956	1108711	0.0169	480	100.0
0:00	22.636	R22.745	1108693	0.0143	384	100.0
0:00	23.444	R23.553	1108695	0.0143	384	100.0
0:00	23.541	R23.65	1114283	0.0151	480	93.8
0:00	25.586	R25.695	1108667	0.0133	480	100.0
0:00	26.641	R26.75	1108669	0.0155	384	100.0



PeMS data ...

0:00	26.641	R26.75	1108669	0.0155	384	100.0
0:00	27.856	R27.965	1108452	0.0124	384	100.0
0:00	28.345	R28.454	1108498	0.0110	384	100.0
0:00	29.512	R29.621	1114832	0.0131	480	93.8
0:00	30.812	R30.921	1114660	0.0121	288	100.0
0:00	32.051	R32.193	1114848	0.0180	576	100.0
0:00	32.648	R32.79	1108434	0.0212	384	100.0
0:00	34.022	R34.164	1108431	0.0173	480	100.0
0:00	36.184	R36.326	1108468	0.0269	384	100.0
0:00	37.118	R37.26	1108471	0.0248	384	100.0
0:00	38.475	R38.617	1108473	0.0303	384	75.0
0:00	38.69	R38.832	1114854	0.0292	384	100.0
0:00	39.464	R39.606	1108475	0.0237	384	100.0
0:00	40.483	R40.625	1108477	0.0261	384	100.0
0:00	41.385	R41.527	1108479	0.0244	384	93.8
0:00	42.449	R42.591	1108723	0.0240	384	100.0
0:00	43.743	R43.885	1108725	0.0224	384	100.0
0:00	45.267	R45.409	1108680	0.0234	384	100.0
0:00	46.955	R47.097	1108685	0.0245	384	100.0
0:00	47.692	R47.834	1108661	0.0237	384	100.0
0:00	49.027	R49.169	1108560	0.0236	384	100.0
0:00	49.872	R50.014	1108657	0.0260	384	85.4
0:00	50.44	R50.582	1108463	0.0254	384	100.0
0:00	51.271	R51.413	1108461	0.0315	384	100.0
0:00	52.212	R52.354	1108459	0.0275	384	100.0
0:00	53.148	R53.29	1108672	0.0269	384	100.0
0:00	53.658	R53.8	1115348	0.0277	384	100.0
0:00	59.248	R59.42	1115338	0.0382	384	0.0
1:00	.057	R.147	1114228	0.00853	672	69.6
1:00	1.291	1.381	1114708	0.0116	480	70.0
1:00	2.559	2.649	1114721	0.00788	384	87.5
1:00	4.06	4.15	1114234	0.00788	384	100.0
1:00	5.231	5.321	1114735	0.0117	480	87.5
1:00	6.193	6.283	1114749	0.0185	480	100.0



PeMS data ...

1:00	16.015	R16.124	1108417	0.0136	480	100.0
1:00	17.173	R17.282	1108605	0.0125	480	100.0
1:00	17.996	R18.105	1108609	0.0120	384	100.0
1:00	18.828	R18.937	1108615	0.0217	480	50.0
1:00	19.675	R19.784	1115355	0.0254	480	0.0
1:00	20.364	R20.473	1114792	0.0106	576	100.0
1:00	20.592	R20.701	1108457	0.0109	480	100.0
1:00	21.366	R21.475	1114806	0.0175	480	87.5
1:00	21.388	R21.497	1114818	0.0112	384	87.5
1:00	21.847	R21.956	1108711	0.0113	480	100.0
1:00	22.636	R22.745	1108693	0.00763	384	100.0
1:00	23.444	R23.553	1108695	0.00751	384	100.0
1:00	23.541	R23.65	1114283	0.00913	480	87.5
1:00	25.586	R25.695	1108667	0.00709	480	100.0
1:00	26.641	R26.75	1108669	0.00826	384	100.0
1:00	27.856	R27.965	1108452	0.00679	384	100.0
1:00	28.345	R28.454	1108498	0.00614	384	100.0
1:00	29.512	R29.621	1114832	0.00851	480	87.5
1:00	30.812	R30.921	1114660	0.00641	288	100.0
1:00	32.051	R32.193	1114848	0.00990	576	100.0
1:00	32.648	R32.79	1108434	0.0118	384	100.0
1:00	34.022	R34.164	1108431	0.0105	480	100.0
1:00	36.184	R36.326	1108468	0.0163	384	100.0
1:00	37.118	R37.26	1108471	0.0214	384	100.0
1:00	38.475	R38.617	1108473	0.0211	384	75.0
1:00	38.69	R38.832	1114854	0.0227	384	100.0
1:00	39.464	R39.606	1108475	0.0150	384	100.0
1:00	40.483	R40.625	1108477	0.0162	384	100.0
1:00	41.385	R41.527	1108479	0.0150	384	93.8
1:00	42.449	R42.591	1108723	0.0149	384	100.0
1:00	43.743	R43.885	1108725	0.0139	384	100.0
1:00	45.267	R45.409	1108680	0.0143	384	100.0
1:00	46.955	R47.097	1108685	0.0152	384	100.0
1:00	47.692	R47.834	1108661	0.0147	384	100.0
1:00	49.027	R49.169	1108560	0.0147	384	100.0
1:00	49.872	R50.014	1108657	0.0153	384	97.9
1:00	50.44	R50.582	1108463	0.0160	384	100.0



PeMS data

2:00	7.401	7.491	1114763	0.0119	480	100.0
2:00	8.763	8.853	1114777	0.0269	480	0.0
2:00	9.897	R9.987	1114240	0.00994	384	100.0
2:00	10.847	R10.95	1114247	0.00971	480	100.0
2:00	11.847	R11.95	1114254	0.0255	480	0.0
2:00	12.748	R12.851	1114261	0.0116	384	100.0
2:00	13.372	R13.475	1114268	0.00886	480	100.0
2:00	14.676	R14.779	1114310	0.0244	480	0.0
2:00	15.594	R15.703	1114318	0.0247	576	0.0
2:00	16.015	R16.124	1108417	0.00938	480	100.0
2:00	17.173	R17.282	1108605	0.00866	480	100.0
2:00	17.996	R18.105	1108609	0.00816	384	100.0
2:00	18.828	R18.937	1108615	0.0186	480	50.0
2:00	19.675	R19.784	1115355	0.0227	480	0.0
2:00	20.364	R20.473	1114792	0.00740	576	100.0
2:00	20.592	R20.701	1108457	0.00773	480	100.0
2:00	21.366	R21.475	1114806	0.0128	480	87.5
2:00	21.388	R21.497	1114818	0.00820	384	87.5
2:00	21.847	R21.956	1108711	0.00796	480	100.0
2:00	22.636	R22.745	1108693	0.00566	384	100.0
2:00	23.444	R23.553	1108695	0.00554	384	100.0
2:00	23.541	R23.65	1114283	0.00661	480	87.5
2:00	25.586	R25.695	1108667	0.00503	480	100.0
2:00	26.641	R26.75	1108669	0.00579	384	100.0
2:00	27.856	R27.965	1108452	0.00484	384	100.0
2:00	28.345	R28.454	1108498	0.00451	384	100.0
2:00	29.512	R29.621	1114832	0.00630	480	87.5
2:00	30.812	R30.921	1114660	0.00458	288	100.0
2:00	32.051	R32.193	1114848	0.00720	576	100.0
2:00	32.648	R32.79	1108434	0.00886	384	100.0
2:00	34.022	R34.164	1108431	0.00796	480	100.0
2:00	36.184	R36.326	1108468	0.0125	384	100.0
2:00	37.118	R37.26	1108471	0.0122	384	100.0
2:00	38.475	R38.617	1108473	0.0175	384	75.0
2:00	38.69	R38.832	1114854	0.0225	384	100.0
2:00	39.464	R39.606	1108475	0.0118	384	100.0
2:00	40.483	R40.625	1108477	0.0127	384	100.0
2:00	41.385	R41.527	1108479	0.0117	384	93.8
2:00	42.449	R42.591	1108723	0.0120	384	100.0



The problem really is ...

making the data comprehensible
and easier to understand

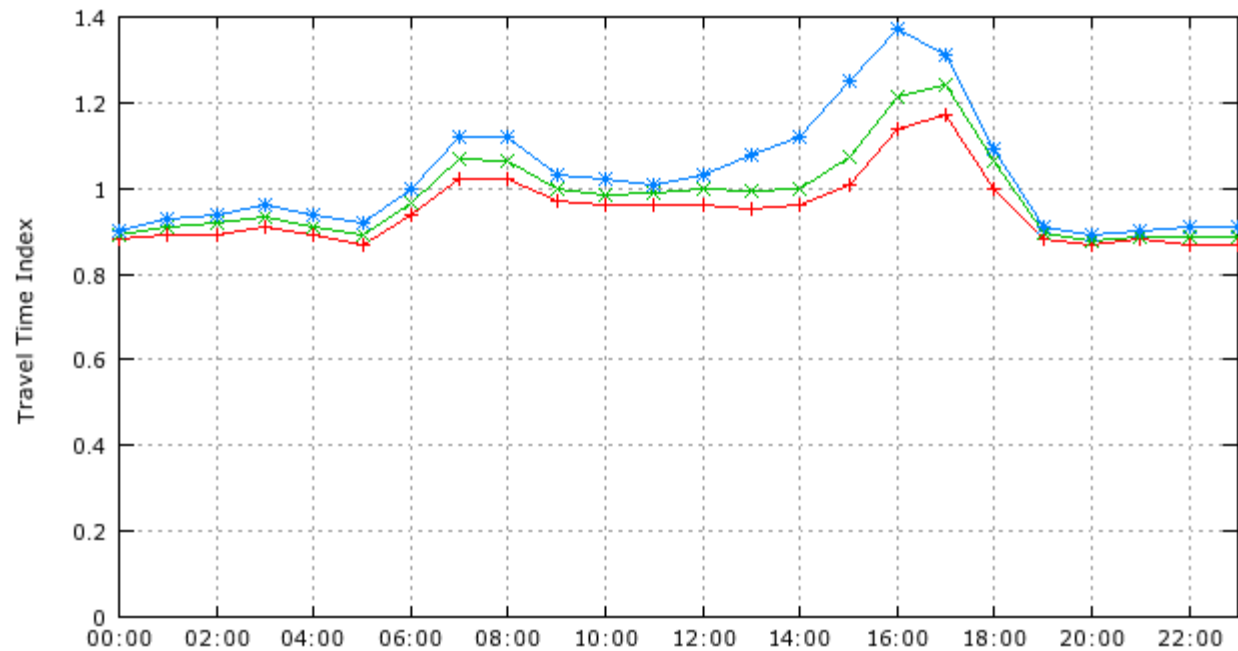




PeMS data ...

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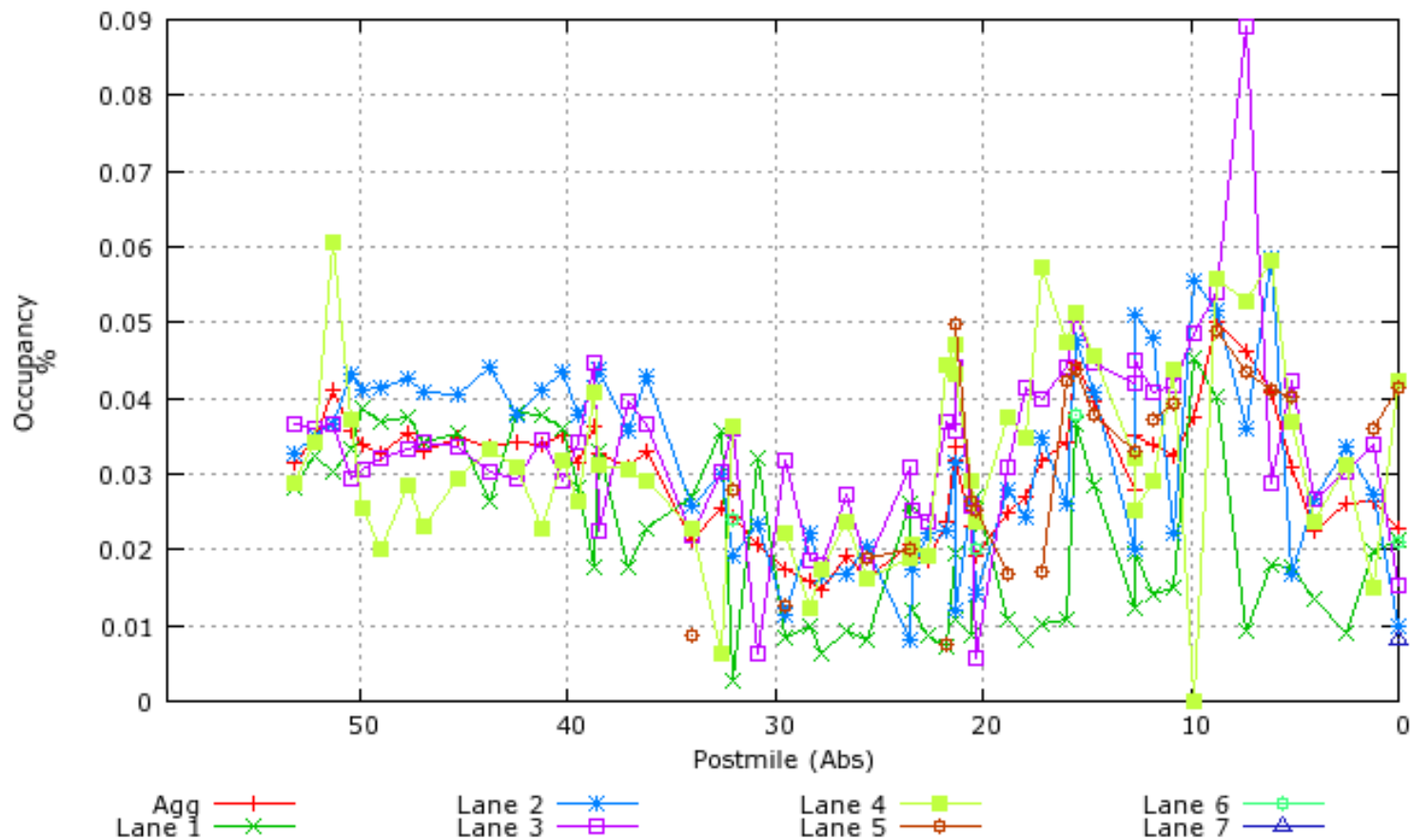
Travel Time Index
3,500,640 Lane Points (91% Observed)
Segment Type: County, Segment Name: San Diego County
07/16/2007 00:00:00 to 07/23/2007 23:59:59 (Days=Mo,Tu,We,Th,Fr)





PeMS data ...

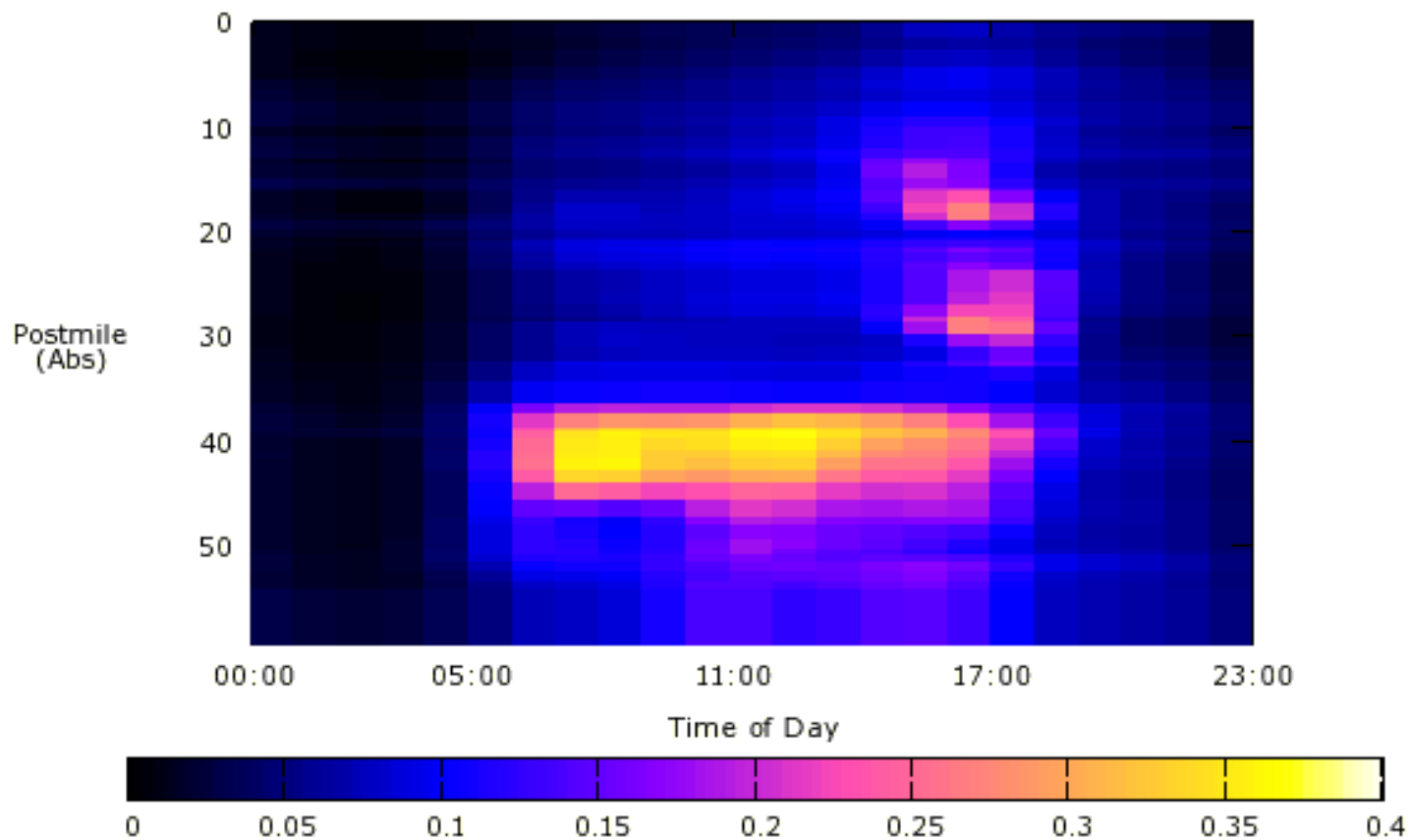
Occupancy for I5-S (91% Observed)
04/01/2006 00:00
Traffic Flows from Left to Right





PeMS data ...

Average Occupancy (%) (85% Observed)
Segment Type: Freeway Segment Name: 15-S
07/16/2007 00:00:00 to 07/23/2007 23:59:59
Traffic Flows from Bottom to Top





A new, better way ...

to visualize freeway traffic in SD...



● ● ● | How did we make it?

PeMS Data

- Download PeMS data
- Import to the project gdb

Highway Network

- Download VDS XY
- Import to the project gdb
- Geocode VDS points
- Join VDS points to hwy segment network (lines)



Spatial Join



Animation Tool

- ArcMap
- ArcGlobe

