

**Evaluation of Ramp Meter Effectiveness for
Wisconsin Freeways, A Milwaukee Case Study:
Part 2, Ramp Metering Effect on Traffic
Operations and Crashes**

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Final Report

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16. Abstract <p>The purpose of the research is to determine the benefits of ramp meters in the Milwaukee area freeway system, to determine underlying relationships that permit evaluation of new ramp meters or ramp meter systems elsewhere, and to develop a coherent framework for performing evaluation of ramp meter effectiveness on a whole system. Part 2 concentrates on the traffic operations effect six new ramp meters had on the 14-mile long corridor where six ramp meters were already operational. A crash rate comparison was performed between the periods the corridor operated without and with the six new ramp meters. Metered on-ramp queue length and delay information is presented in Appendix A; details of the operation of a metered on-ramp as well as mainline speed occupancy and volume information in the vicinity of the ramp are presented in Appendix B.</p> <p>Average corridor speeds improved when the new ramp meters were operational. Vehicle-hours of travel were lower during the more congested afternoon peak period. It is suggested that fine-tuning of ramp metering parameters is very likely to result in additional benefits for the corridor.</p> <p>Crash rates during ramp metering hours were lower by 13% with the new ramp meters operational.</p>					
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Appendix A

Inventory of Ramp Delay and Queue Length Information

Introduction

The present appendix contains all collected ramp delay and queue length information. Information is presented in spatial order, from the North to the South end of the analyzed corridor. Data for each ramp are presented in a temporal sequence; High-Occupancy-Vehicle (HOV) ramp data are presented, wherever available, following Single-Occupancy-Vehicle (SOV) ramp data. Where no HOV ramp was present, the term SOV was used, although high-occupancy vehicles would also use the same ramp.

The index in pages A - ii through A - v provides Appendix page numbers where information about a specific location can be found for a specific peak period and a specific ramp. Shaded cells indicate that ramp metering was not operational during this time. Blank cells indicate that, although the ramp was operational, information for a specific period was not available. HOV cells left blank for all four weeks indicate locations that did not have an HOV ramp.

Weeks 1 and 2 (February 1-3 and 8-10) correspond to freeway operation without the new ramp meters; weeks 3 and 4 (March 14-16 and 21-23) correspond to freeway operation with the new ramp meters on-line.

Graphs contained in this Appendix provide a visual representation of queue length (used as the y-axis) and delay (the shaded area in each graph) during any instant (the x-axis represents time) of a reported peak period. Heavily shaded graphs represent peak periods with more significant ramp delay.

Certain ramps present an appearance of frequent narrow “spikes,” indicating an increased arrival rate (the left side of the spike, leading to the peak), followed by vehicles being released from the stop line, leading to shorter queues or completely dissipated queues (the right side of the spike). When ramp occupancies reached a predetermined level, “queue override” took over and set the fastest ramp metering rate, until ramp occupancy was at a predetermined low level. Such occurrences would be indicated by a faster queue length dissipation.

The operation of the Wisconsin Avenue ramp meter during the afternoon peak period of February 9, 2000, is examined in **Appendix B**, where the factors determining ramp metering rates are analyzed in detail.

RAMP DELAY DATA AVAILABILITY

February-March 2000

Table entries indicate appendix page number

Week 1

	2/1				2/2				2/3			
	AM		PM		AM		PM		AM		PM	
	SOV	HOV	SOV	HOV	SOV	HOV	SOV	HOV	SOV	HOV	SOV	HOV
County Line Rd. (North end)												
Pilgrim Rd.												
Good Hope Rd. Loop Ramp	8										9	
Good Hope Rd. Slip Ramp	16	16	17	17	18	18	19	19	20	20	21	21
Appleton Ave.												
Hampton Ave.												
Capitol Dr.												
Burleigh St.												
North Ave.	72		73		73		74		74		75	
Watertown Plank Rd.	83	83	84		84	85	85	86	86	87	87	
Wisconsin Ave.			100		101				101			
Greenfield Ave. (South end)			110				111					

NOTES:

SOV = Single-Occupancy-Vehicle lane

HOV = High-Occupancy-Vehicle lane

Shaded areas: ramp meters operational only during the after period

RAMP DELAY DATA AVAILABILITY

February-March 2000

Table entries indicate appendix page number

Week 2

	2/8				2/9				2/10			
	AM		PM		AM		PM		AM		PM	
	SOV	HOV	SOV	HOV	SOV	HOV	SOV	HOV	SOV	HOV	SOV	HOV
County Line Rd. (North end)												
Pilgrim Rd.												
Good Hope Rd. Loop Ramp			9		10		10		11		11	
Good Hope Rd. Slip Ramp	22	22	23	23	24	24	25	25	26	26	27	27
Appleton Ave.												
Hampton Ave.												
Capitol Dr.												
Burleigh St.												
North Ave.	75		76		76		77		77		78	
Watertown Plank Rd.	88	88	89		89	90	90	91	91	92	92	
Wisconsin Ave.	102				102		103		103		104	
Greenfield Ave. (South end)			111				112				112	

NOTES:

SOV = Single-Occupancy-Vehicle lane

HOV = High-Occupancy-Vehicle lane

Shaded areas: ramp meters operational only dt

RAMP DELAY DATA AVAILABILITY

February-March 2000

Table entries indicate appendix page number

Week 3

	3/14				3/15				3/16			
	AM		PM		AM		PM		AM		PM	
	SOV	HOV	SOV	HOV	SOV	HOV	SOV	HOV	SOV	HOV	SOV	HOV
County Line Rd. (North end)	1	1			2	2			3	3		
Pilgrim Rd.	6								6			
Good Hope Rd. Loop Ramp	12				12		13		13		14	
Good Hope Rd. Slip Ramp	28	28	29	29			30	30	31	31		32
Appleton Ave.	35		36		36		37		37		38	
Hampton Ave.	40	41			41	42			42	43	43	44
Capitol Dr.	49	50	50	51	51	52	52	53			53	54
Burleigh St.	60	61	61	62	62	63	63	64	64	65	65	66
North Ave.	78		79				79		80		80	
Watertown Plank Rd.	93	93	94		94	95	95	96	96	97	97	
Wisconsin Ave.	104		105		105		106		106		107	
Greenfield Ave. (South end)			113		113	114	114					

NOTES:

SOV = Single-Occupancy-Vehicle lane

HOV = High-Occupancy-Vehicle lane

Shaded areas: ramp meters operational only dt

RAMP DELAY DATA AVAILABILITY

February-March 2000

Table entries indicate appendix page number

Week 4

	3/21				3/22				3/23			
	AM		PM		AM		PM		AM		PM	
	SOV	HOV	SOV	HOV	SOV	HOV	SOV	HOV	SOV	HOV	SOV	HOV
County Line Rd. (North end)	4	4							5	5		
Pilgrim Rd.	7				7				8			
Good Hope Rd. Loop Ramp			14		15						15	
Good Hope Rd. Slip Ramp			32	33	33	34					34	35
Appleton Ave.	38		39		39				40			
Hampton Ave.	44	45	45	46			46	47	47	48	48	49
Capitol Dr.	54	55	55	56	56	57	57	58	58	59	59	60
Burleigh St.	66	67	67	68	68	69	69	70	70	71	71	72
North Ave.			81		81		82				82	
Watertown Plank Rd.	98		98		99		99				100	
Wisconsin Ave.	107		108		108		109		109		110	
Greenfield Ave. (South end)											115	

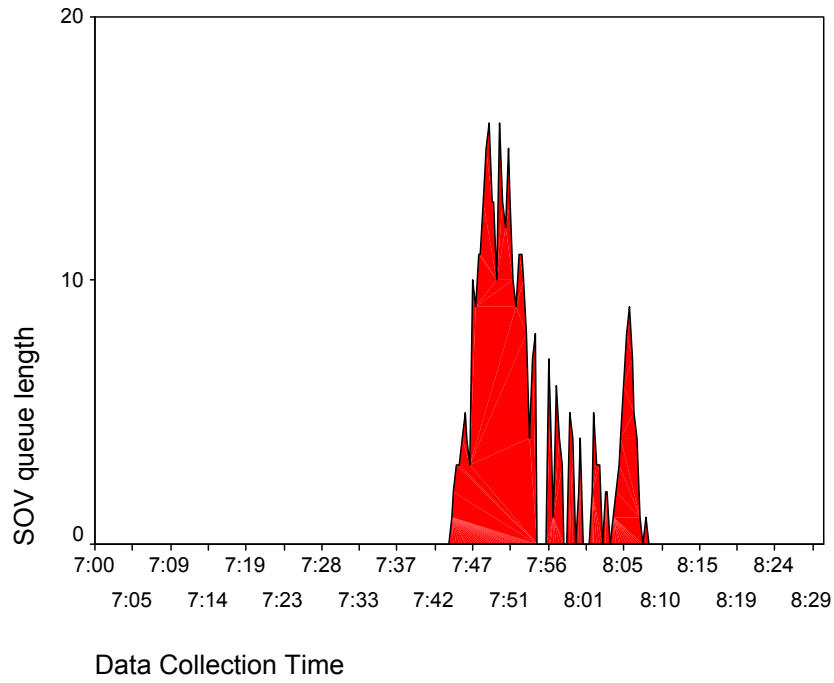
NOTES:

SOV = Single-Occupancy-Vehicle lane

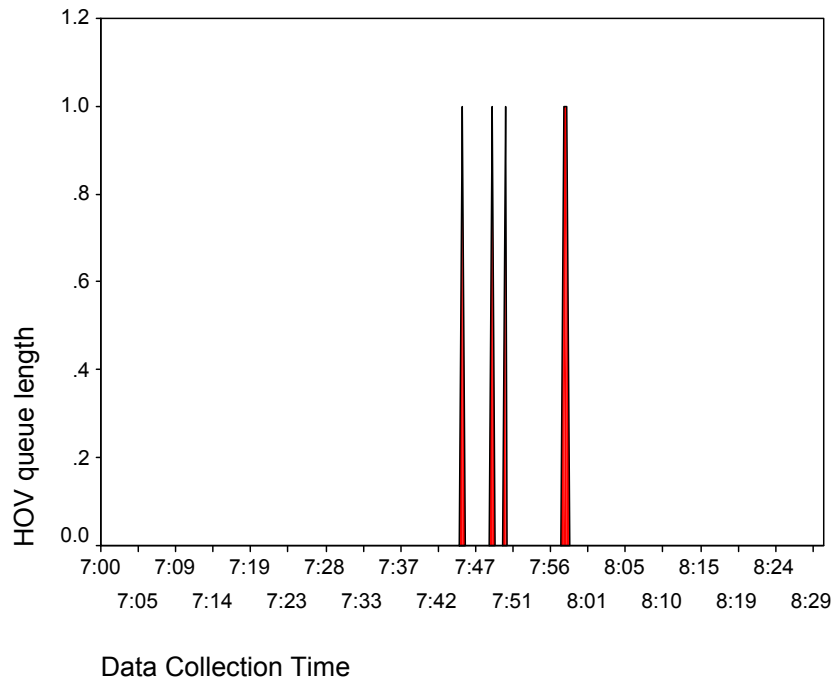
HOV = High-Occupancy-Vehicle lane

Shaded areas: ramp meters operational only dt

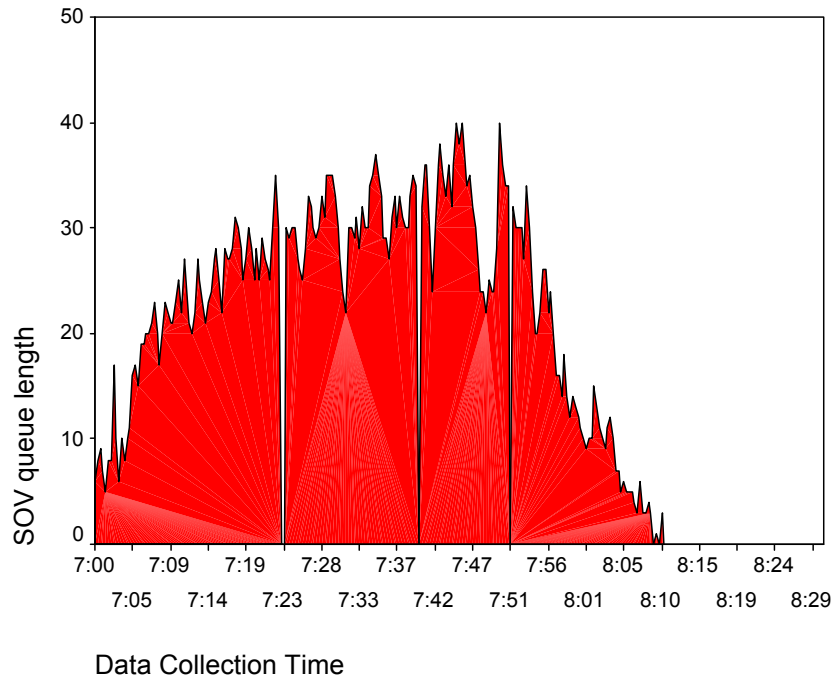
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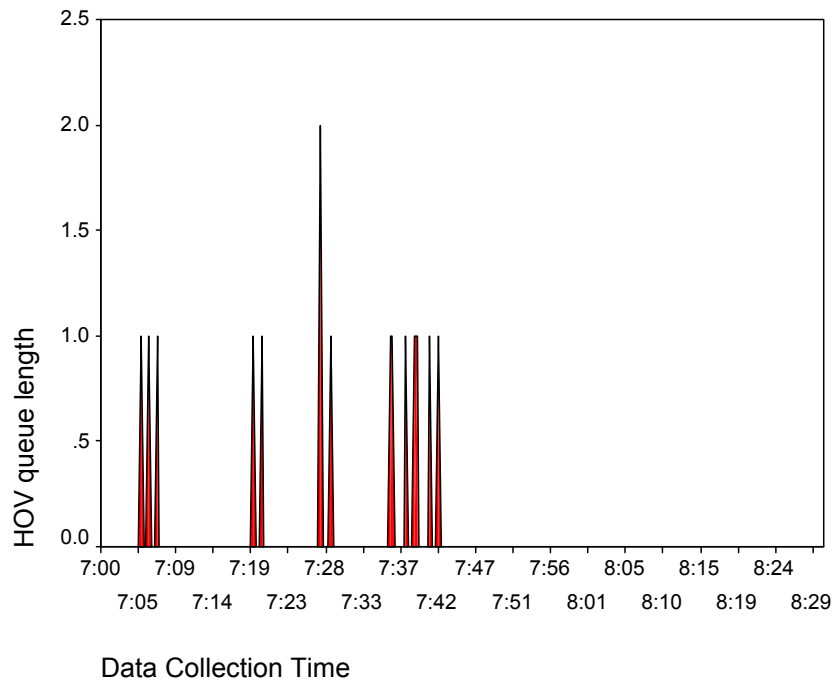
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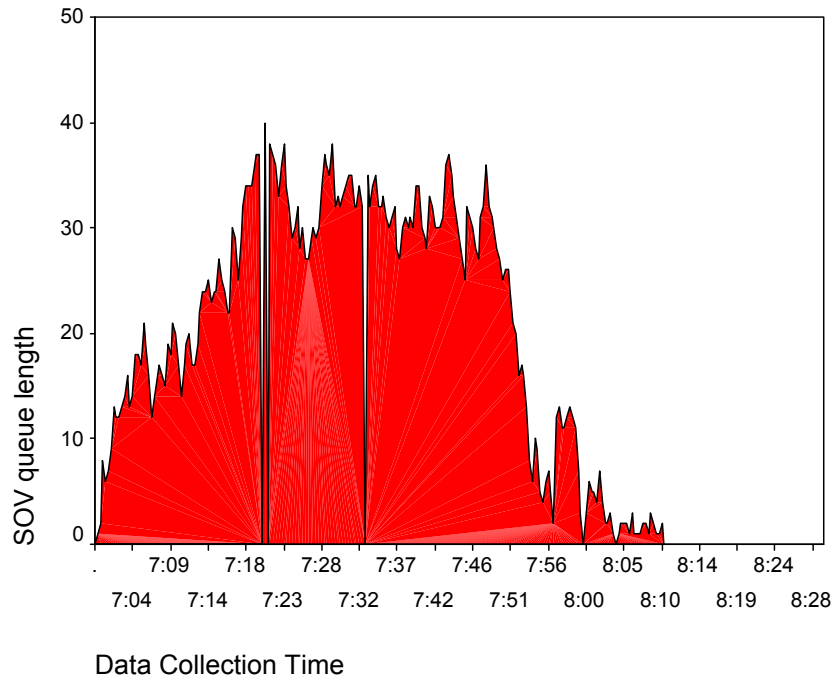
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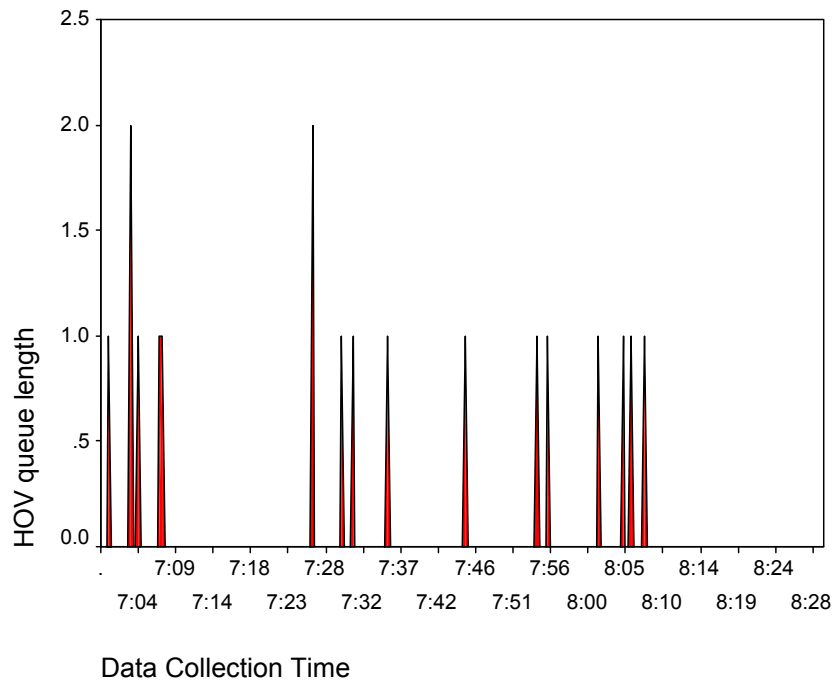
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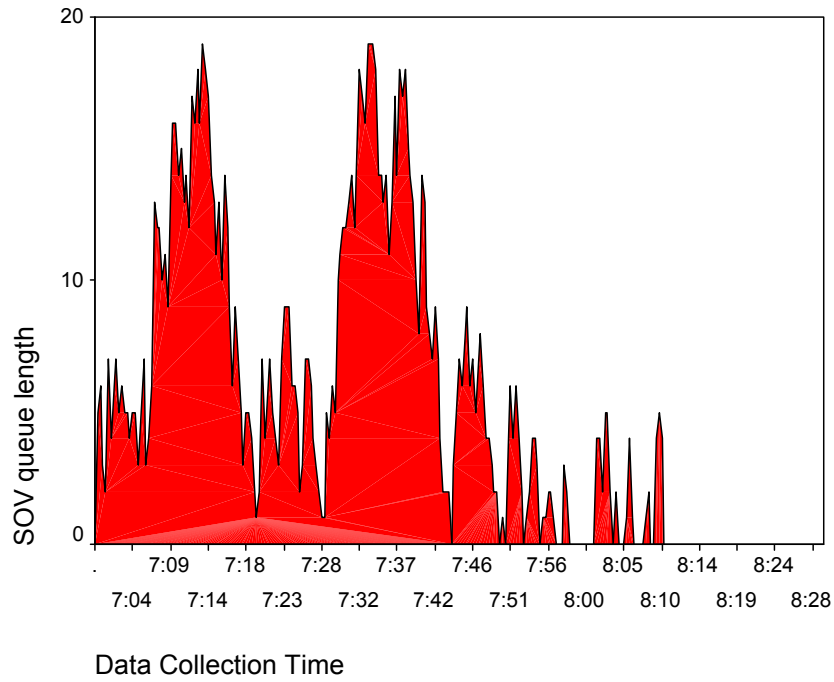
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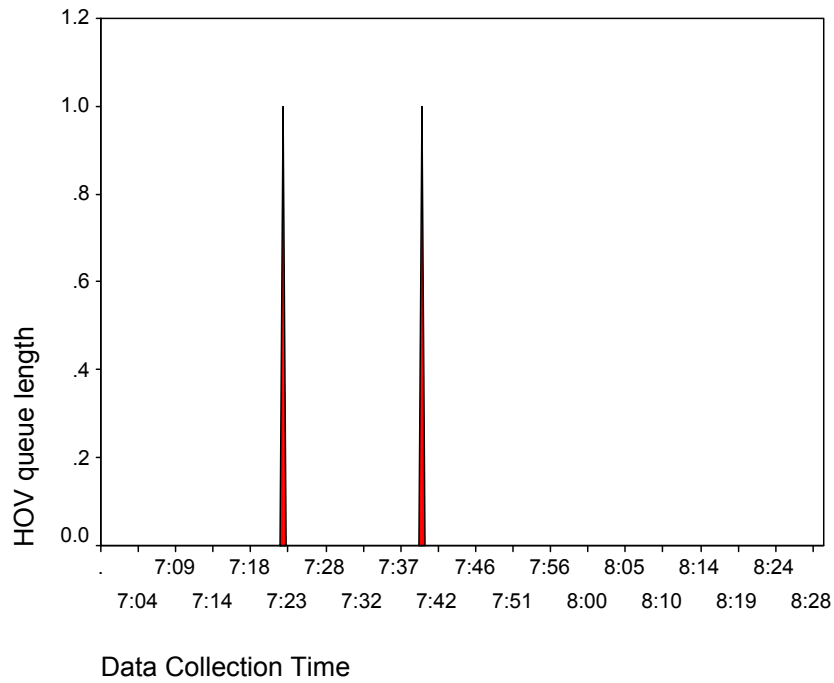
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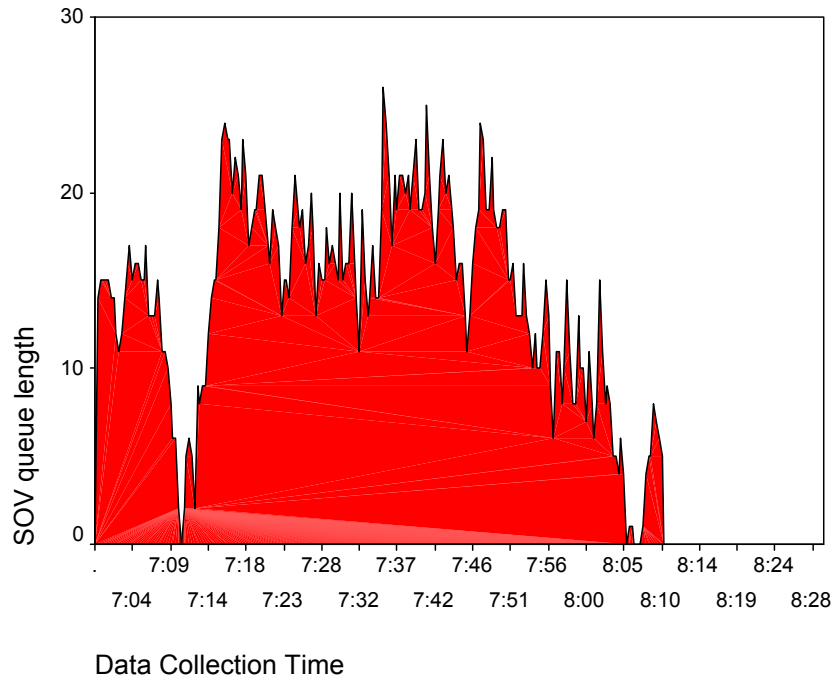
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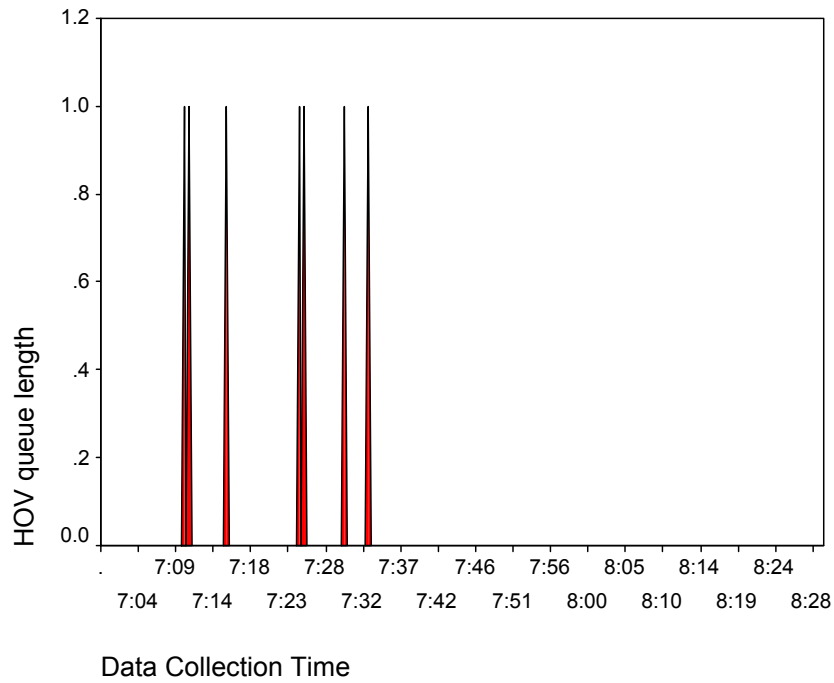
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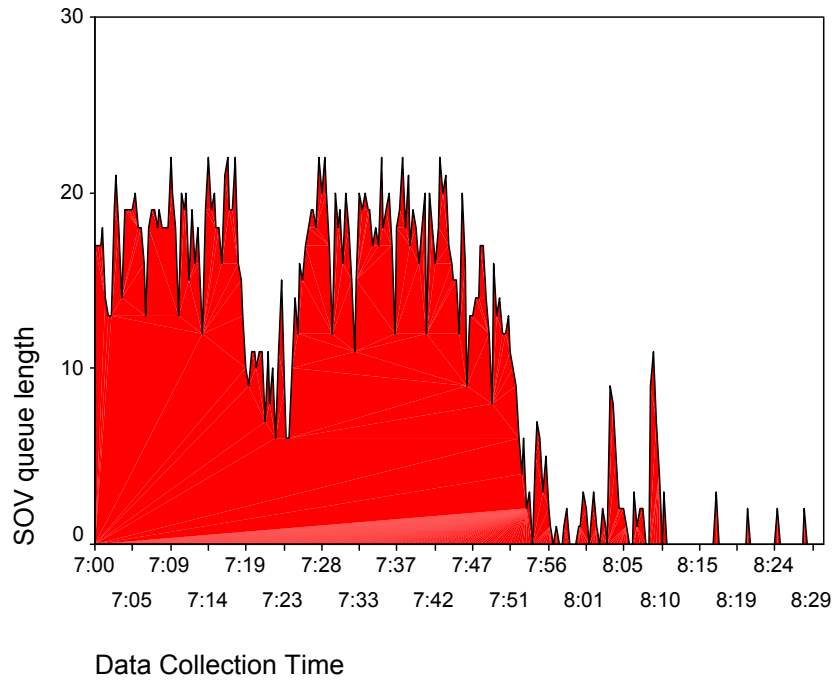
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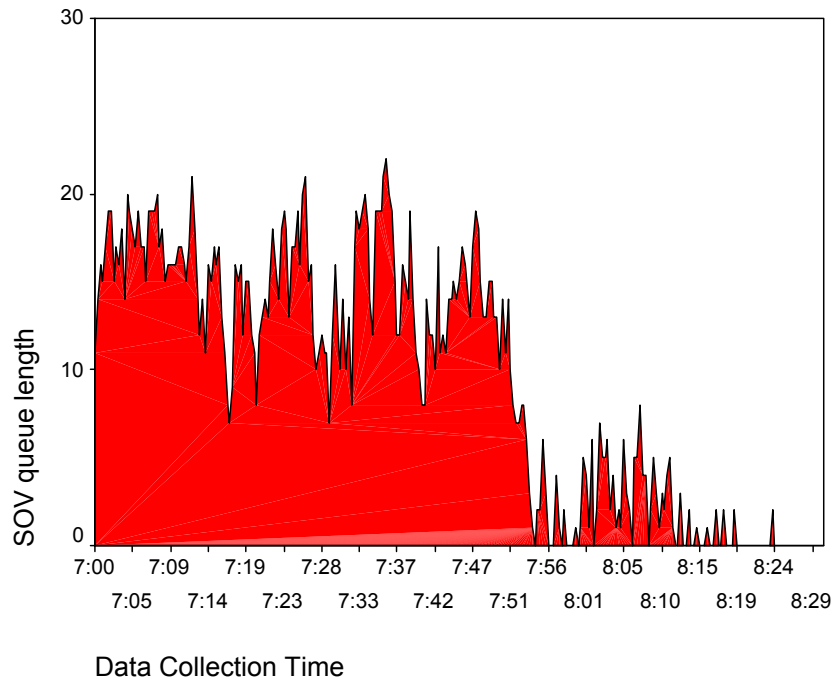
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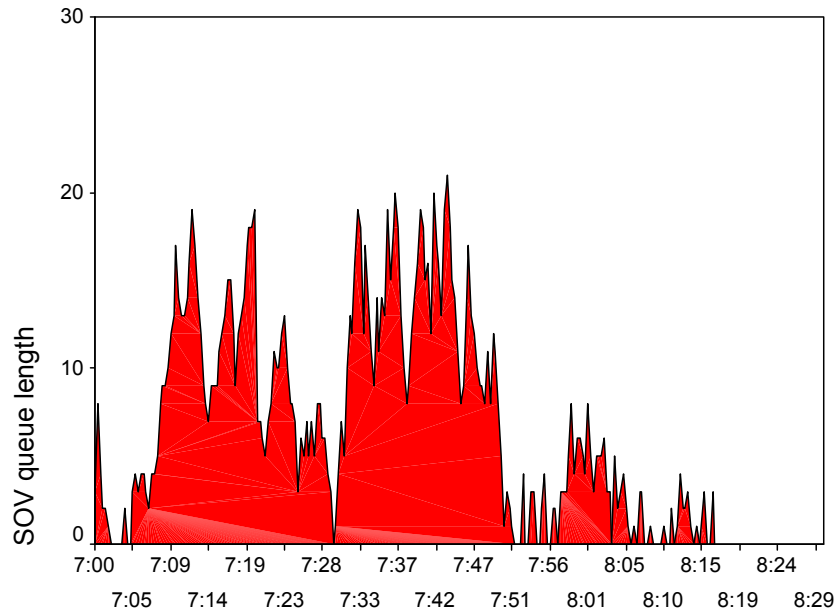
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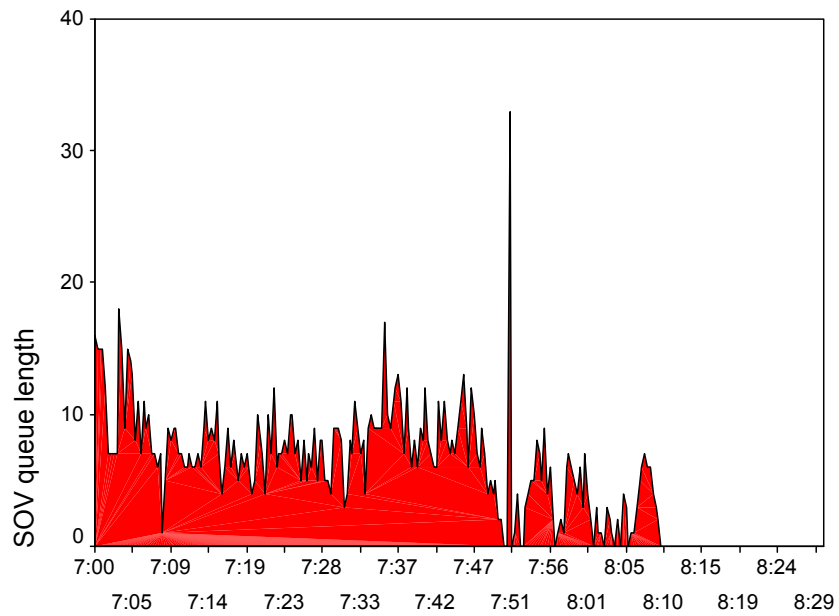


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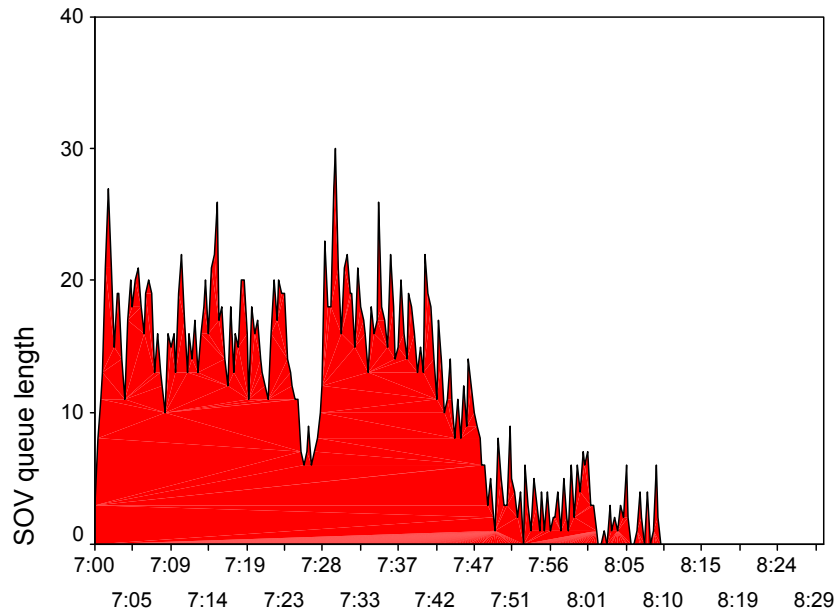
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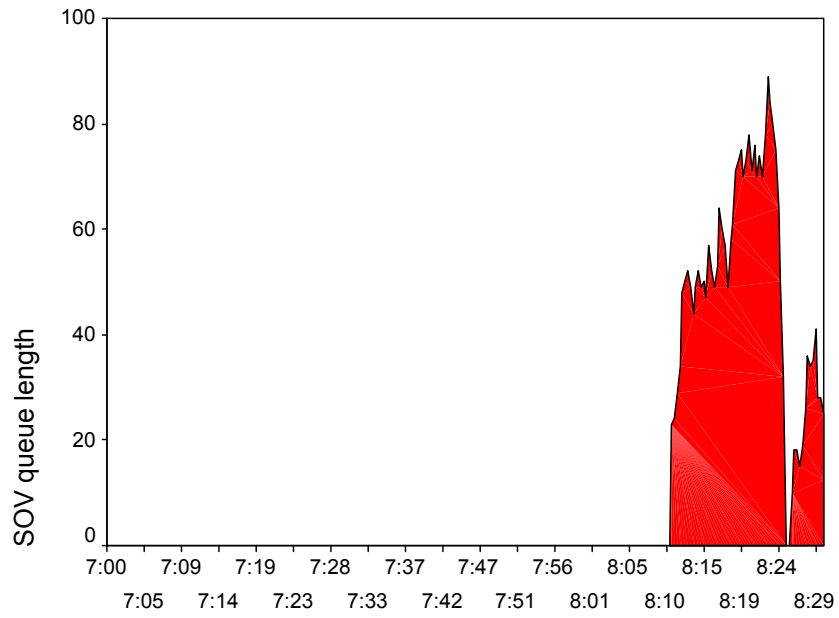
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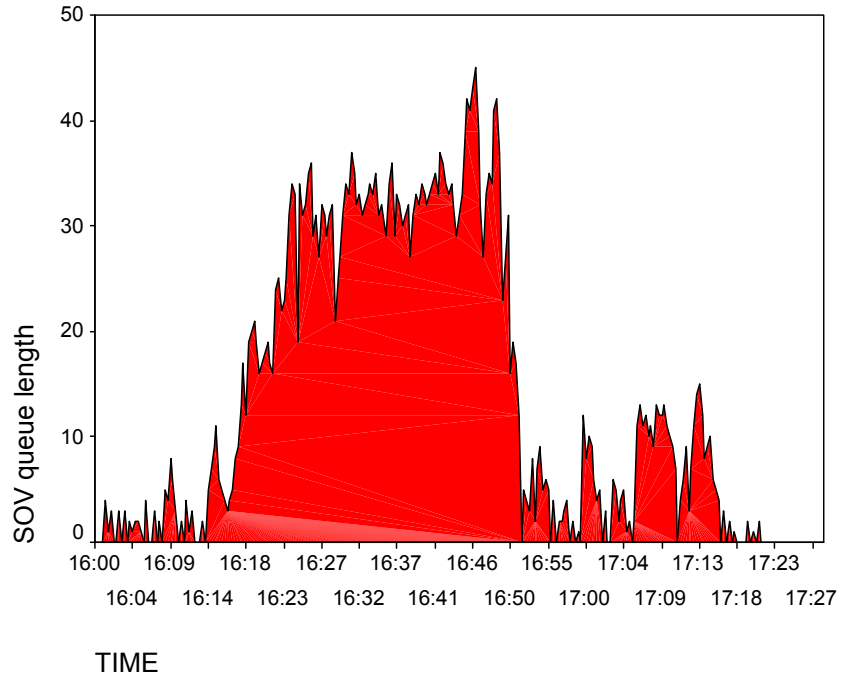
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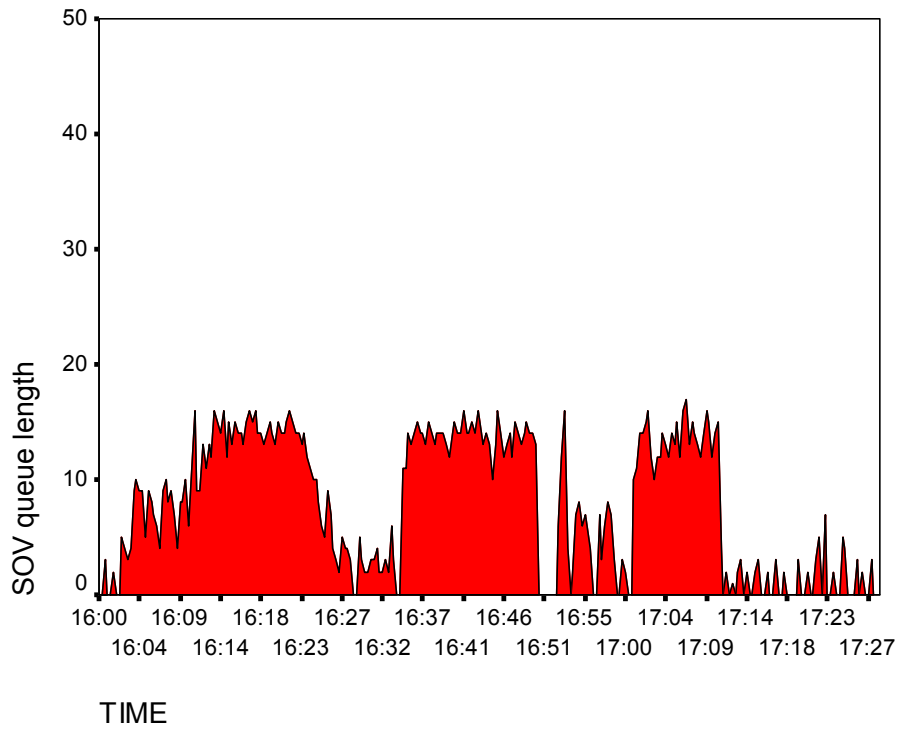


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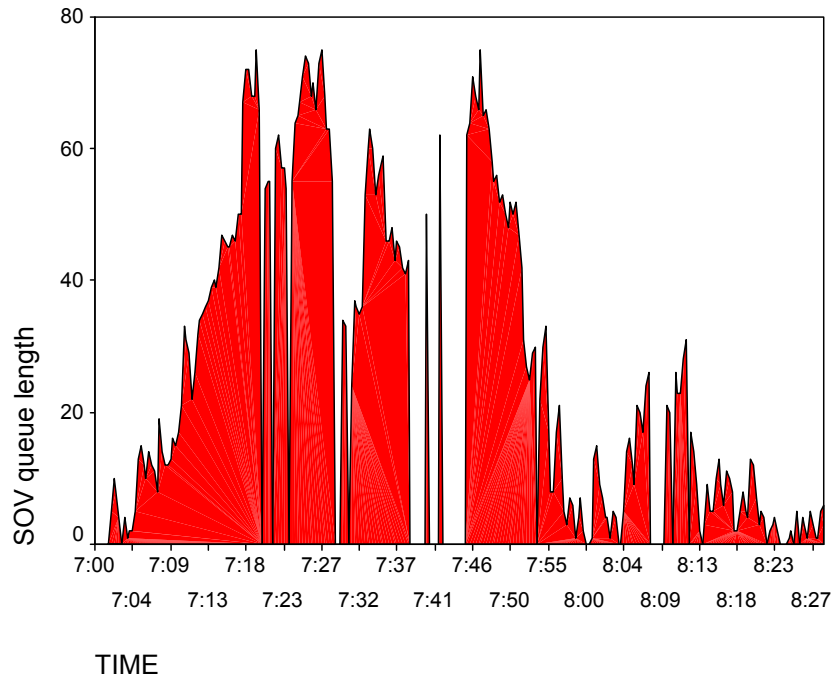
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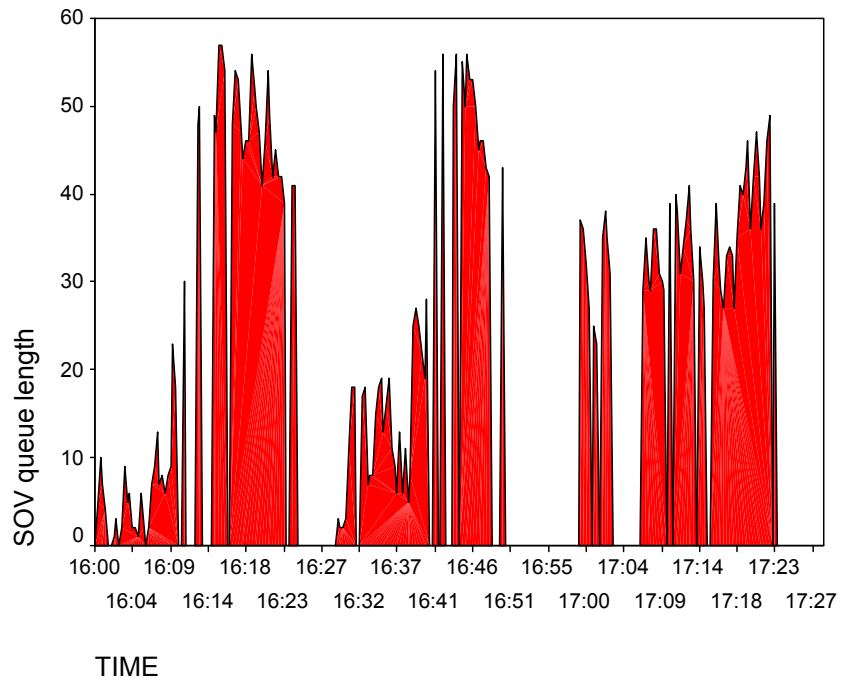
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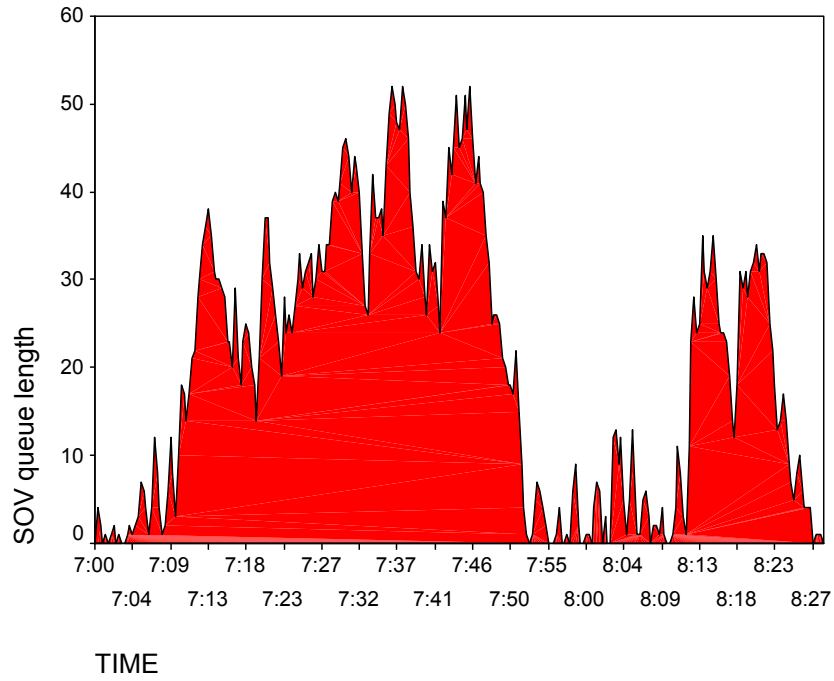
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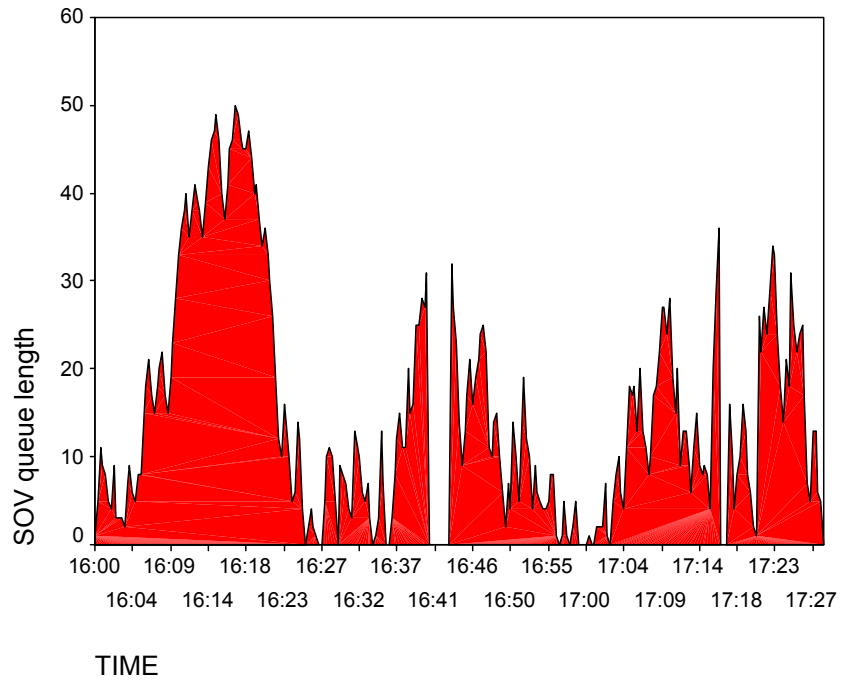
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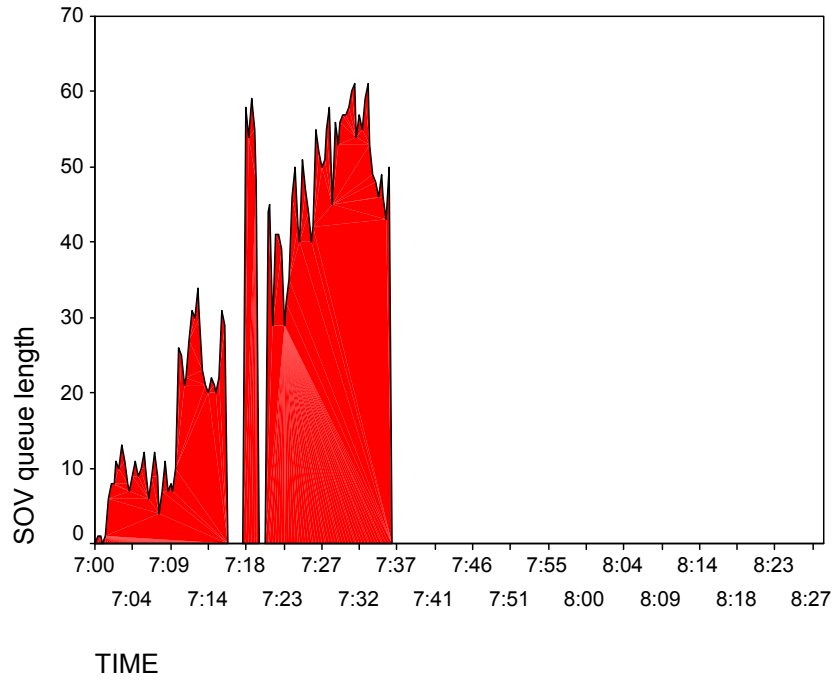
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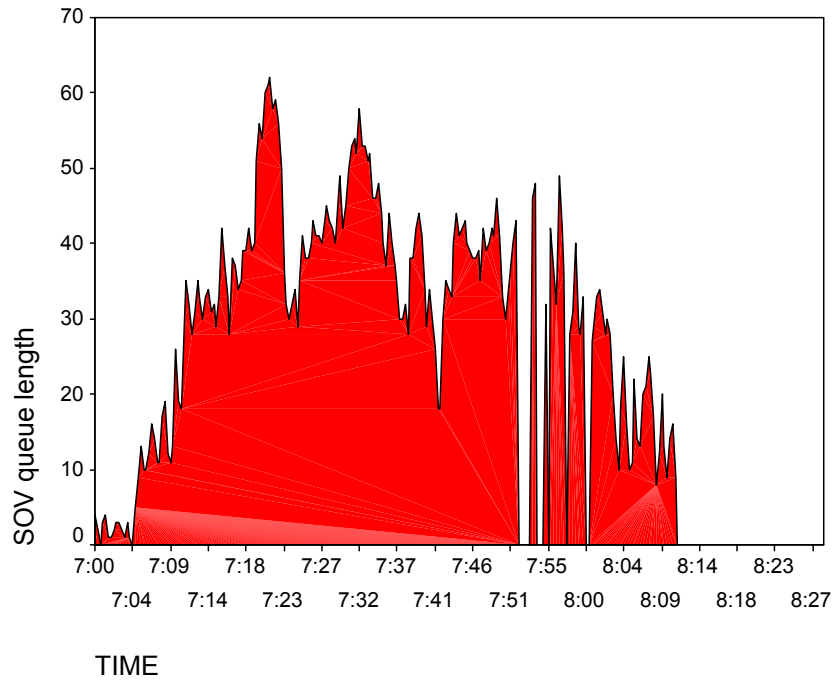
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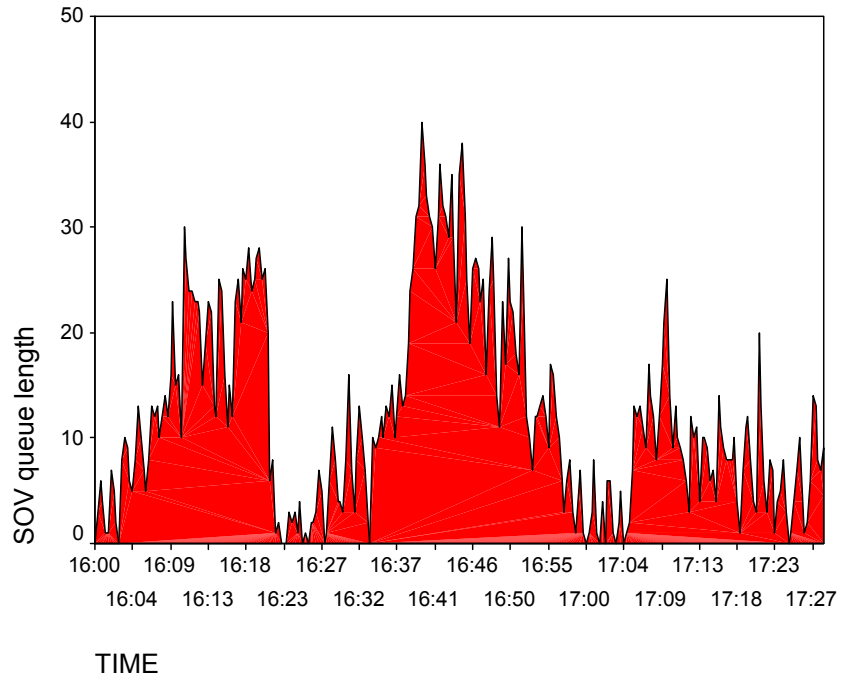
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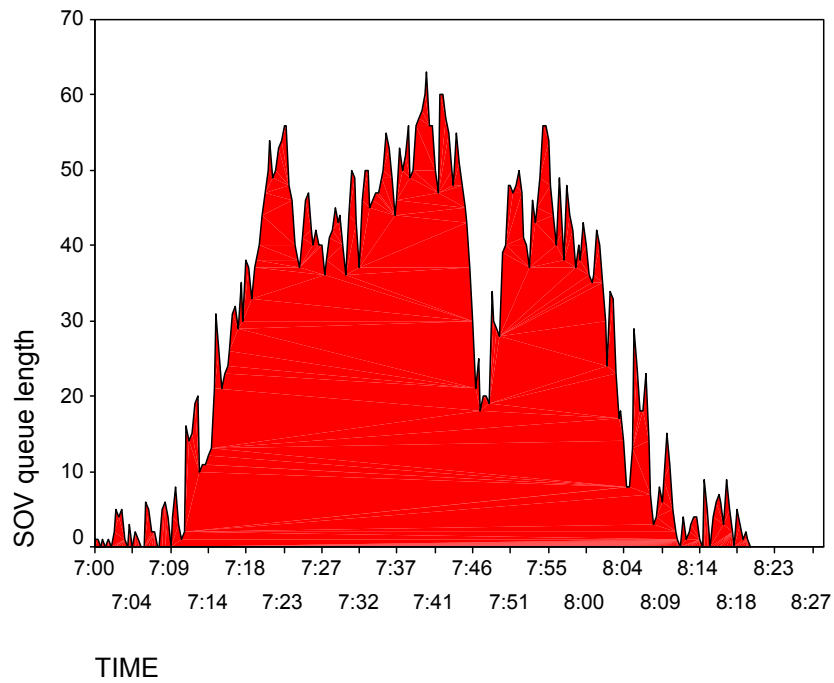
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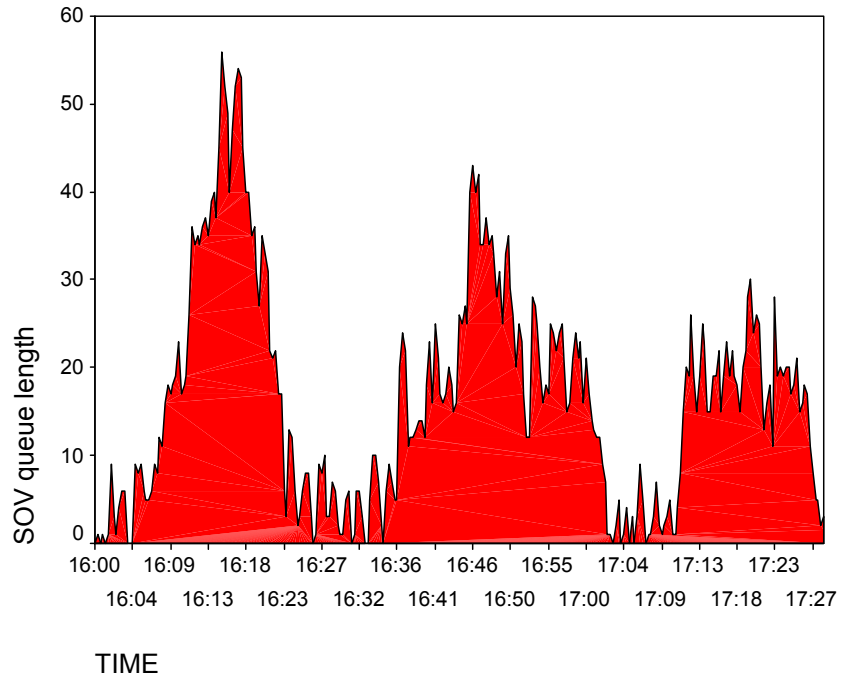
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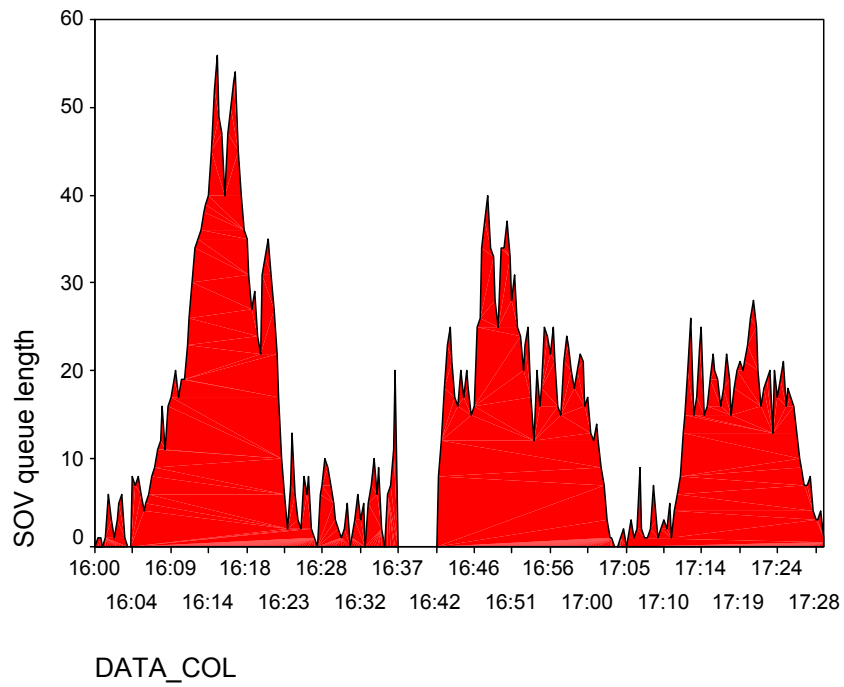
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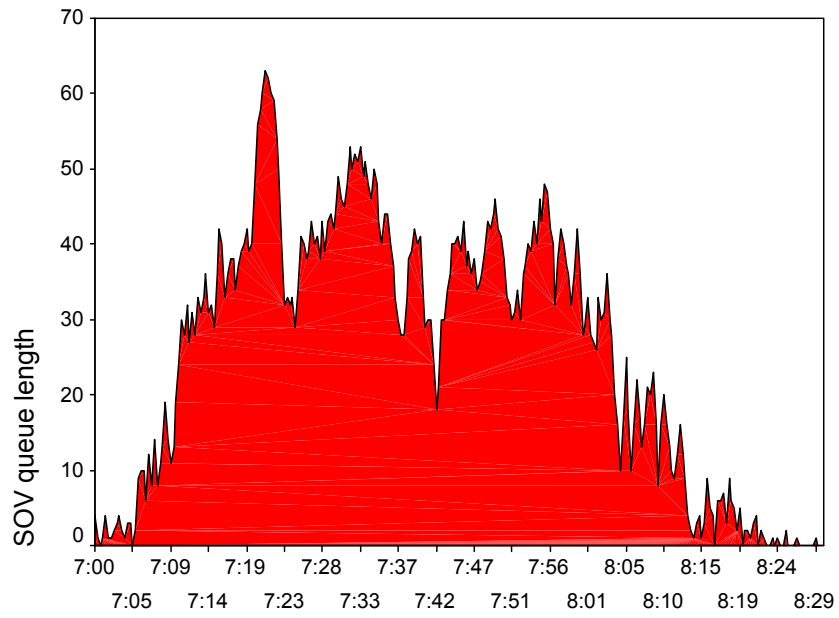
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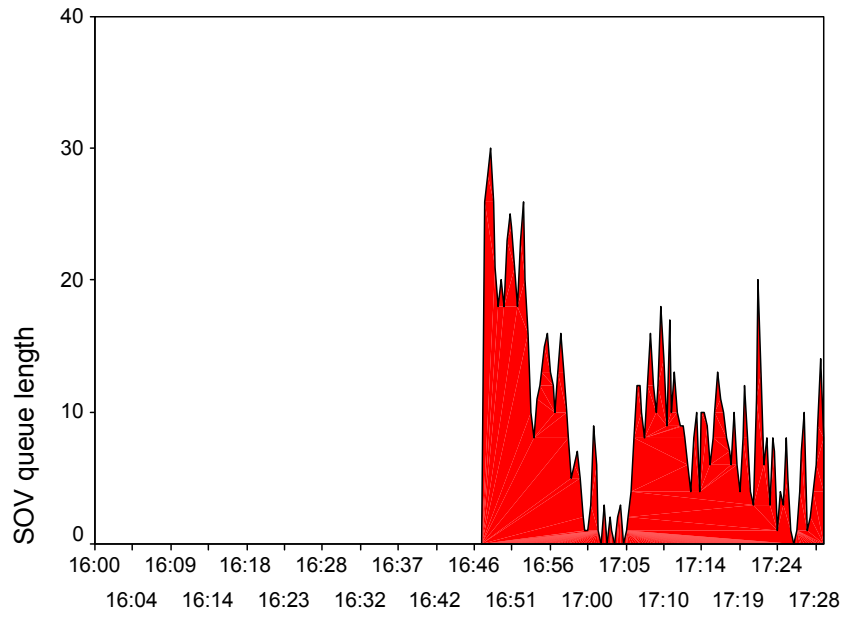


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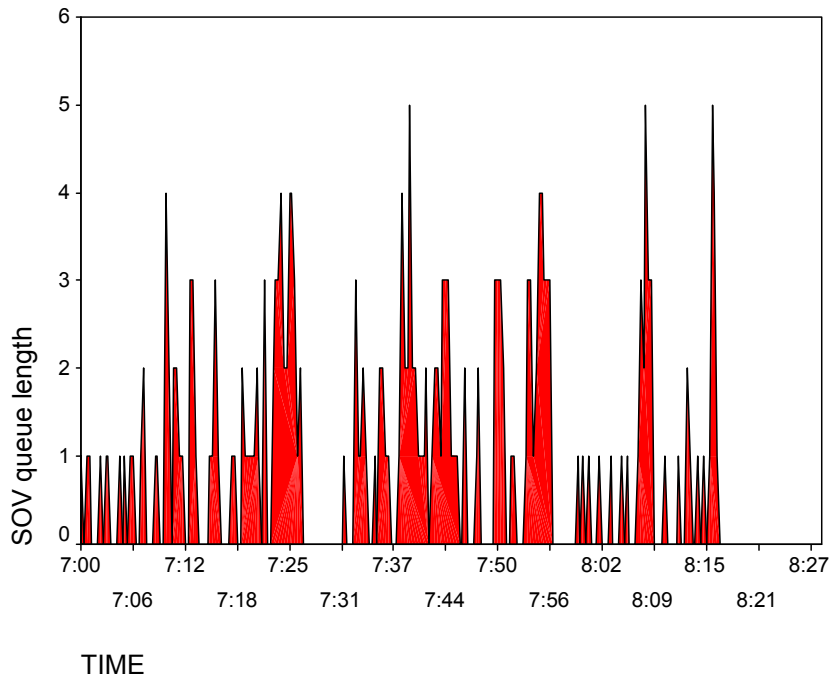
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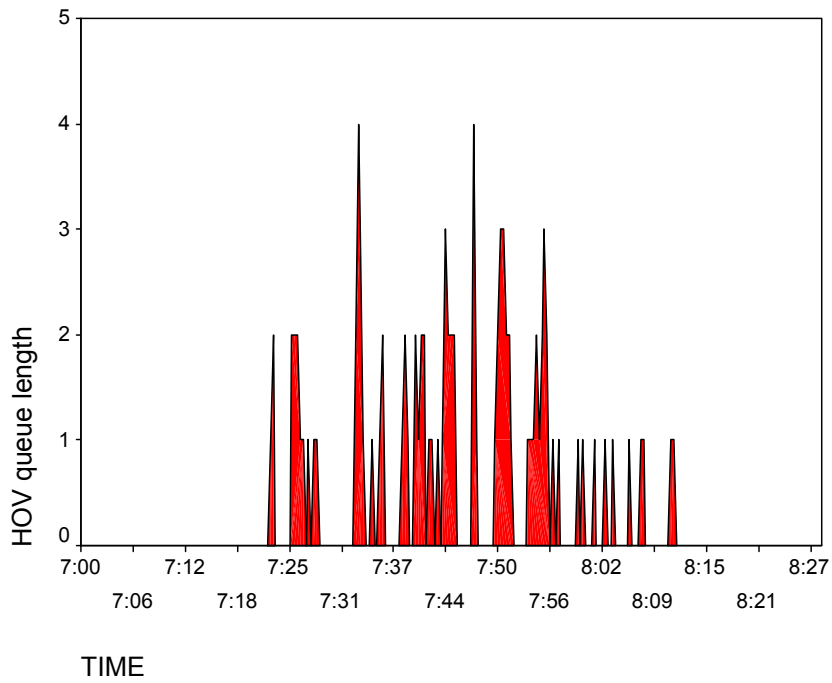


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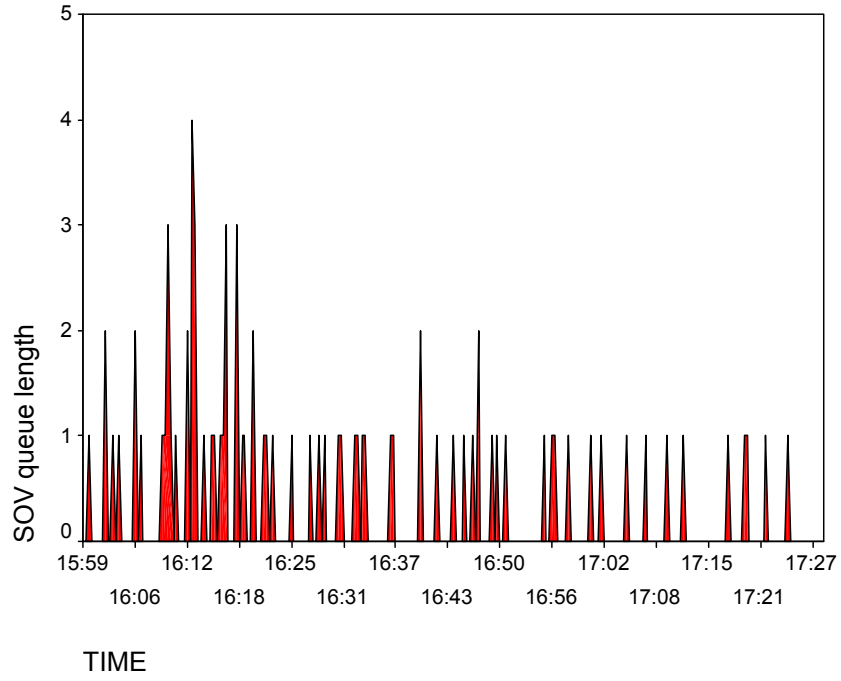
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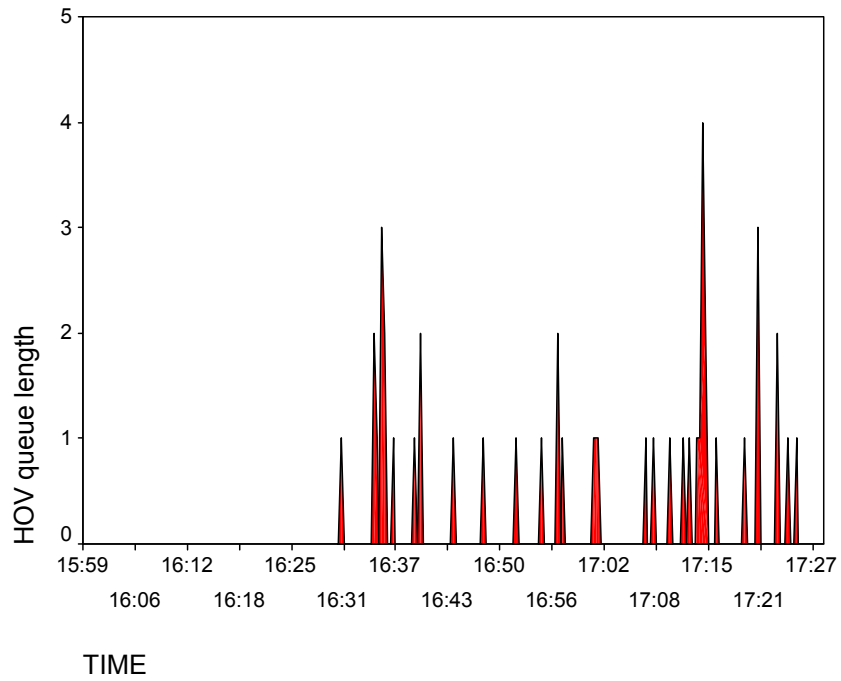
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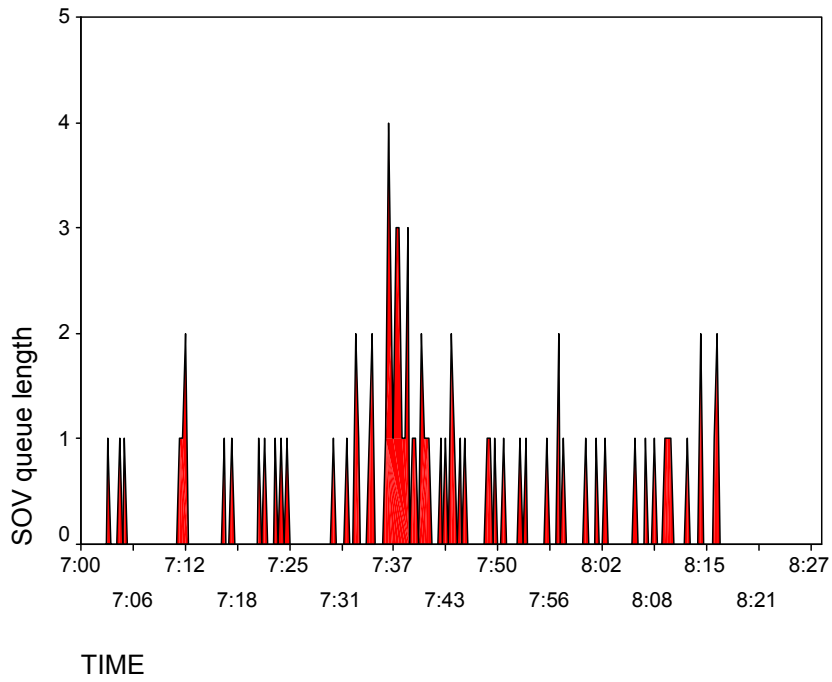
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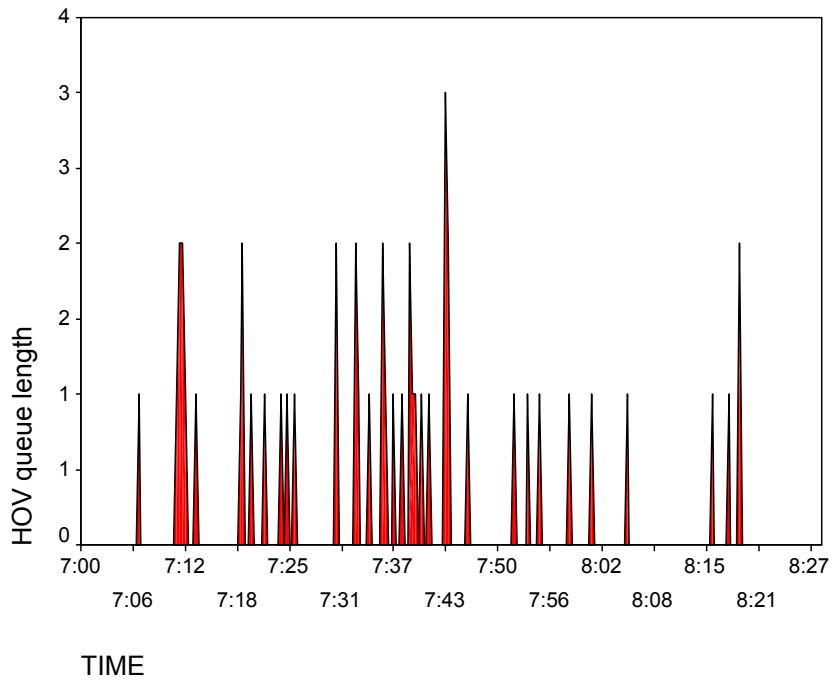
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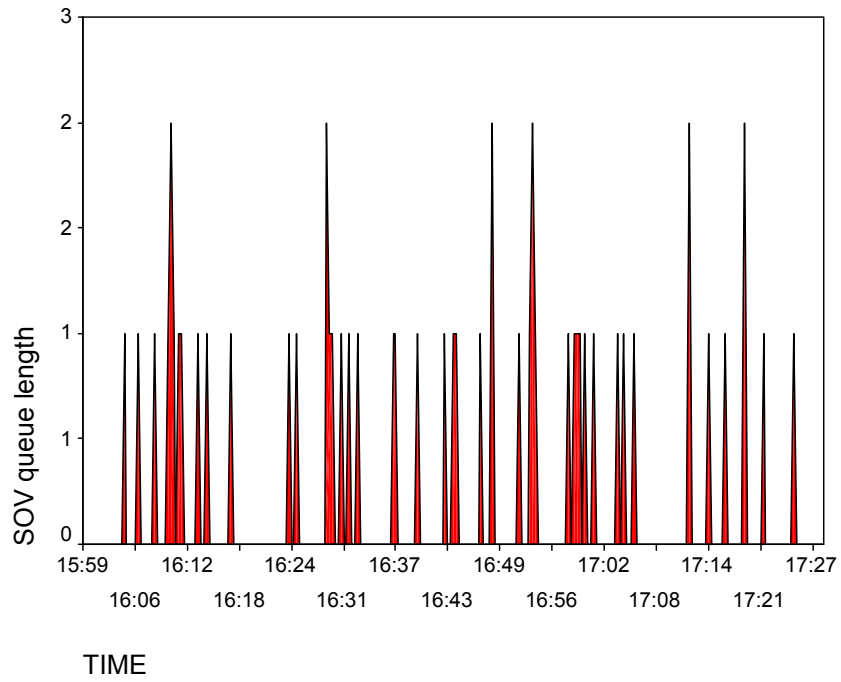
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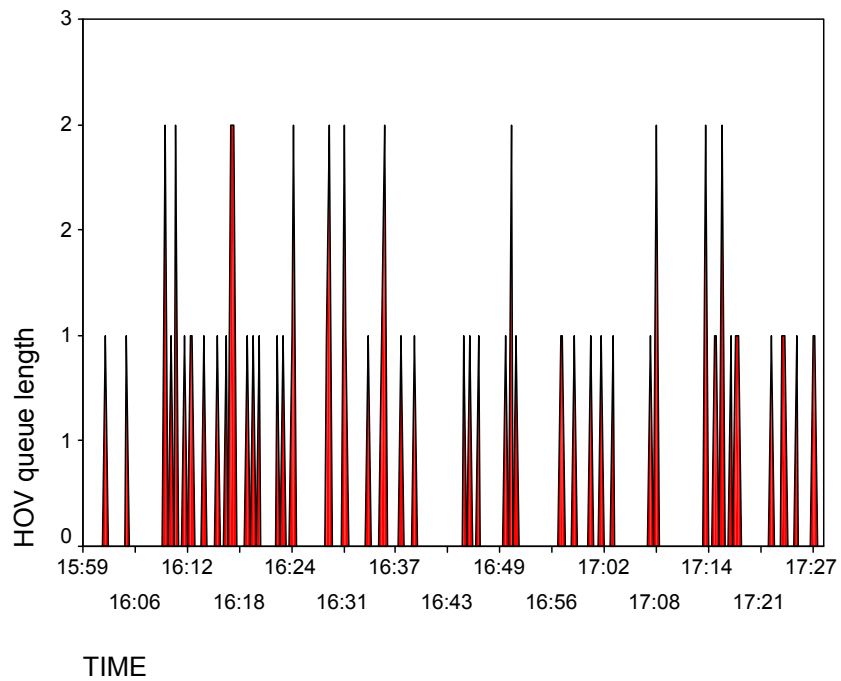
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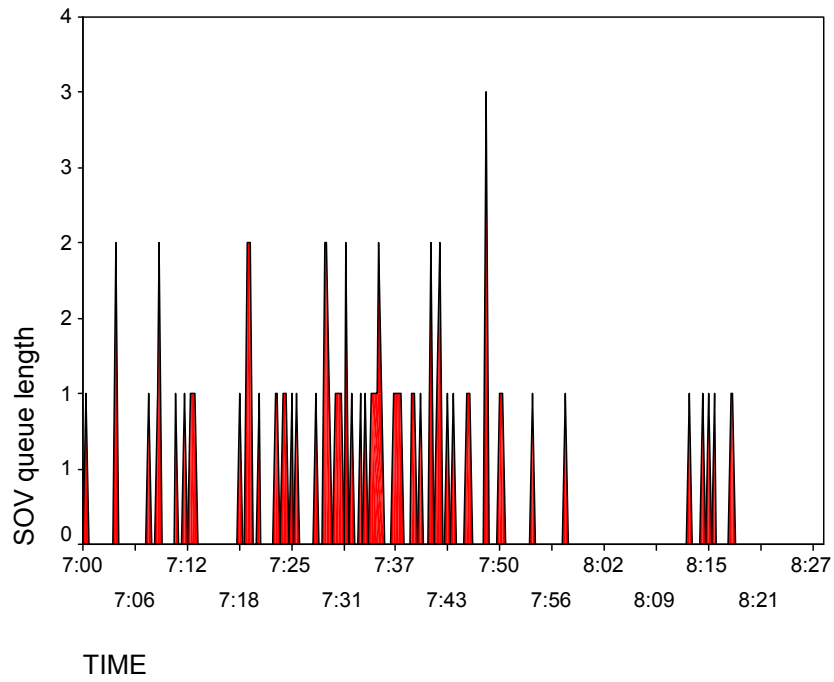
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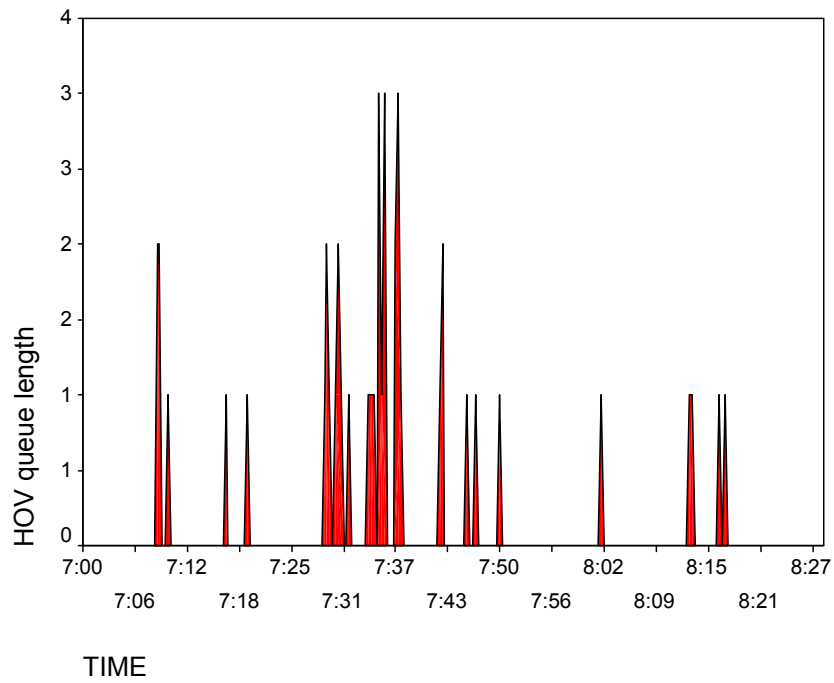
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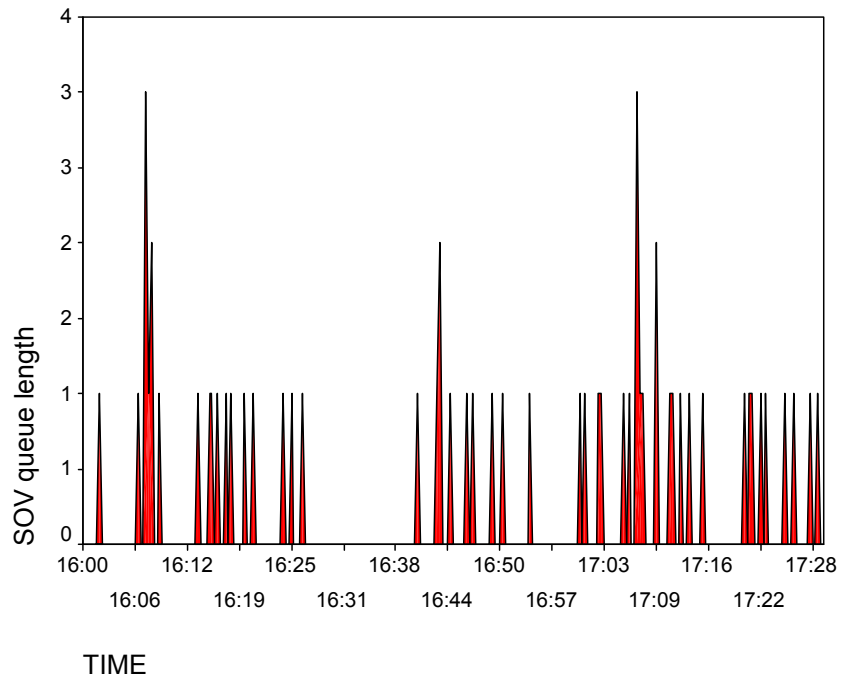
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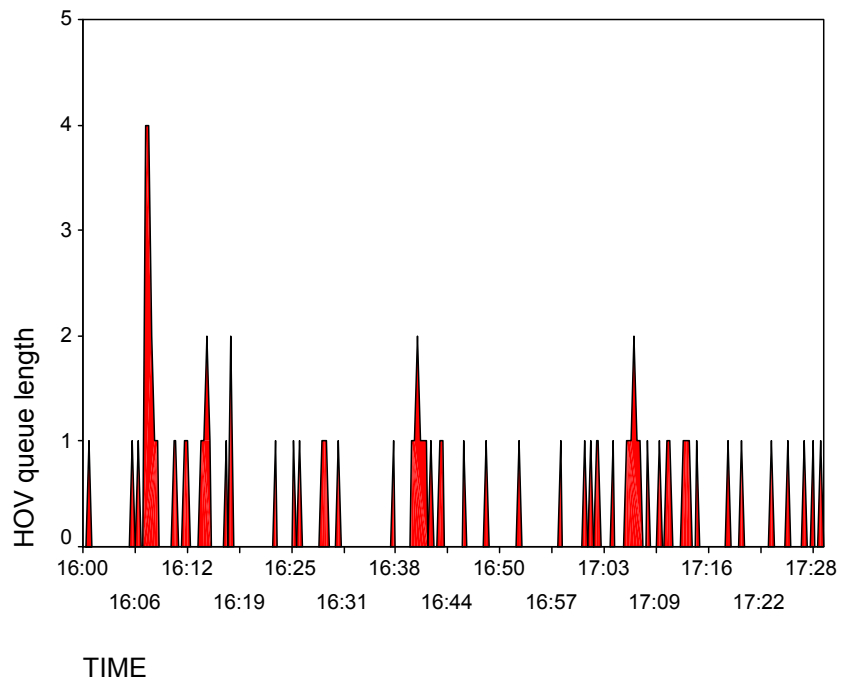
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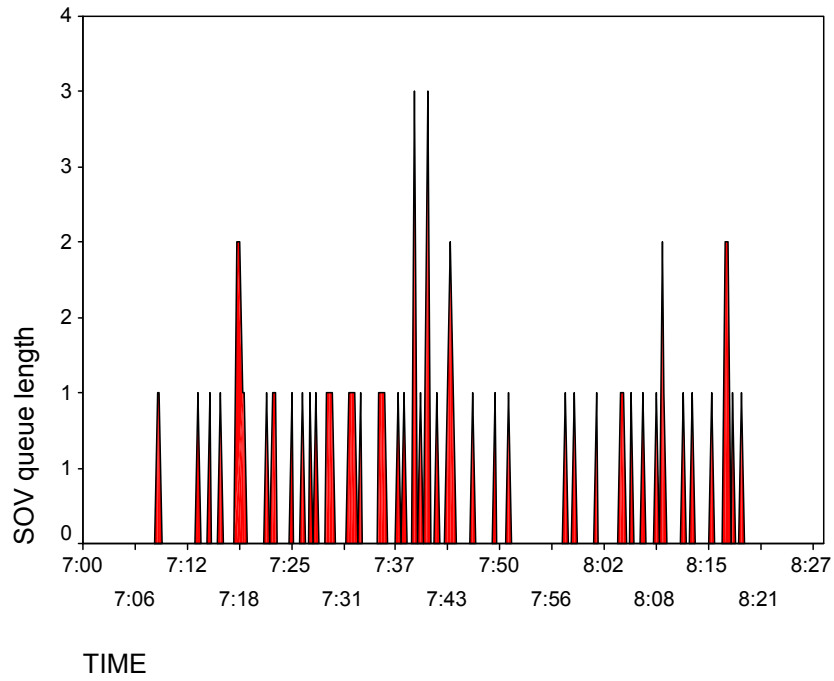
Good Hope Road Slip Ramp 2/3/2000 PM peak



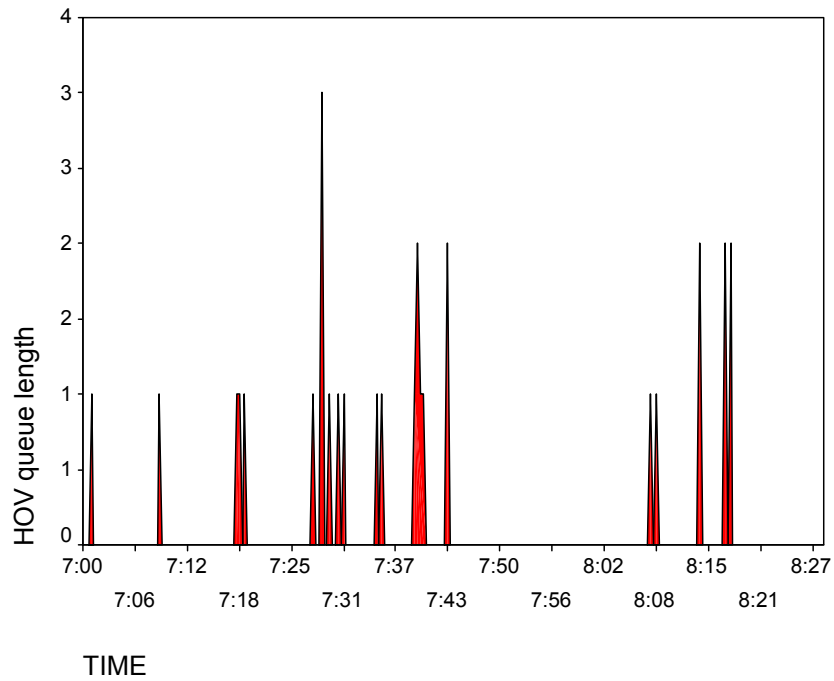
Good Hope Road Slip Ramp 2/3/2000 PM peak



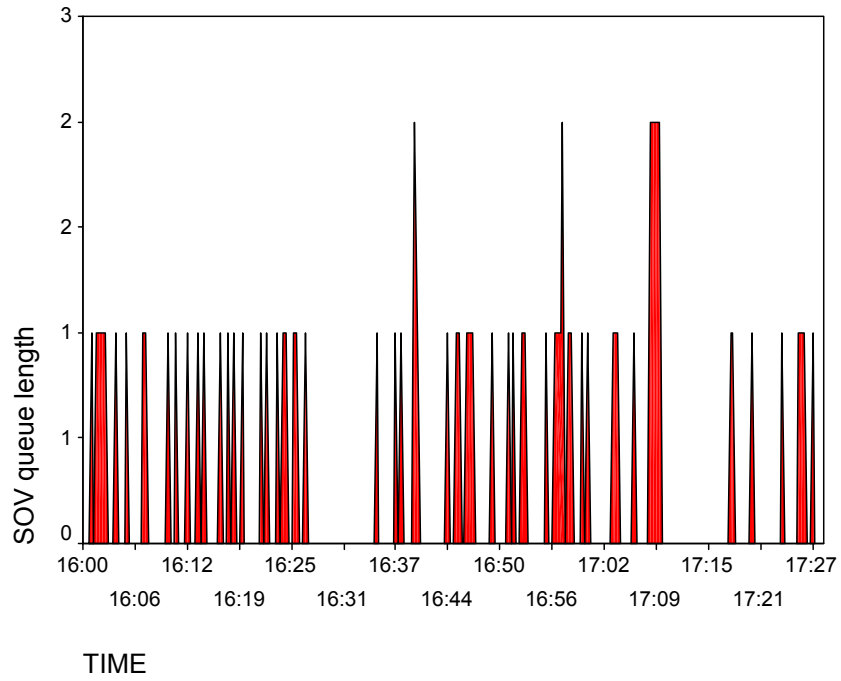
Good Hope Road Slip Ramp 2/8/2000 AM peak



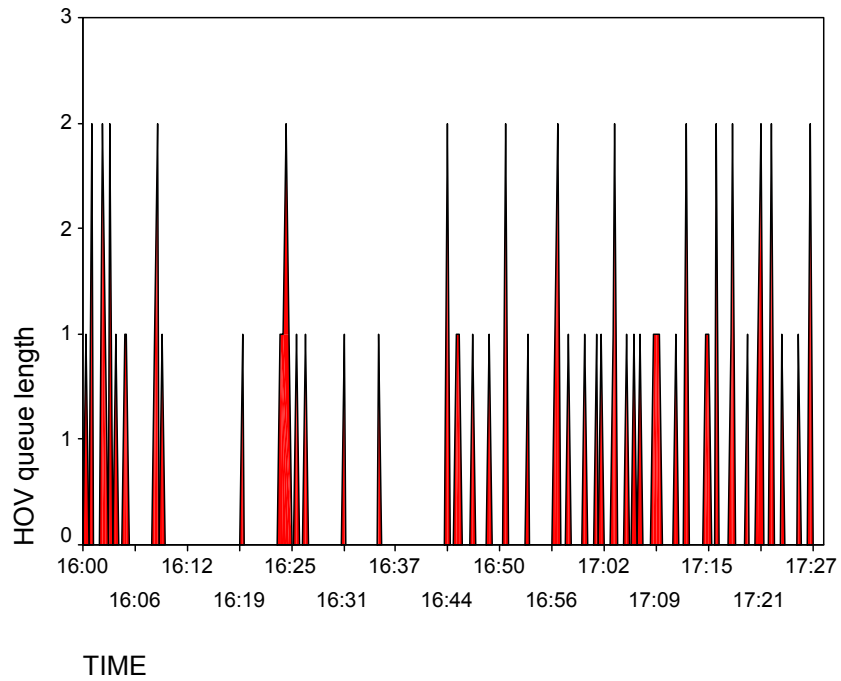
Good Hope Road Slip Ramp 2/8/2000 AM peak



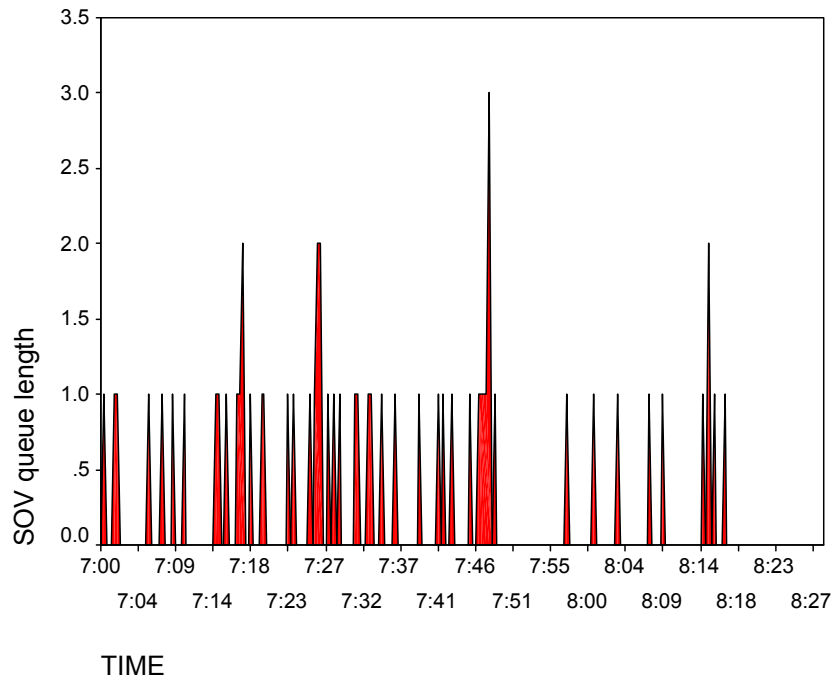
Good Hope Road Slip Ramp 2/8/2000 PM peak



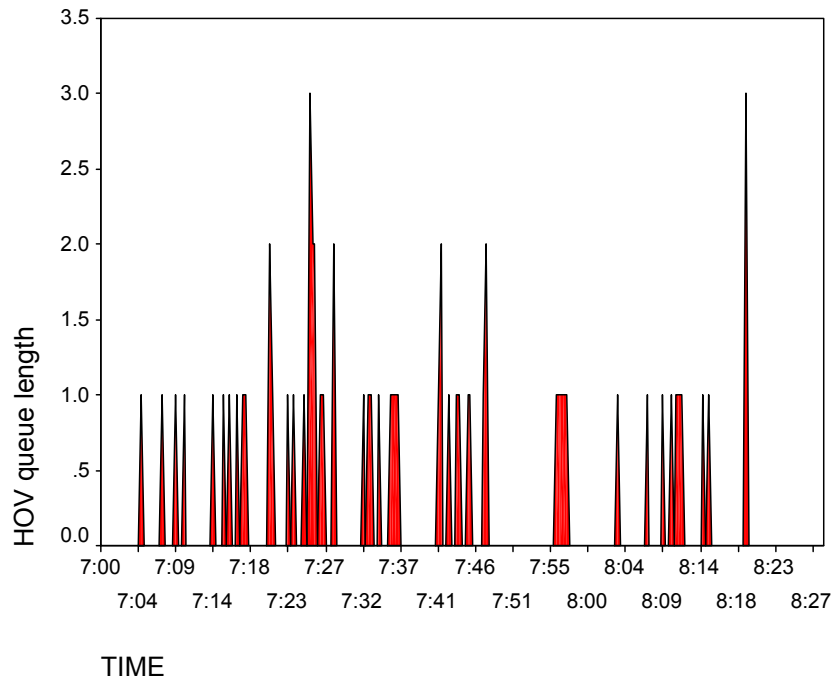
Good Hope Road Slip Ramp 2/8/2000 PM peak



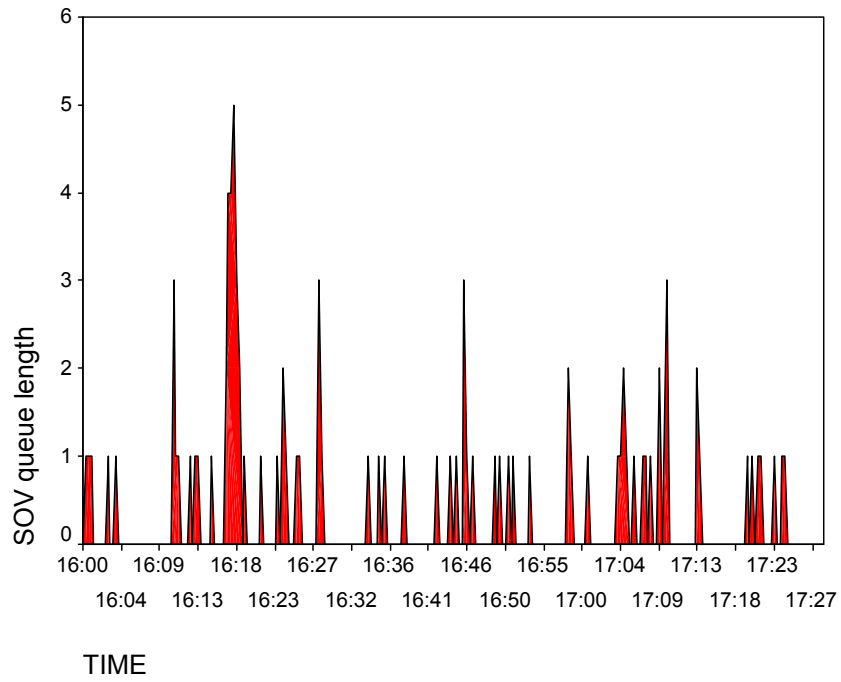
Good Hope Slip Ramp 2/9/2000 AM peak



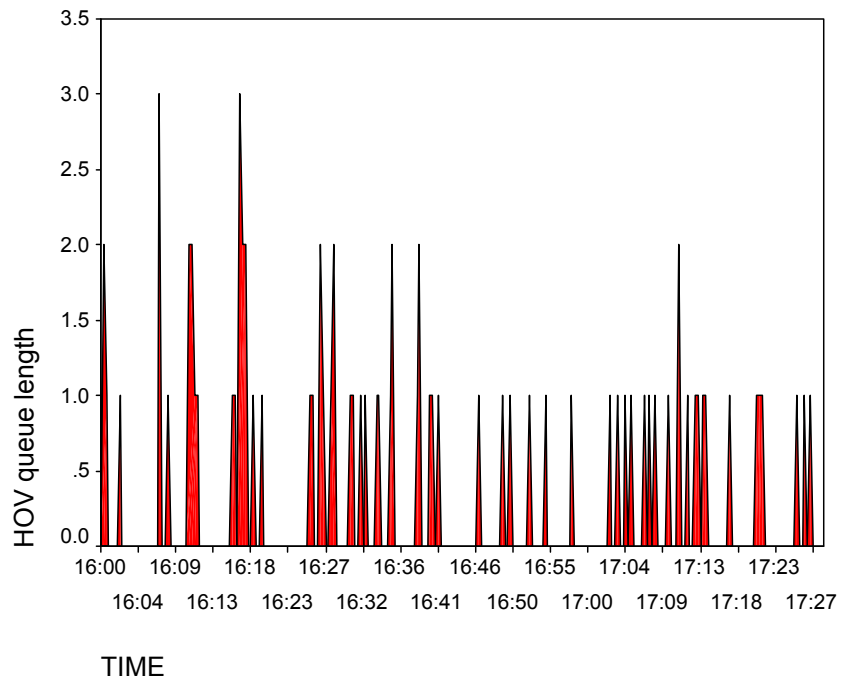
Good Hope Slip Ramp 2/9/2000 AM peak



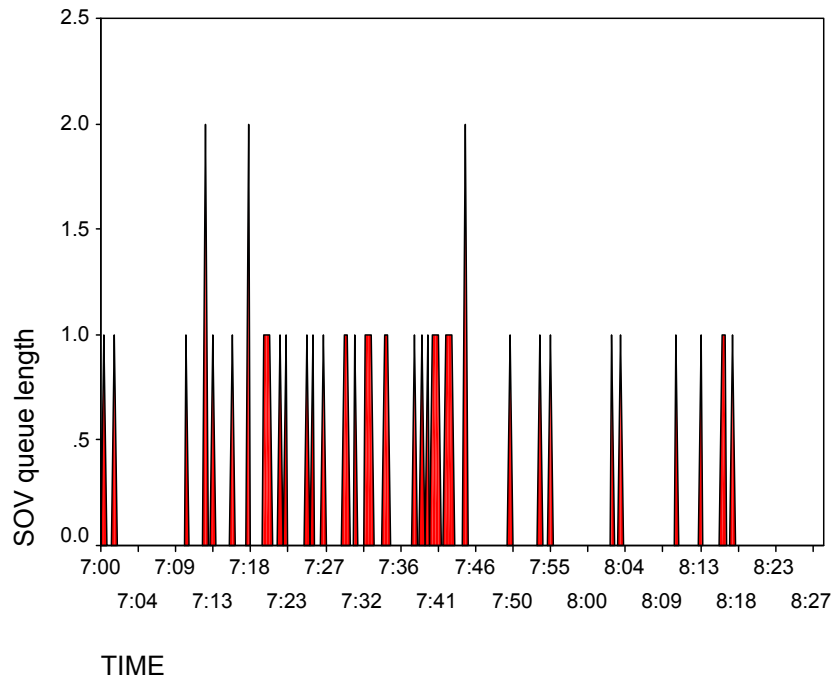
Good Hope Slip Ramp 2/9/2000 PM peak



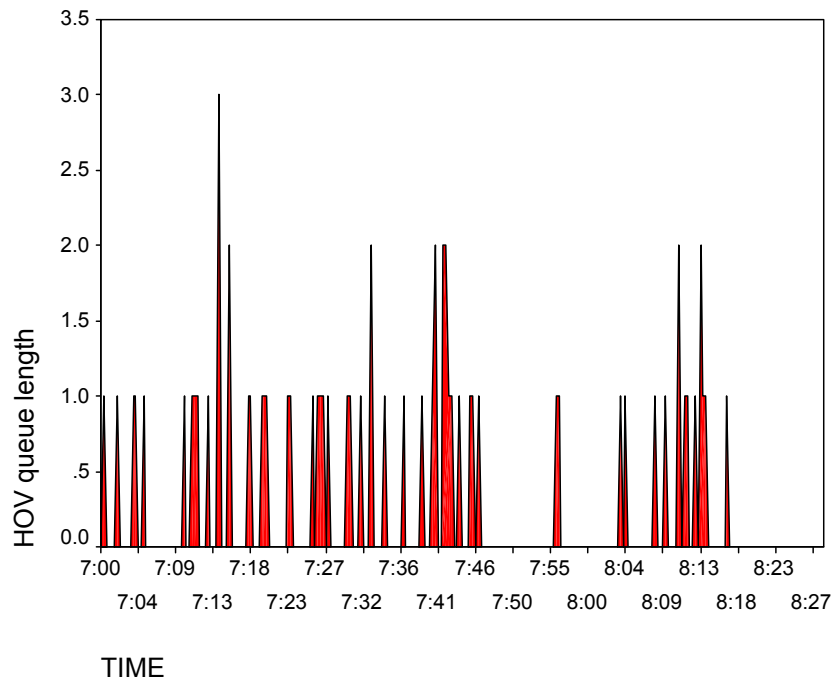
Good Hope Slip Ramp 2/9/2000 PM peak



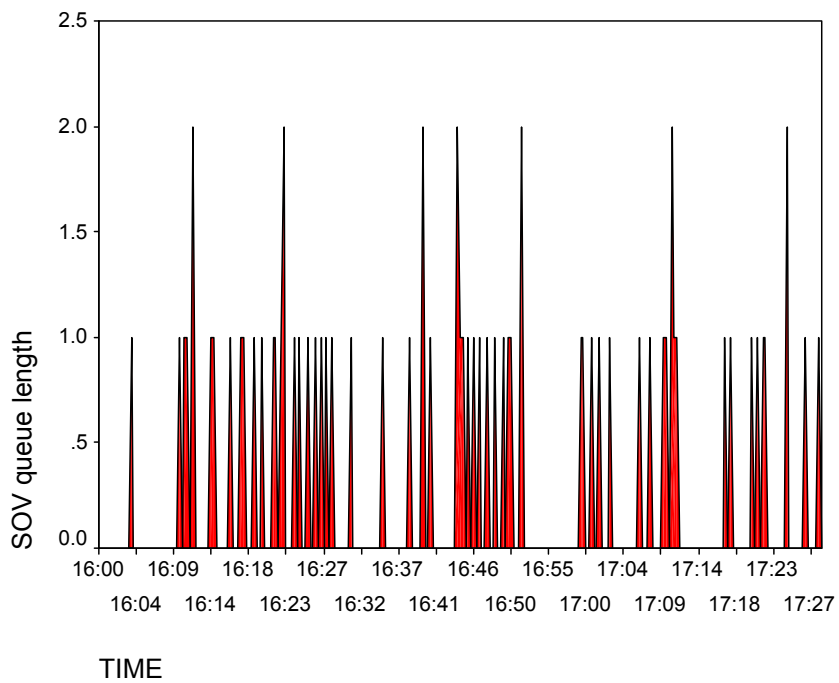
Good Hope Slip Ramp 2/10/2000 AM peak



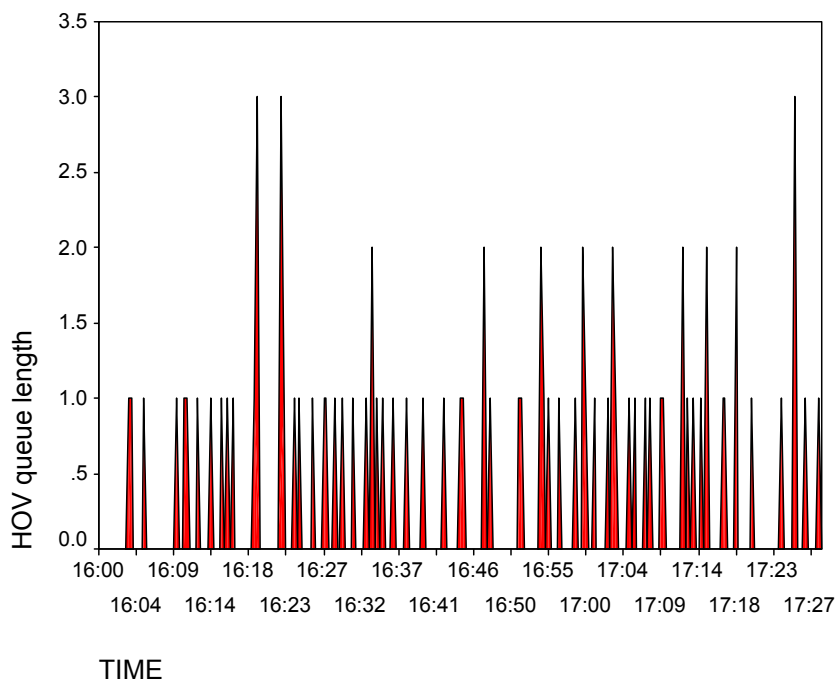
Good Hope Slip Ramp 2/10/2000 AM peak



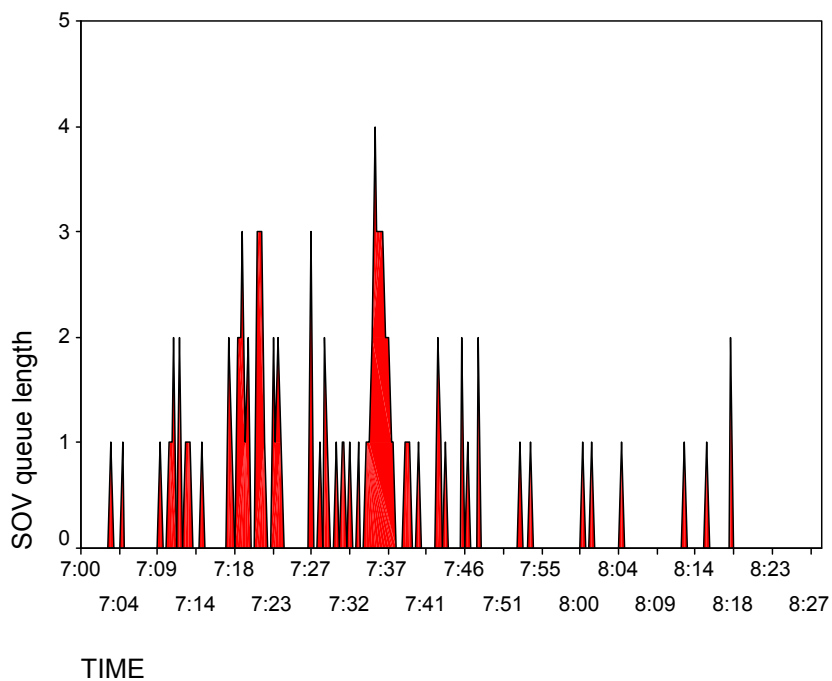
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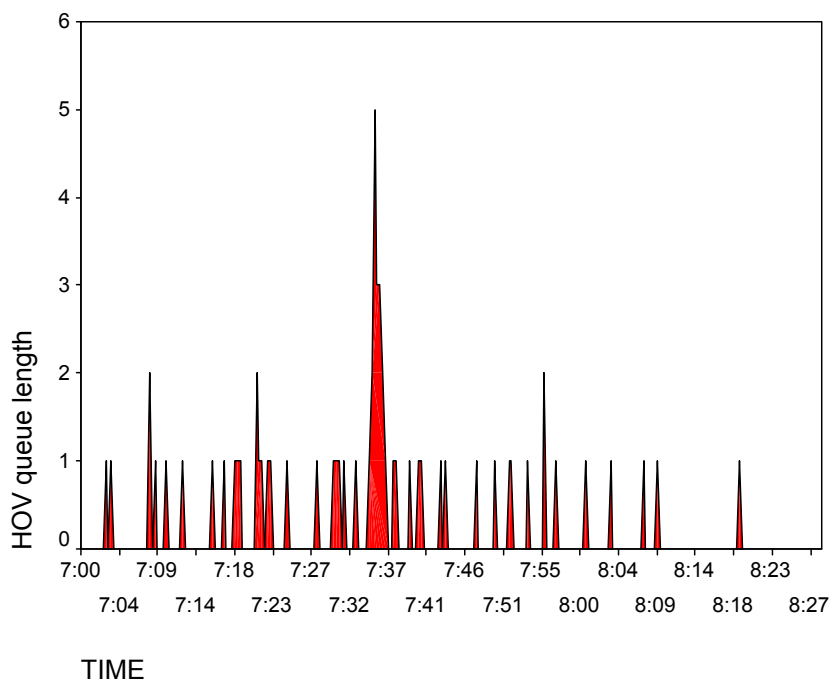
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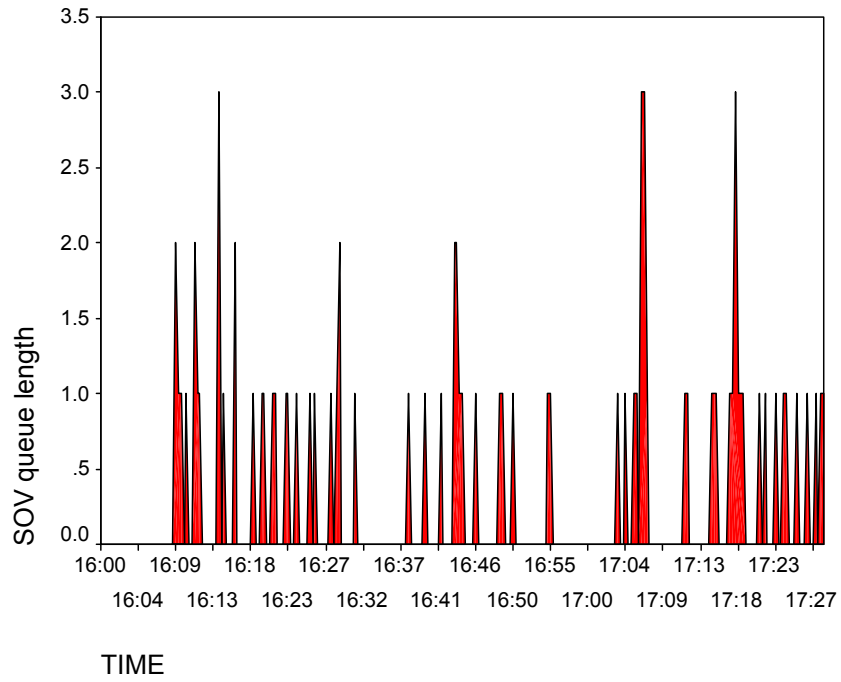
Good Hope Slip Ramp 3/14/2000 AM peak



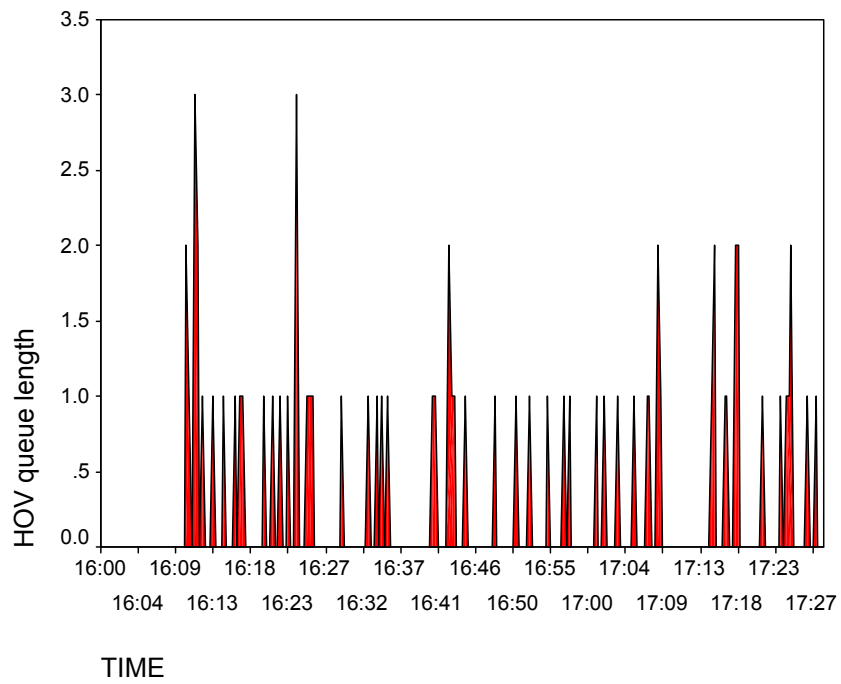
Good Hope Slip Ramp 3/14/2000 AM peak



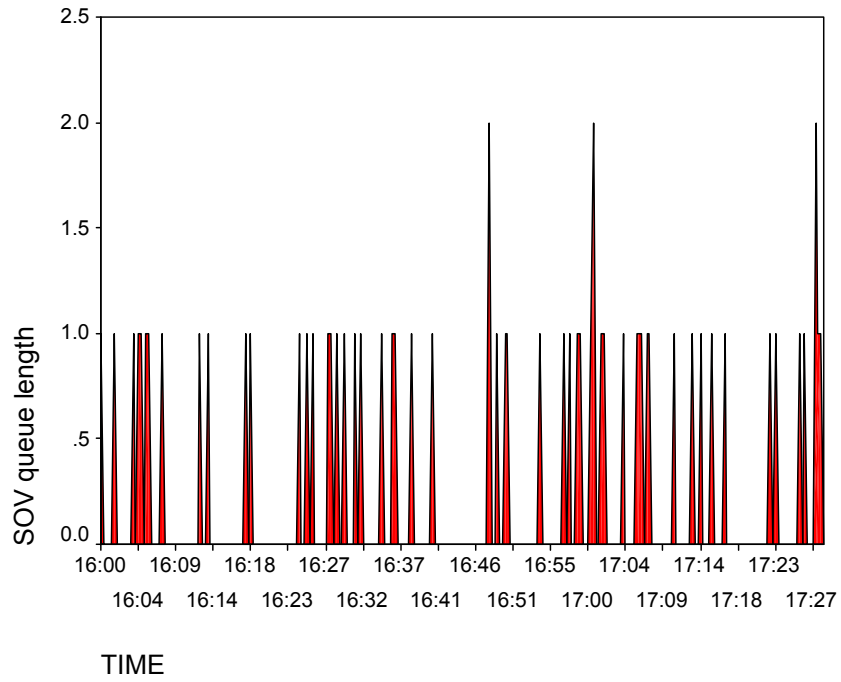
Good Hope Slip Ramp 3/14/2000 PM peak



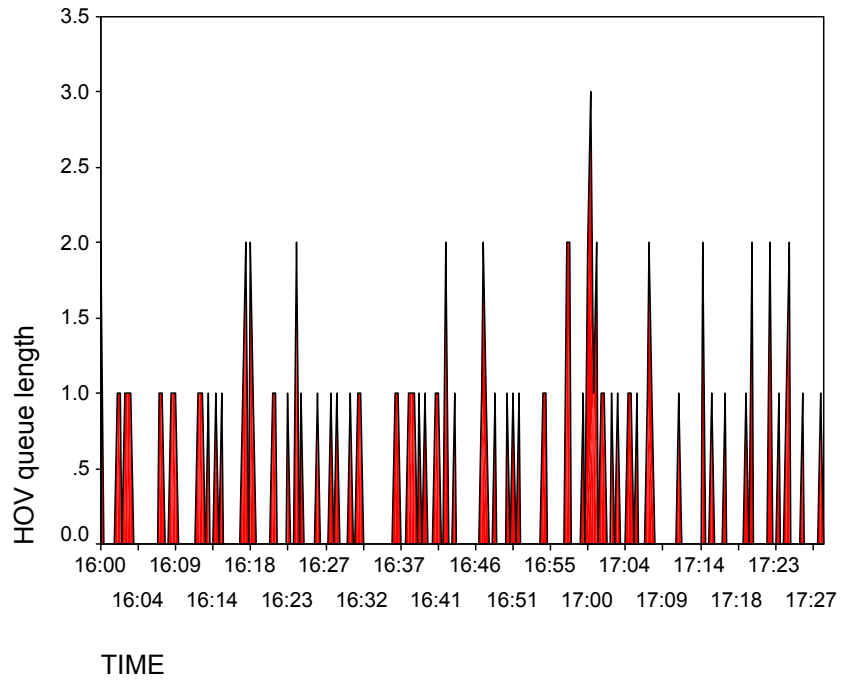
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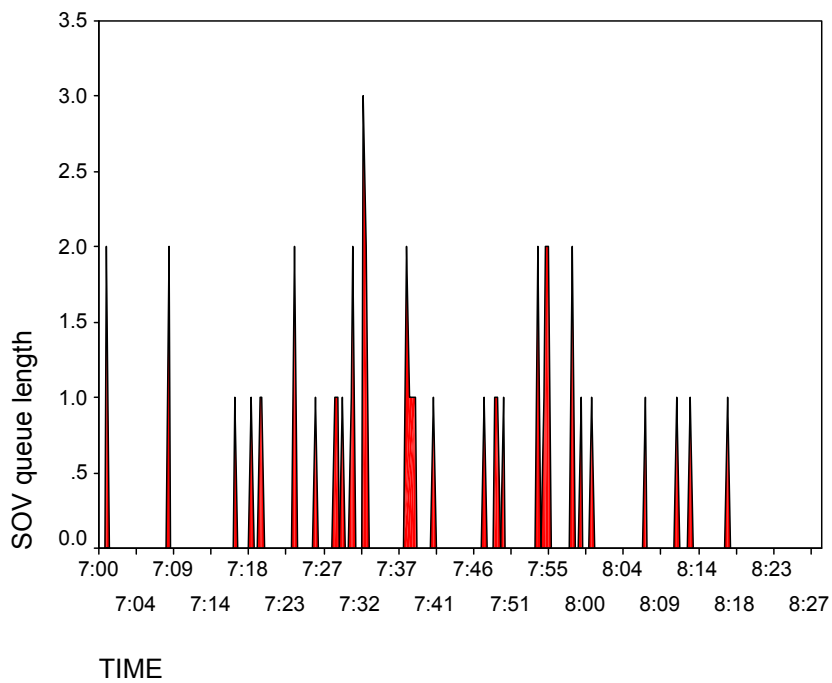
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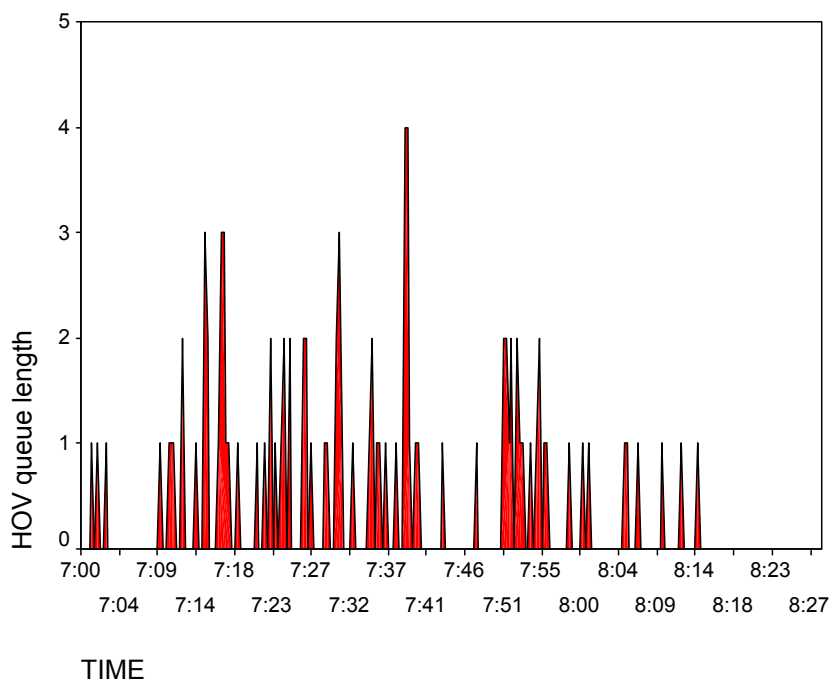
Good Hope Slip Ramp 3/15/2000 PM peak



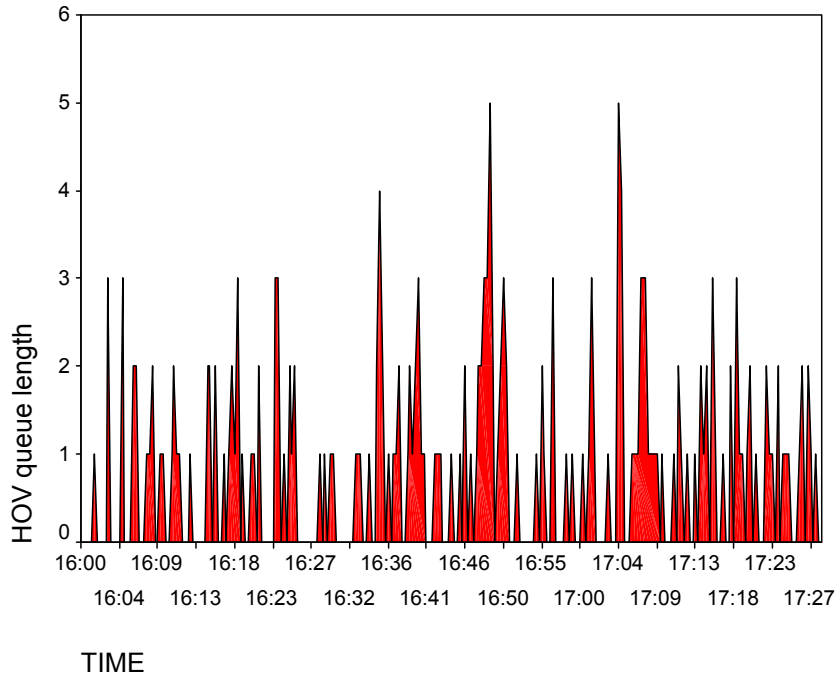
Good Hope Slip Ramp 3/16/2000 AM peak



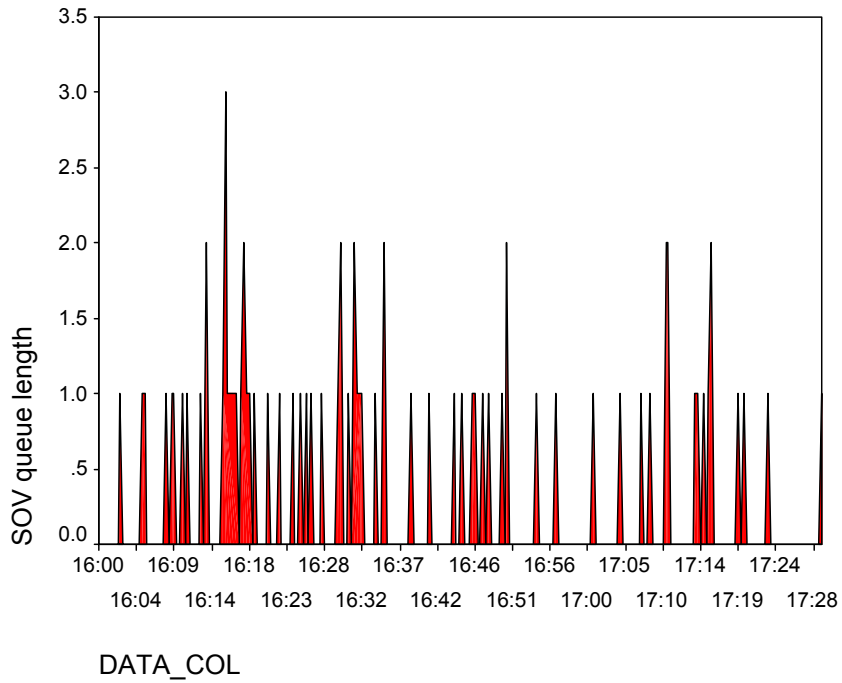
Good Hope Slip Ramp 3/16/2000 AM peak



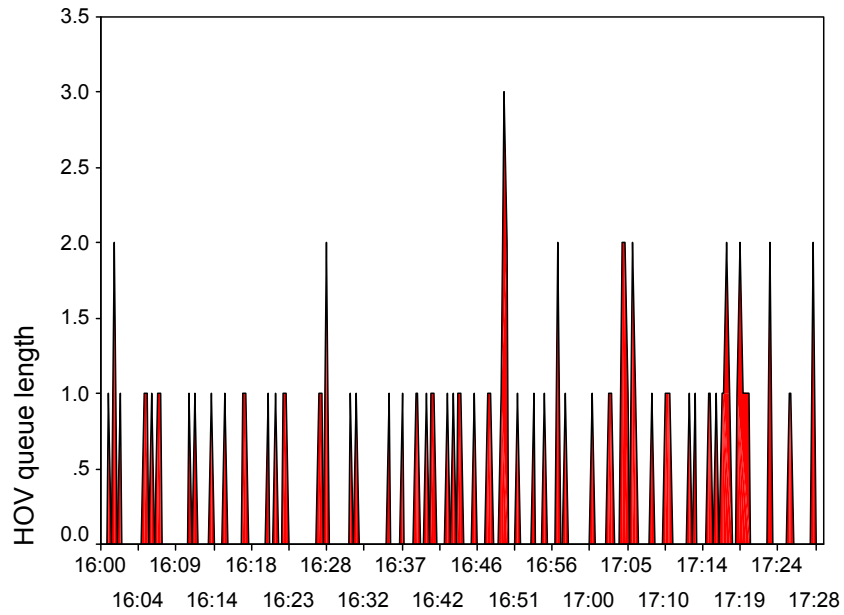
Good Hope Slip Ramp 3/16/2000 PM peak



Good Hope Road Slip Ramp 3/21/2000 PM peak

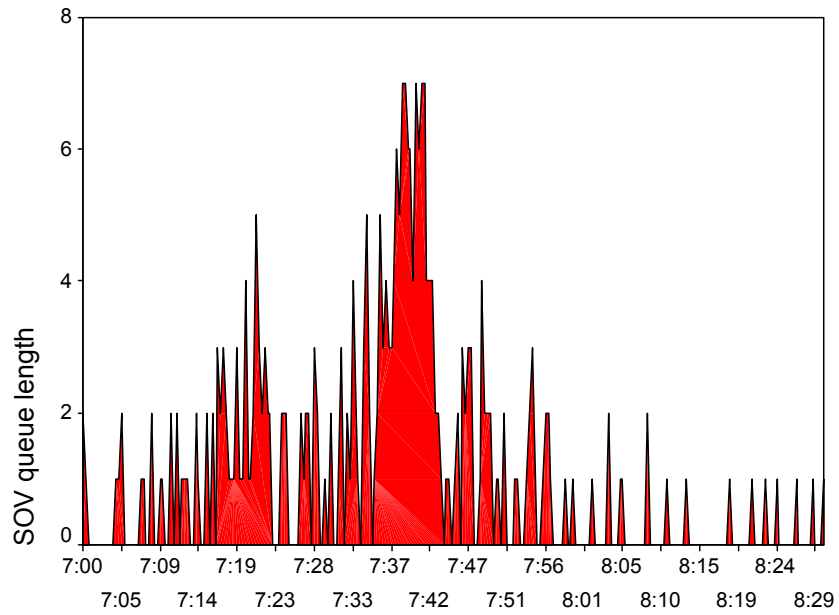


Good Hope Road Slip Ramp 3/21/2000 PM peak



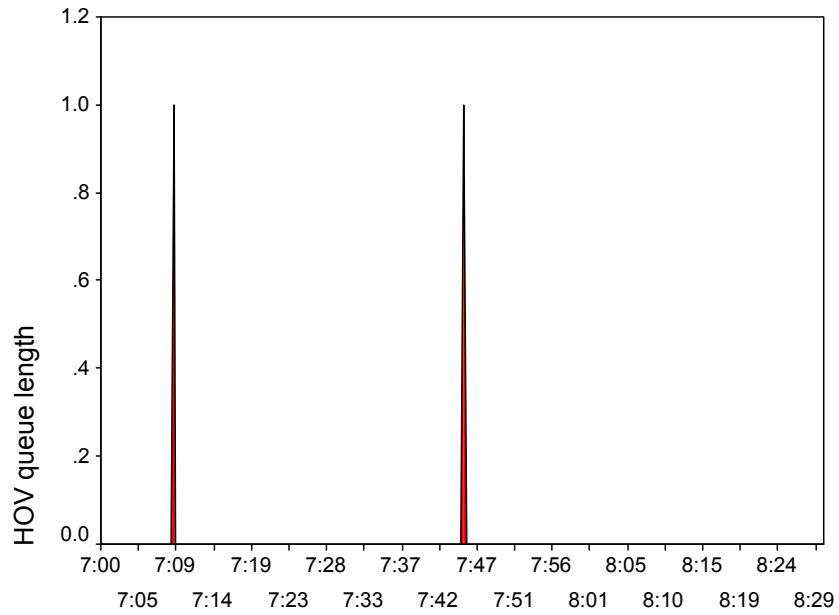
DATA_COL

Good Hope Road Slip Ramp 3/22/2000 AM peak



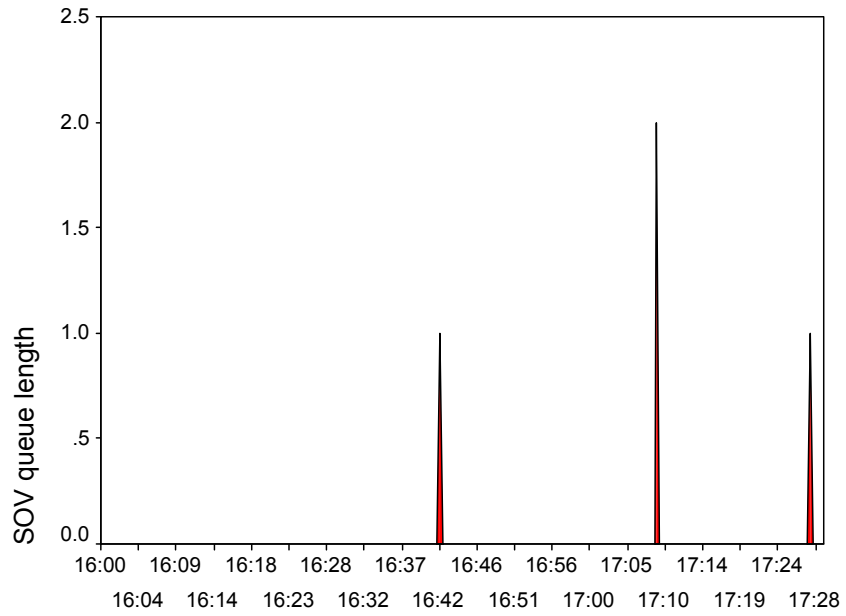
DATA_COL

Good Hope Road Slip Ramp 3/22/2000 AM peak



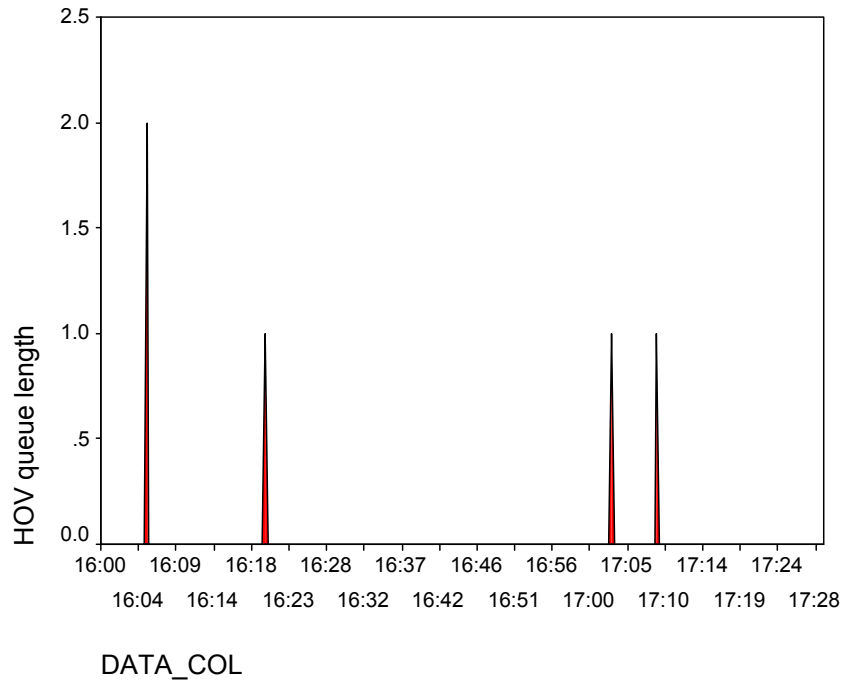
DATA_COL

Good Hope Road Slip Ramp 3/23/2000 PM peak

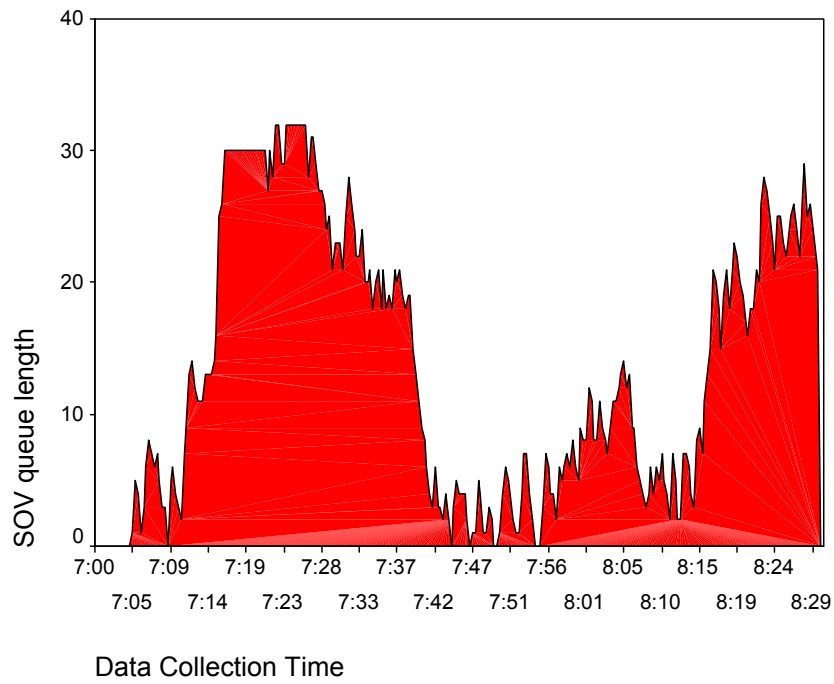


DATA_COL

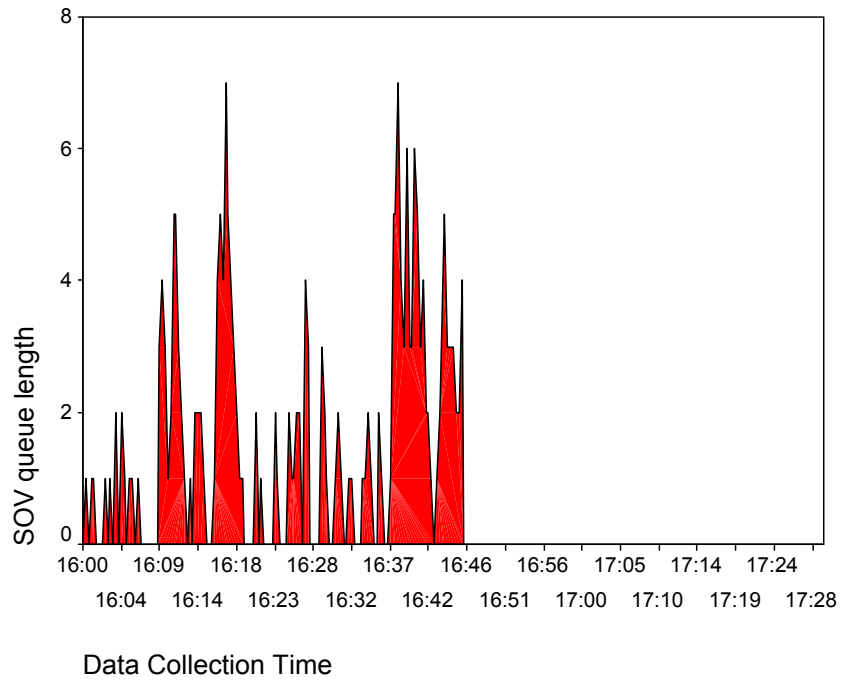
Good Hope Road Slip Ramp 3/23/2000 PM peak



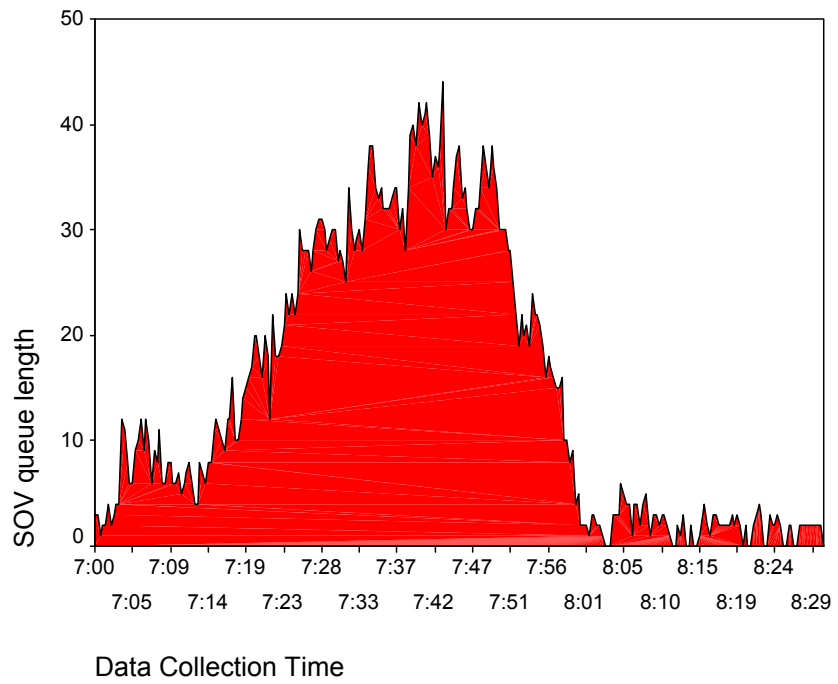
Appleton Avenue Street 3/14/2000 AM peak



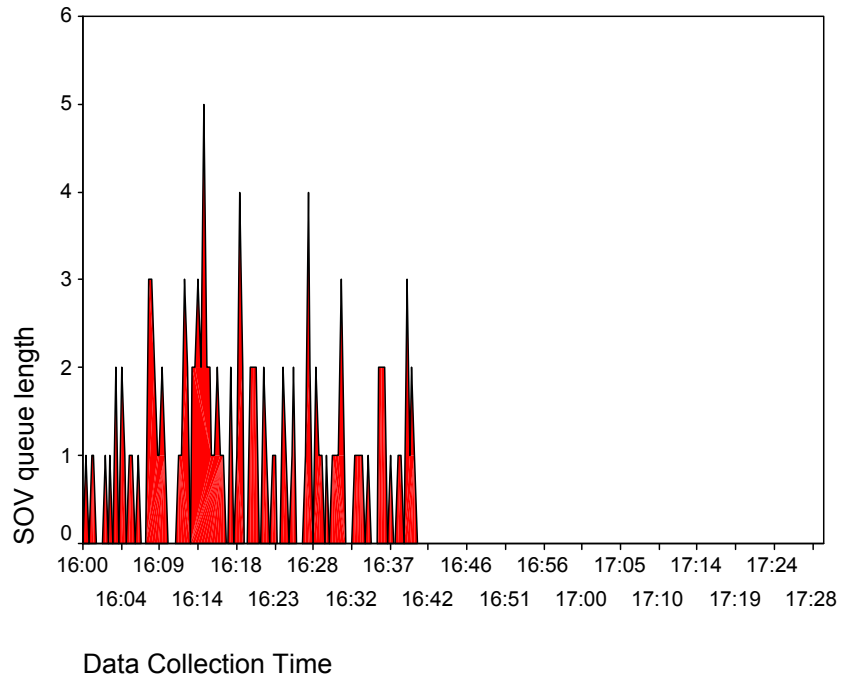
Appleton Avenue 3/14/2000 PM peak



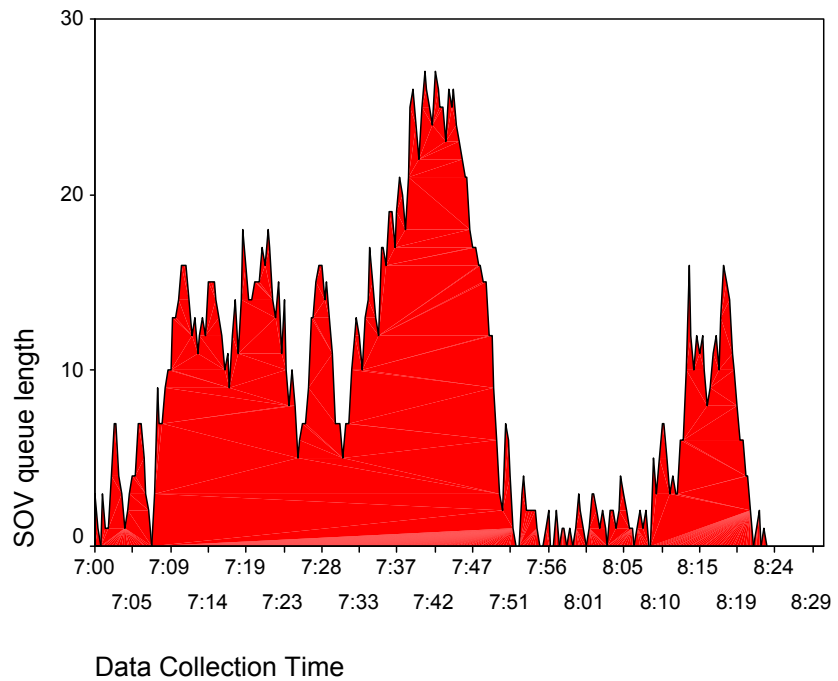
Appleton Avenue 3/15/2000 AM peak



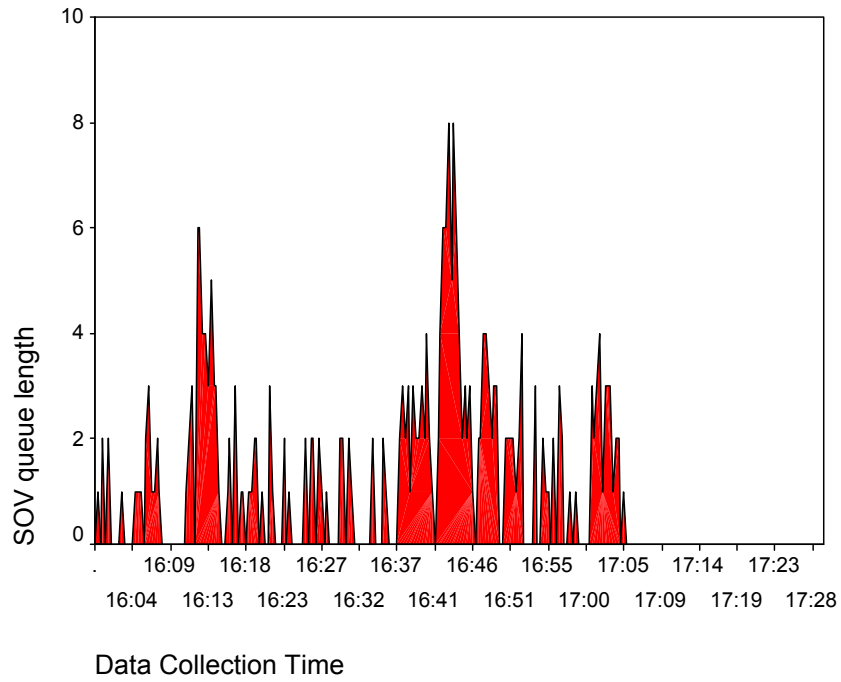
Appleton Avenue 3/15/2000 PM peak



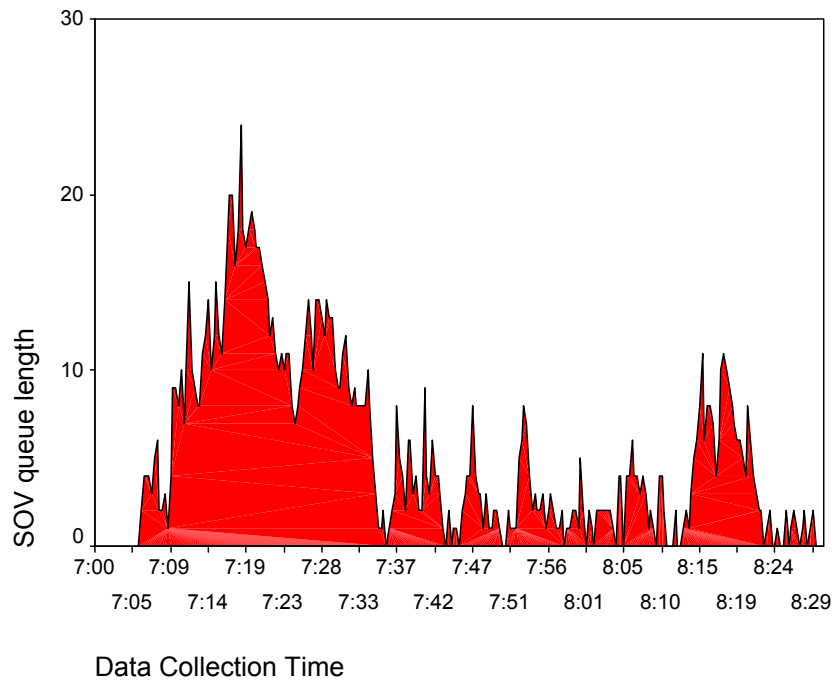
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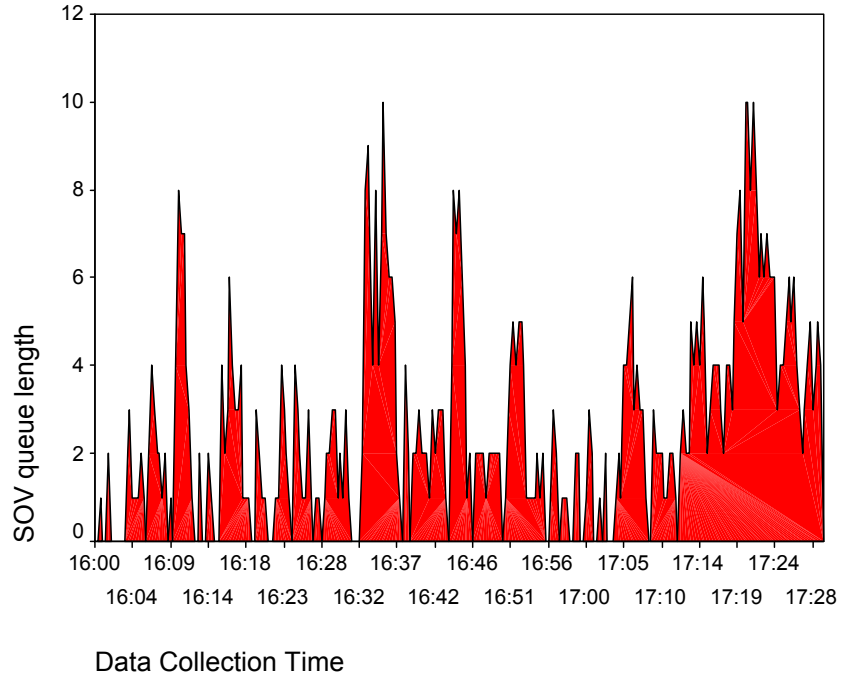
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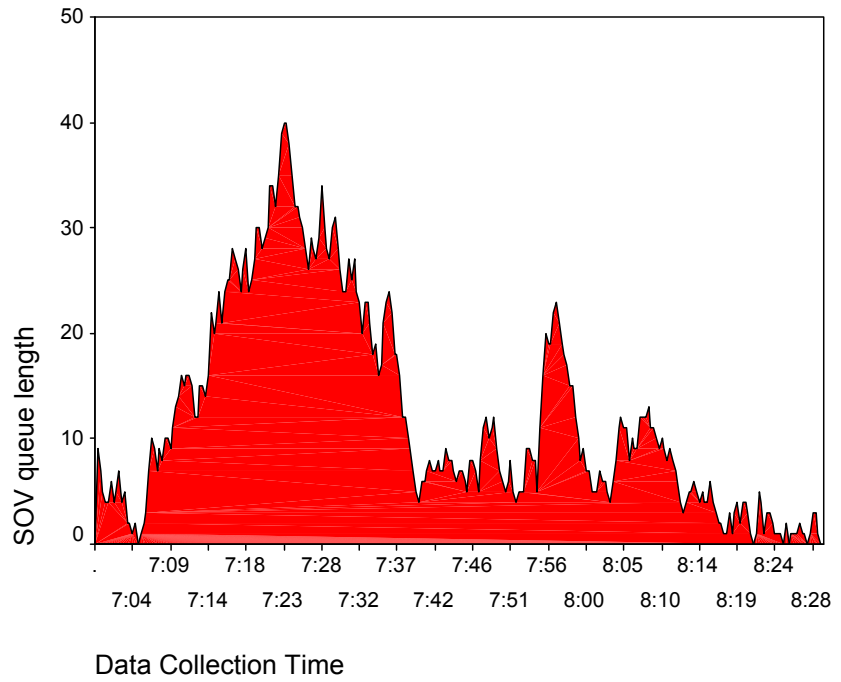
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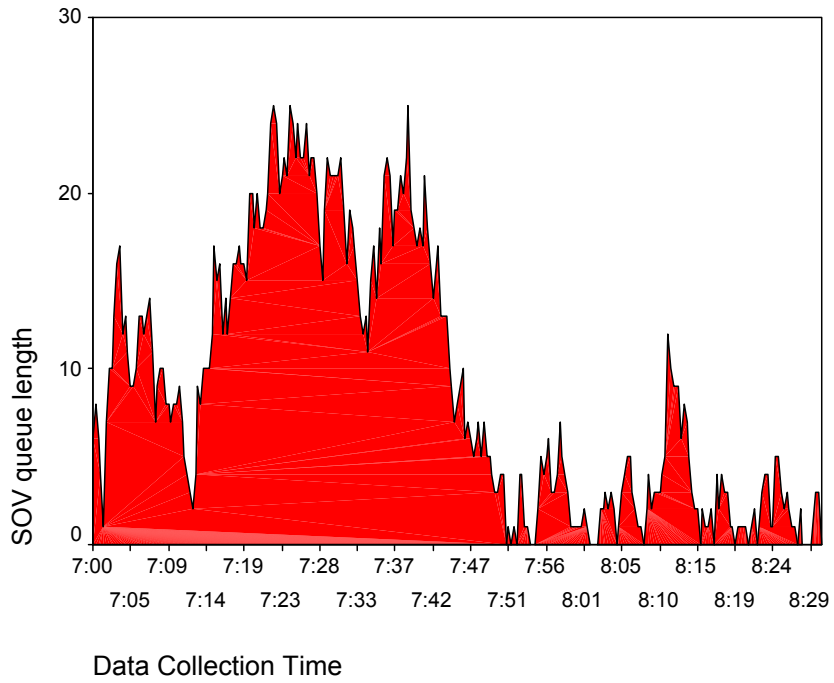
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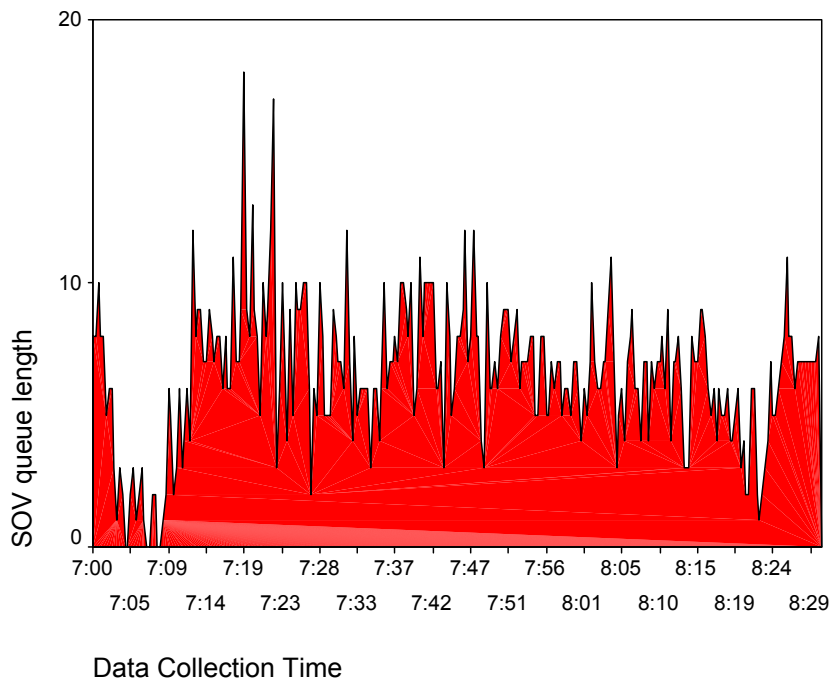
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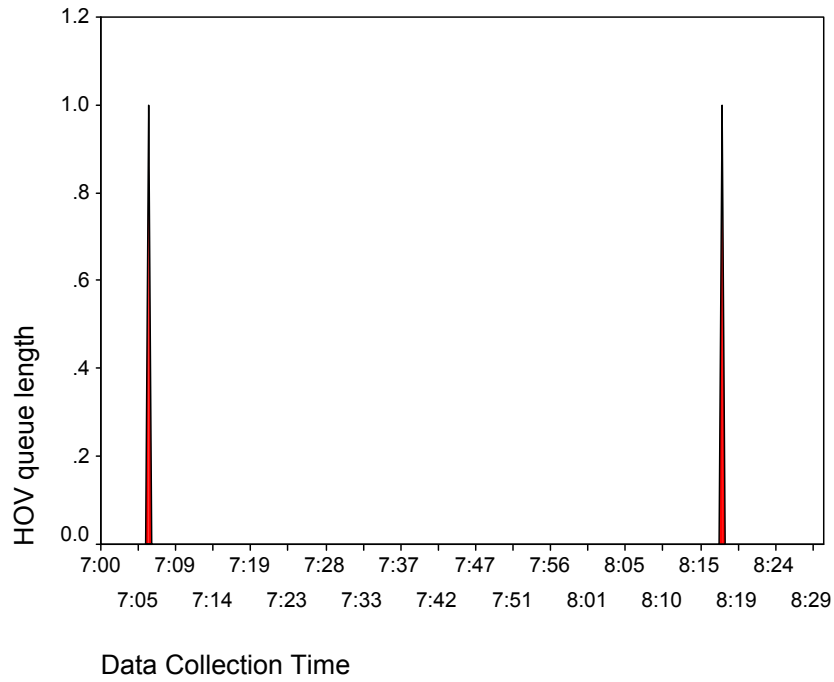
Appleton Avenue 3/23/2000 AM peak



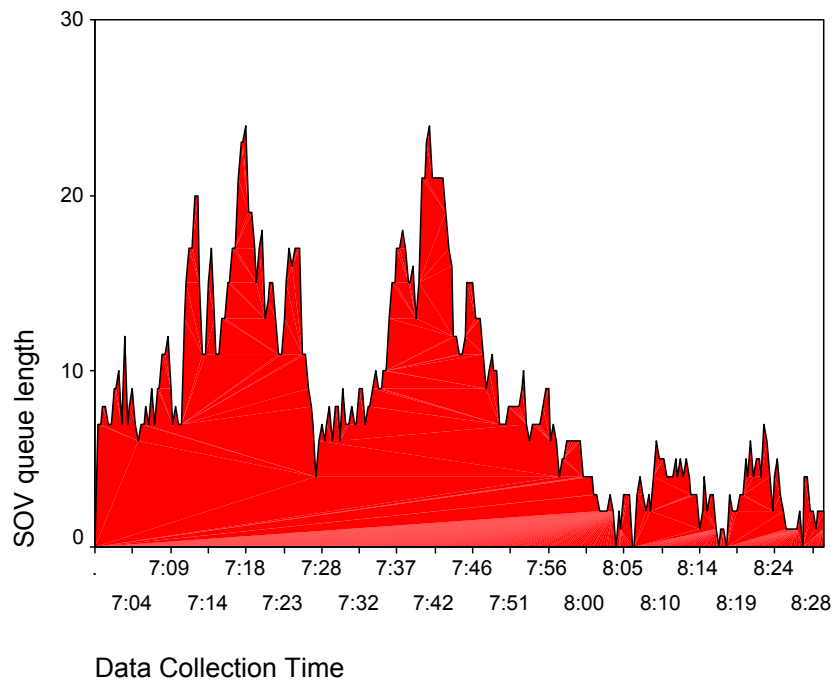
Hampton Avenue 3/14/2000 AM peak



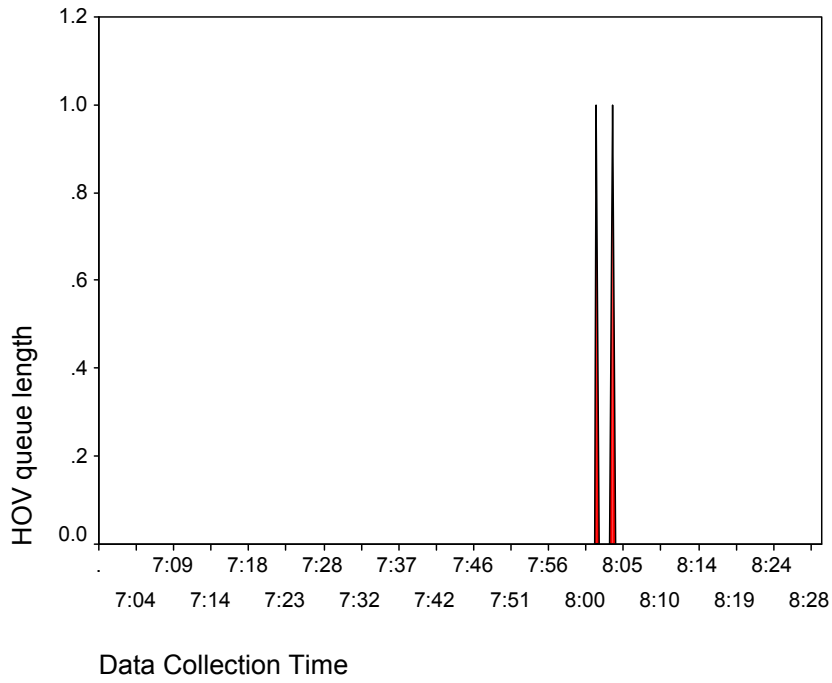
Hampton Avenue 3/14/2000 AM peak



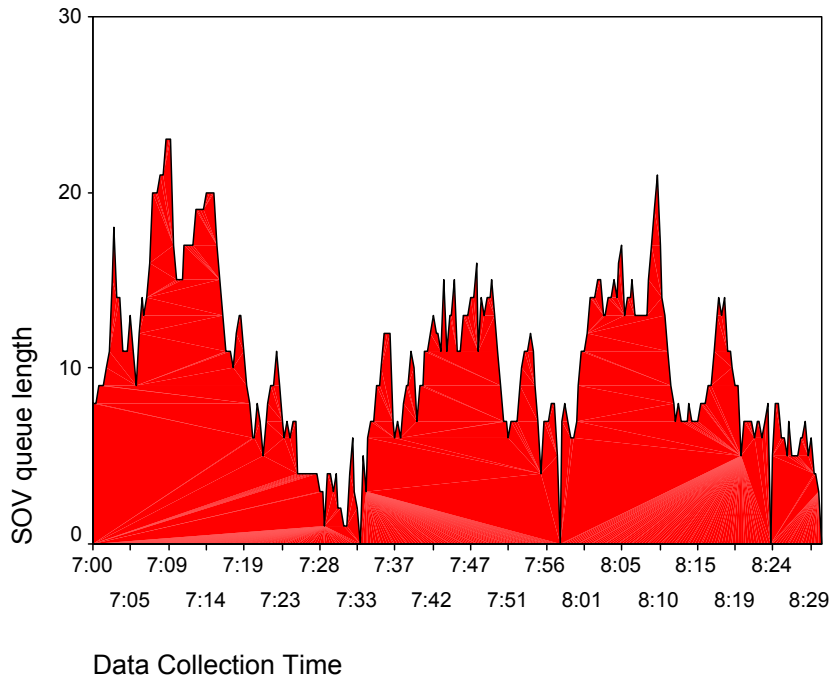
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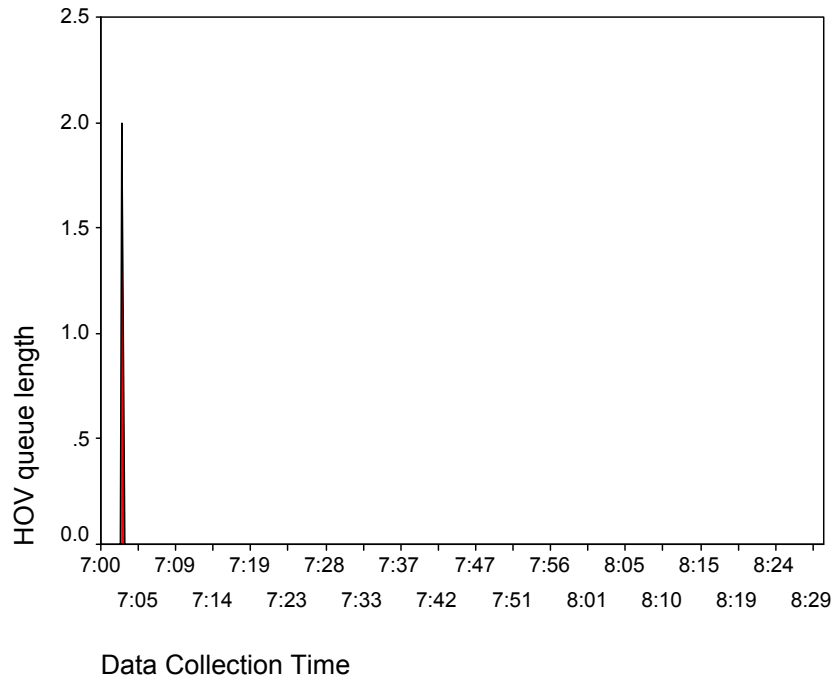
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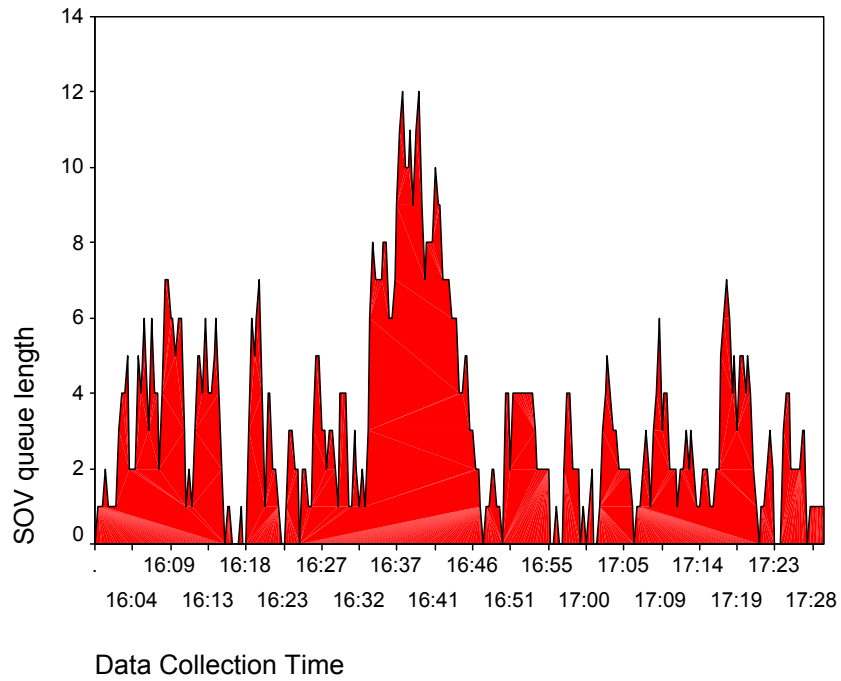
Hampton Avenue 3/16/2000 AM peak



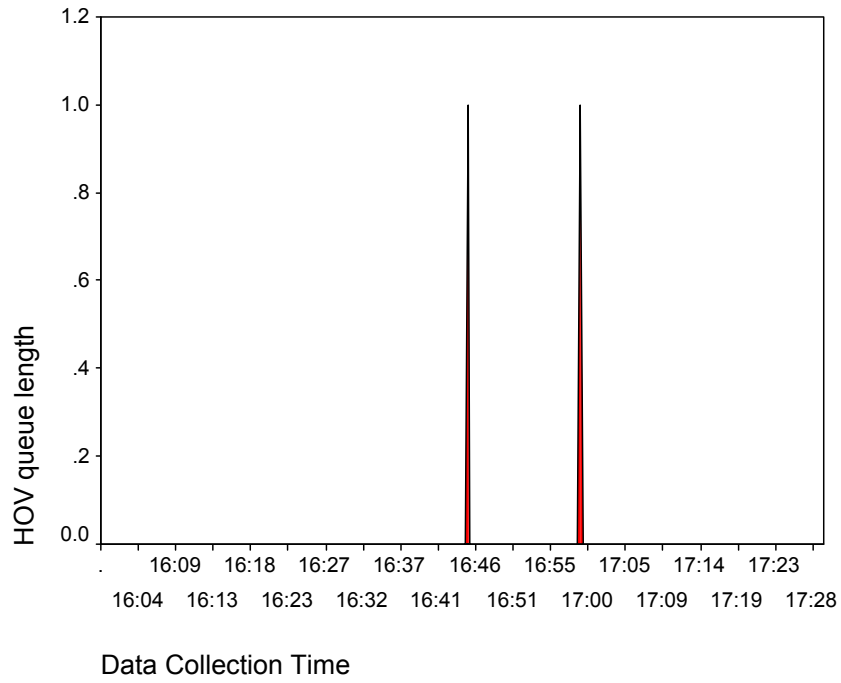
Hampton Avenue 3/16/2000 AM peak



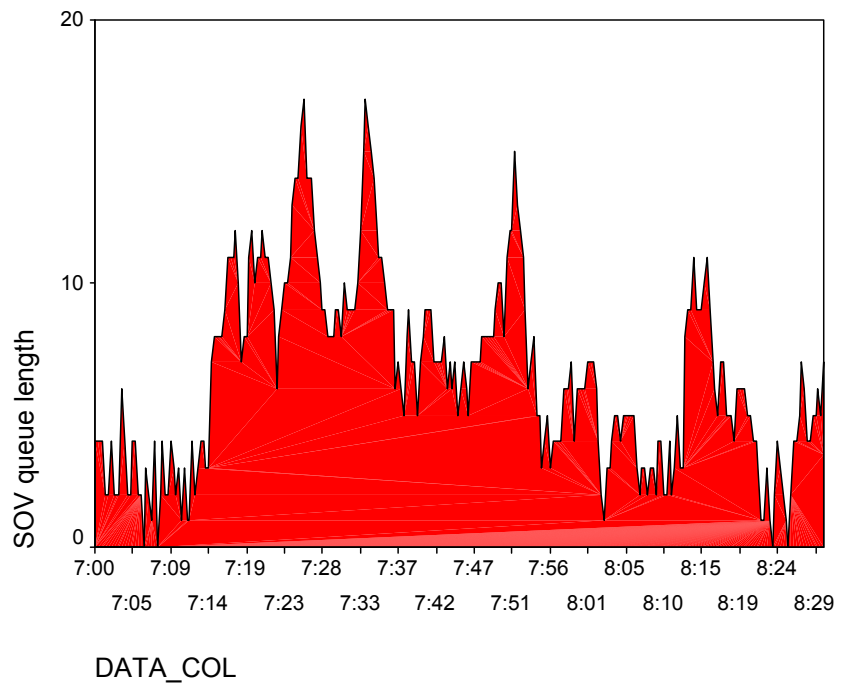
Hampton Avenue 3/16/2000 PM peak



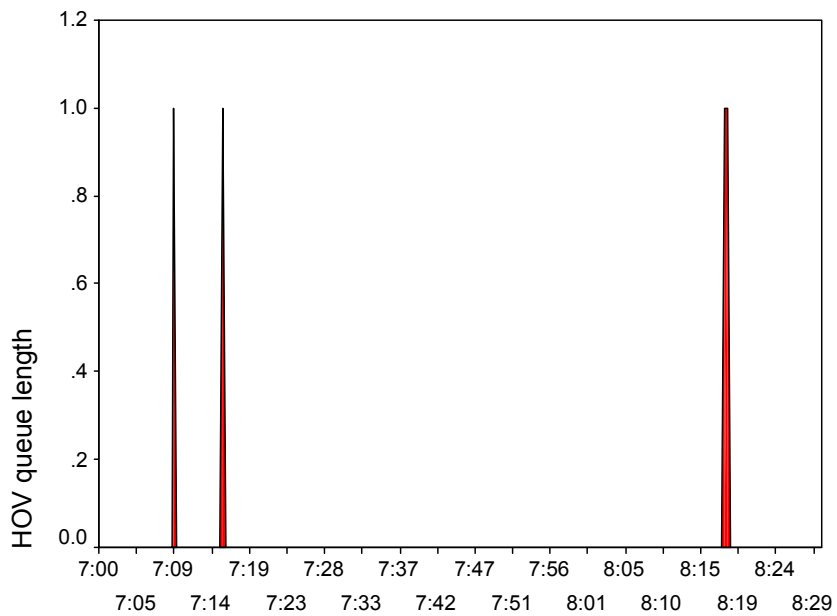
Hampton Avenue 3/16/2000 PM peak



Hampton Avenue 3/21/2000 AM peak

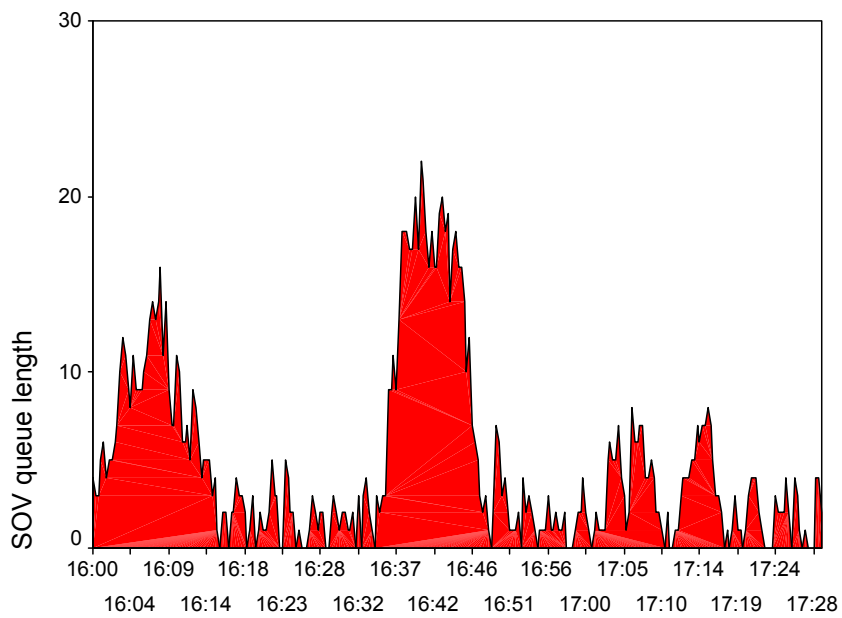


Hampton Avenue 3/21/2000 AM peak



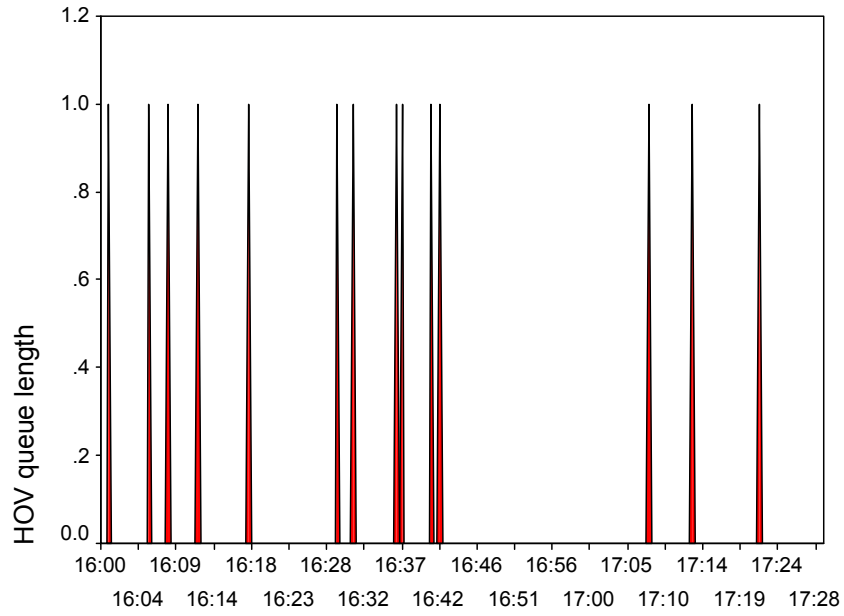
DATA_COL

Hampton Avenue 3/21/2000 PM peak



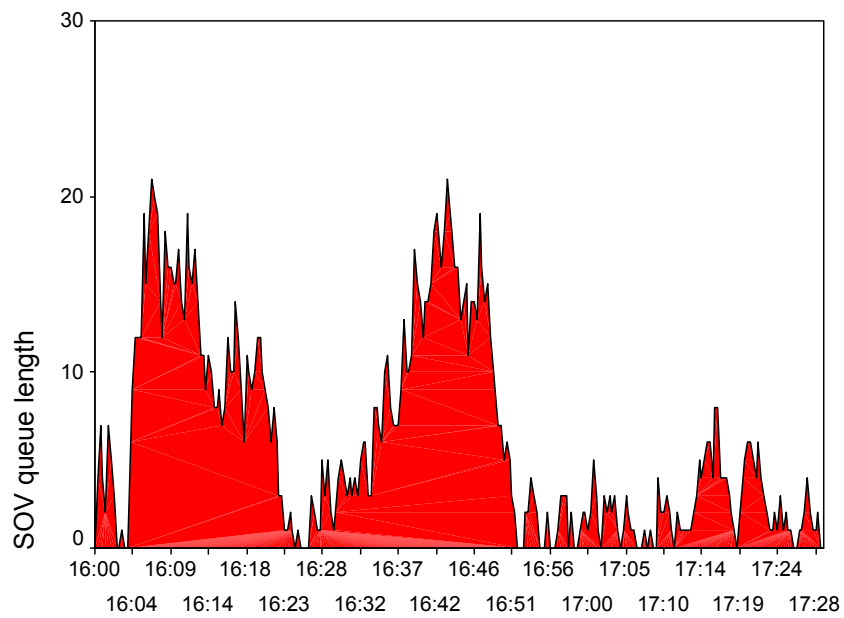
DATA_COL

Hampton Avenue 3/21/2000 PM peak



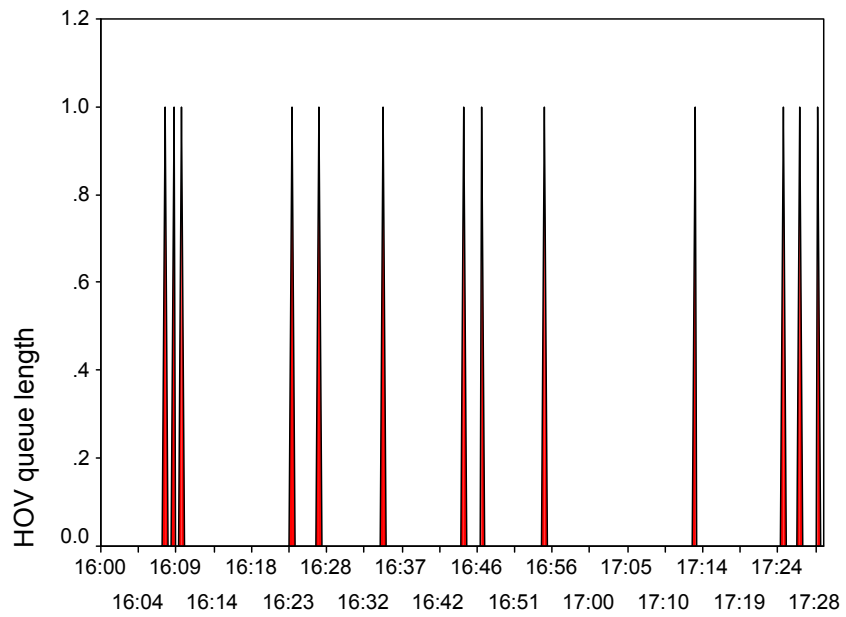
DATA_COL

Hampton Avenue 3/22/2000 PM peak



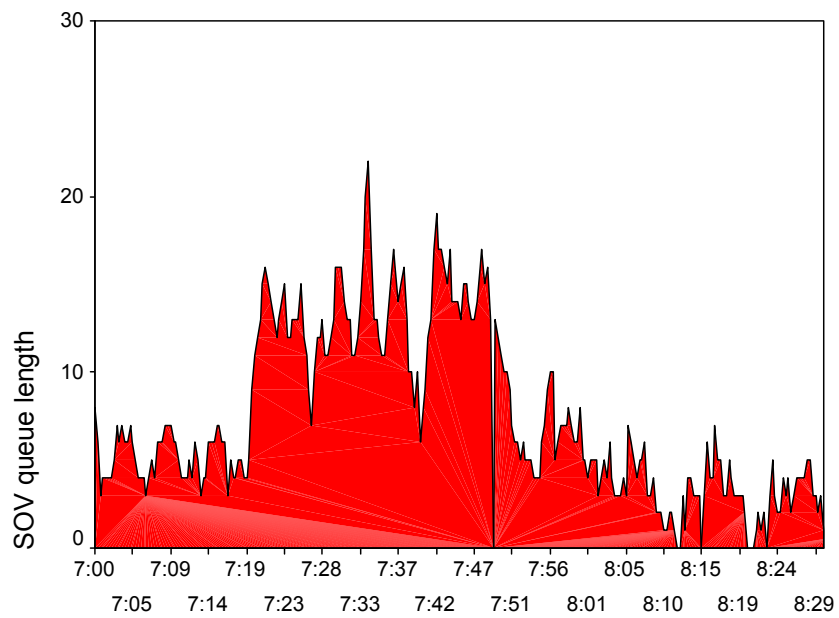
DATA_COL

Hampton Avenue 3/22/2000 PM peak



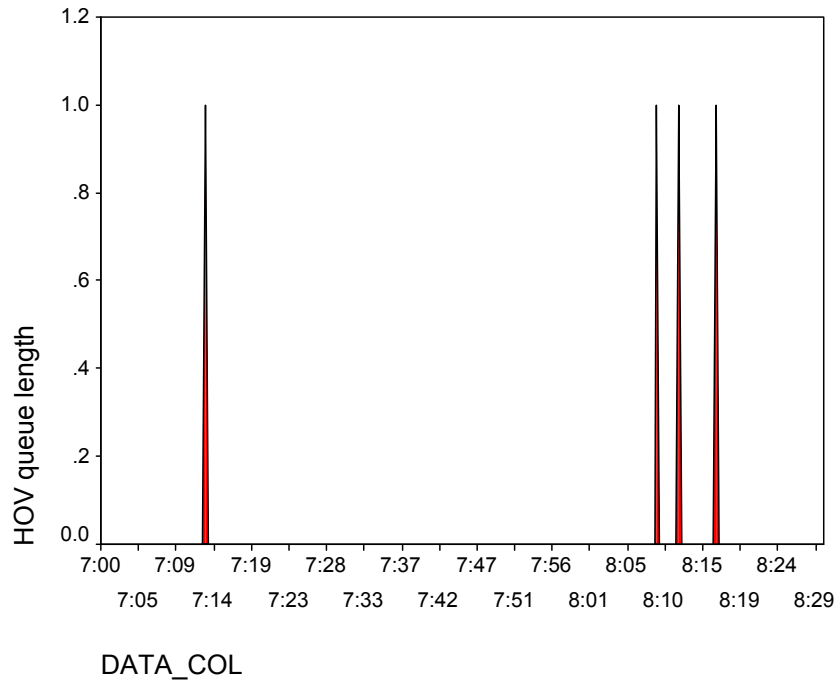
DATA_COL

Hampton Avenue 3/23/2000 AM peak

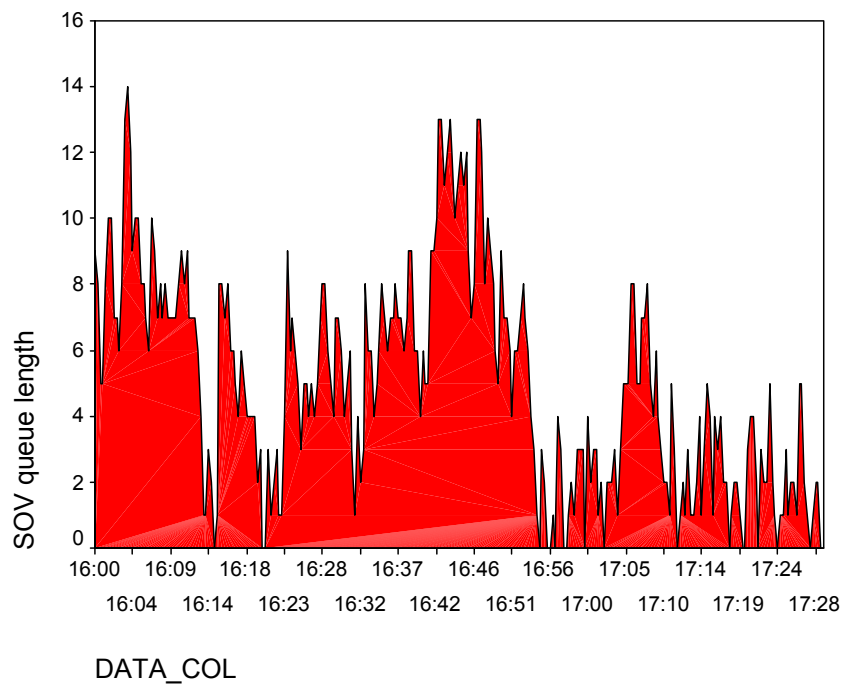


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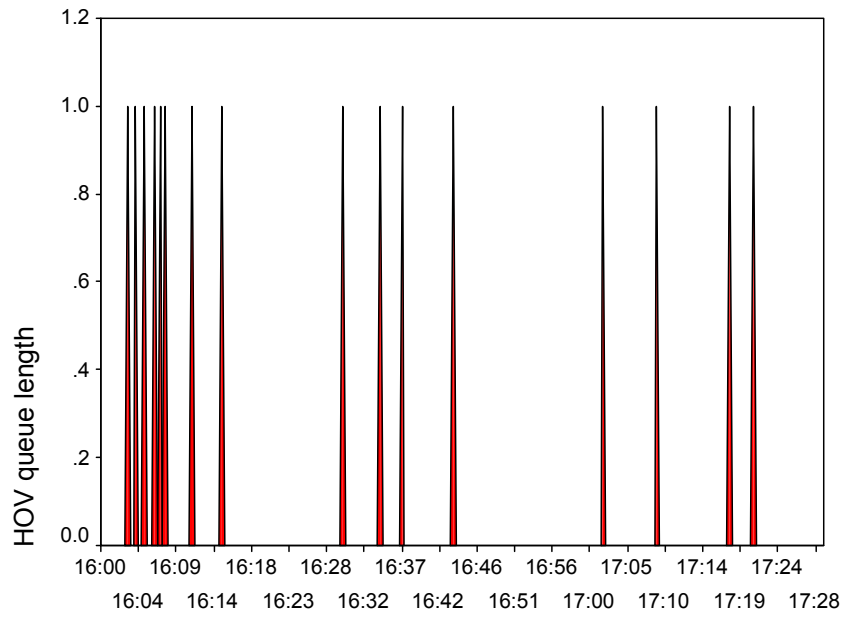
Hampton Avenue 3/23/2000 AM peak



Hampton Avenue 3/23/2000 PM peak

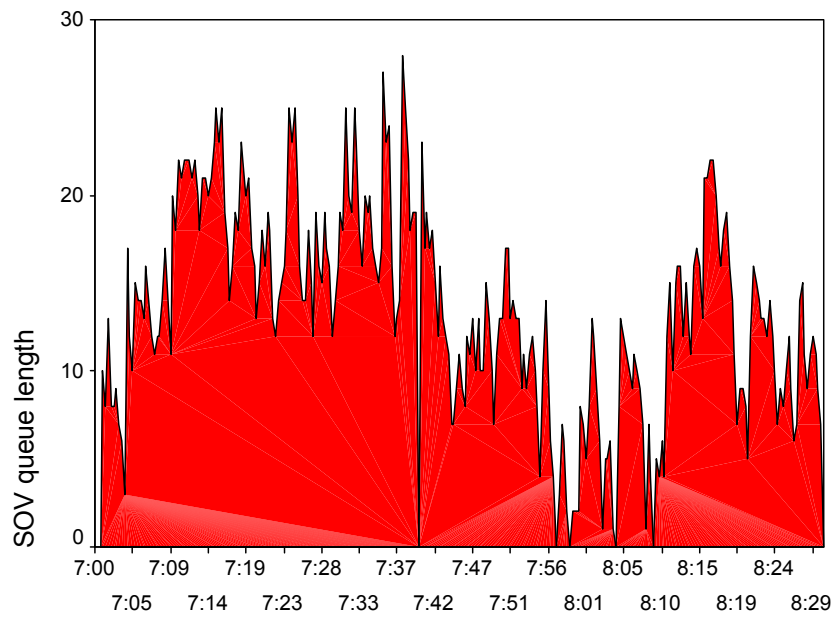


Hampton Avenue 3/23/2000 PM peak



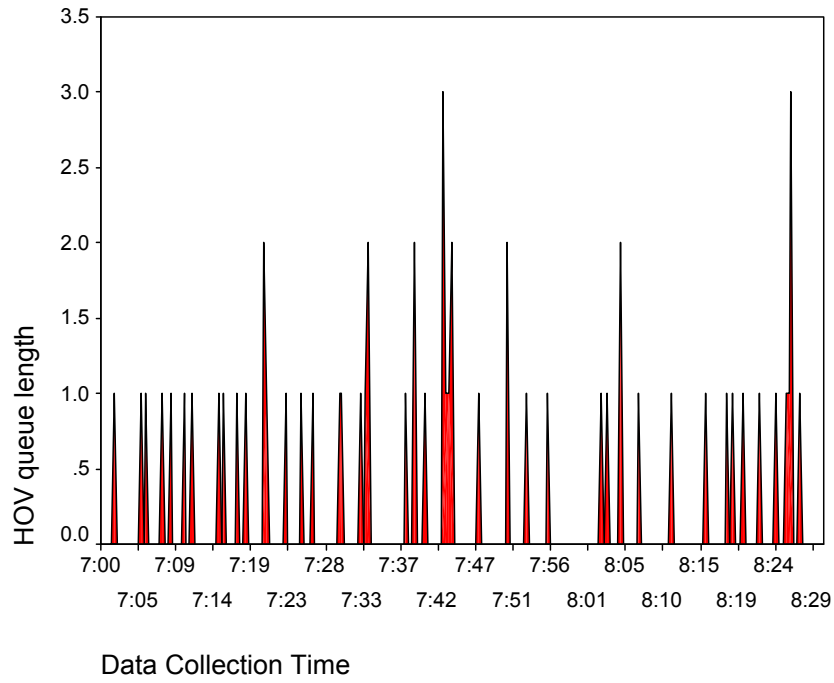
DATA_COL

Capitol Drive 3/14/2000 AM peak

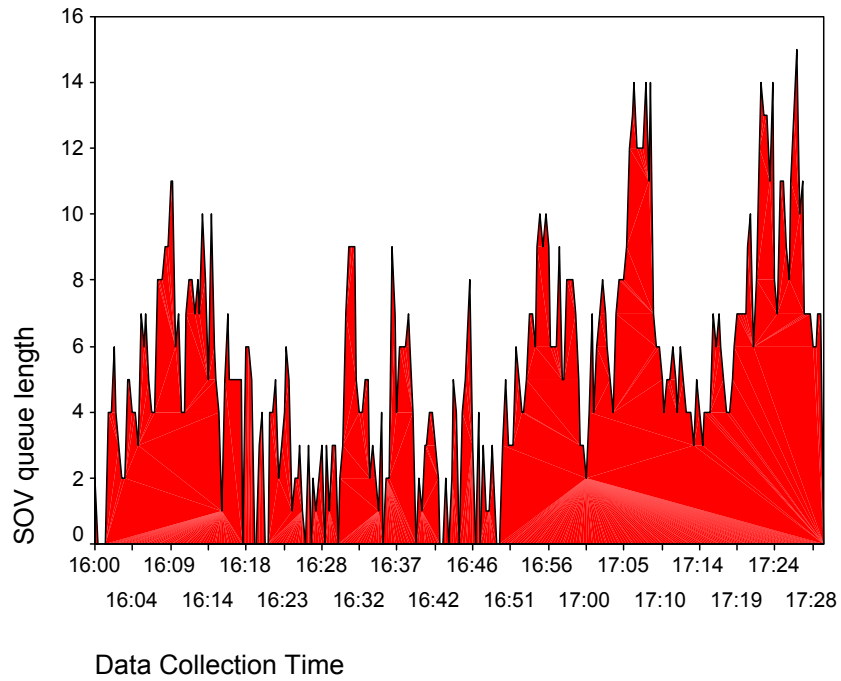


Data Collection Time

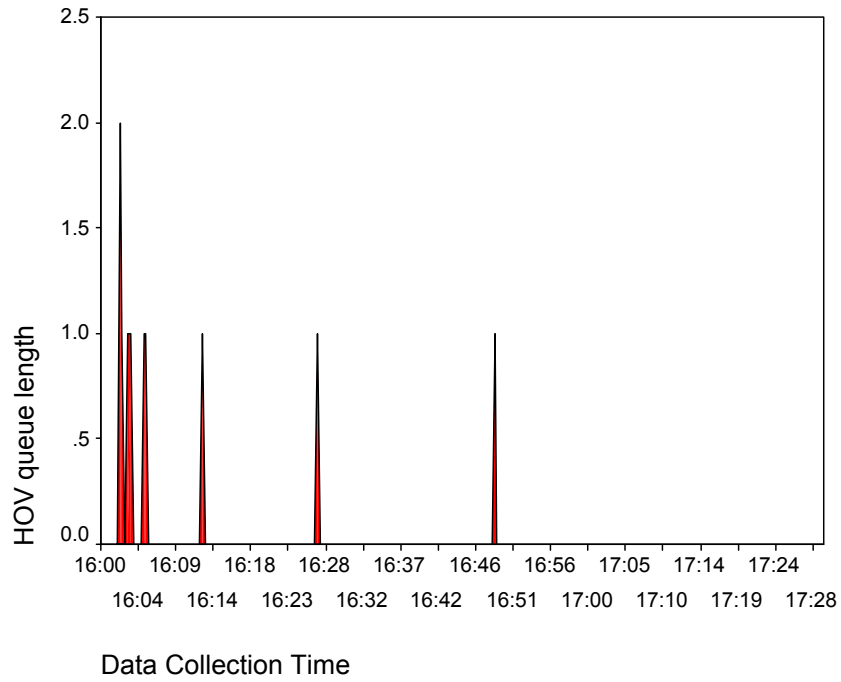
Capitol Drive 3/14/2000 AM peak



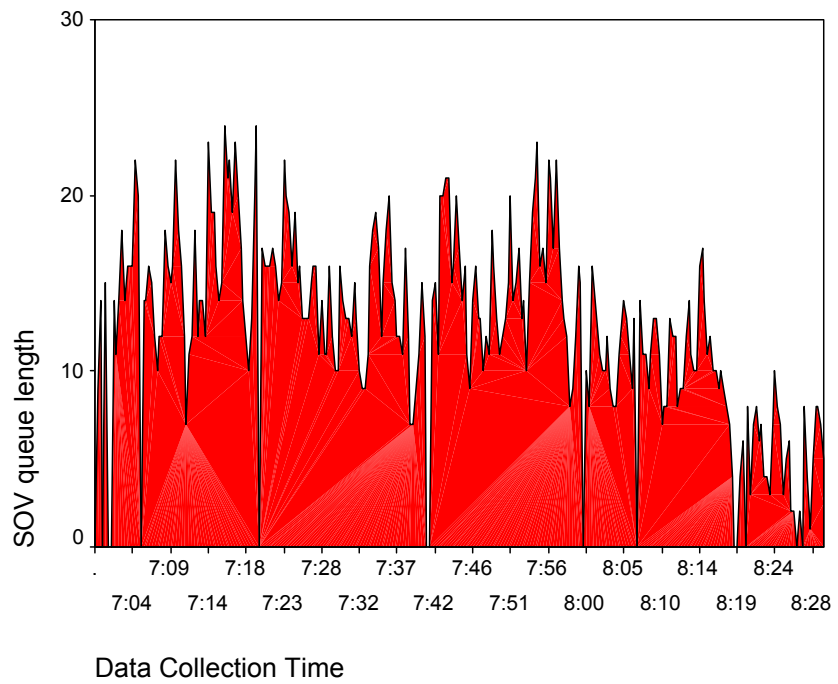
Capitol Drive 3/14/2000 PM peak



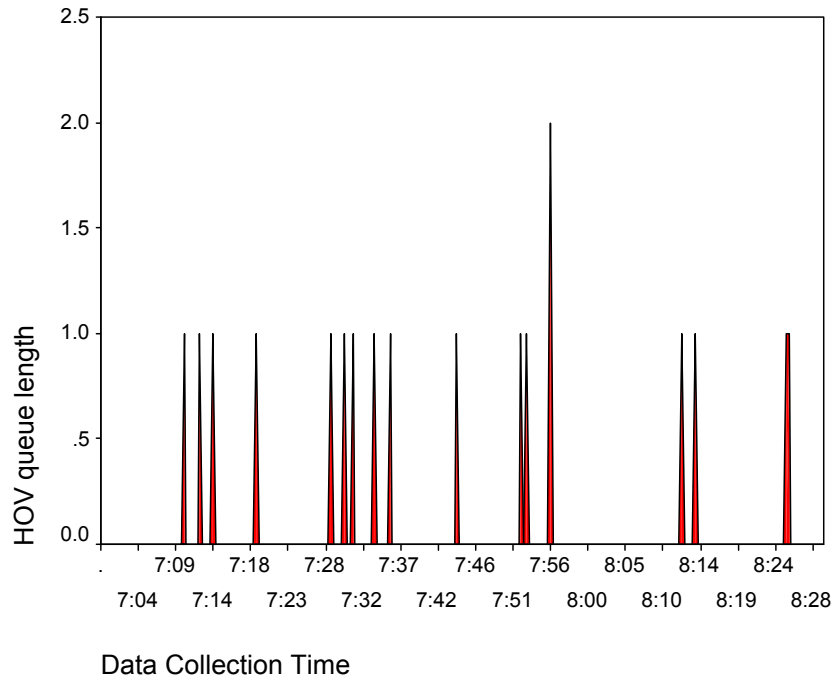
Capitol Drive 3/14/2000 PM peak



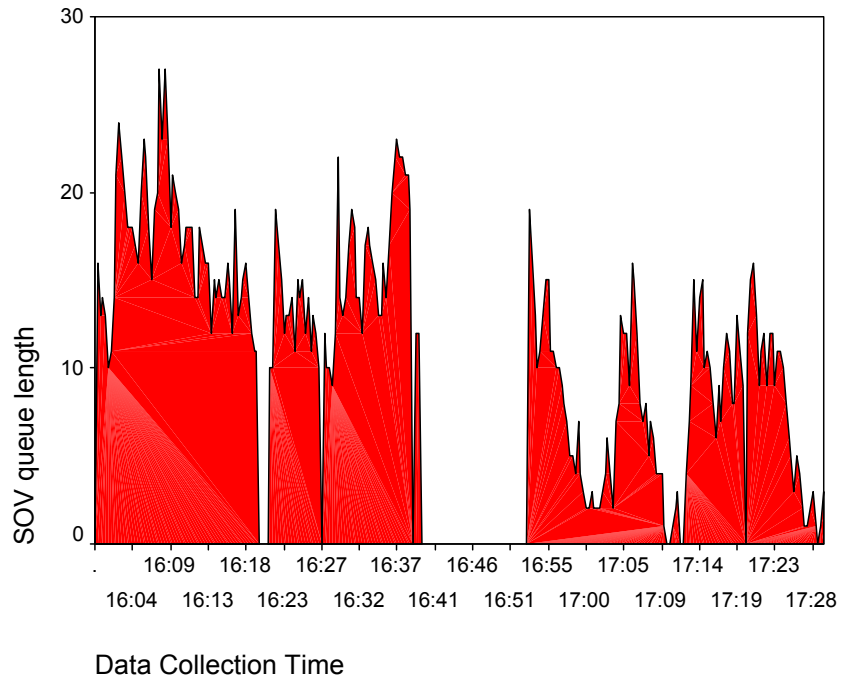
Capitol Drive 3/15/2000 AM peak



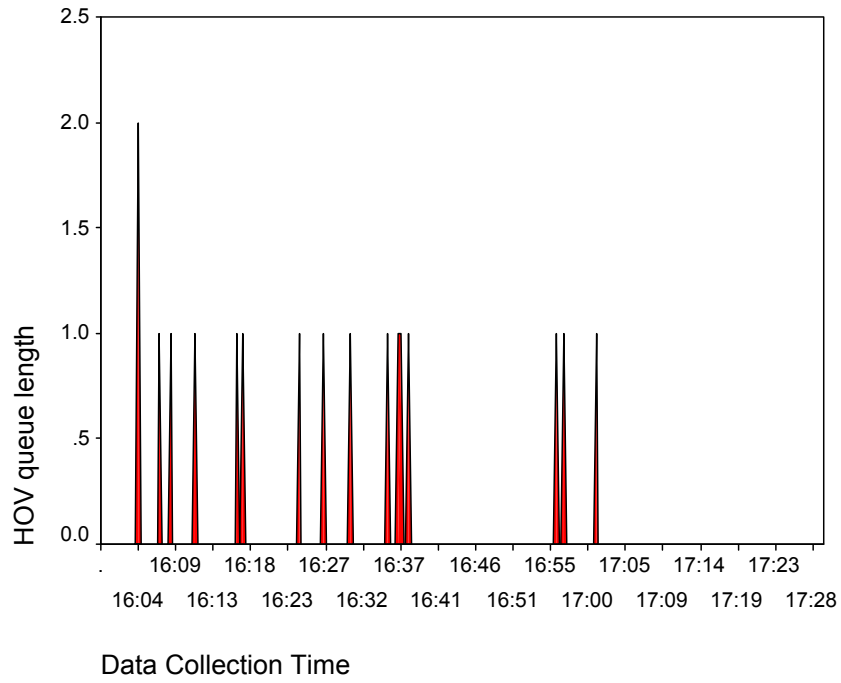
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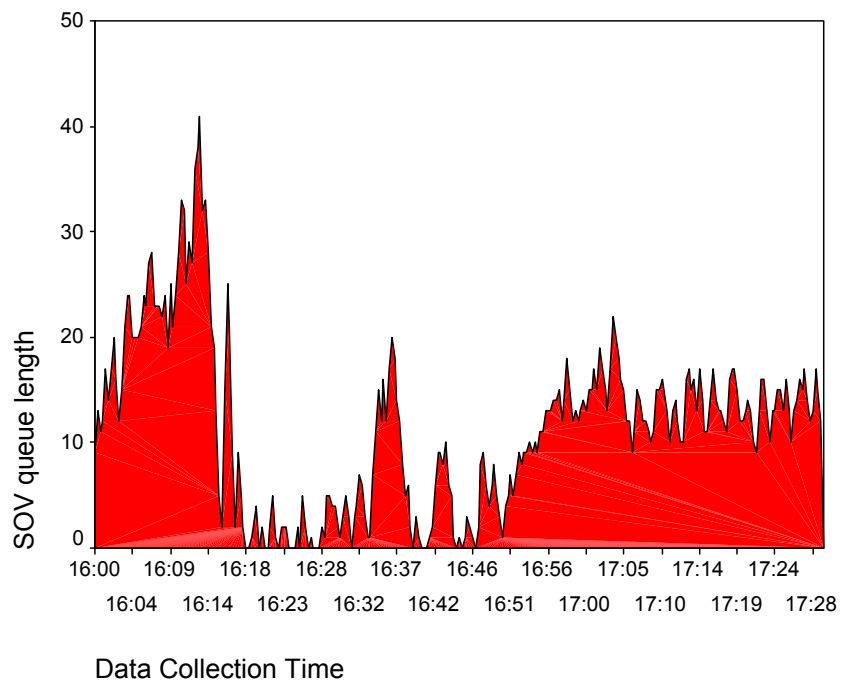
Capitol Drive 3/15/2000 PM peak



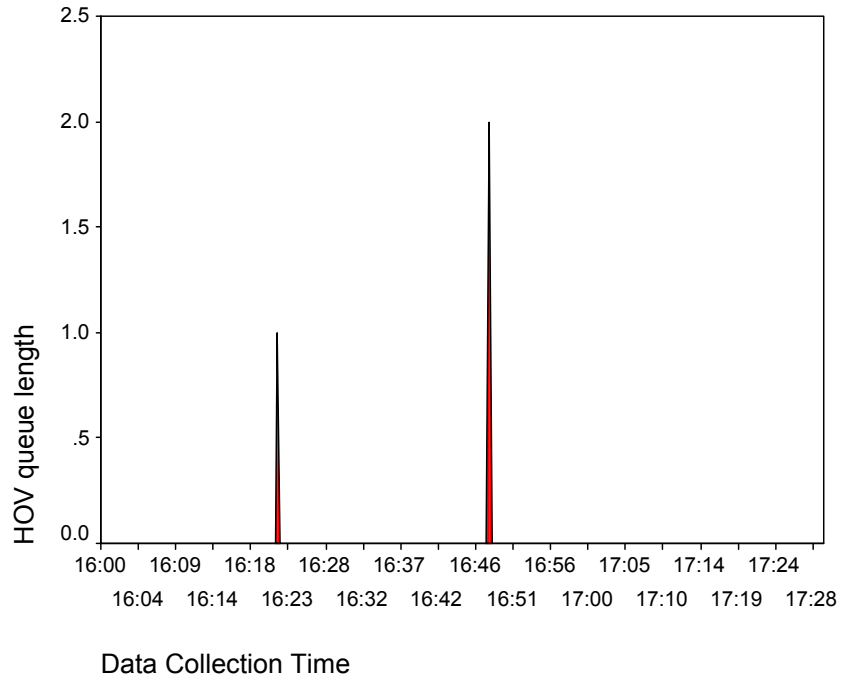
Capitol Drive 3/15/2000 PM peak



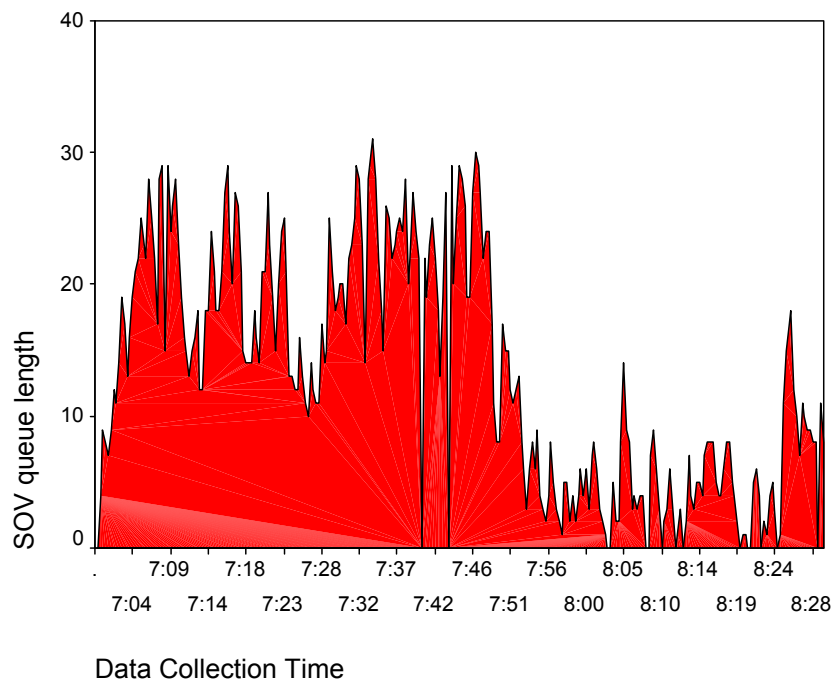
Capitol Drive 3/16/2000 PM peak



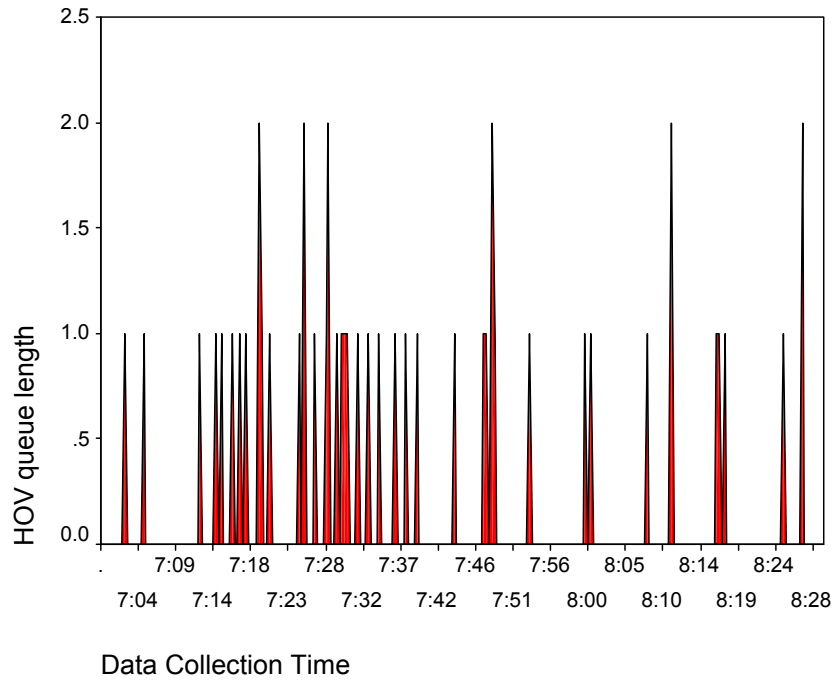
Capitol Drive 3/16/2000 PM peak



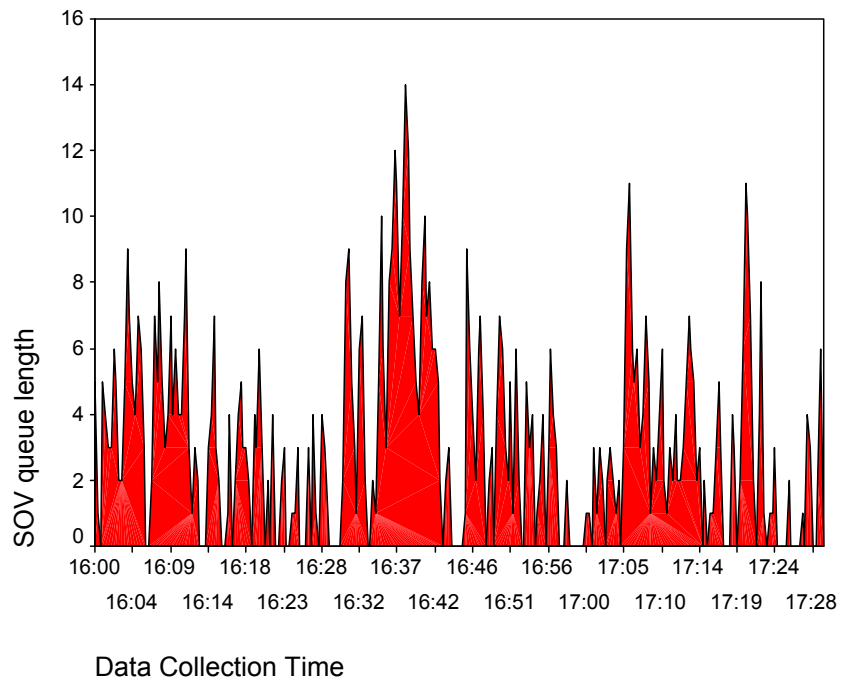
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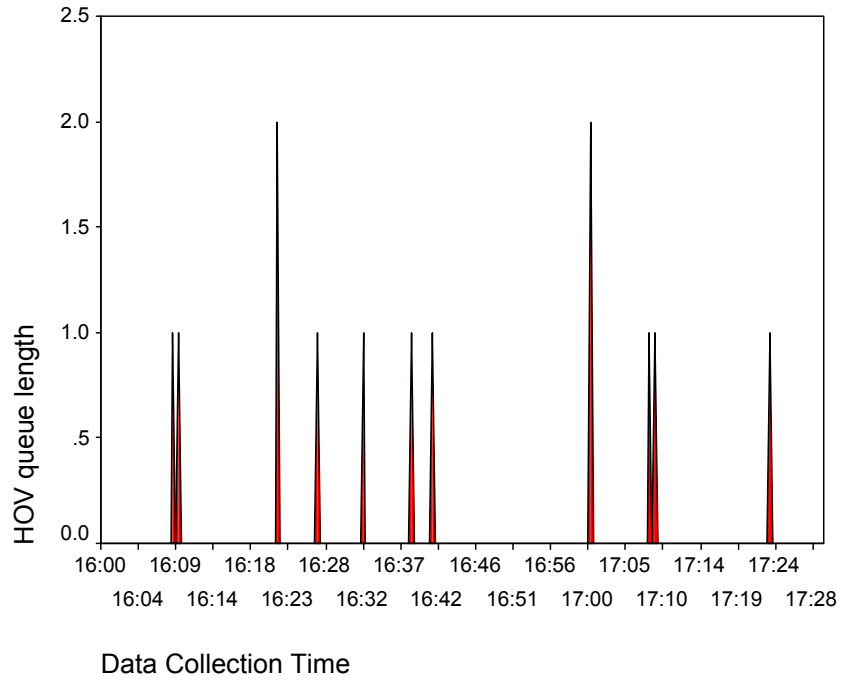
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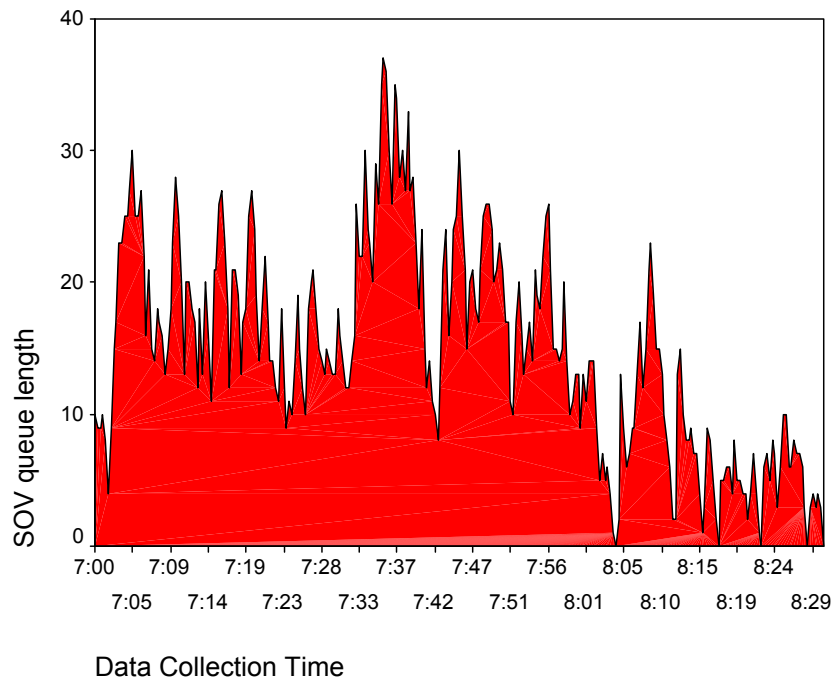
Capitol Drive 3/21/2000 PM peak



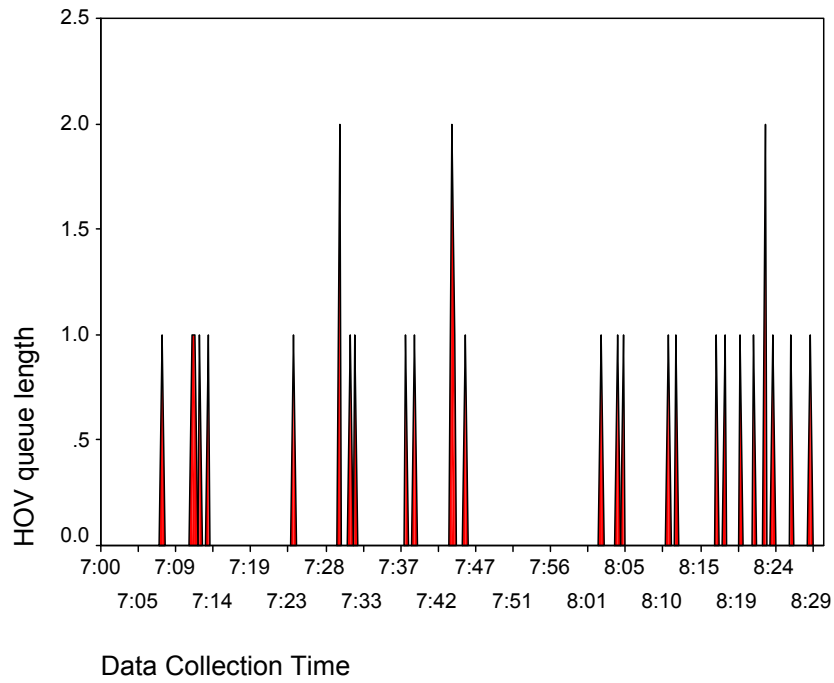
Capitol Drive 3/21/2000 PM peak



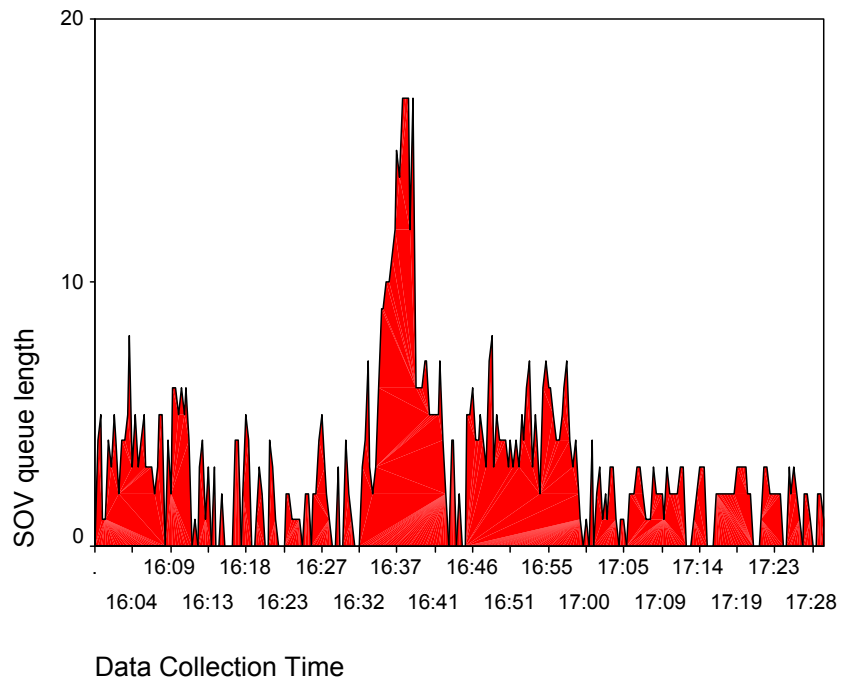
Capitol Drive 3/22/2000 AM peak



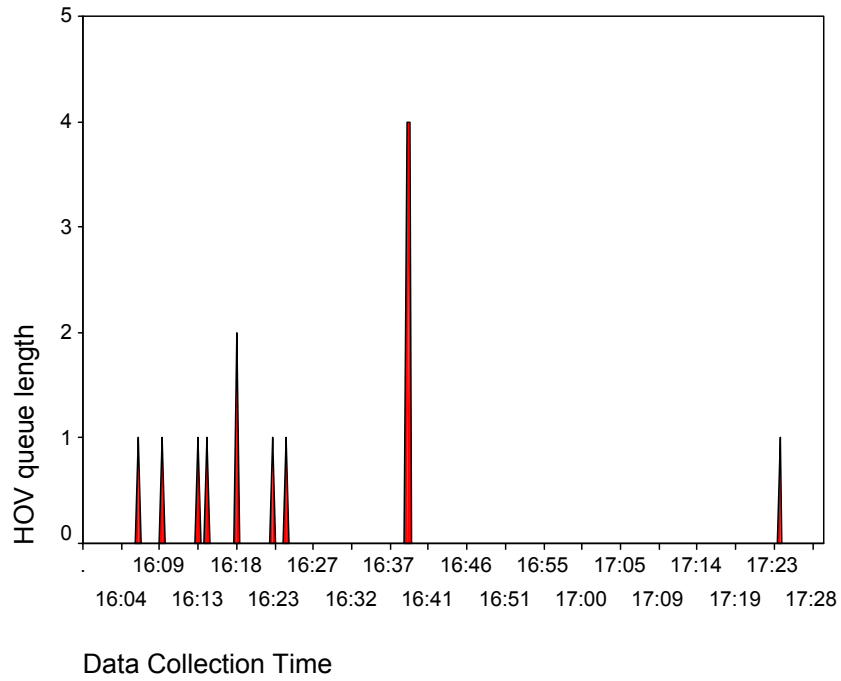
Capitol Drive 3/22/2000 AM peak



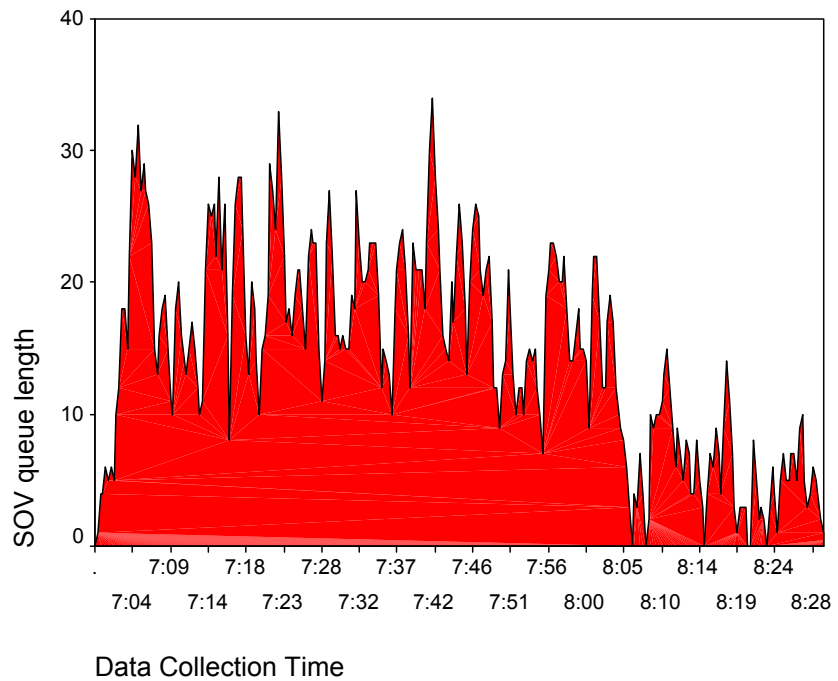
Capitol Drive 3/22/2000 PM peak



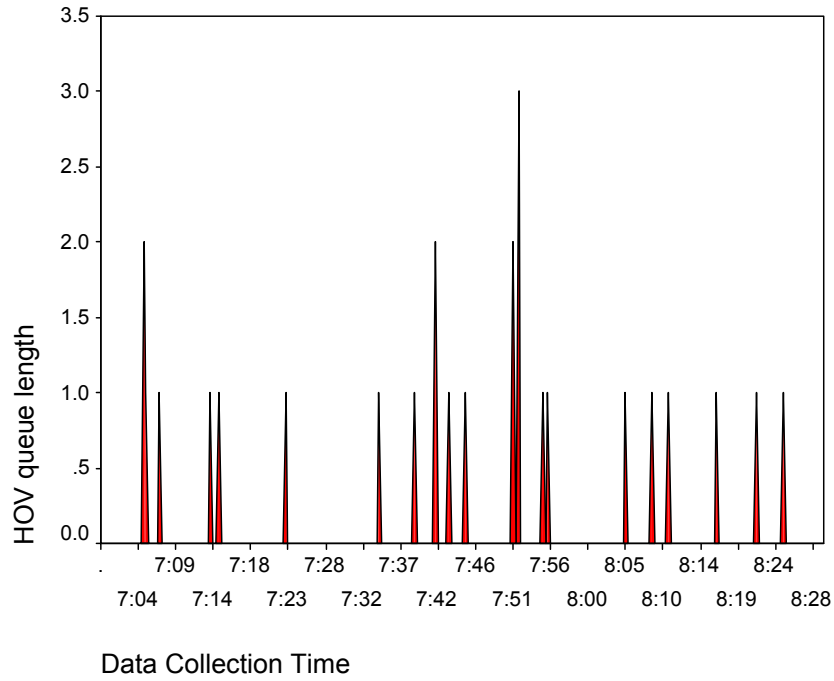
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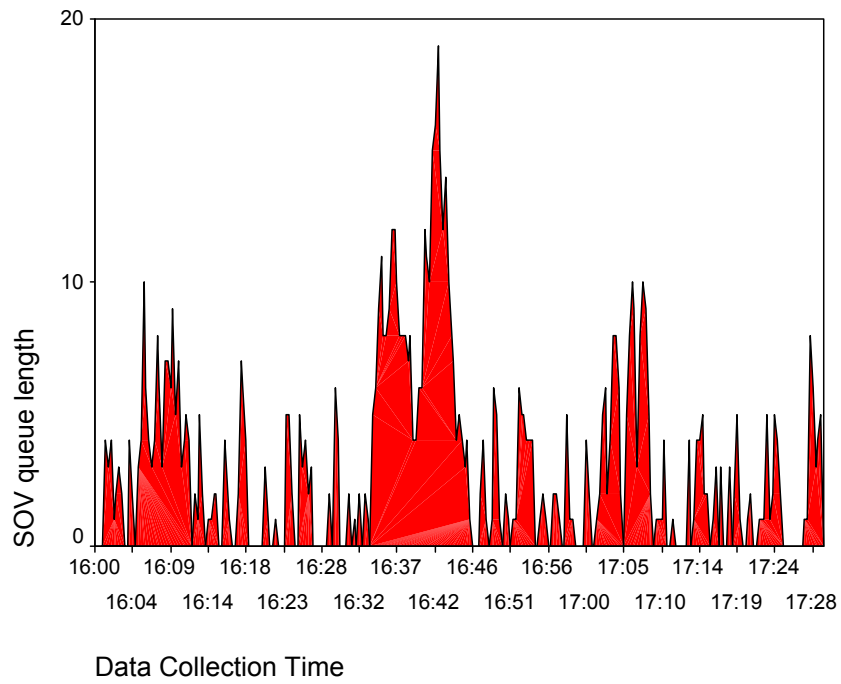
Capitol Drive 3/23/2000 AM peak



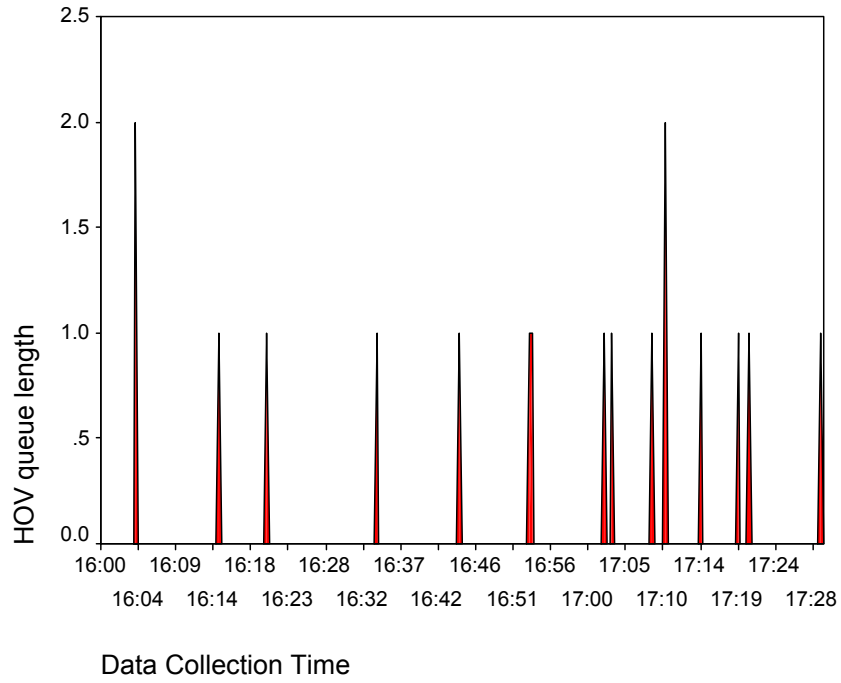
Capitol Drive 3/23/2000 AM peak



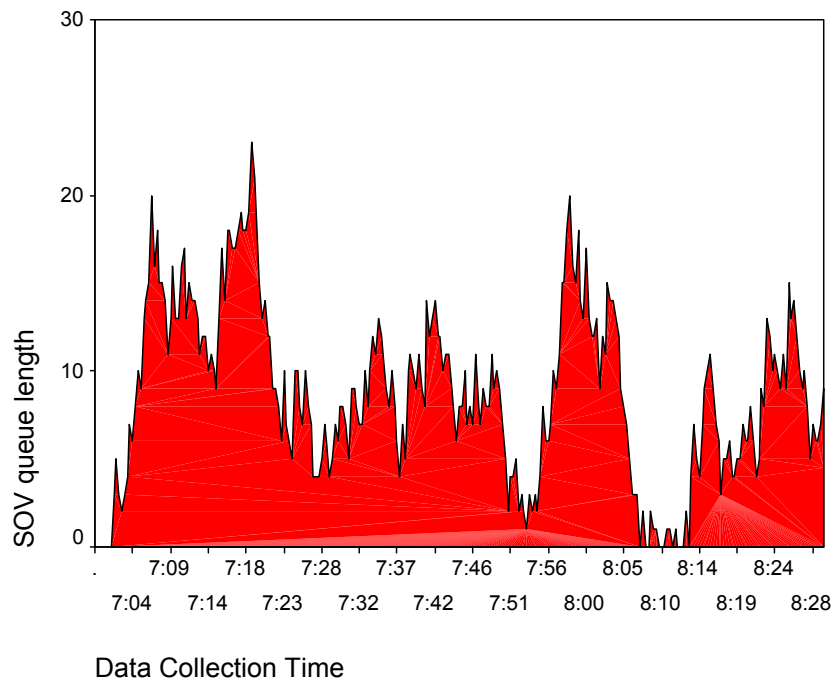
Capitol Drive 3/23/2000 PM peak



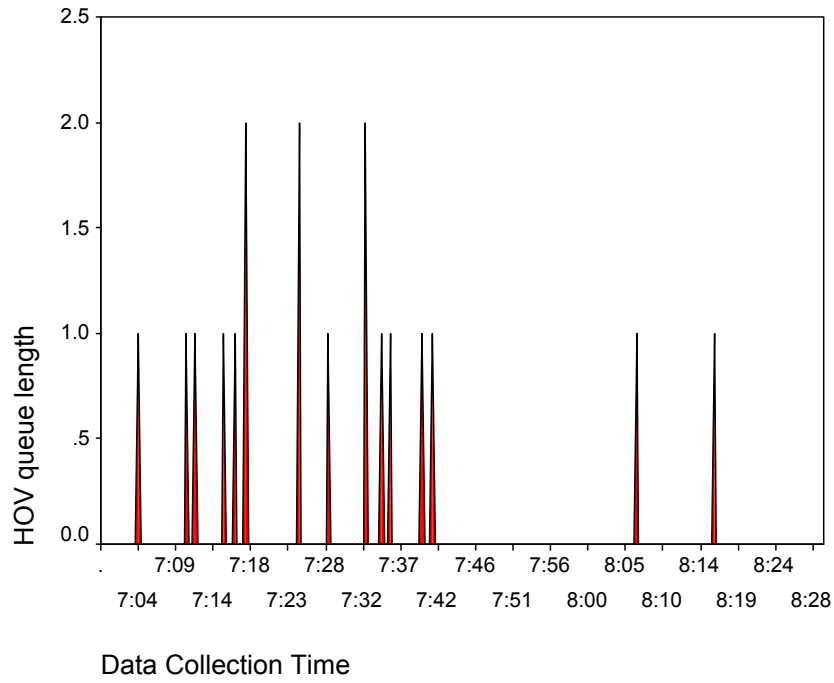
Capitol Drive 3/23/2000 PM peak



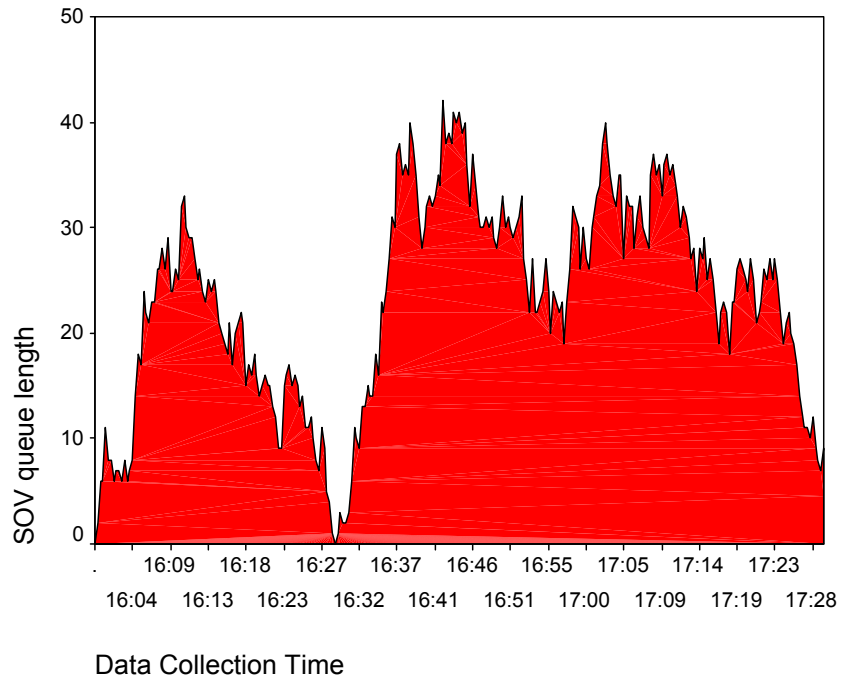
Burleigh Street 3/14/2000 AM peak



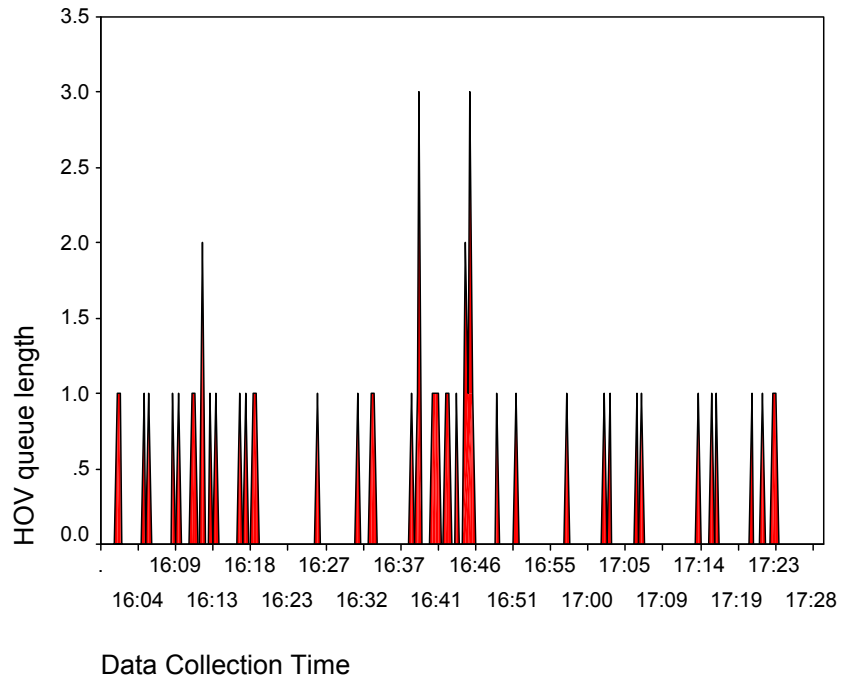
Burleigh Street 3/14/2000 AM peak



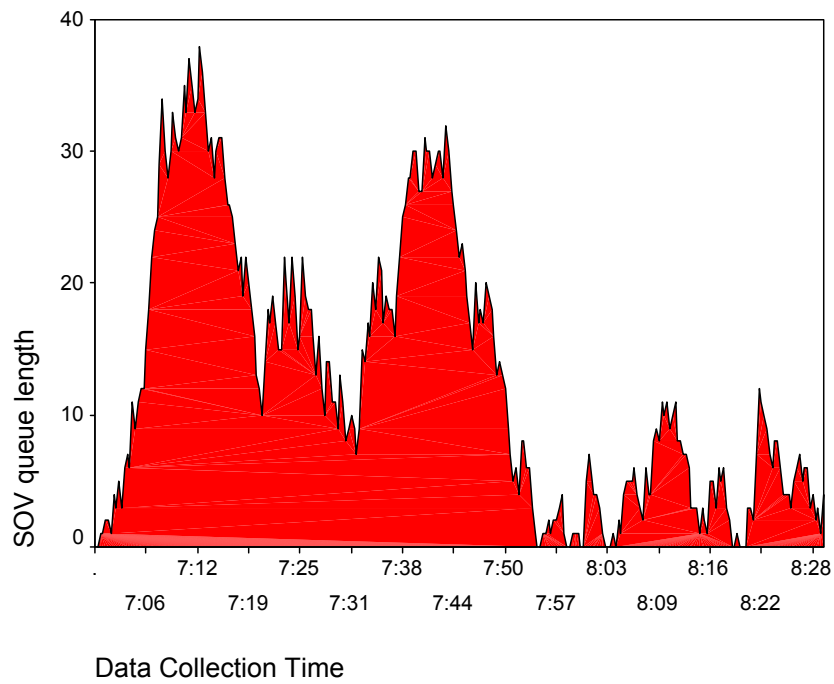
Burleigh Street 3/14/2000 PM peak



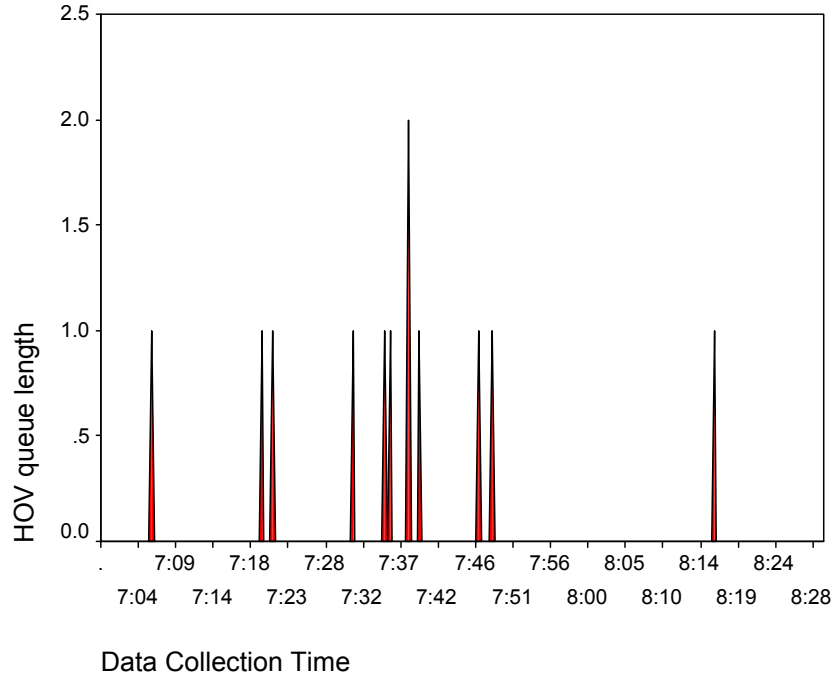
Burleigh Street 3/14/2000 PM peak



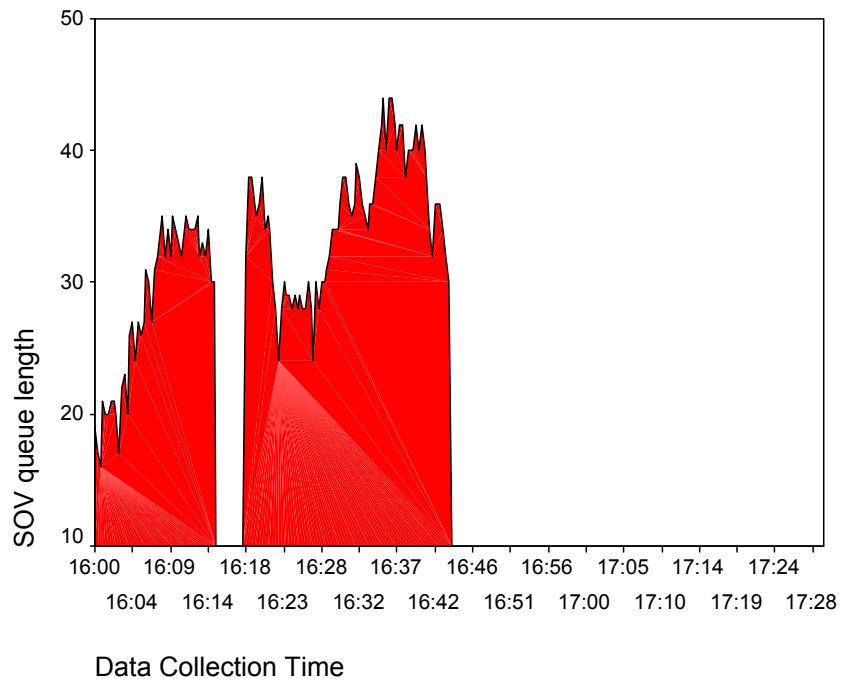
Burleigh Street 3/15/2000 AM peak



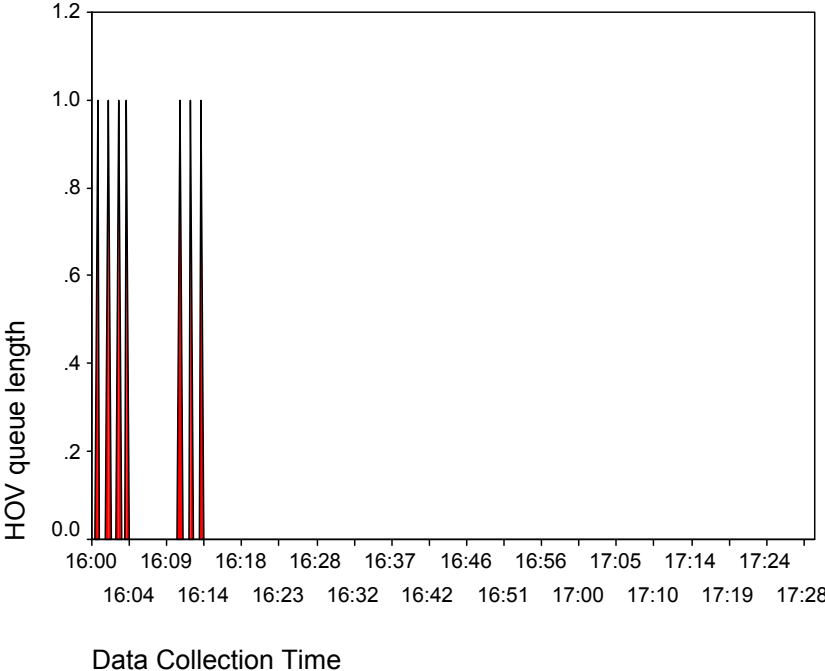
Burleigh Street 3/15/2000 AM peak



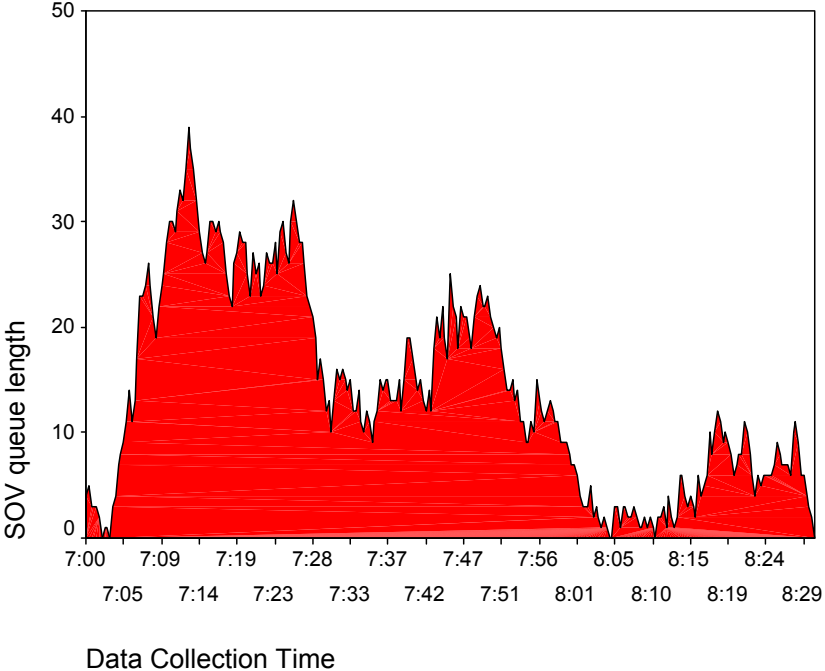
Burleigh Street 3/15/2000 PM peak



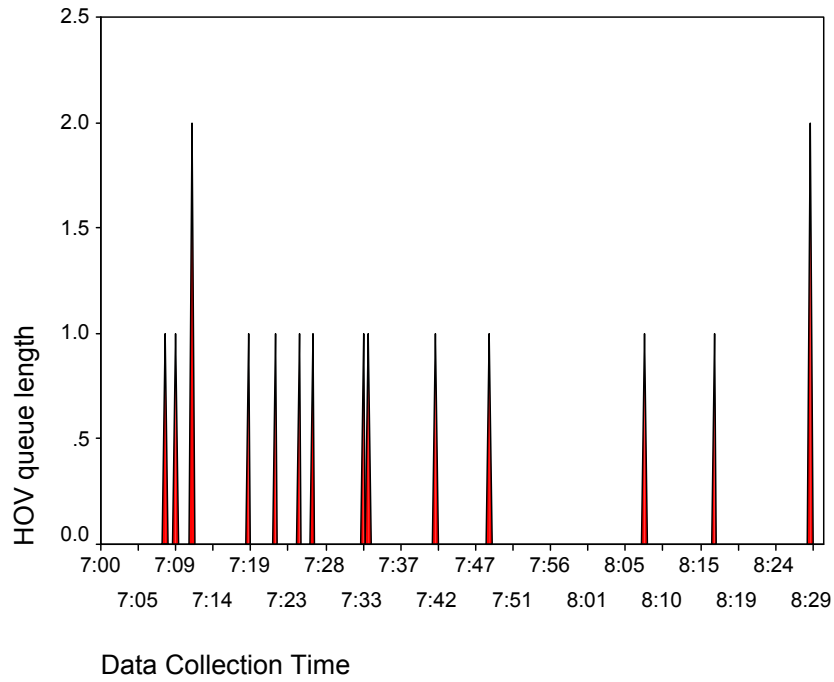
Burleigh Street 3/15/2000 PM peak



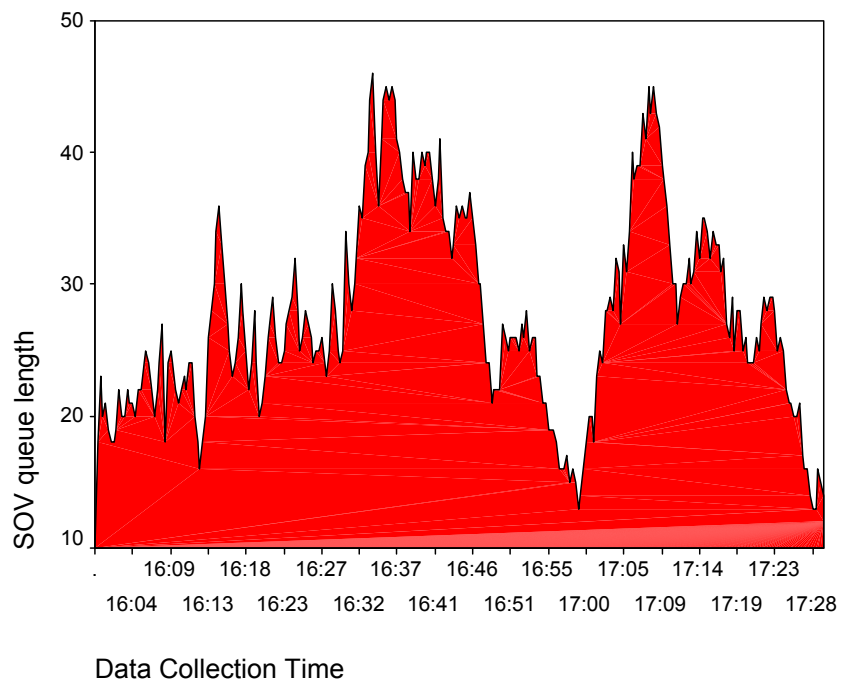
Burleigh Street 3/16/2000 AM peak



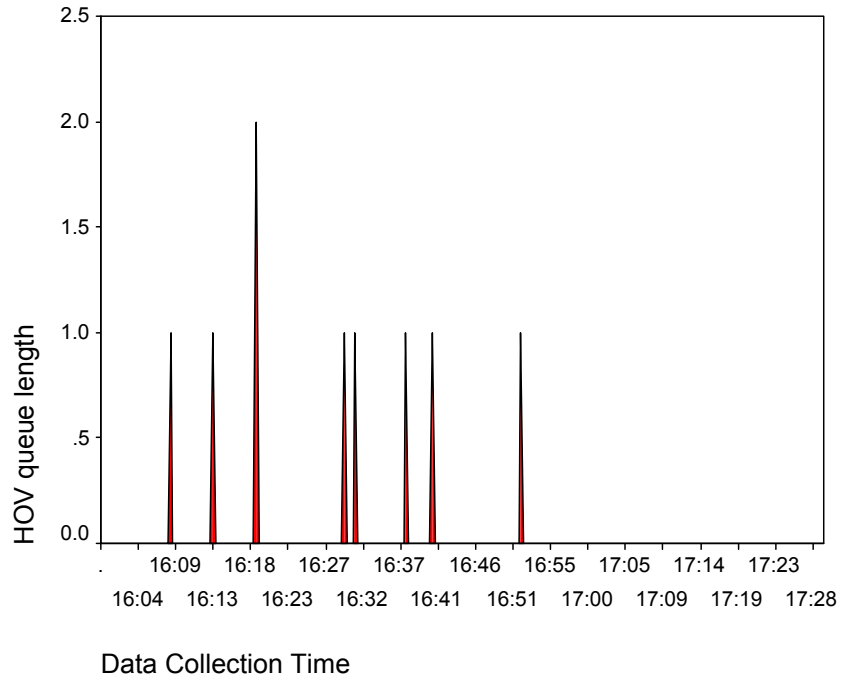
Burleigh Street 3/16/2000 AM peak



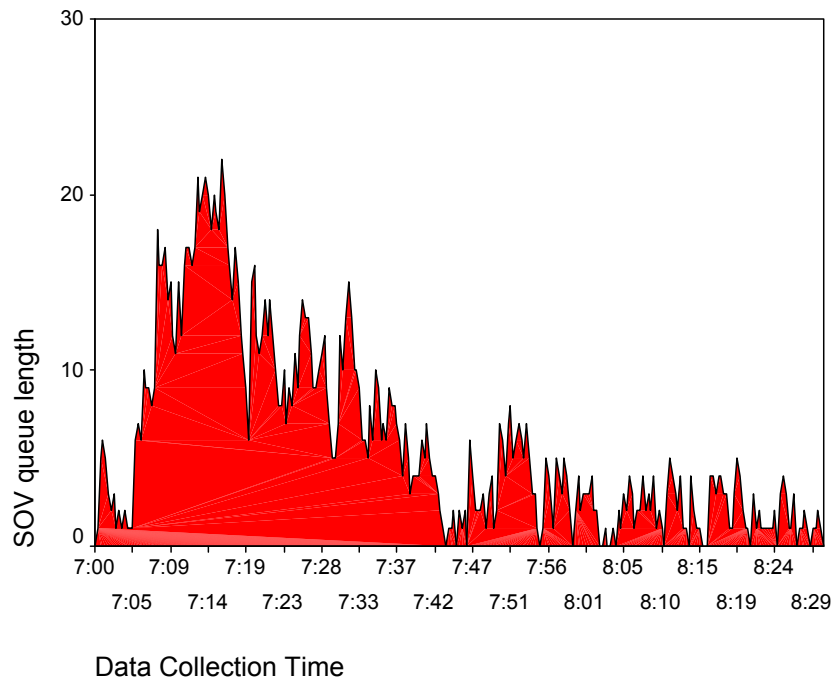
Burleigh Street 3/16/2000 PM peak



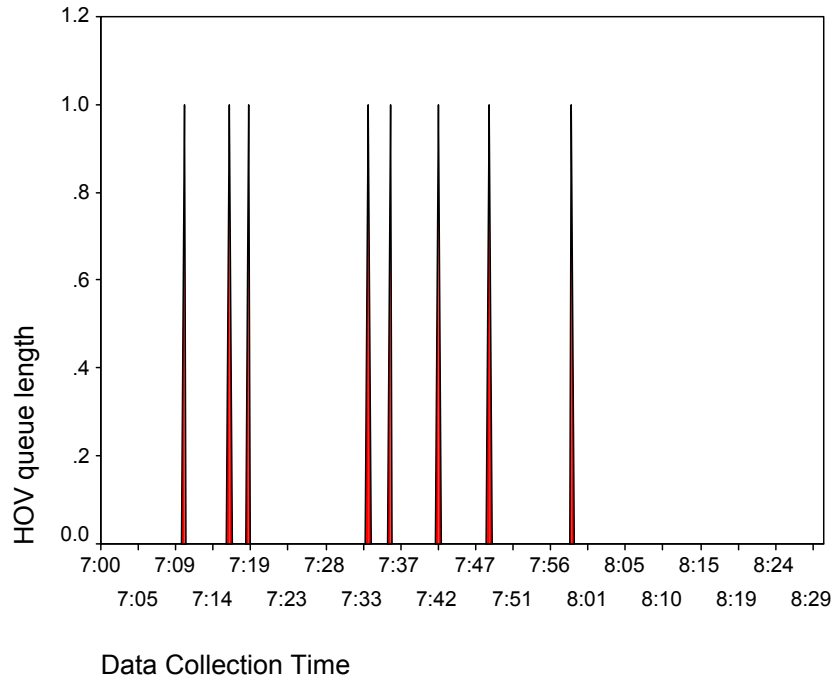
Burleigh Street 3/16/2000 PM peak



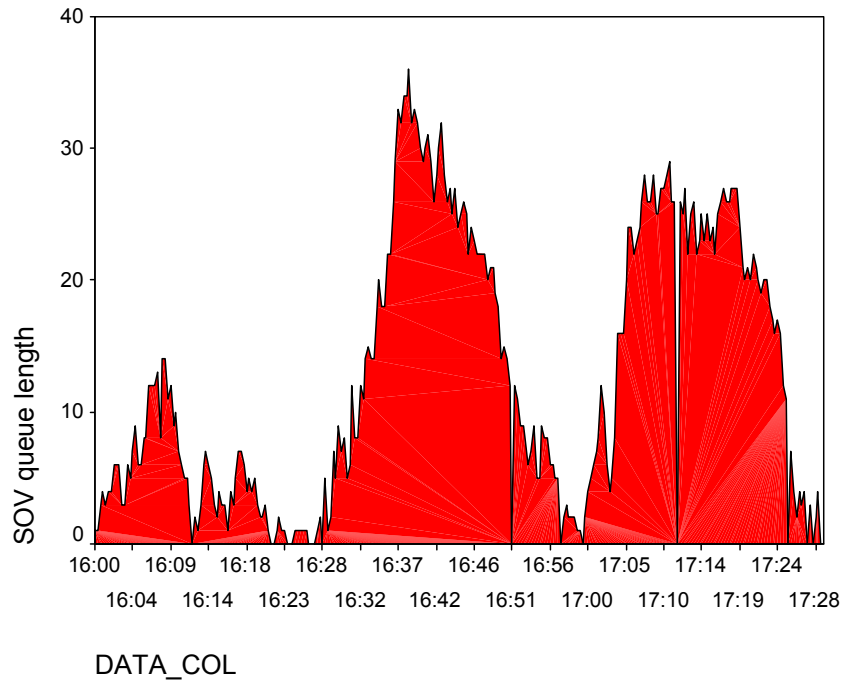
Burleigh Street 3/21/2000 AM peak



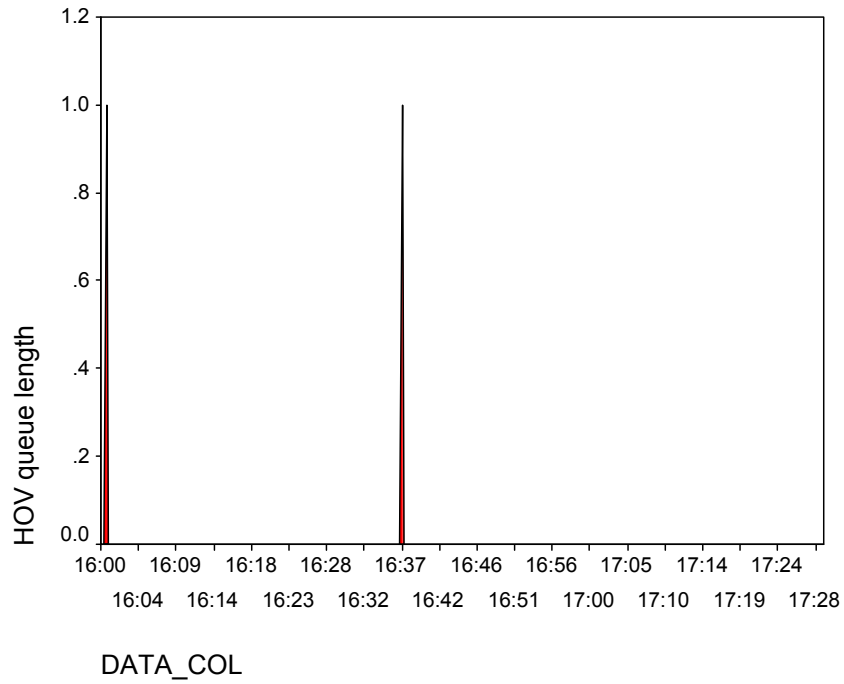
Burleigh Street 3/21/2000 AM peak



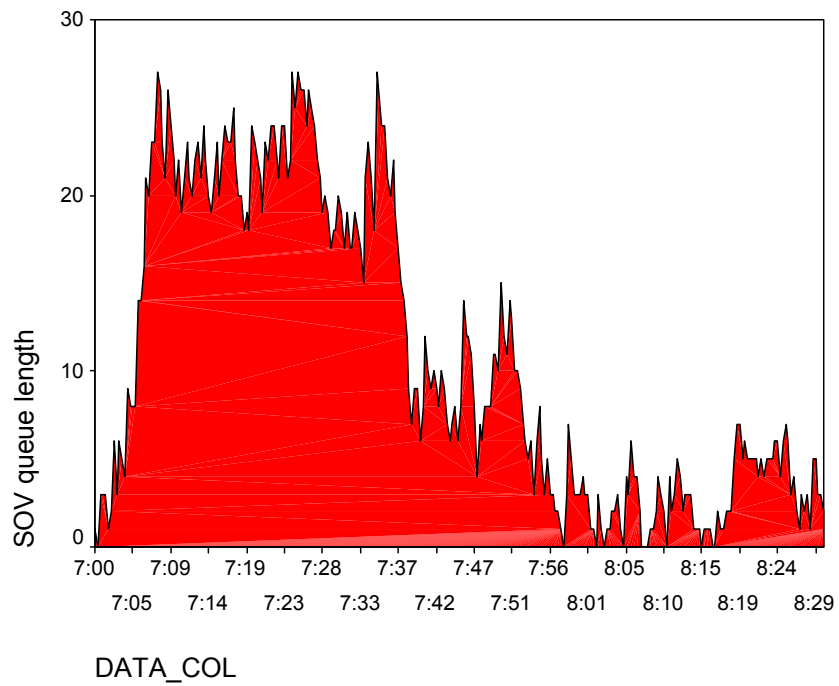
Burleigh Street 3/21/2000 PM peak



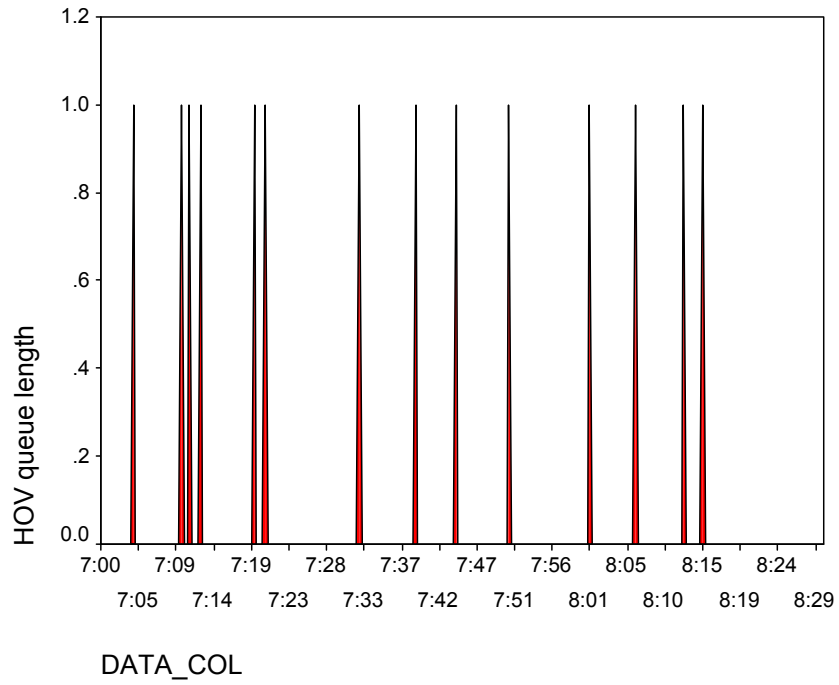
Burleigh Street 3/21/2000 PM peak



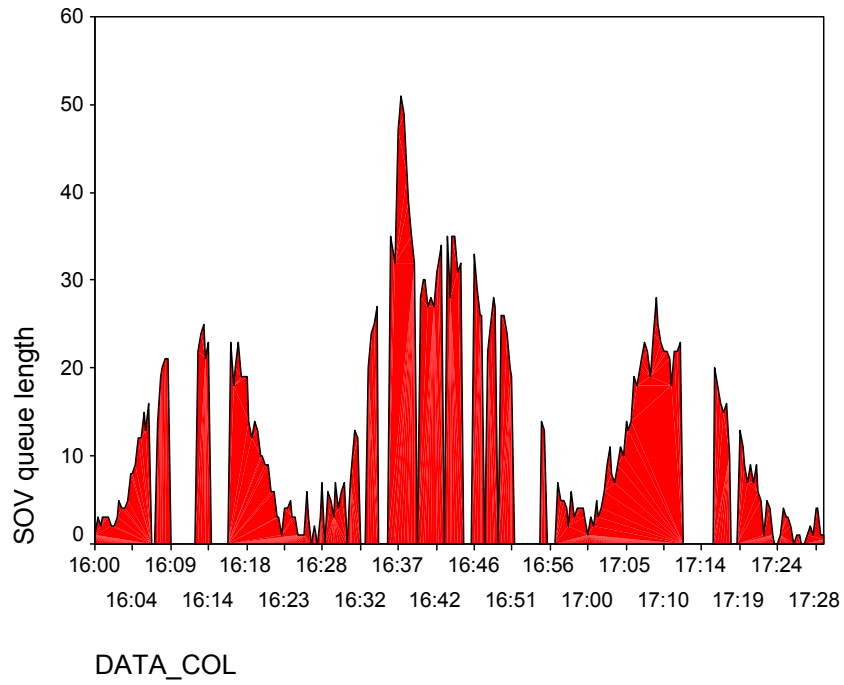
Burleigh Street 3/22/2000 AM peak



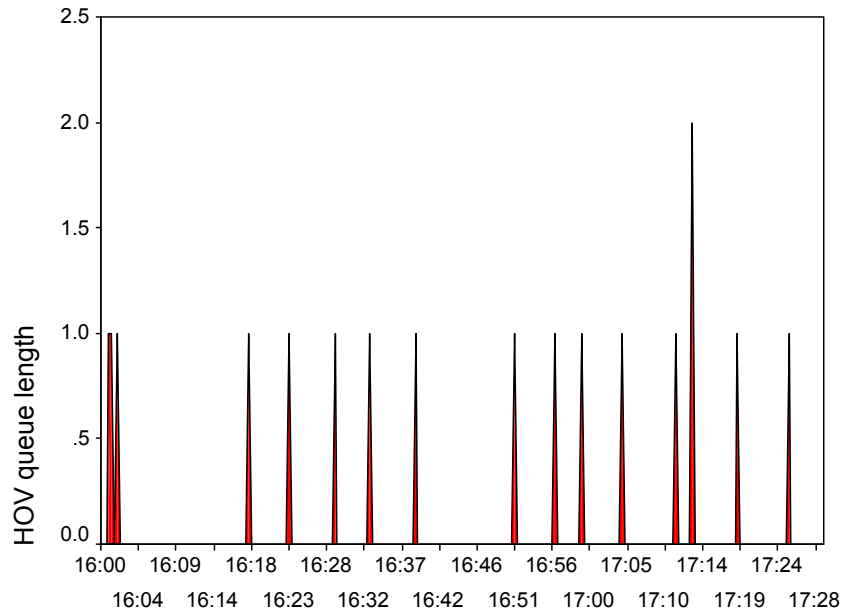
Burleigh Street 3/22/2000 AM peak



Burleigh Street 3/22/2000 PM peak

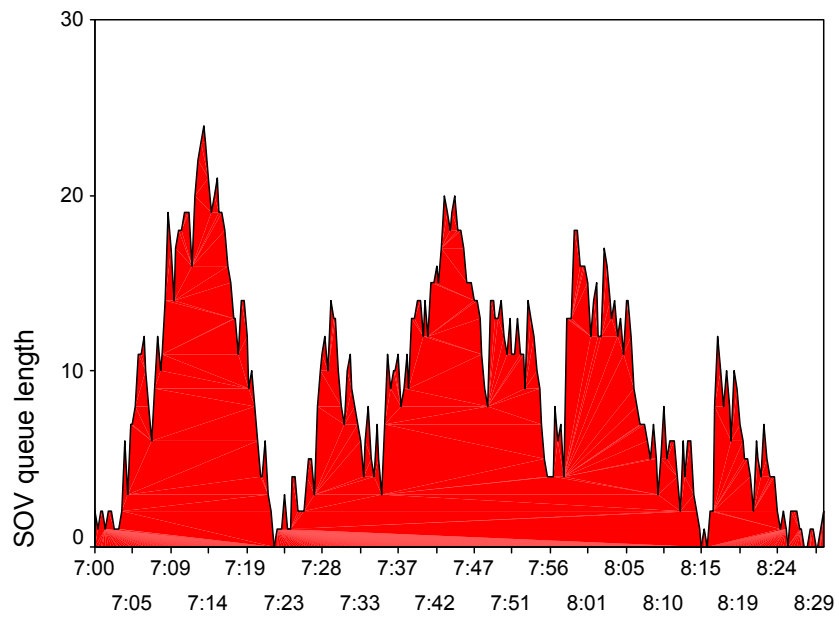


Burleigh Street 3/22/2000 PM peak



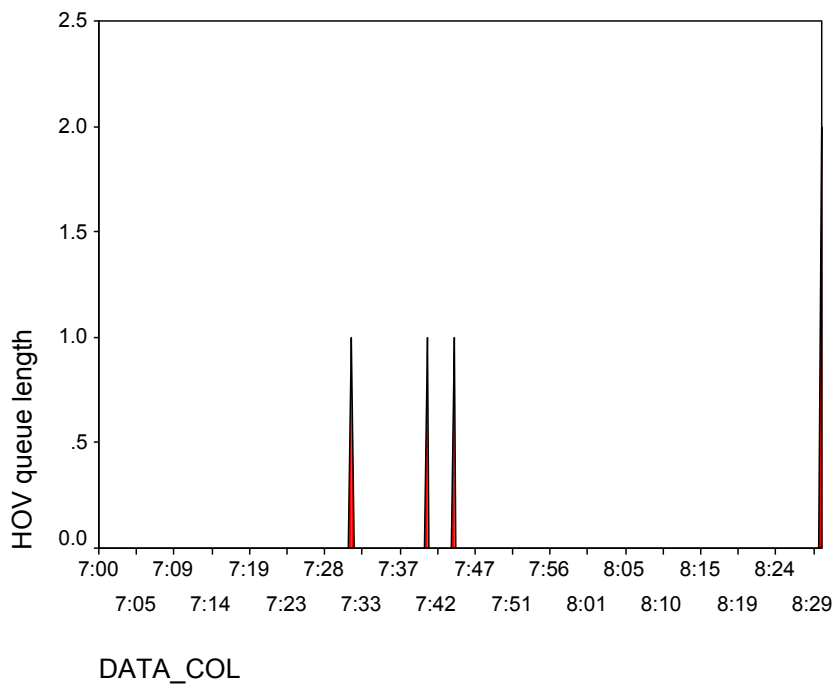
DATA_COL

Burleigh Street 3/23/2000 AM peak

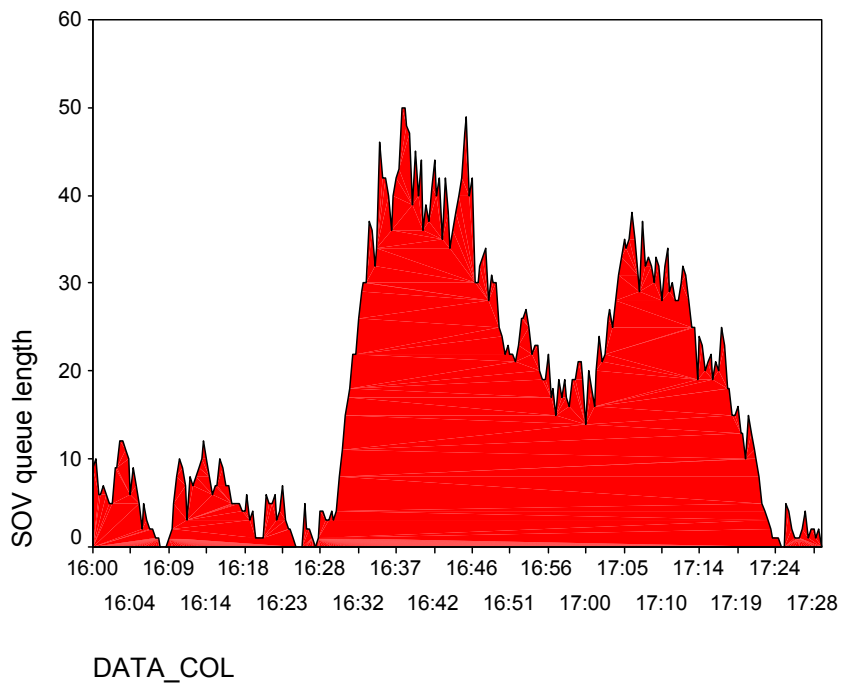


DATA_COL

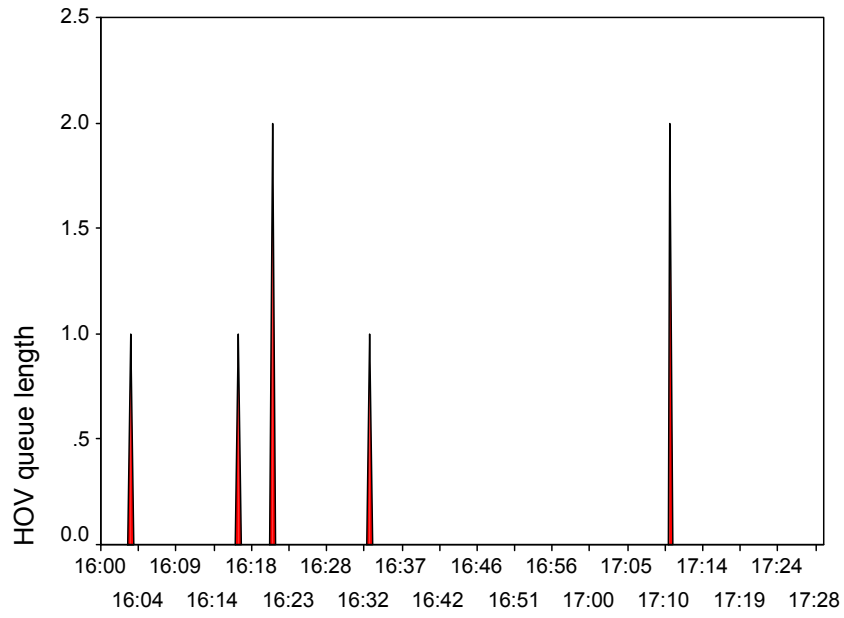
Burleigh Street 3/23/2000 AM peak



Burleigh Street 3/23/2000 PM peak

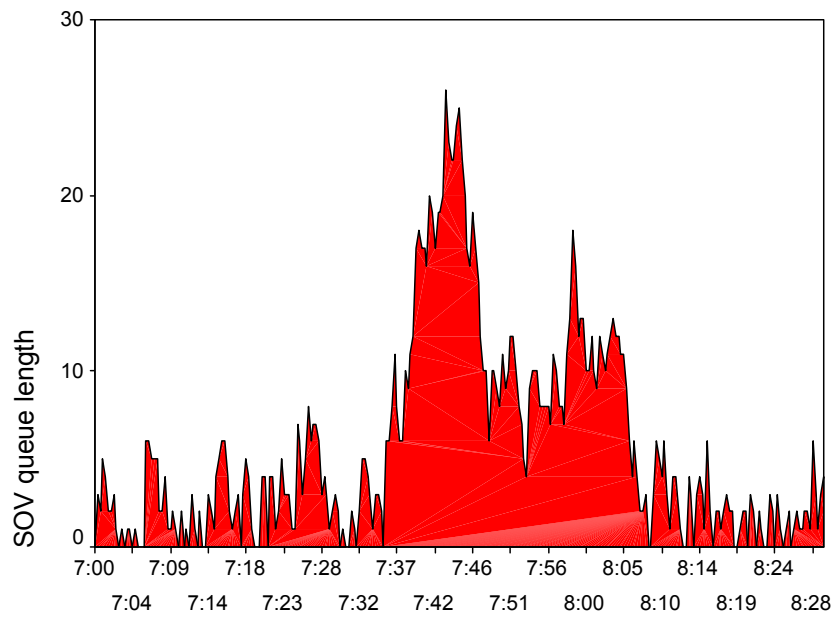


Burleigh Street 3/23/2000 PM peak



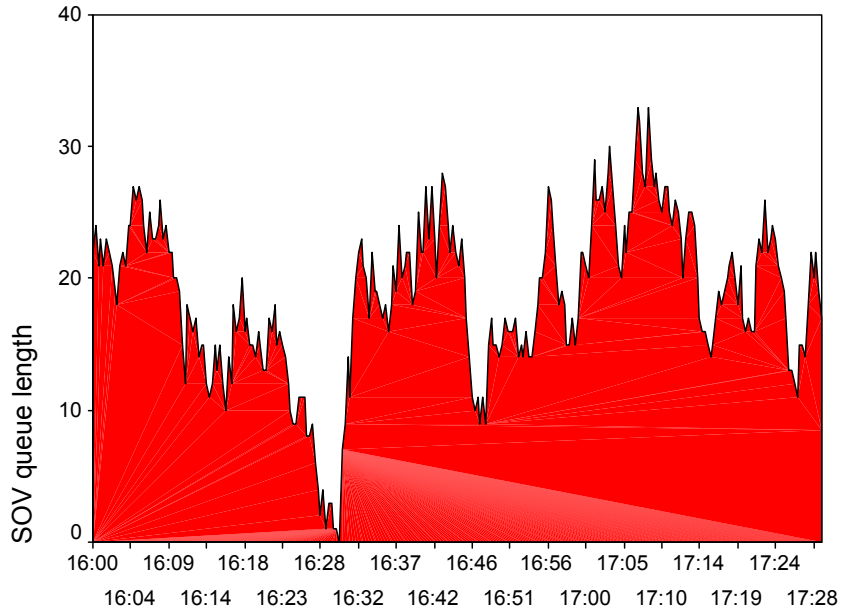
DATA_COL

North Avenue 2/1/2000 AM peak



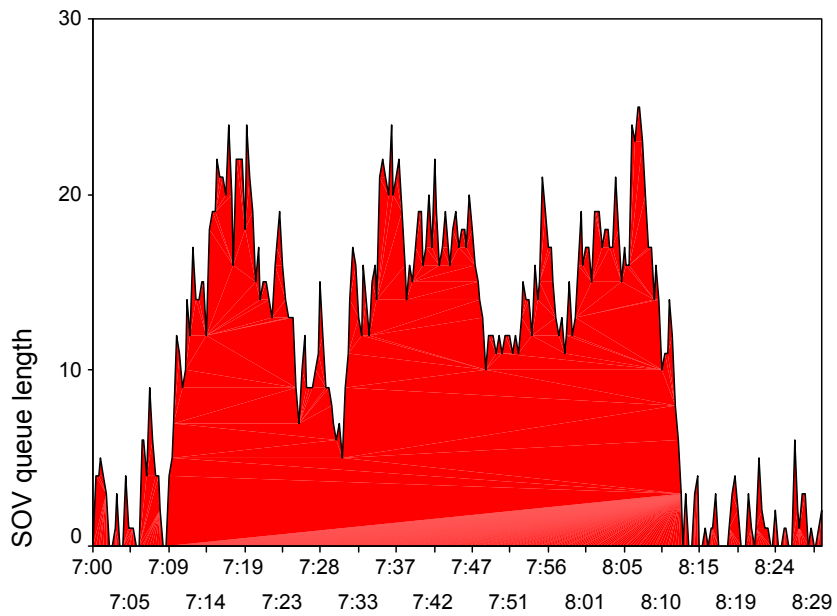
Data Collection Time

North Avenue 2/1/2000 PM peak



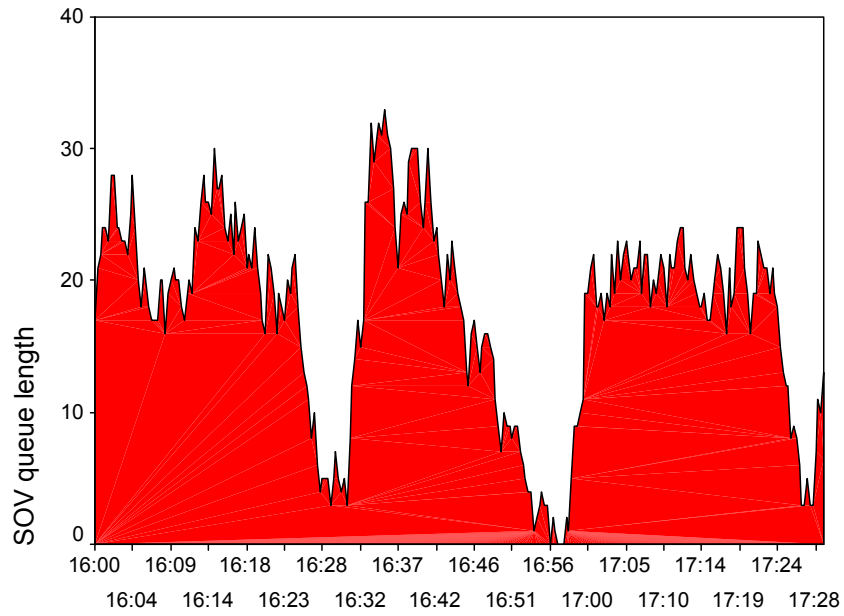
DATA_COL

North Avenue 2/2/2000 AM peak



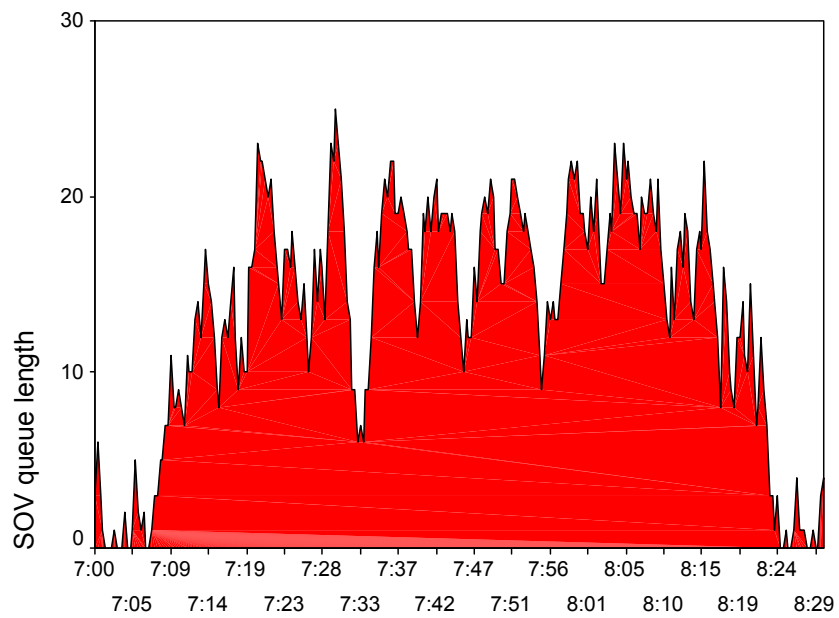
DATA_COL

North Avenue 2/2/2000 PM peak



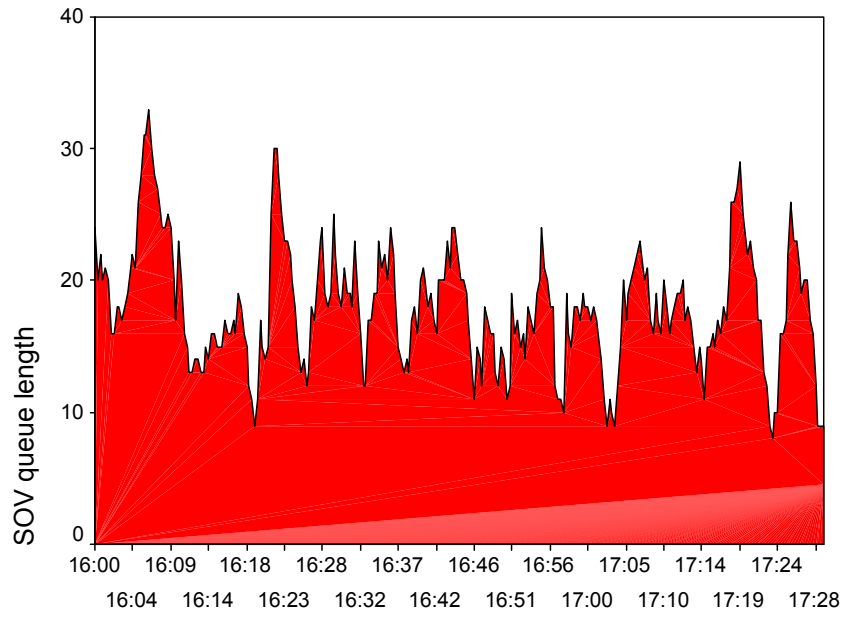
DATA_COL

North Avenue 2/3/2000 AM peak



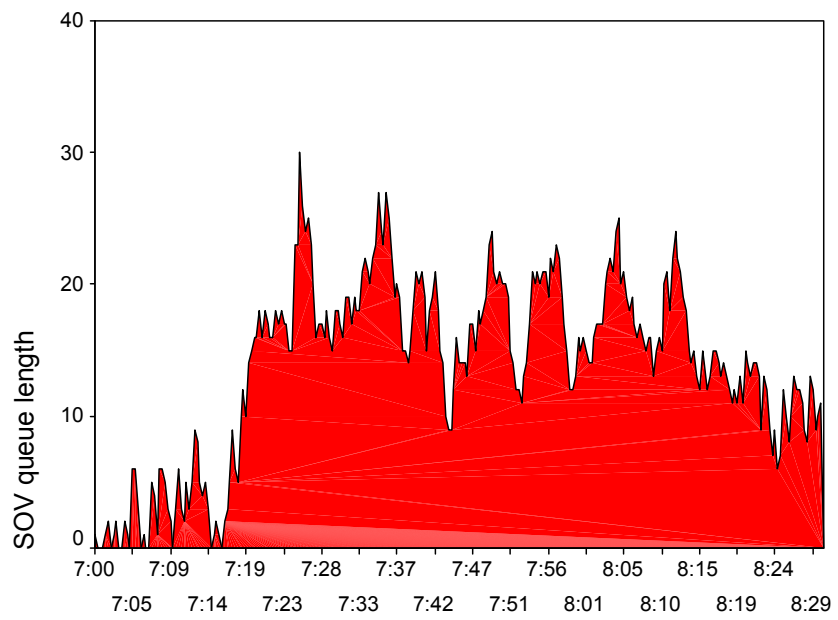
DATA_COL

North Avenue 2/3/2000 PM peak



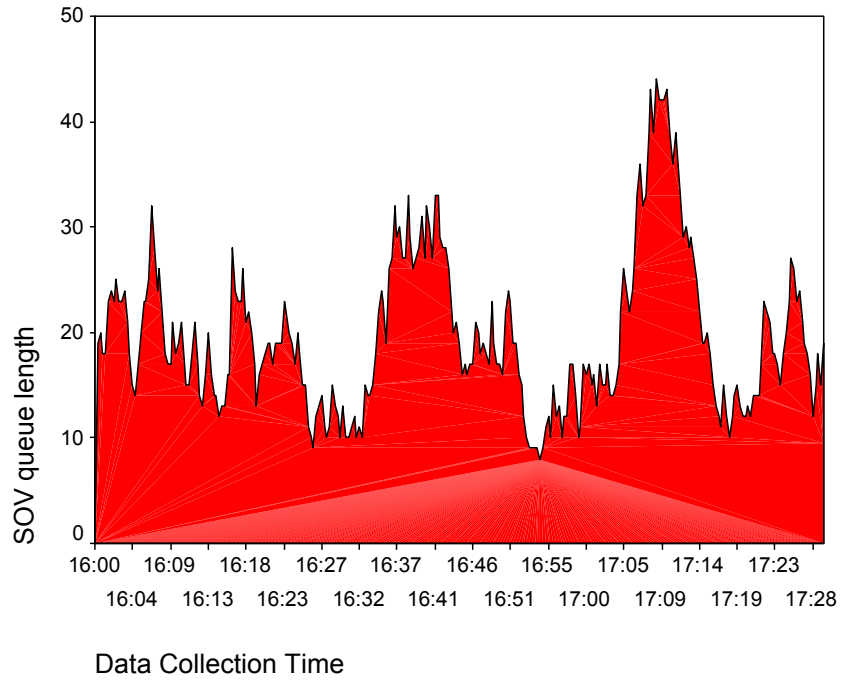
DATA_COL

North Avenue 2/8/2000 AM peak

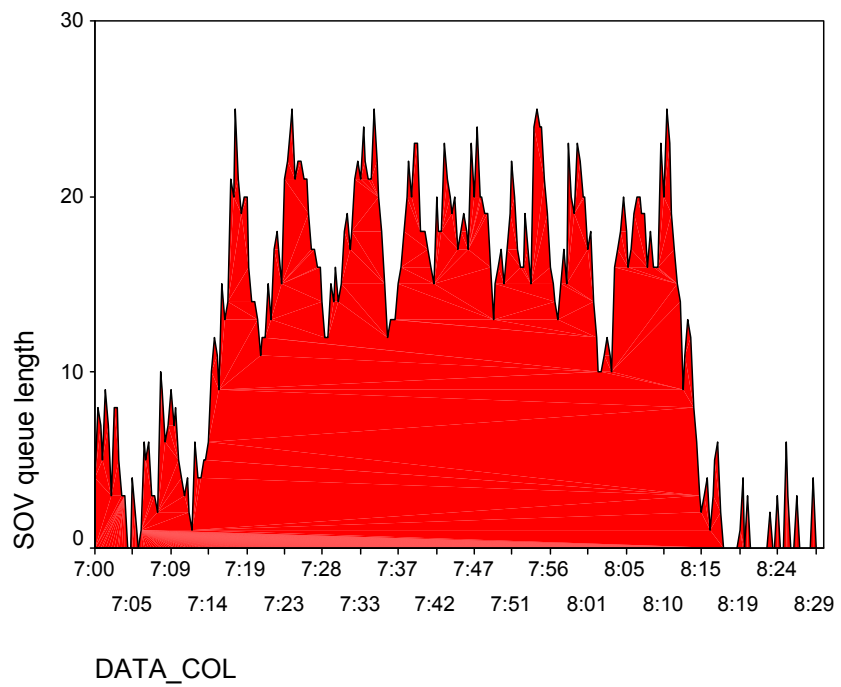


Data Collection Time

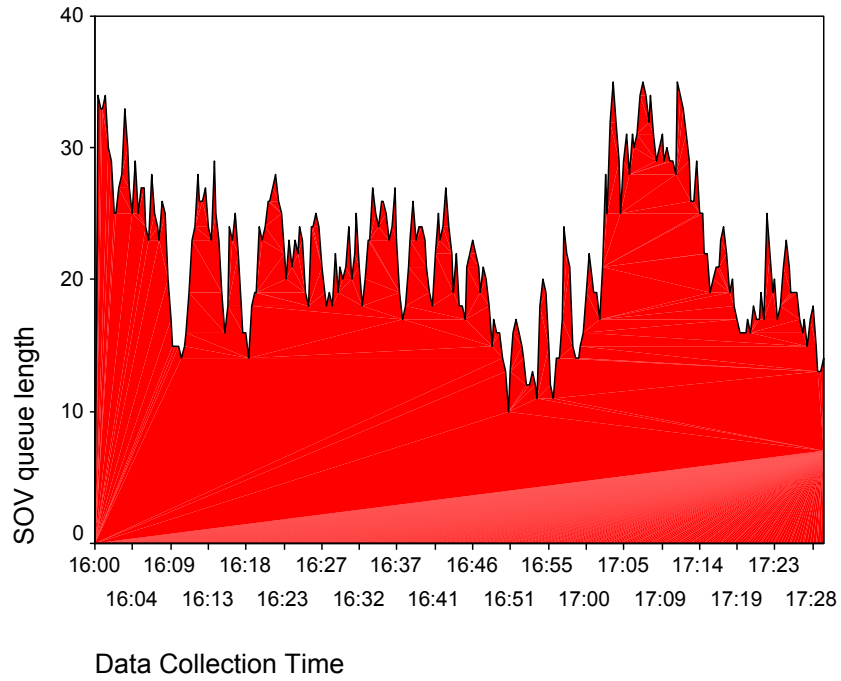
North Avenue 2/8/2000 PM peak



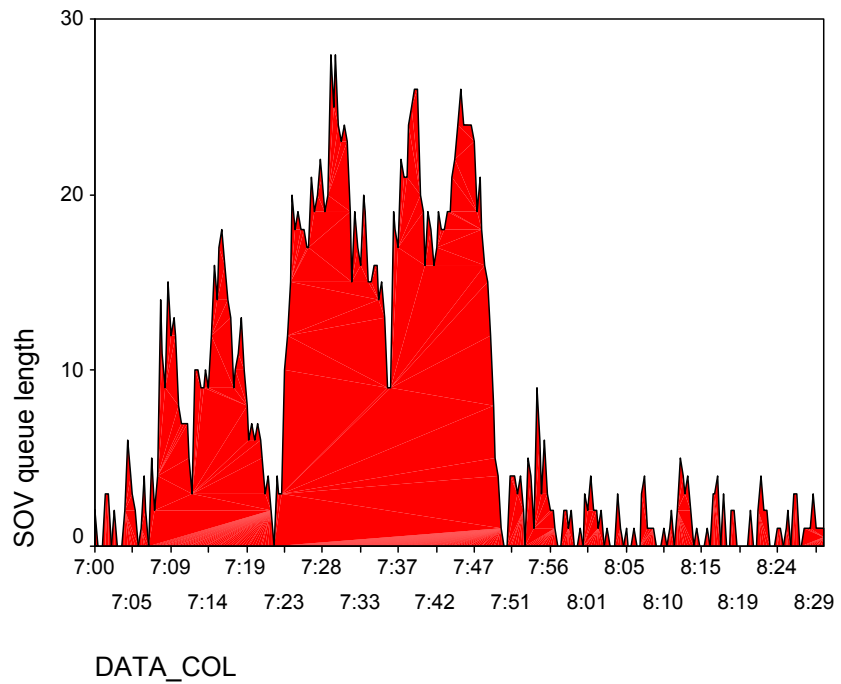
North Avenue 2/9/2000 AM peak



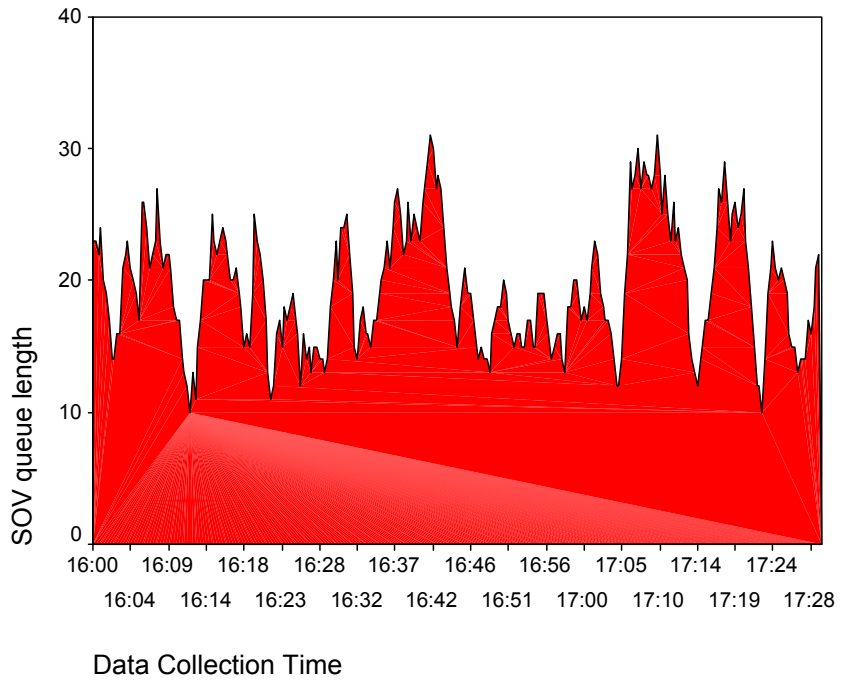
North Avenue 2/9/2000 PM peak



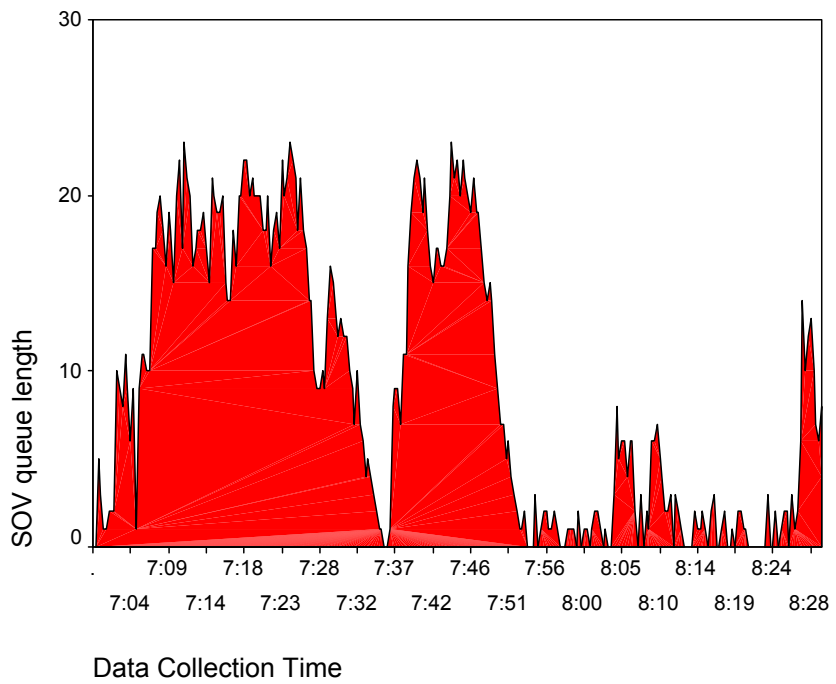
North Avenue 2/10/2000 AM peak



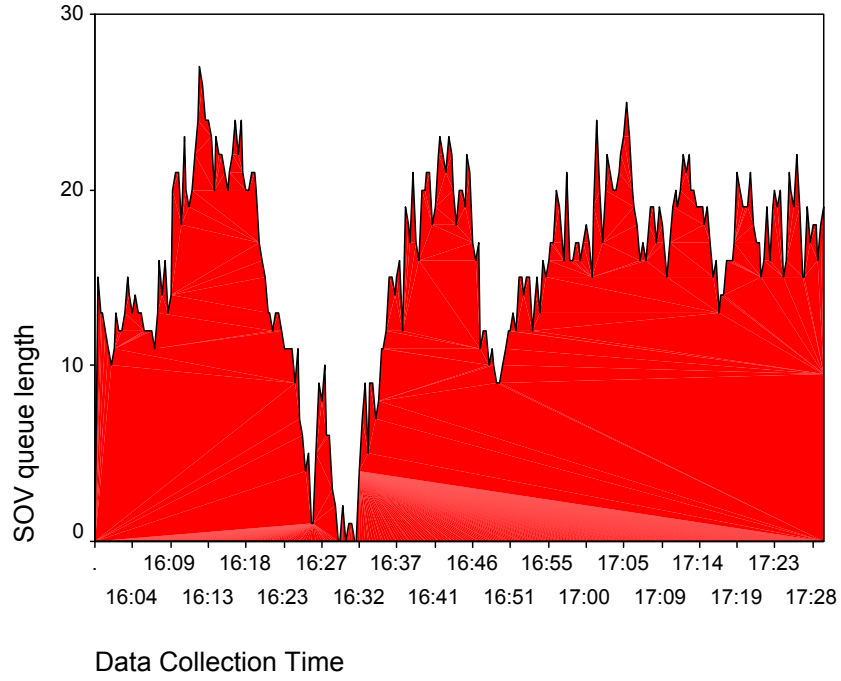
North Avenue 2/10/2000 PM peak



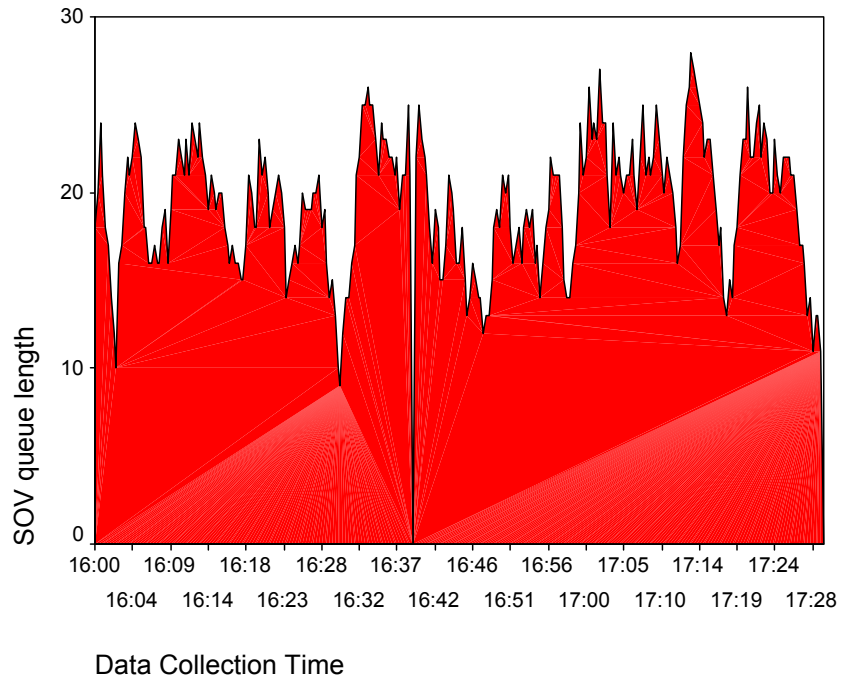
North Avenue 3/14/2000 AM peak



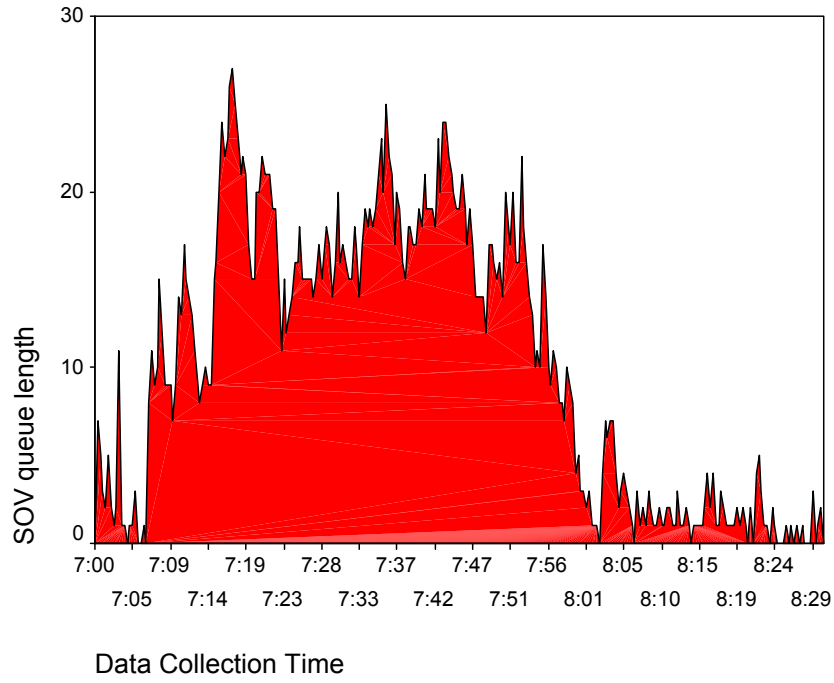
North Avenue 3/14/2000 PM peak



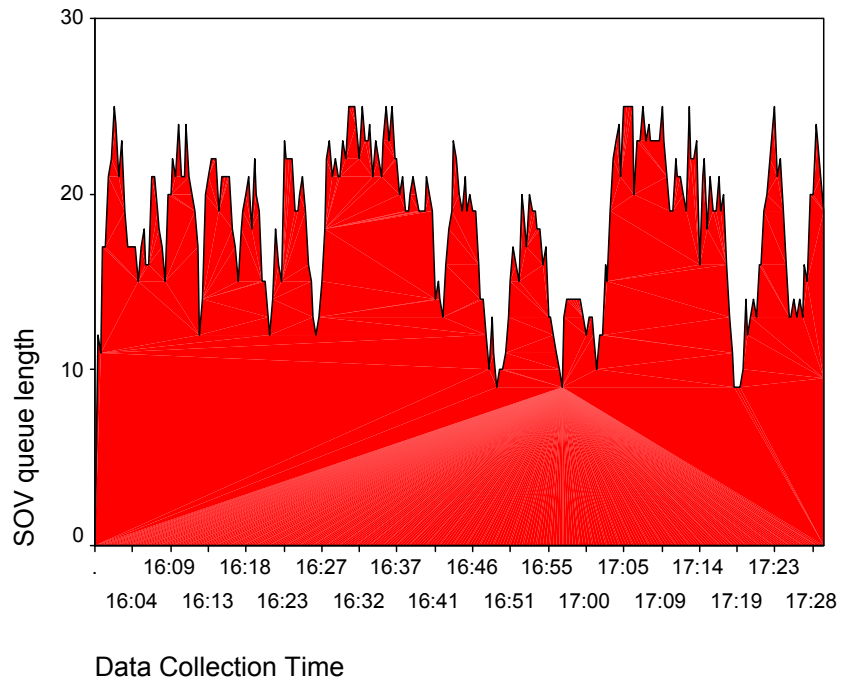
North Avenue 3/15/2000 PM peak



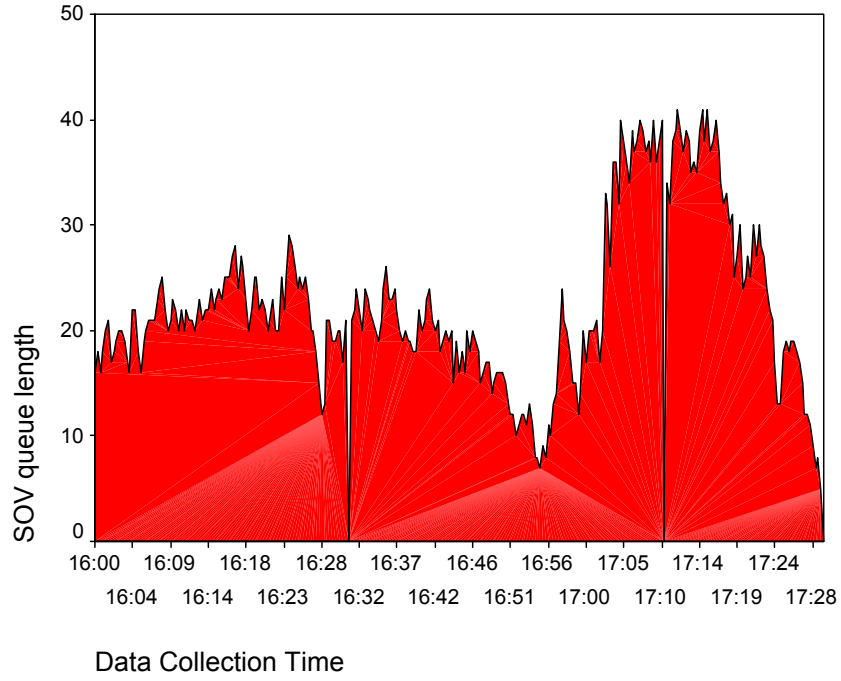
North Avenue 3/16/2000 AM peak



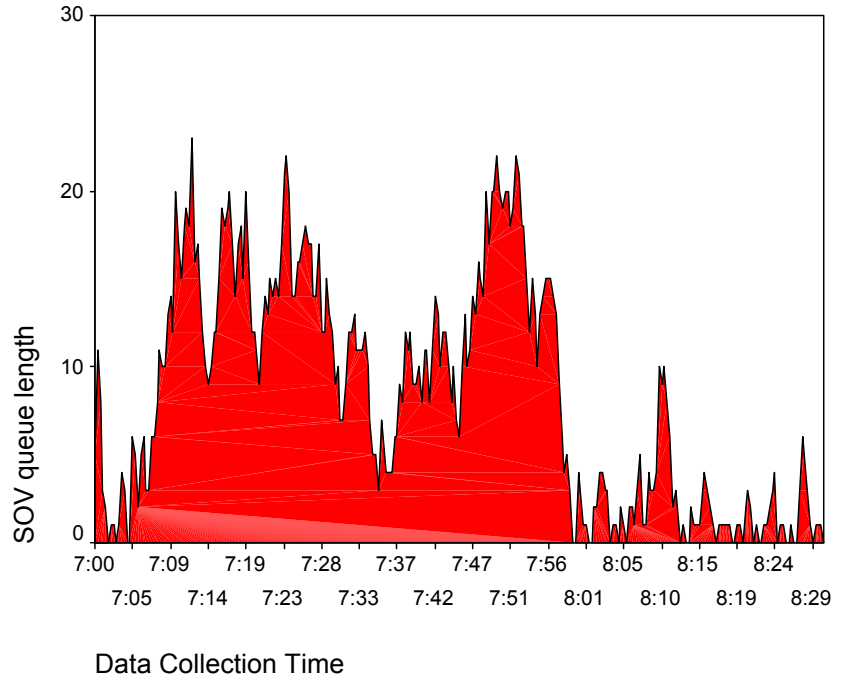
North Avenue 3/16/2000 PM peak



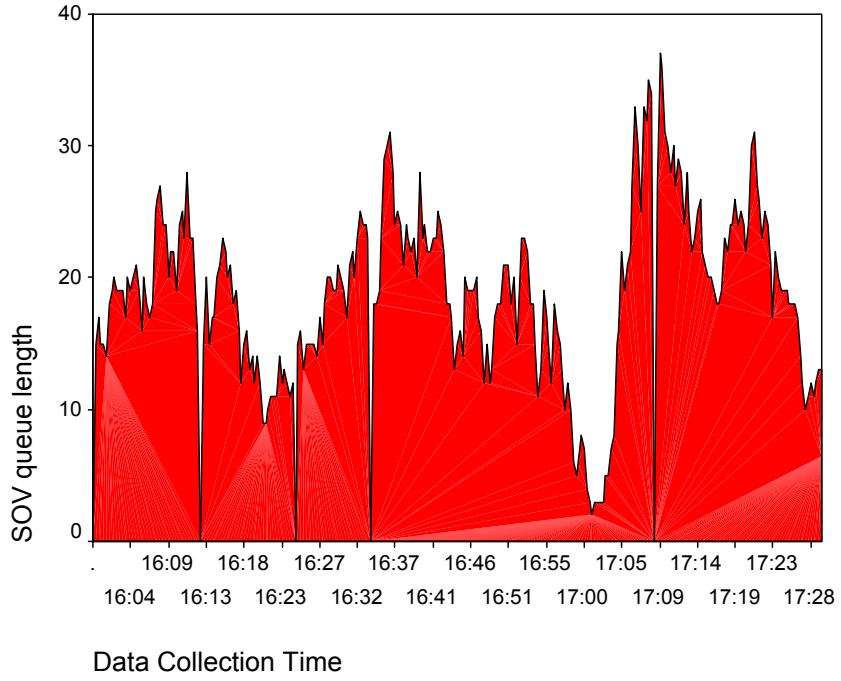
North Avenue 3/21/2000 PM peak



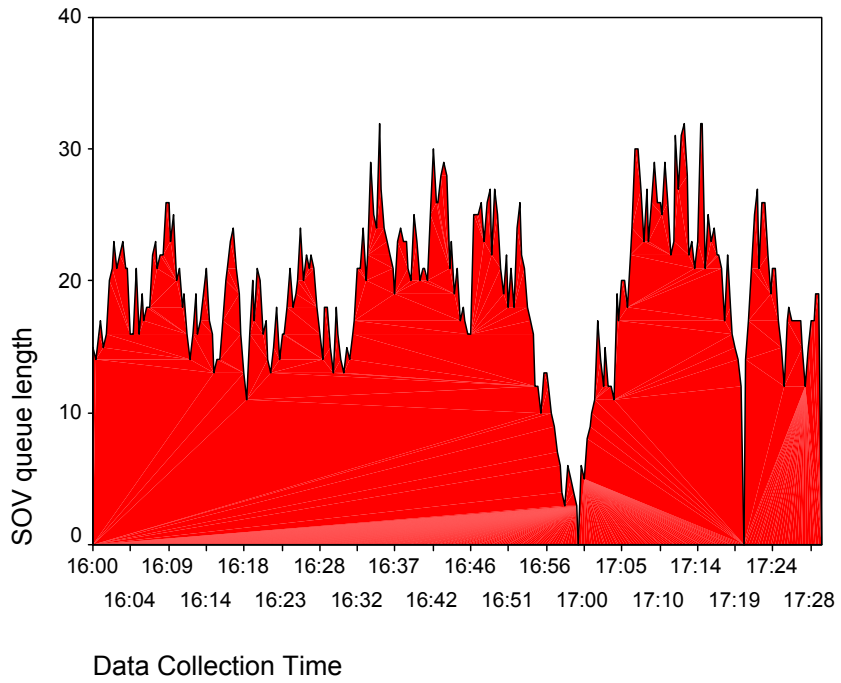
North Avenue 3/22/2000 AM peak



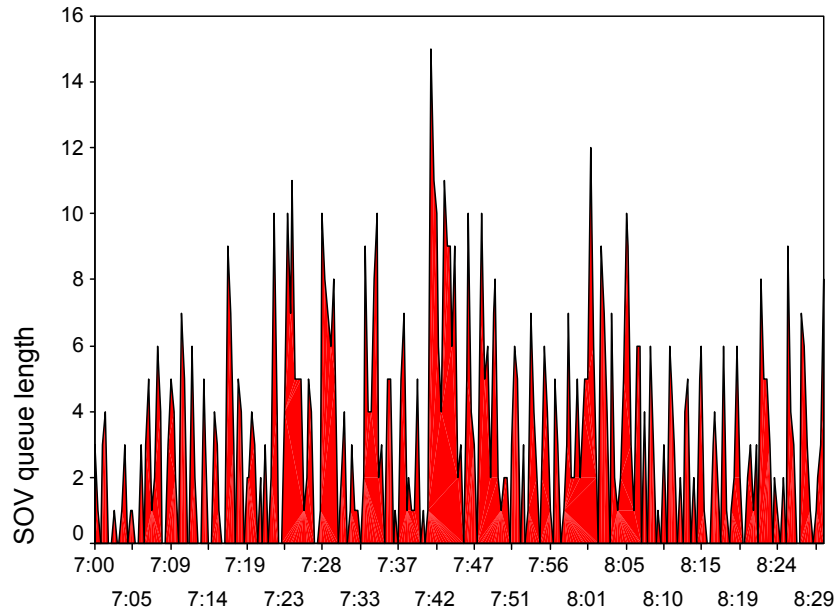
North Avenue 3/22/2000 PM peak



North Avenue 3/23/2000 PM peak

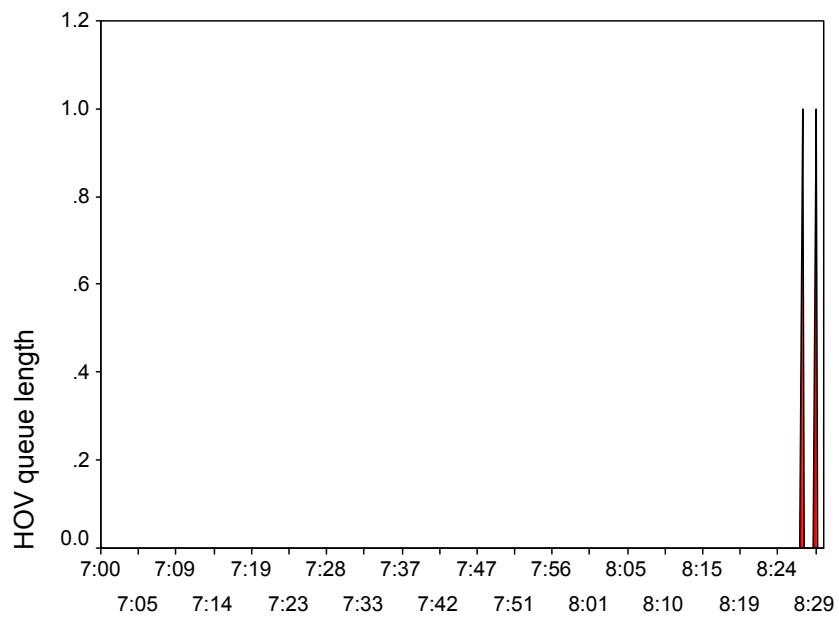


Watertown Plank Road 2/1/2000 AM peak



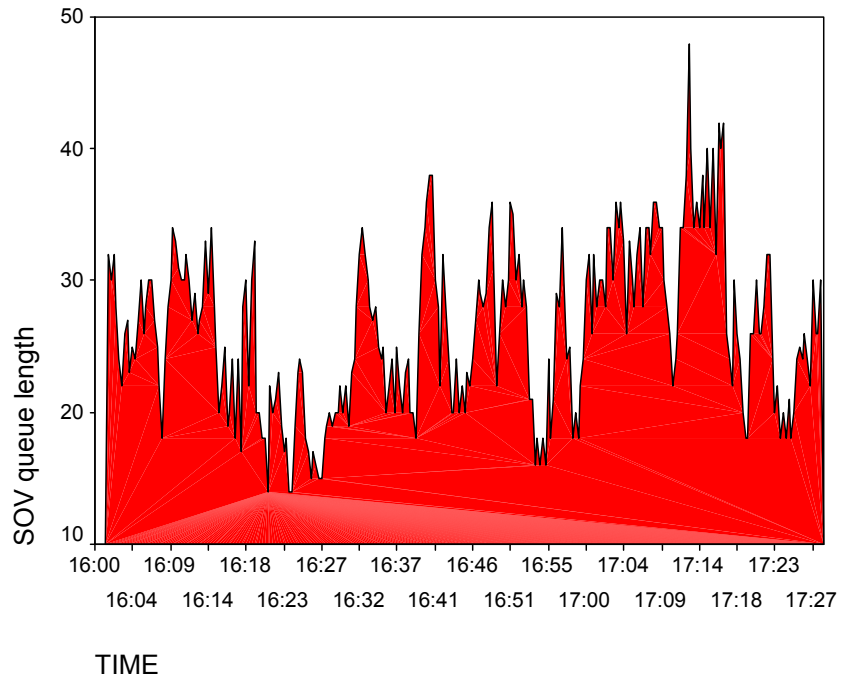
DATA_COL

Watertown Plank Road 2/1/2000 AM peak

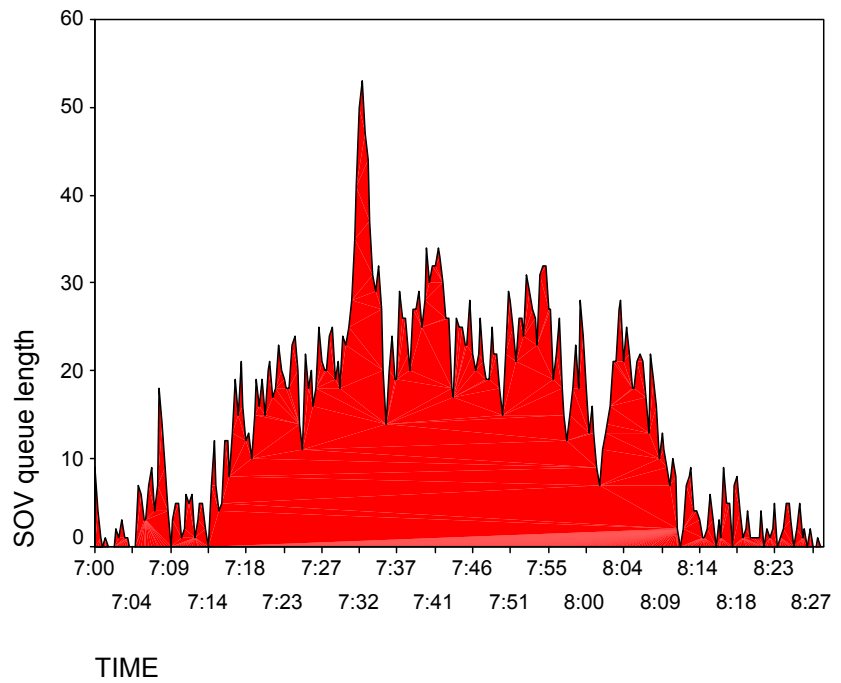


DATA_COL

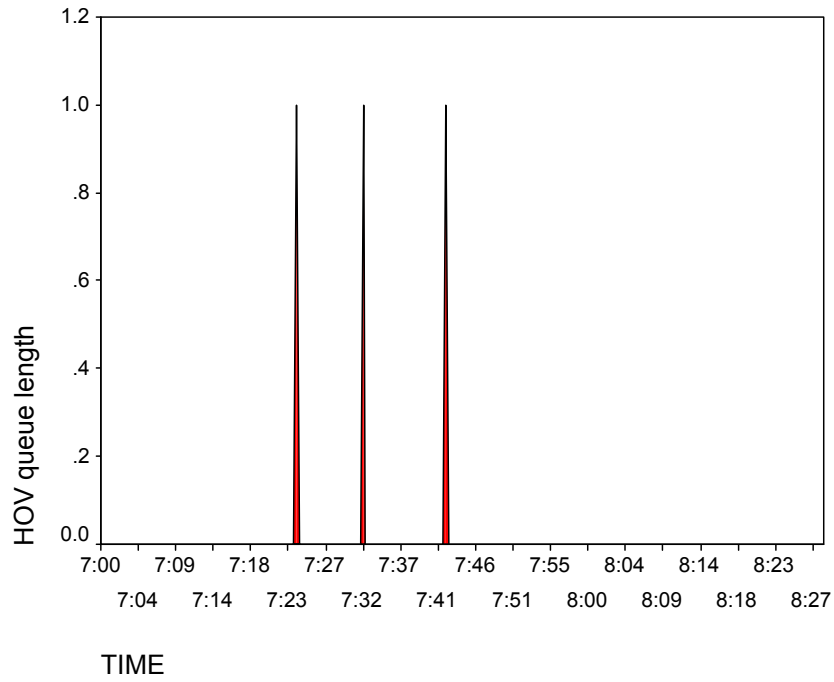
Watertown Plank Road 2/1/2000 PM peak



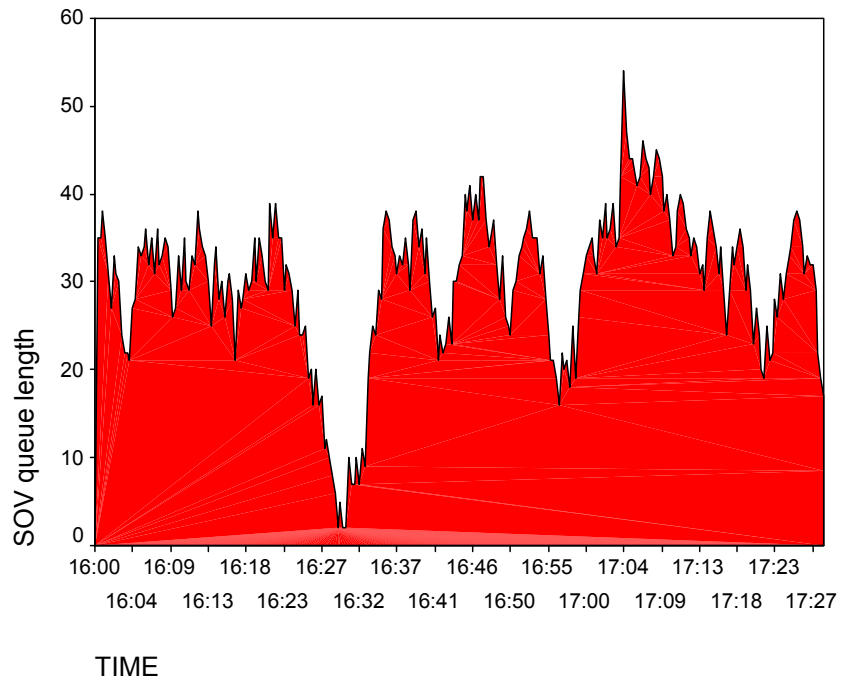
Watertown Plank Road 2/2/2000 AM peak



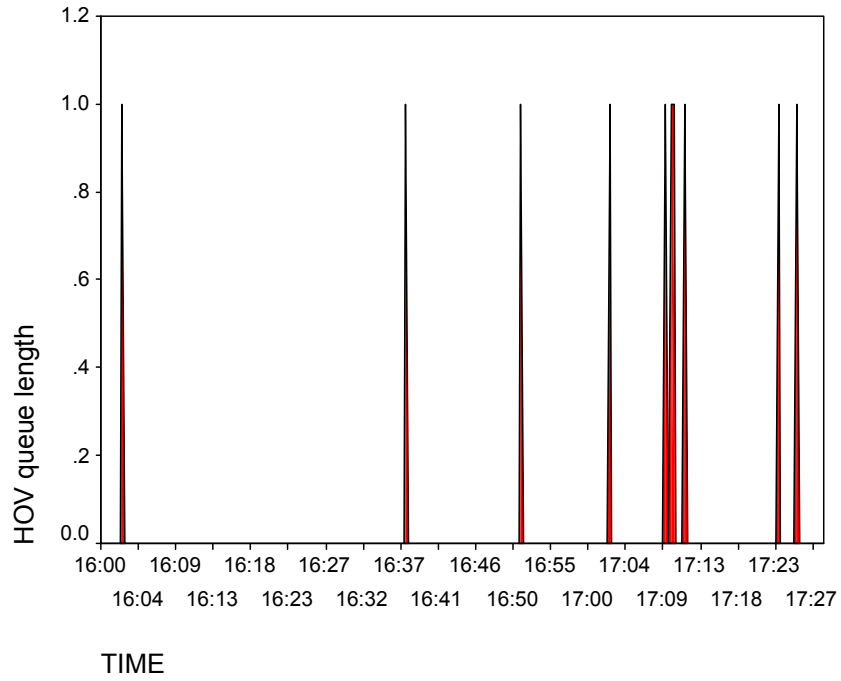
Watertown Plank Road 2/2/2000 AM peak



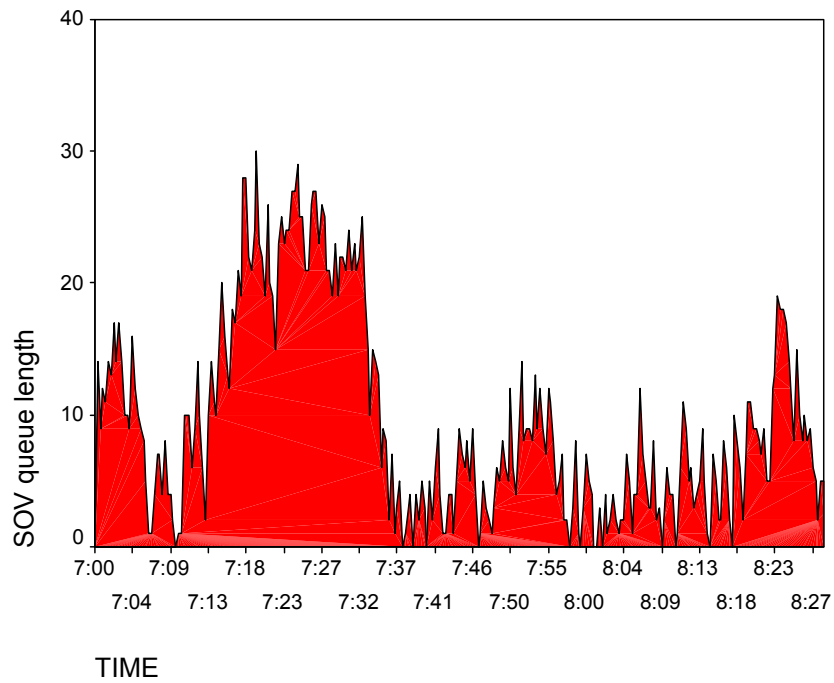
Watertown Plank Road 2/2/2000 PM peak



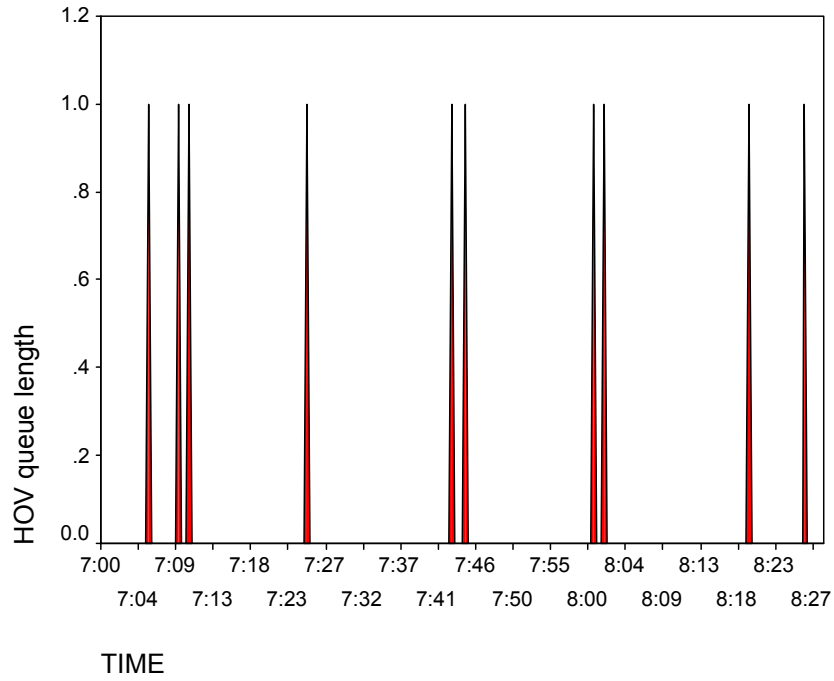
Watertown Plank Road 2/2/2000 PM peak



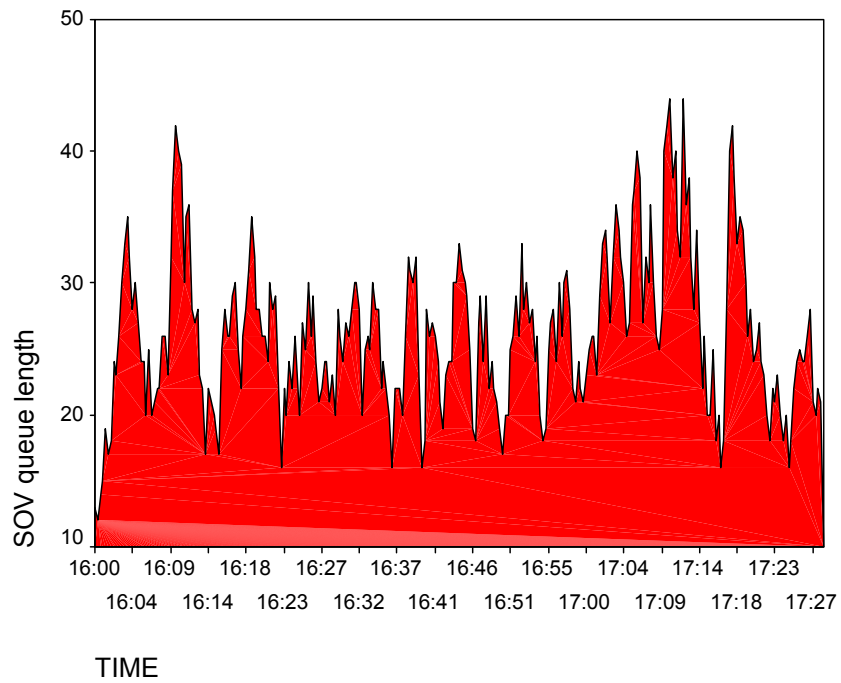
Watertown Plank Road 2/3/2000 AM peak



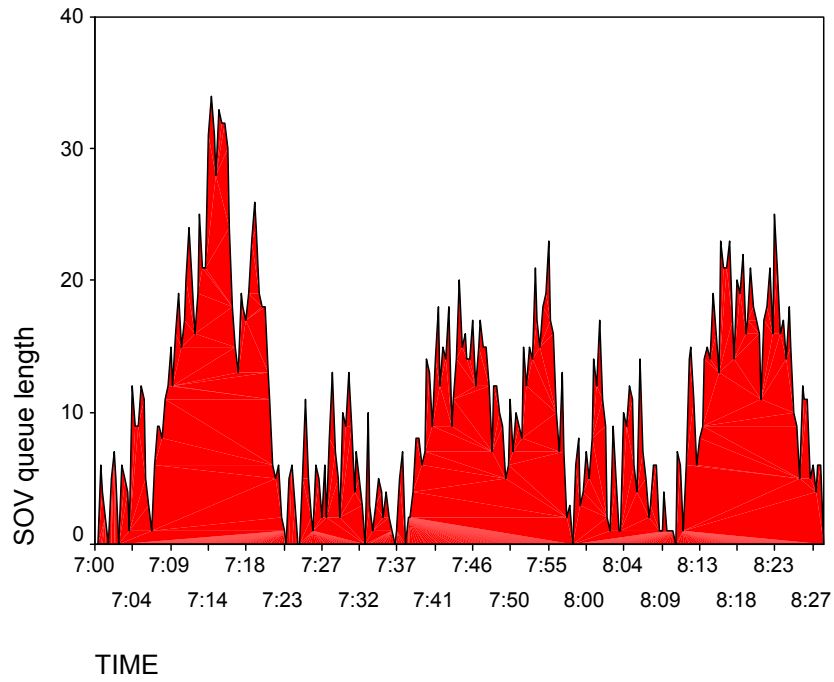
Watertown Plank Road 2/3/2000 AM peak



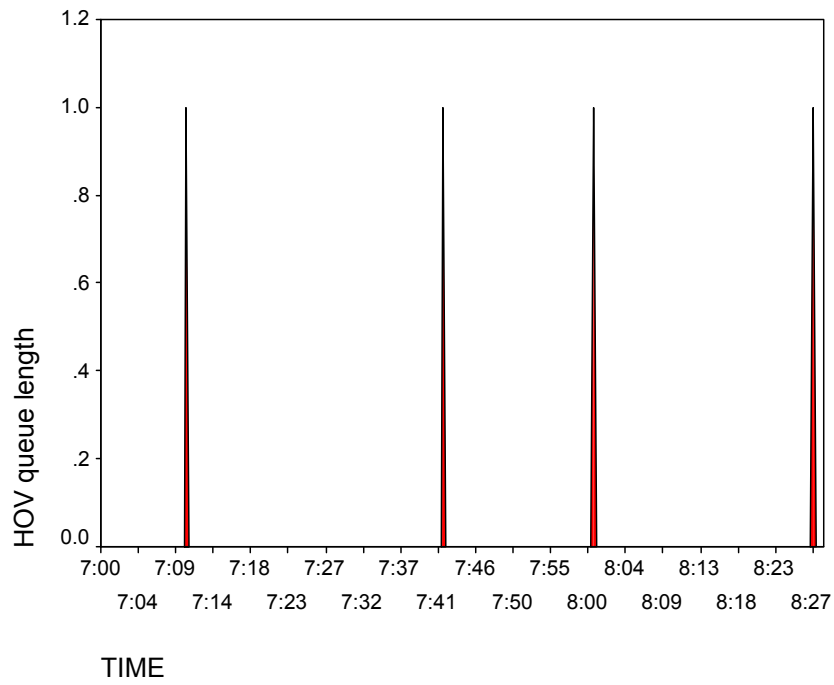
Watertown Plank Road 2/3/2000 PM peak



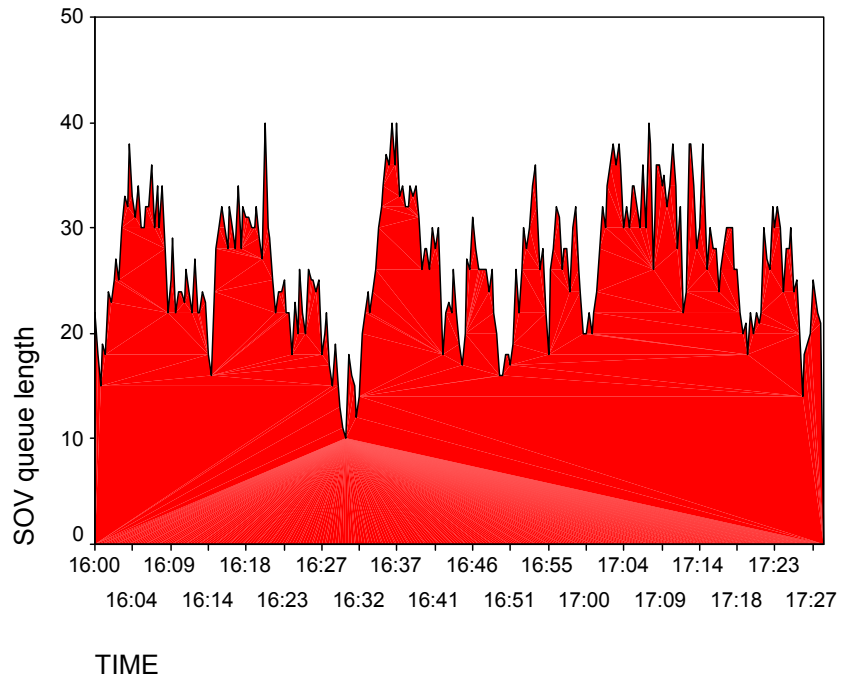
Watertown Plank Road 2/8/2000 AM peak



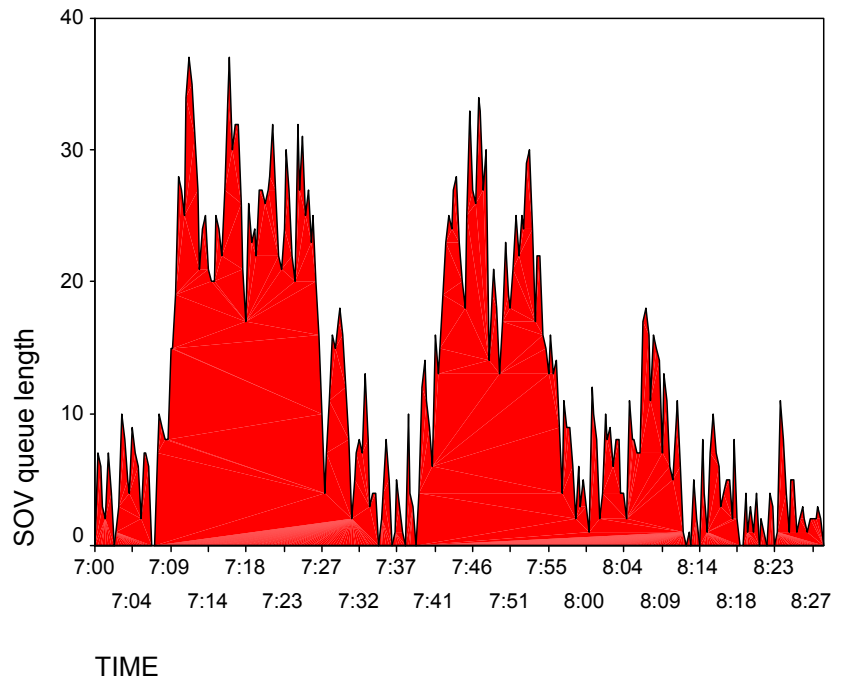
Watertown Plank Road 2/8/2000 AM peak



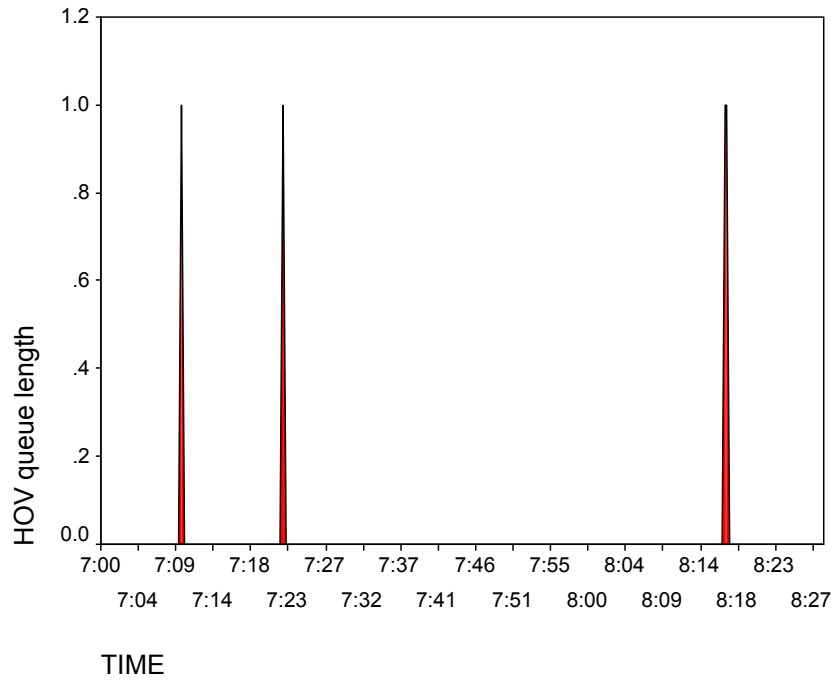
Watertown Plank Road 2/8/2000 PM peak



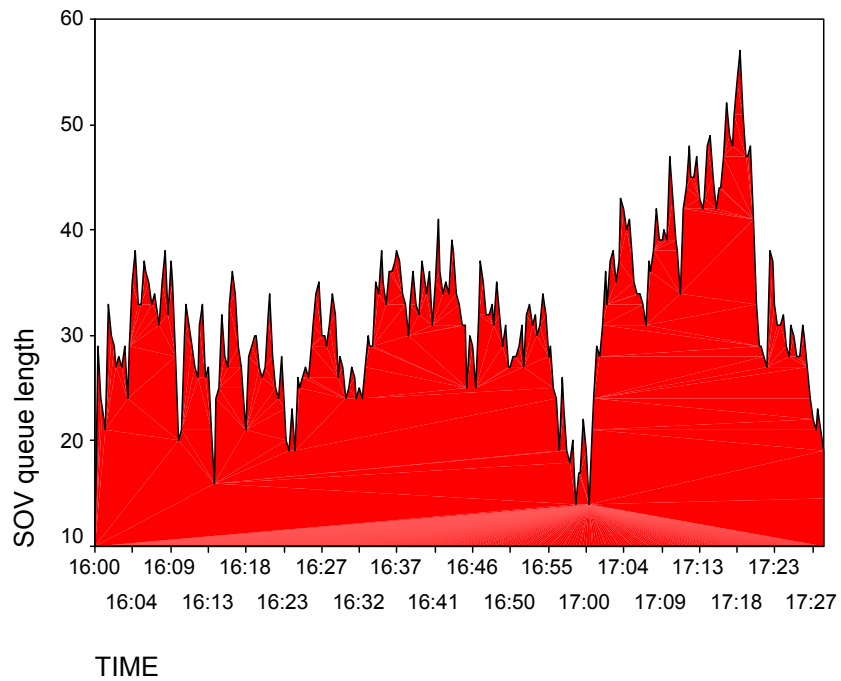
Watertown Plank Road 2/9/2000 AM peak



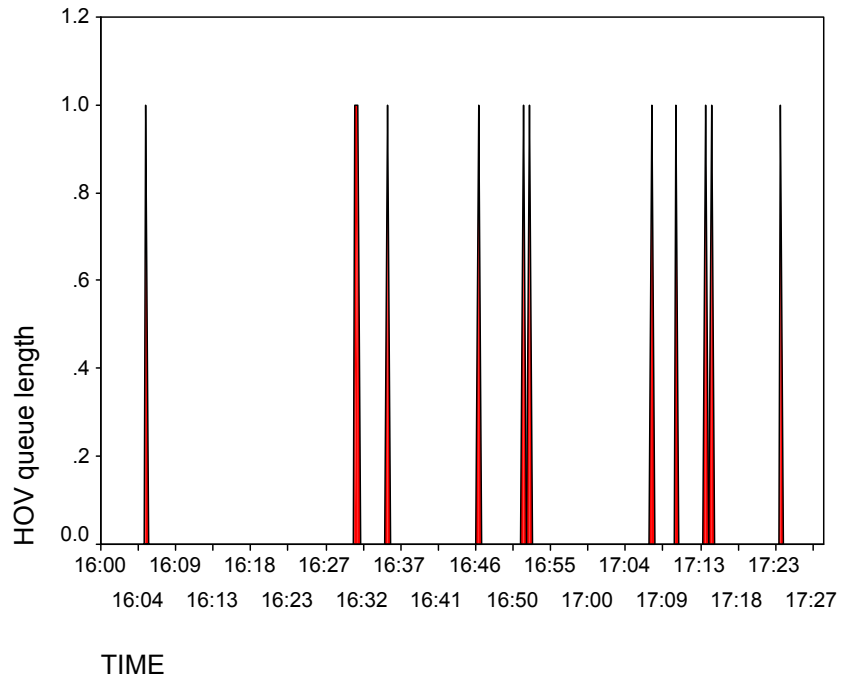
Watertown Plank Road 2/9/2000 AM peak



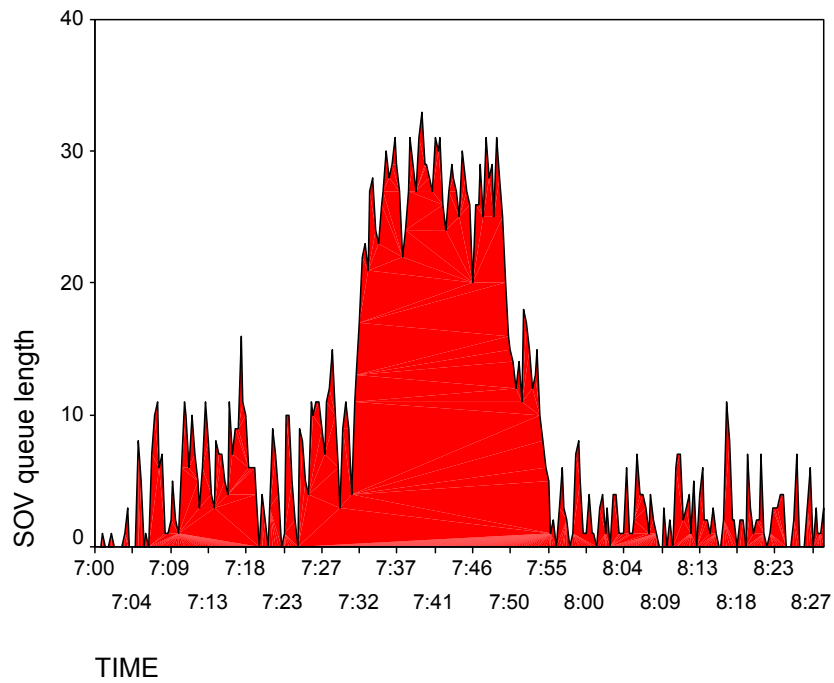
Watertown Plank Road 2/9/2000 PM peak



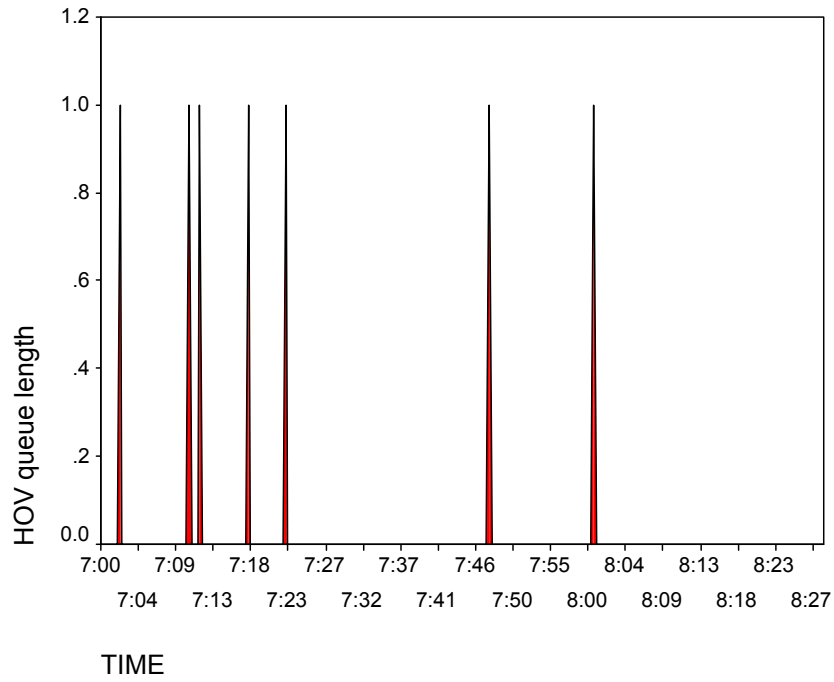
Watertown Plank Road 2/9/2000 PM peak



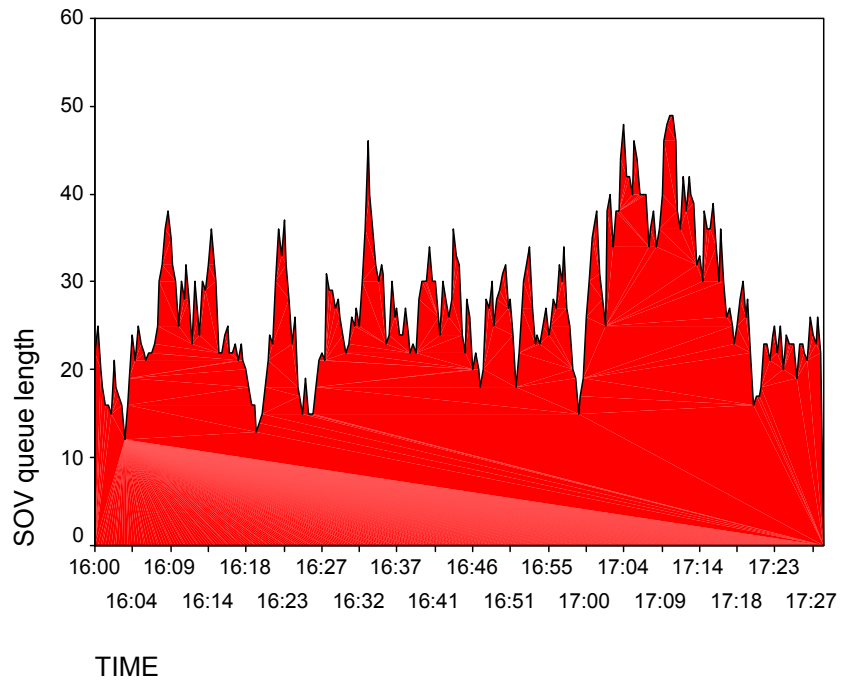
Watertown Plank Road 2/10/2000 AM peak



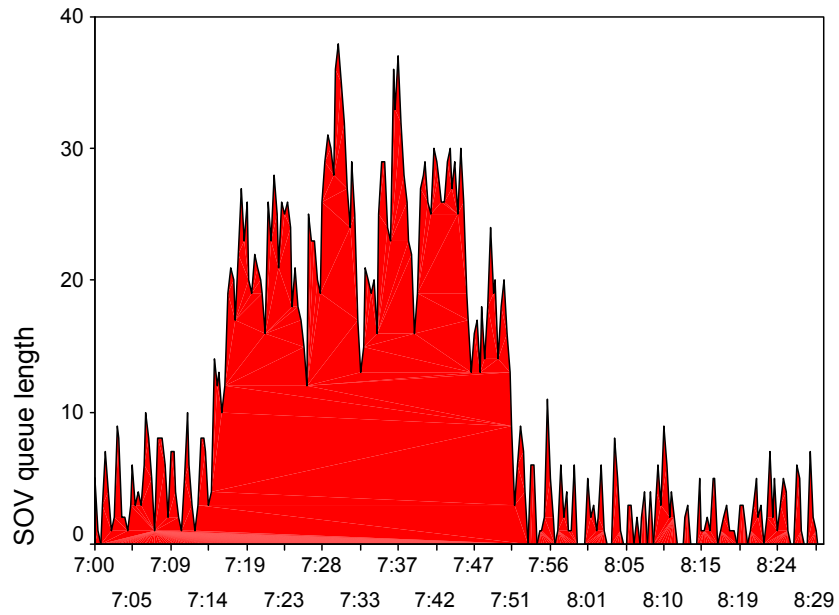
Watertown Plank Road 2/10/2000 AM peak



Watertown Plank Road 2/10/2000 PM peak

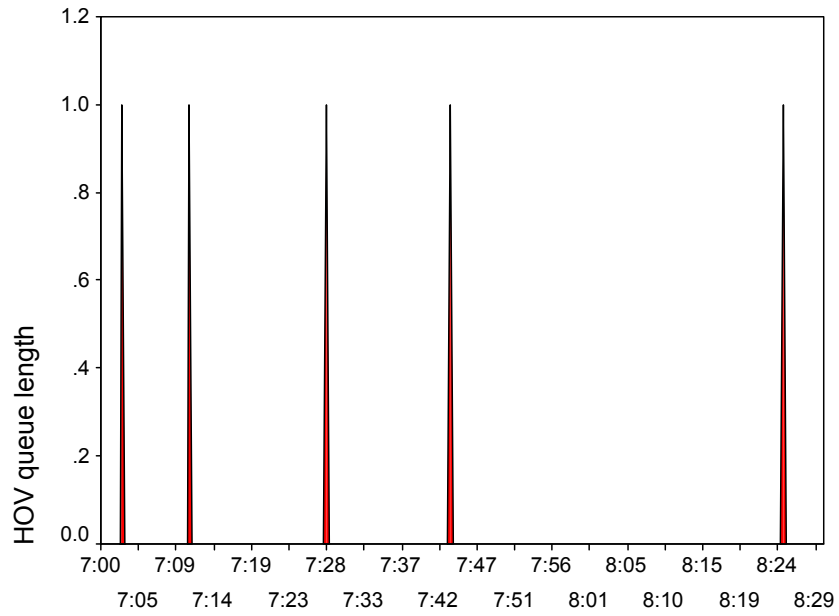


Watertown Plank Road 3/14/2000 AM peak



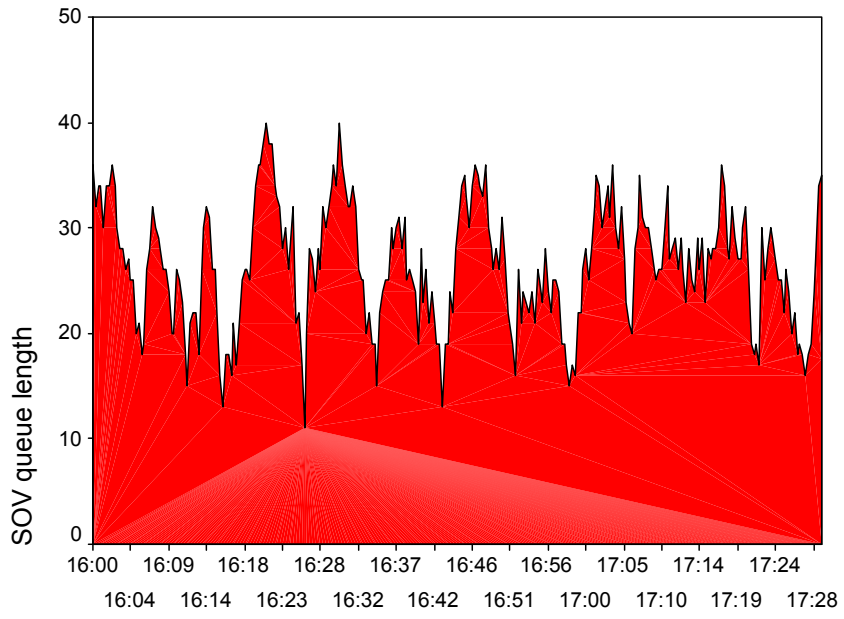
DATA_COL

Watertown Plank Road 3/14/2000 AM peak



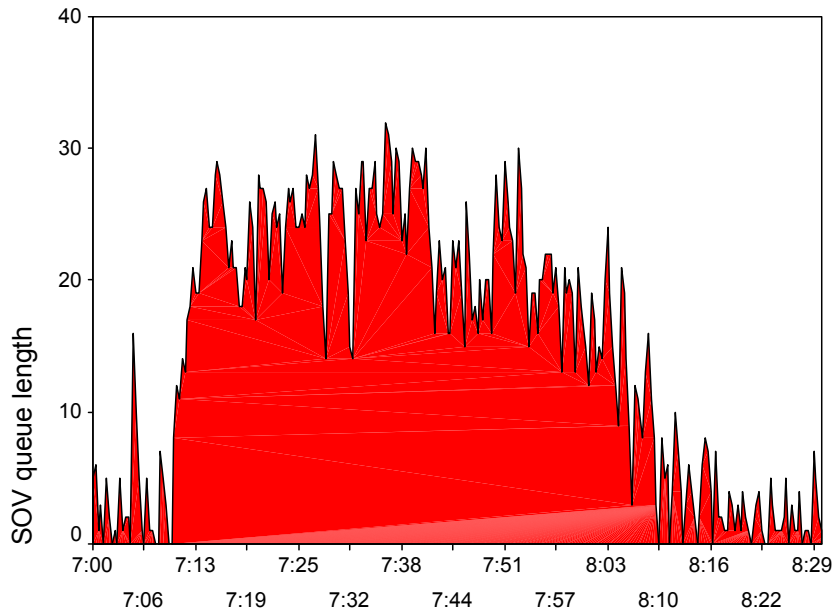
DATA_COL

Watertown Plank Road 3/14/2000 PM peak



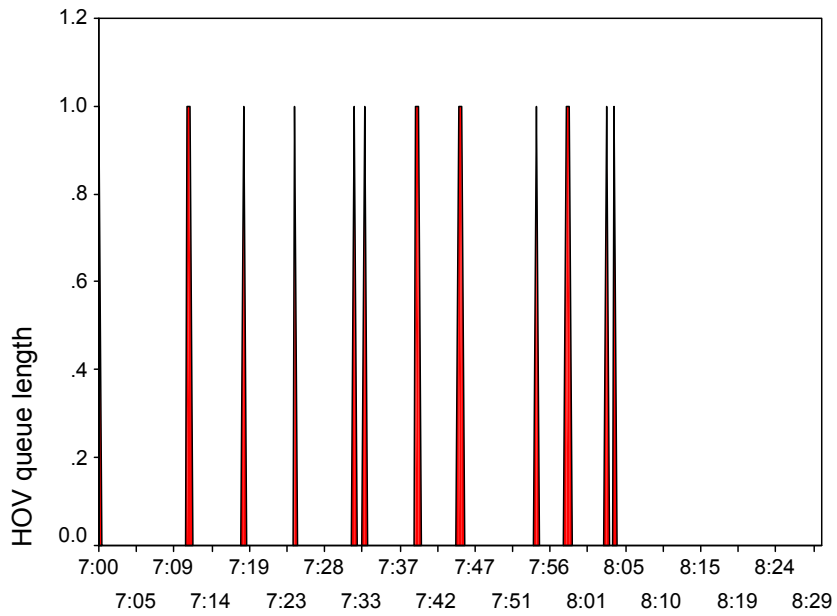
DATA_COL

Watertown Plank Road 3/15/2000 AM peak



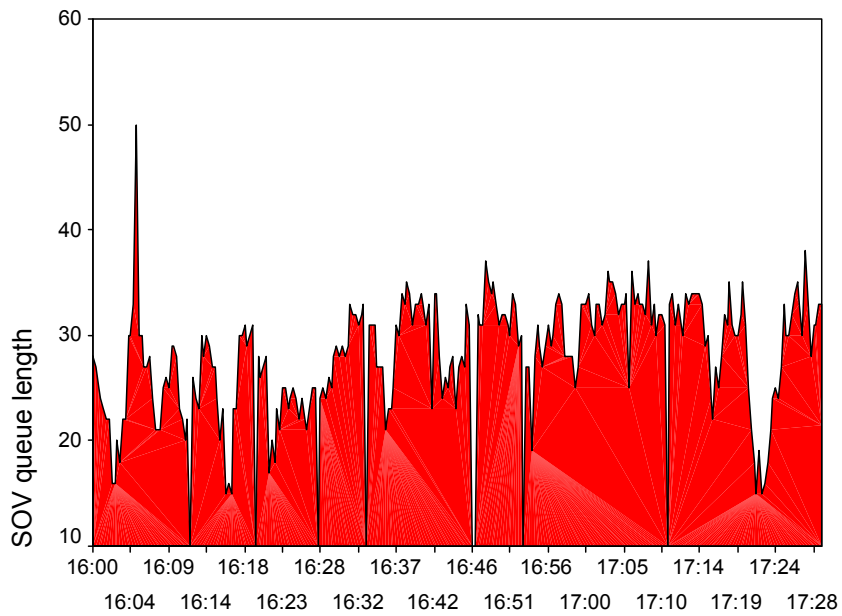
DATA_COL

Watertown Plank Road 3/15/2000 AM peak



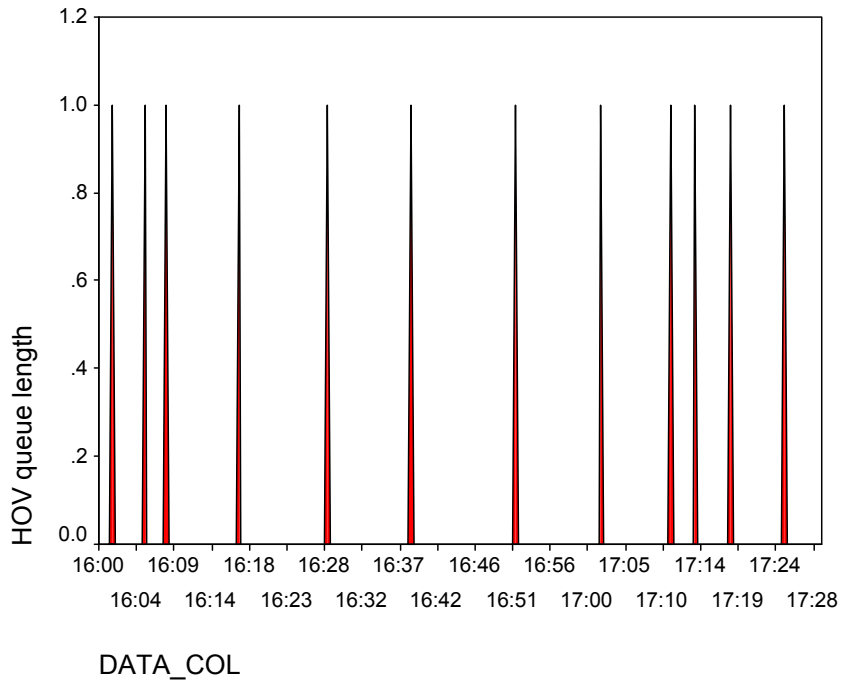
DATA_COL

Watertown Plank Road 3/15/2000 PM peak

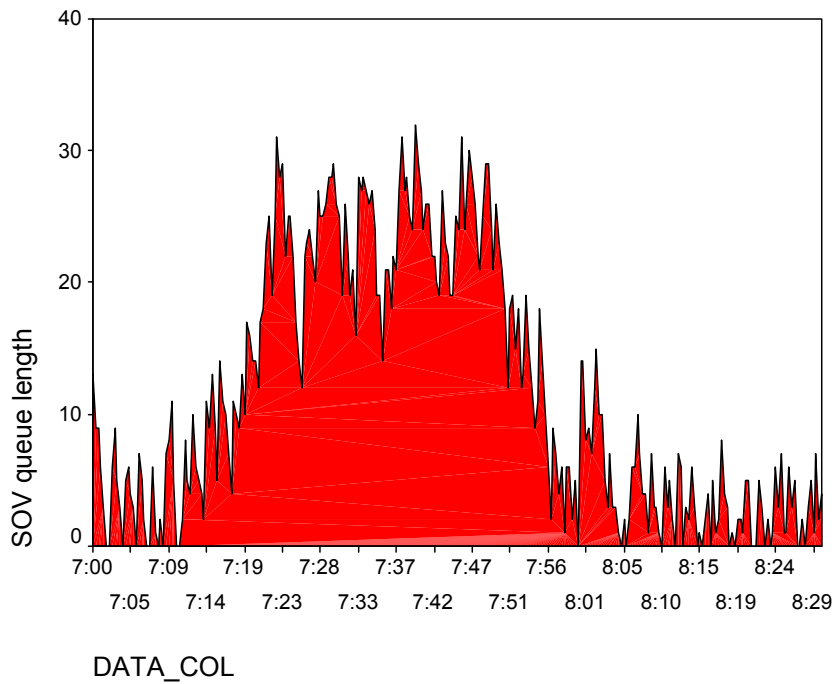


DATA_COL

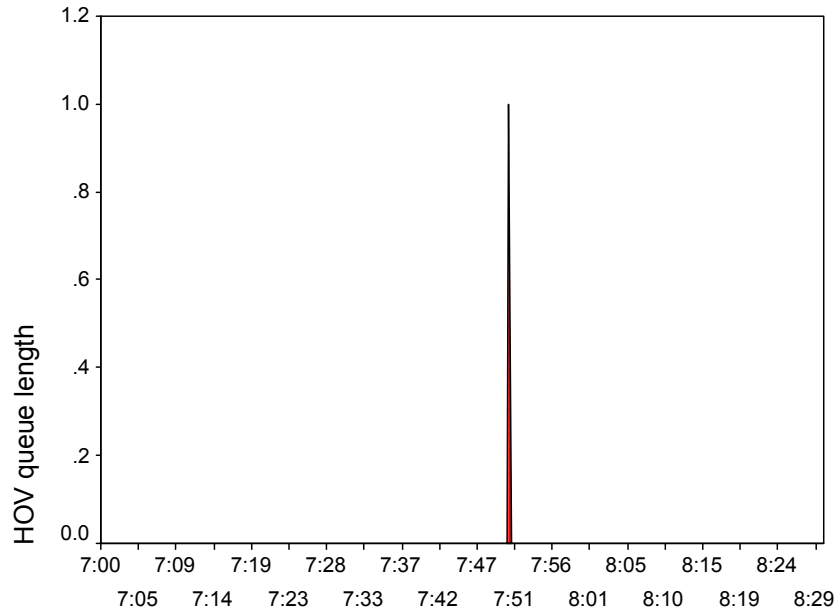
Watertown Plank Road 3/15/2000 PM peak



Watertown Plank Road 3/16/2000 AM peak

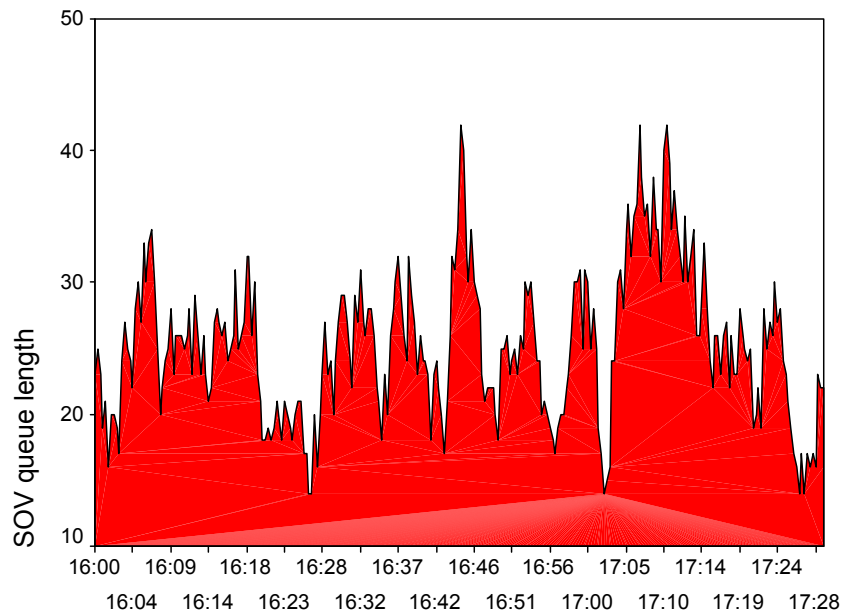


Watertown Plank Road 3/16/2000 AM peak



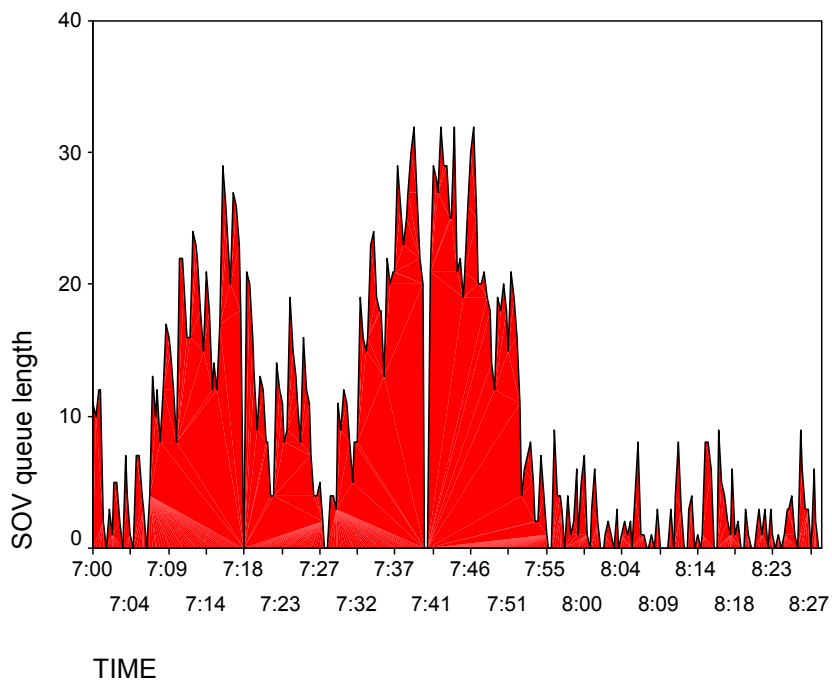
DATA_COL

Watertown Plank Road 3/16/2000 PM peak

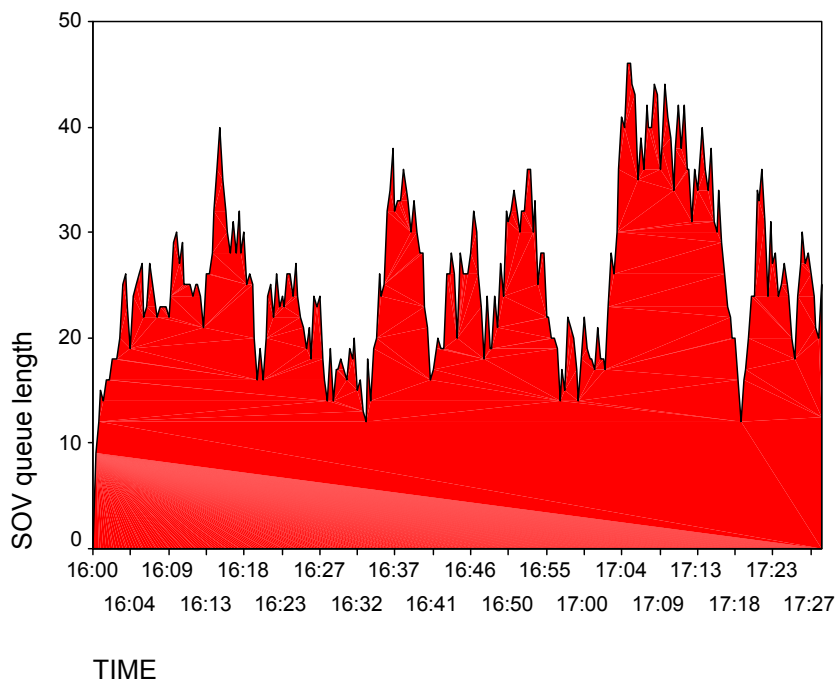


DATA_COL

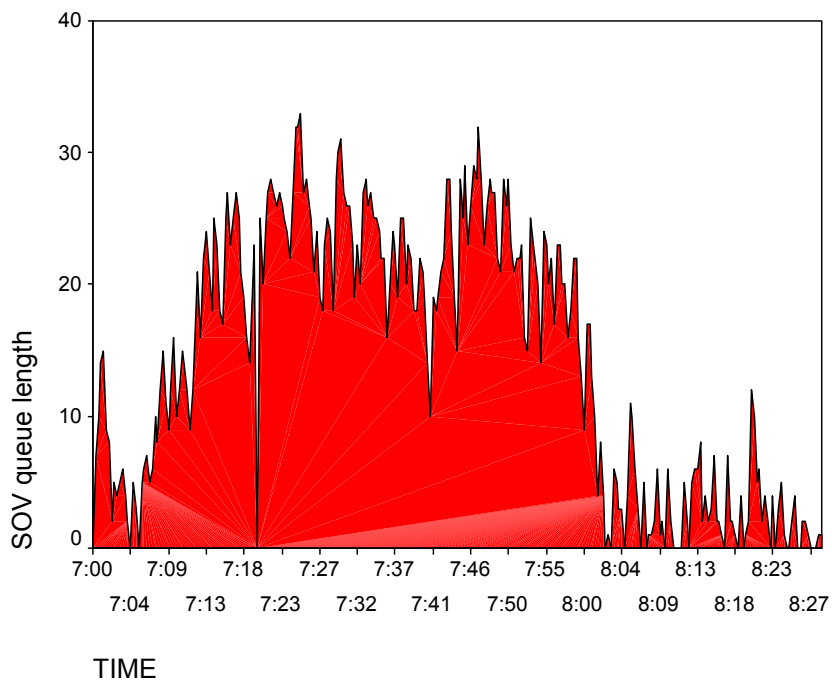
Watertown Plank Road 3/21/2000 AM peak



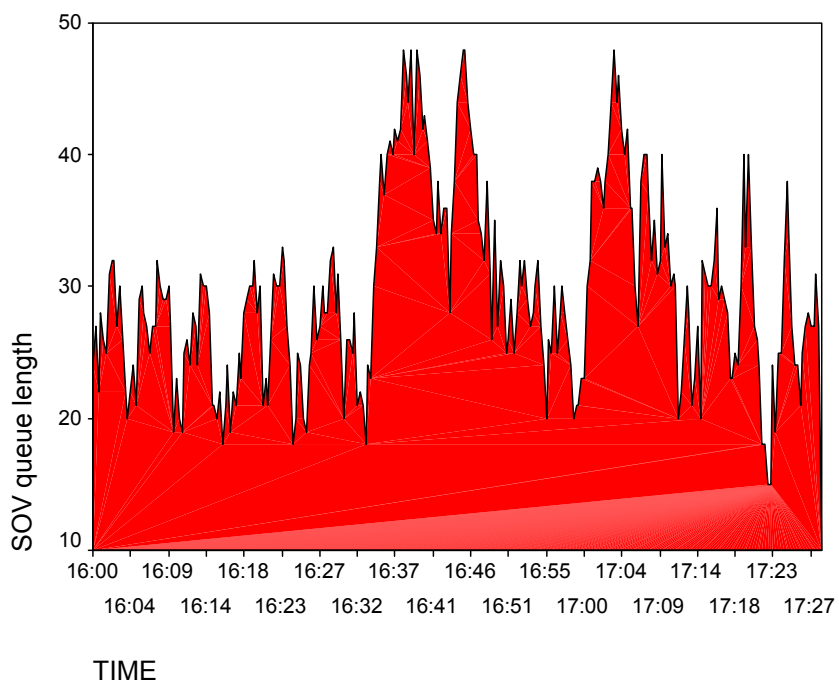
Watertown Plank Road 3/21/2000 PM peak



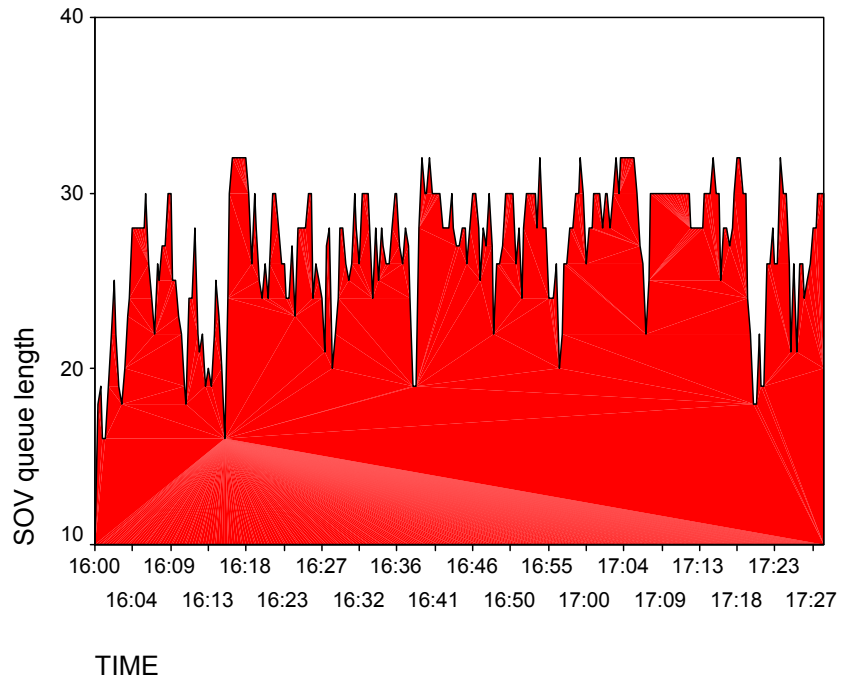
Watertown Plank Road 3/22/2000 AM peak



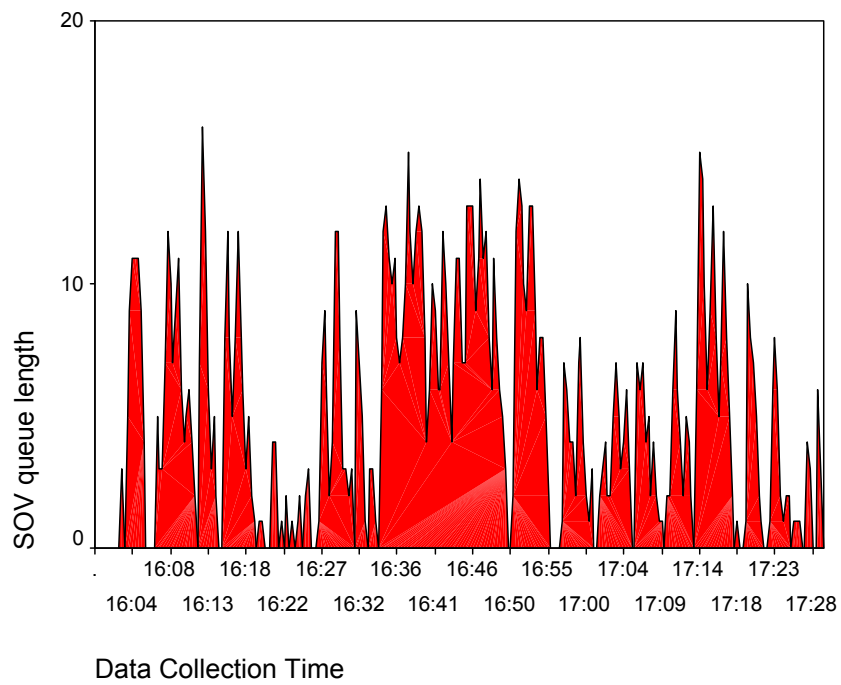
Watertown Plank Road 3/22/2000 PM peak



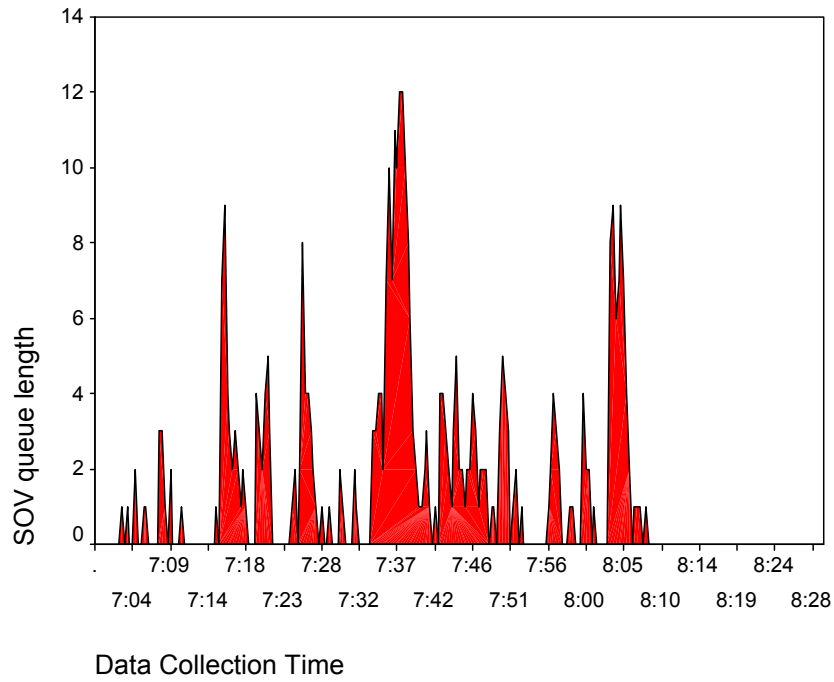
Watertown Plank Road 3/23/2000 PM peak



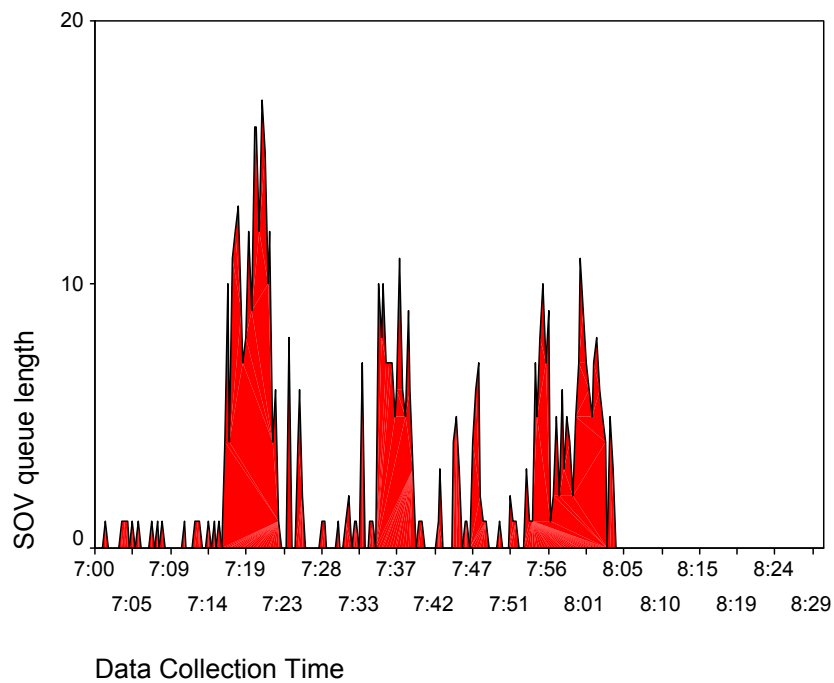
Wisconsin Avenue 2/1/2000 PM peak



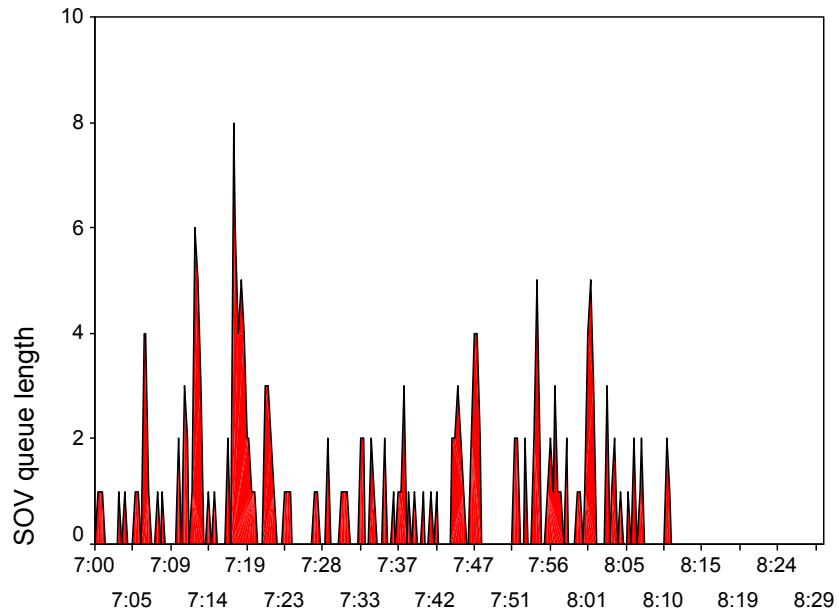
Wisconsin Avenue 2/2/2000 AM peak



Wisconsin Avenue 2/3/2000 AM peak

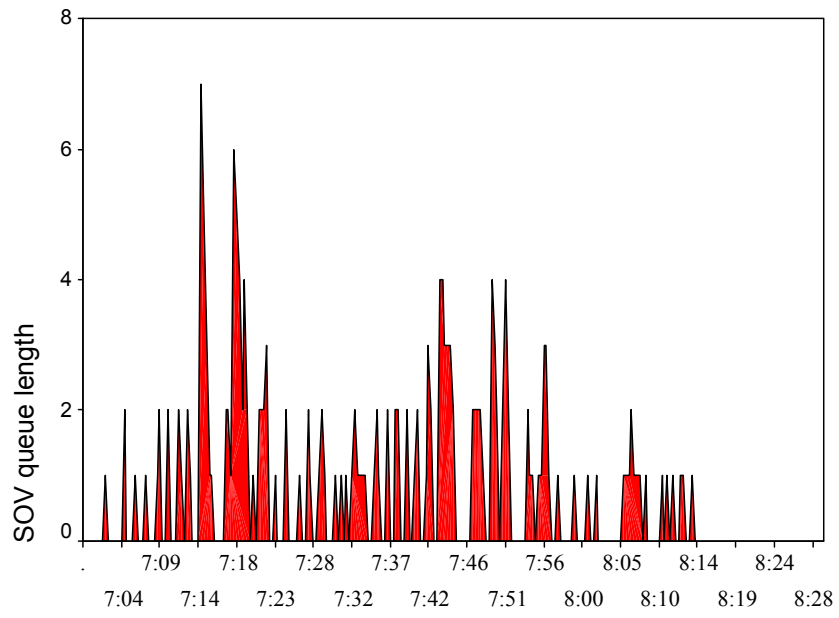


Wisconsin Avenue 2/8/2000 AM peak



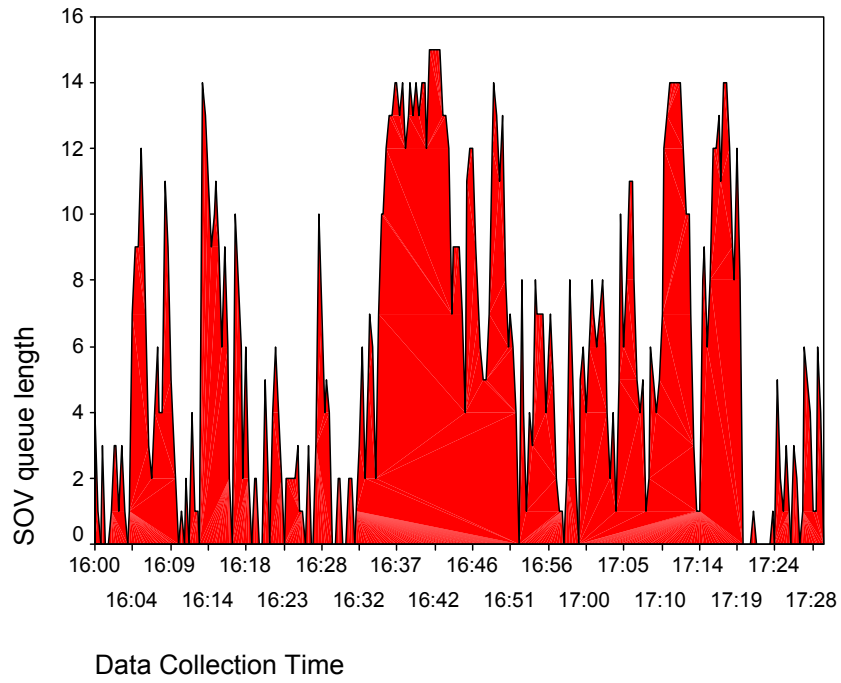
DATA_COL

Wisconsin Avenue 2/9/2000 AM peak

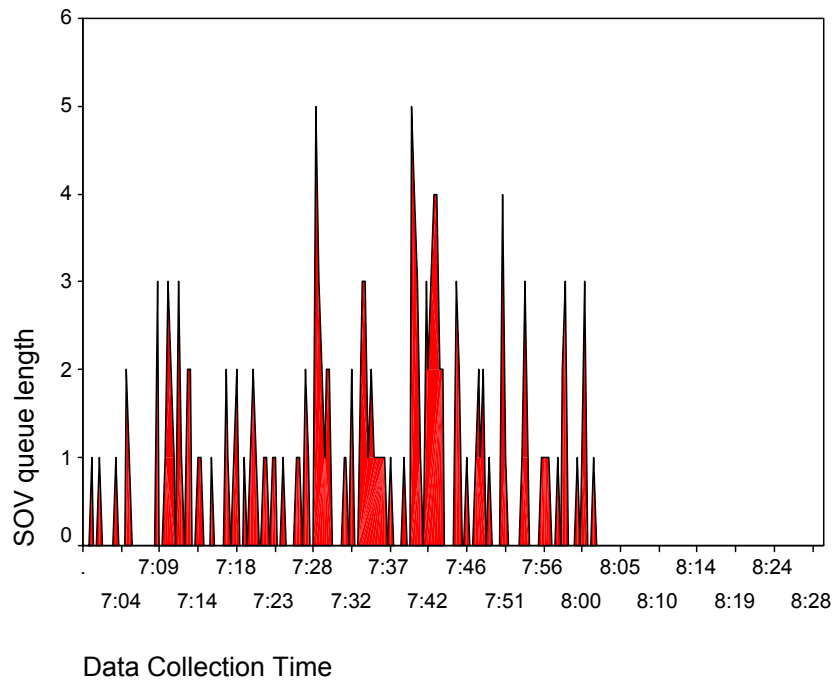


Data Collection Time

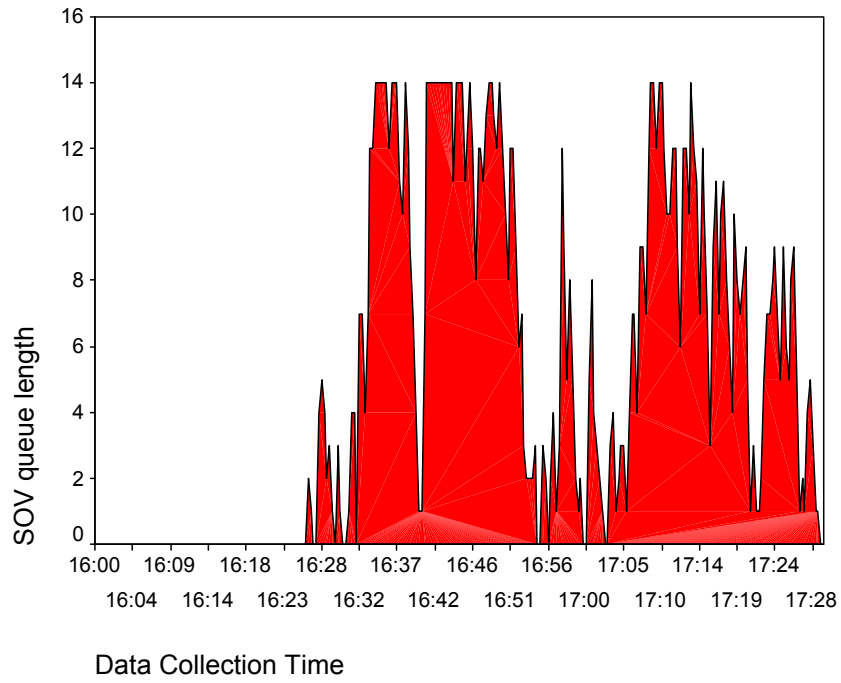
Wisconsin Avenue 2/9/2000 PM peak



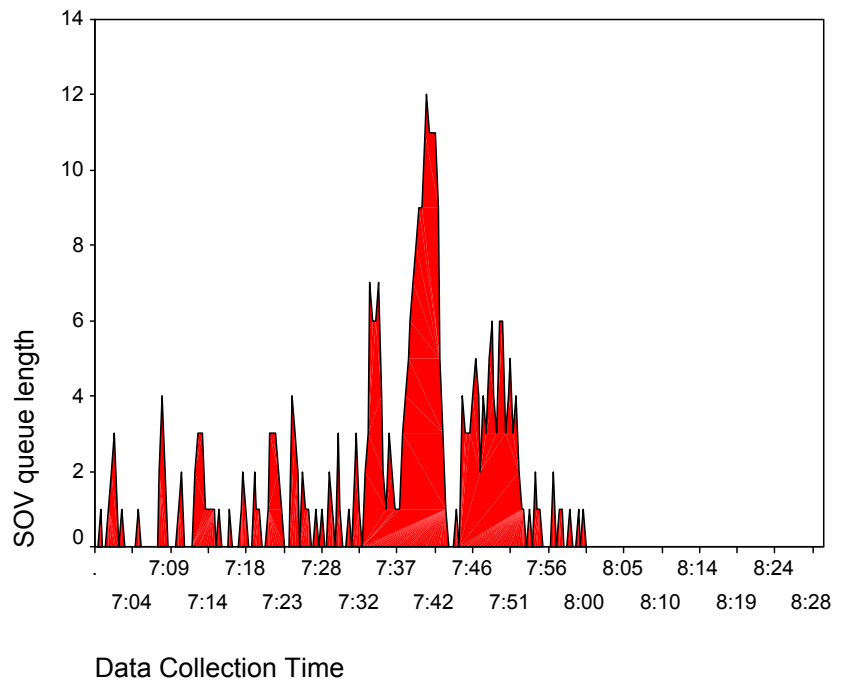
Wisconsin Avenue 2/10/2000 AM peak



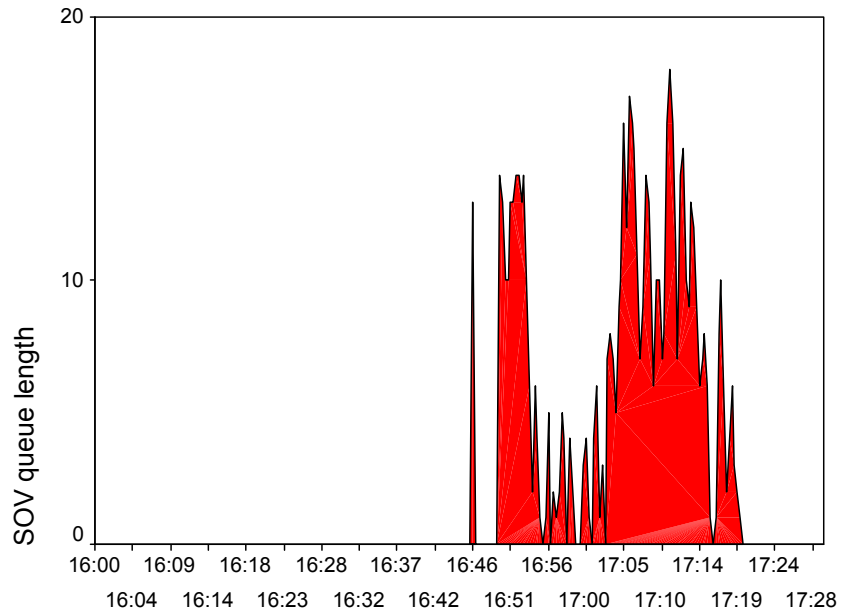
Wisconsin Avenue 2/10/2000 PM peak



Wisconsin Avenue 3/14/2000 AM peak

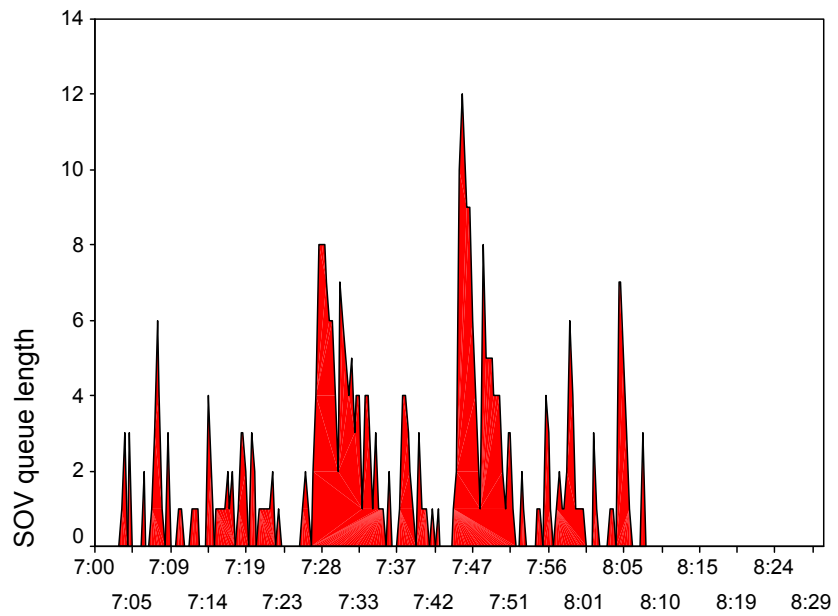


Wisconsin Avenue 3/14/2000 PM peak



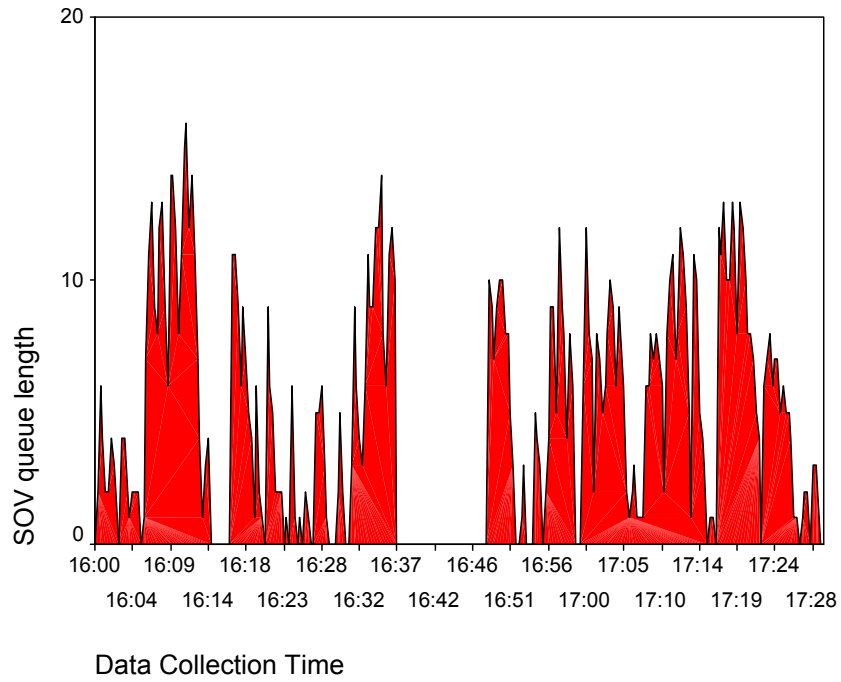
Data Collection Time

Wisconsin Avenue 3/15/2000 AM peak

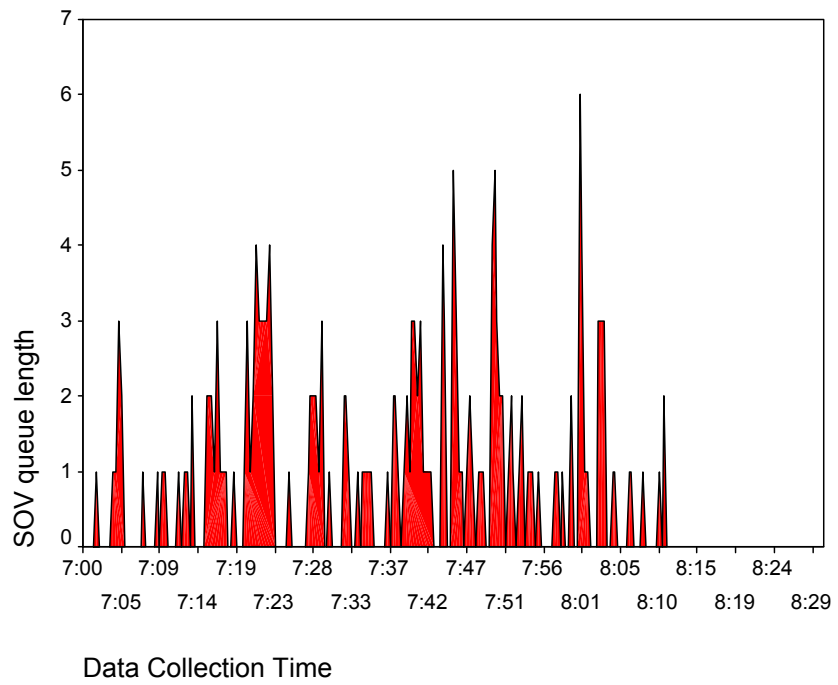


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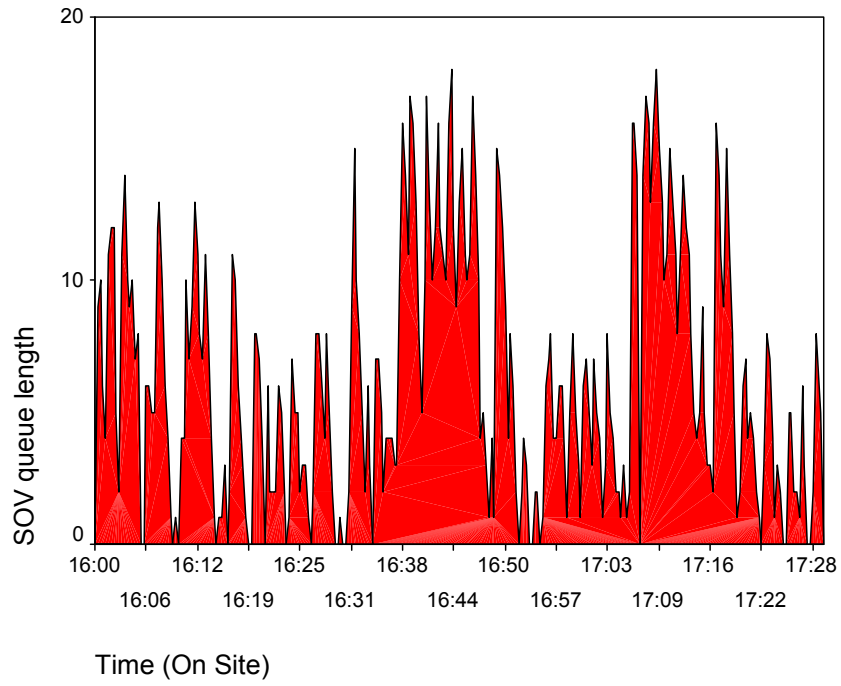
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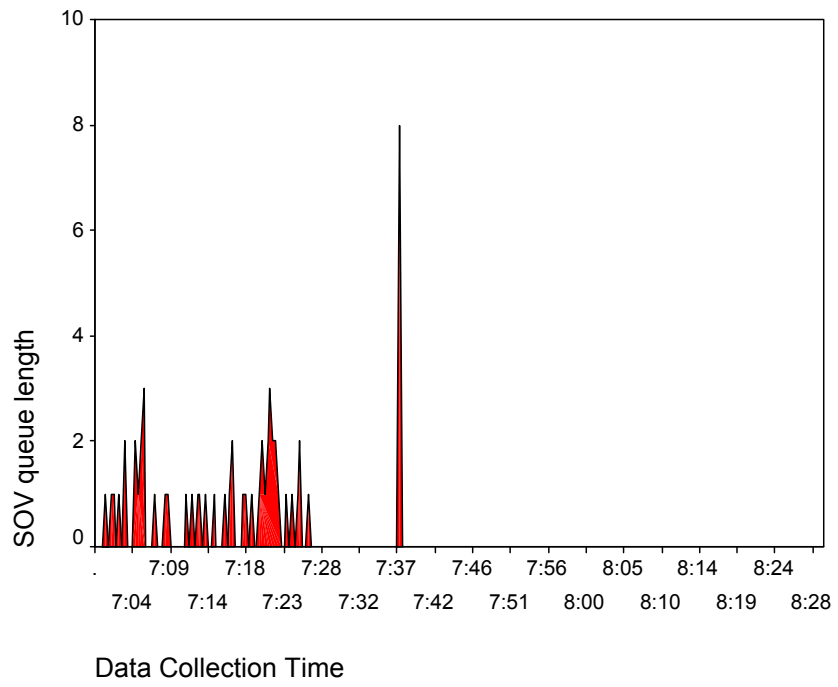
Wisconsin Avenue 3/16/2000 AM peak



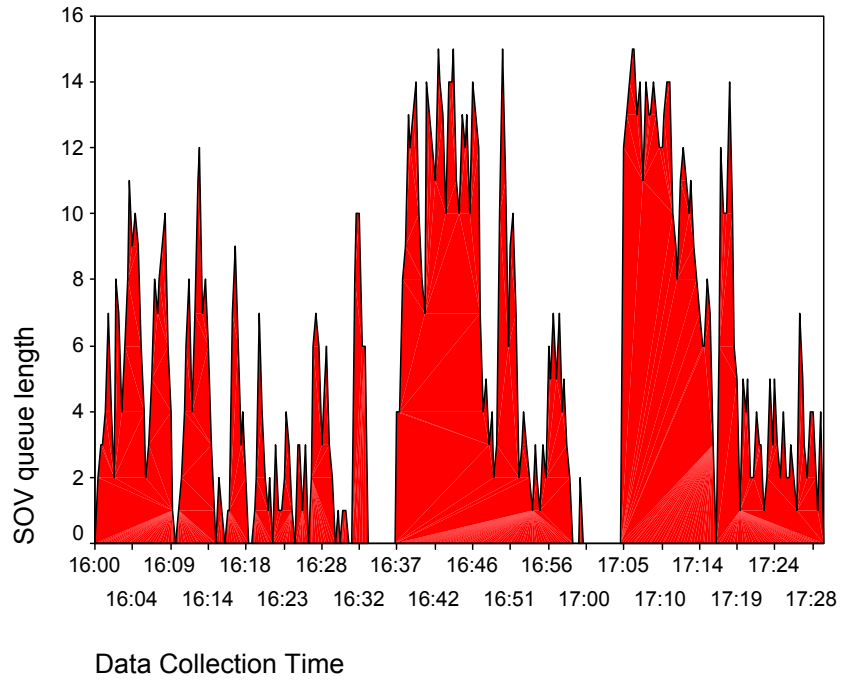
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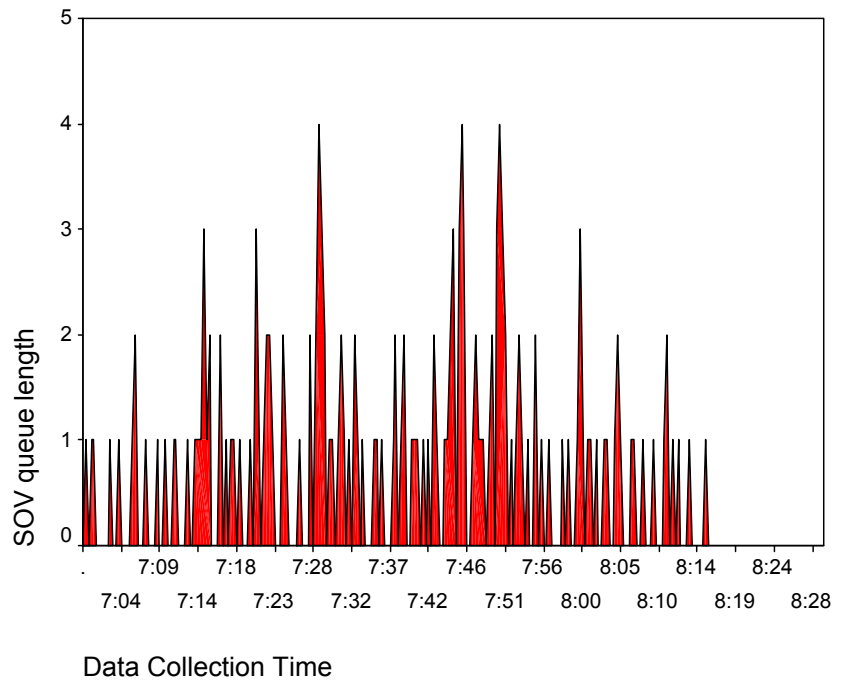
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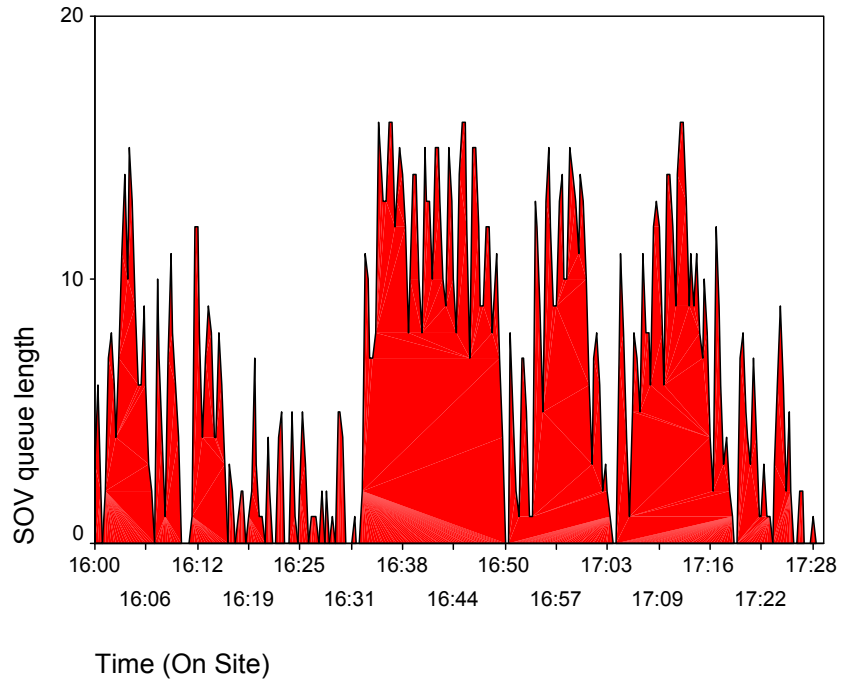
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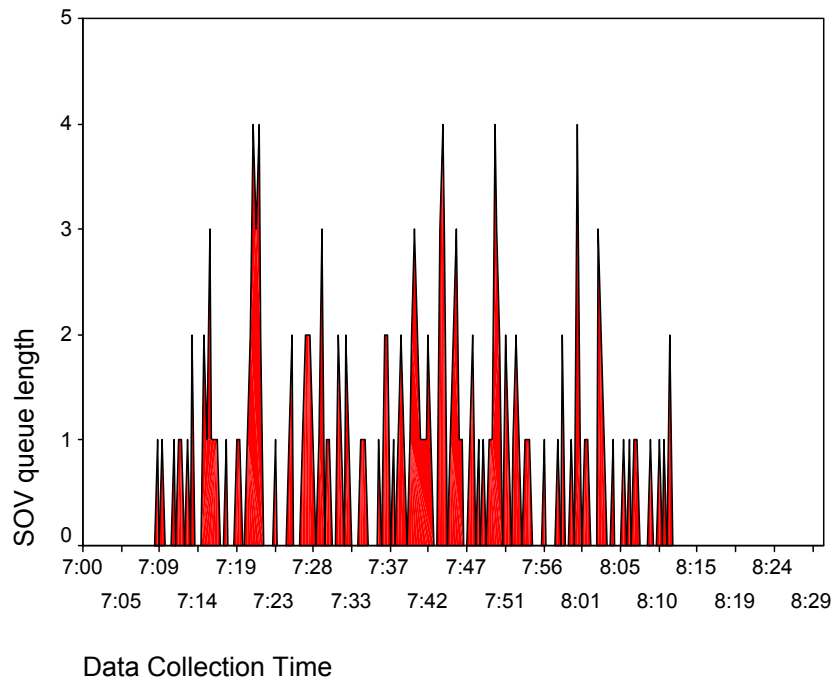
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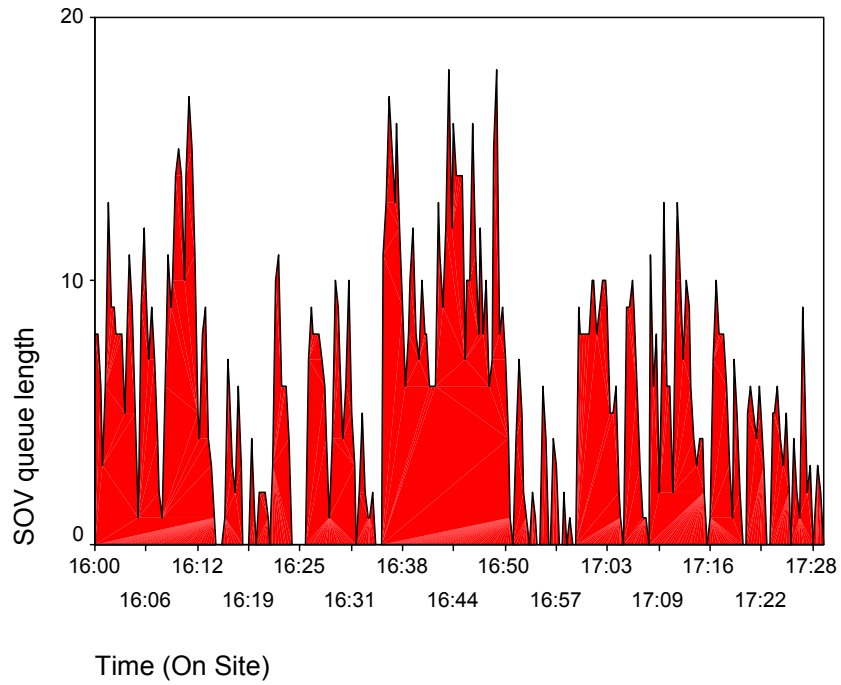
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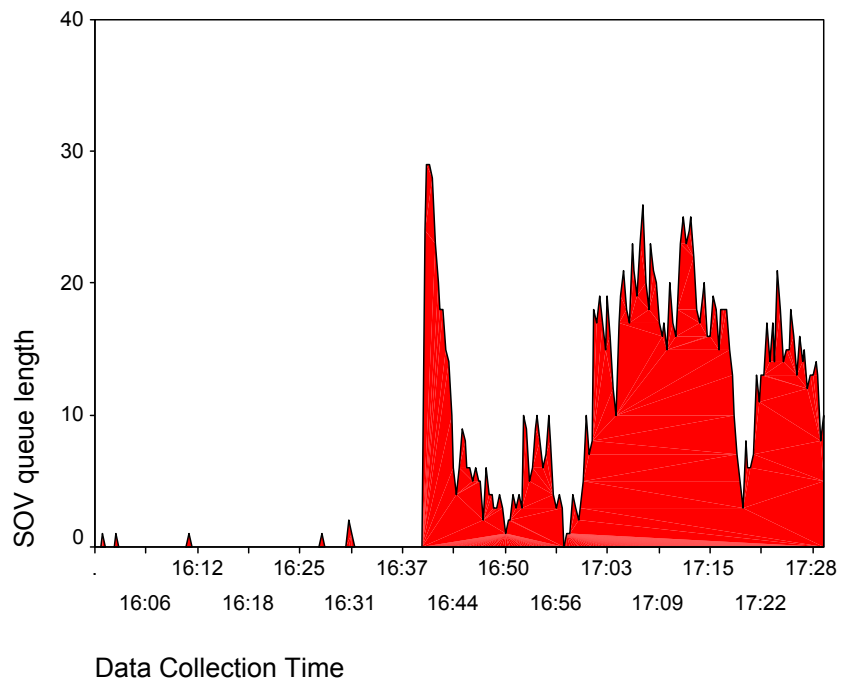
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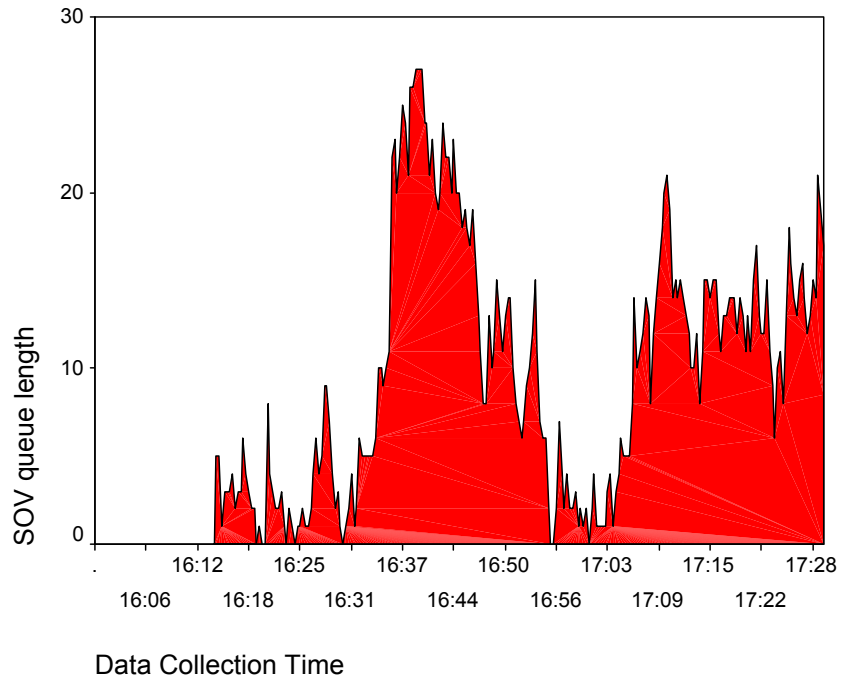
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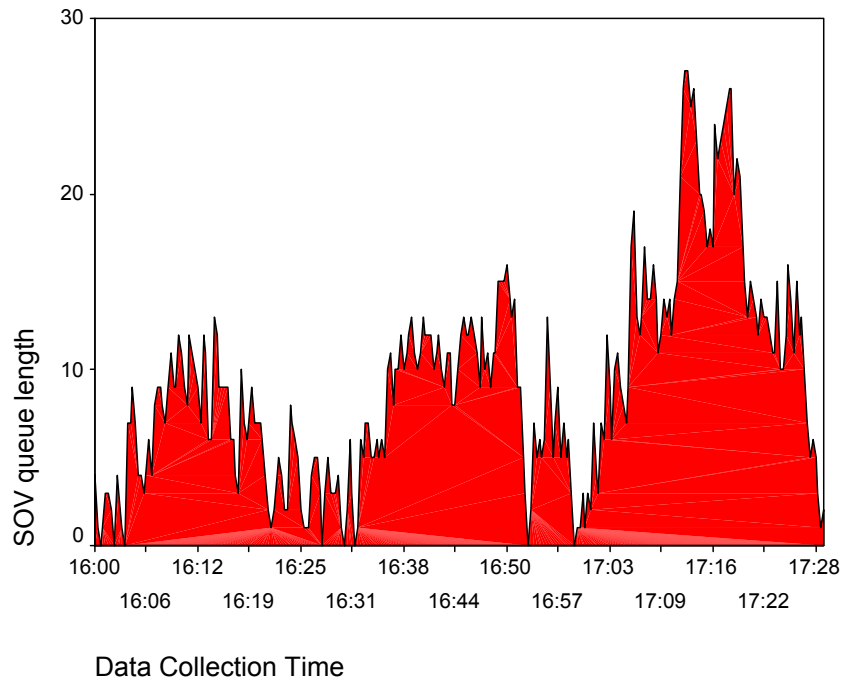
Greenfield Avenue 2/1/2000 PM peak



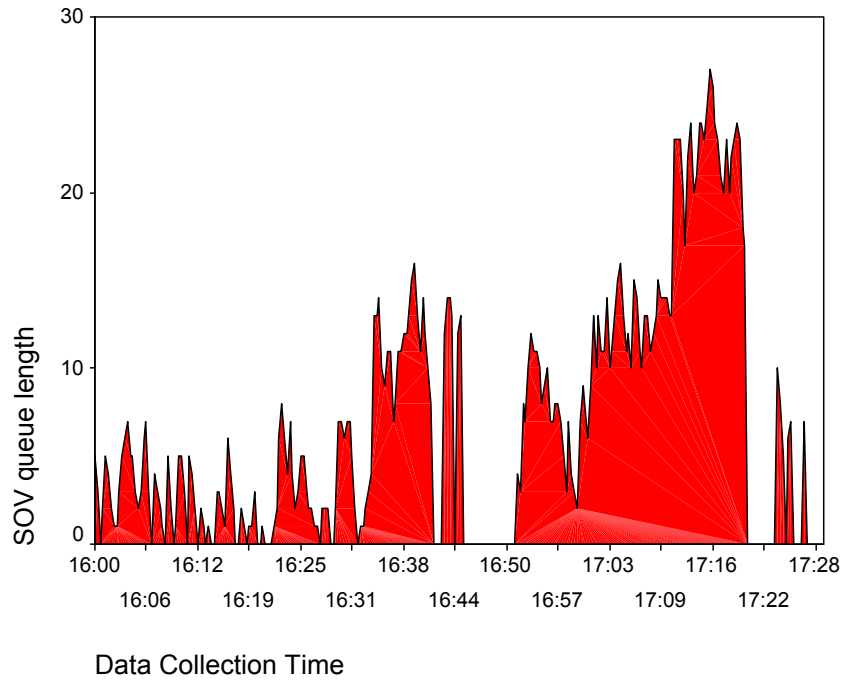
Greenfield Avenue 2/2/2000 PM peak



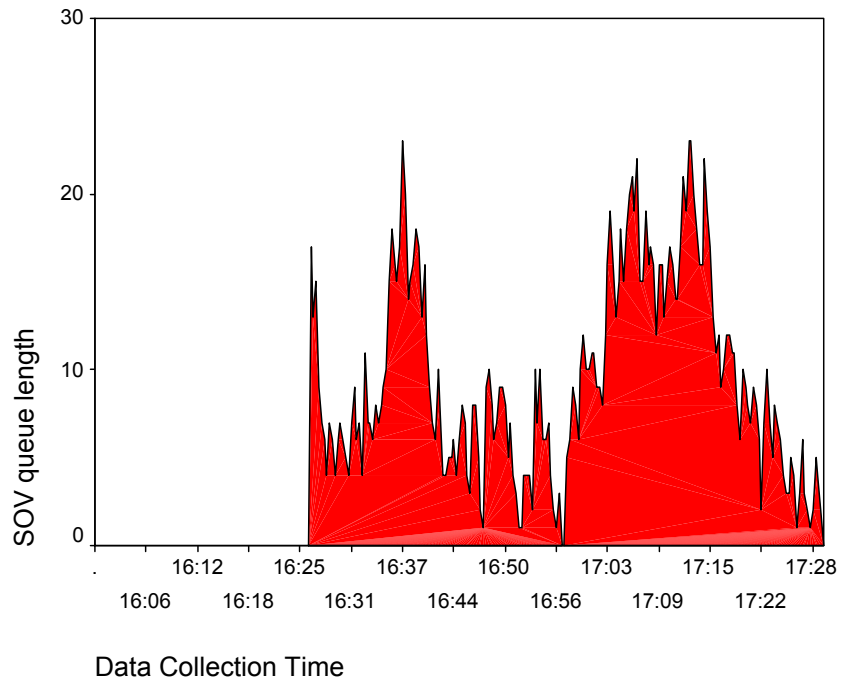
Greenfield Avenue 2/8/2000 PM peak



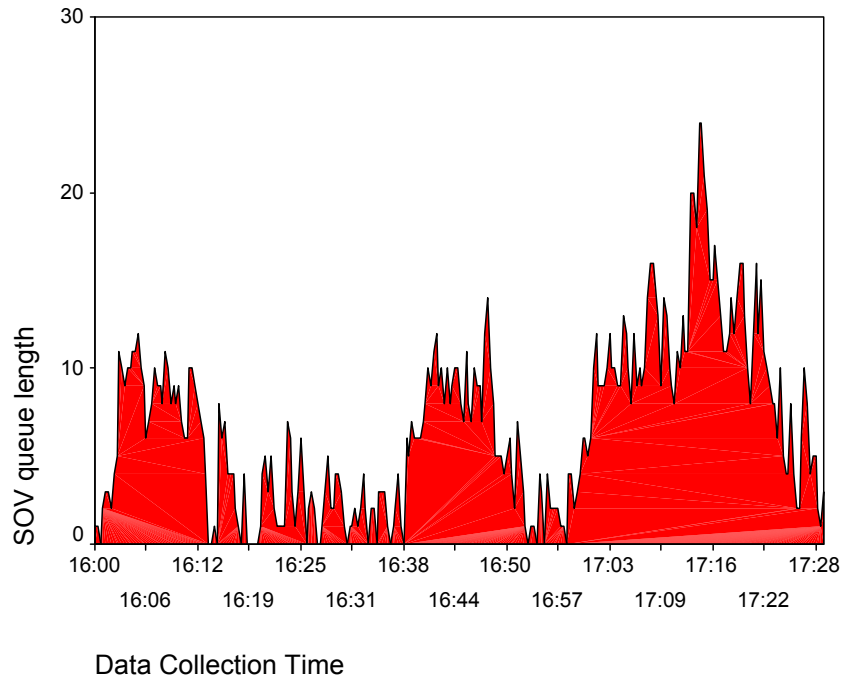
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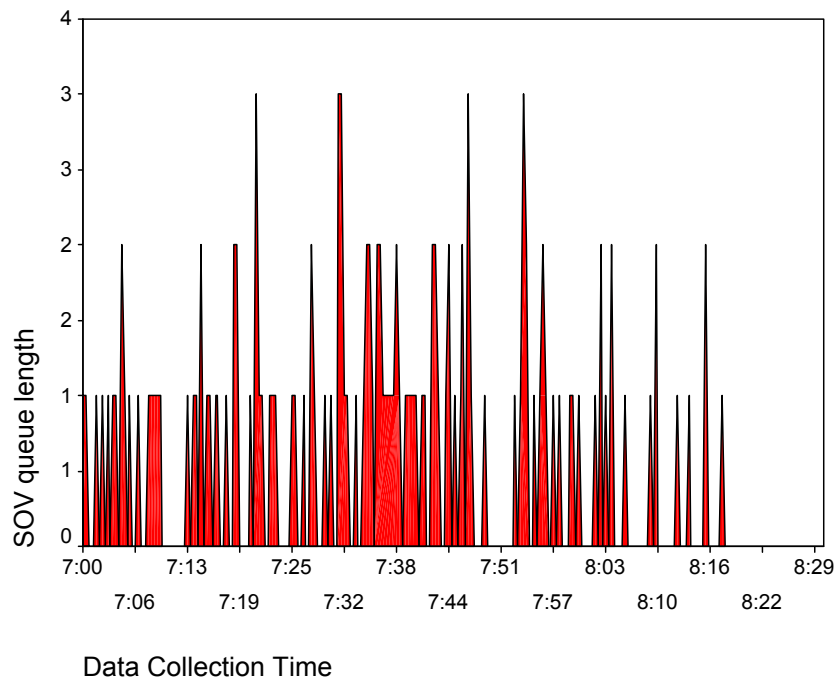
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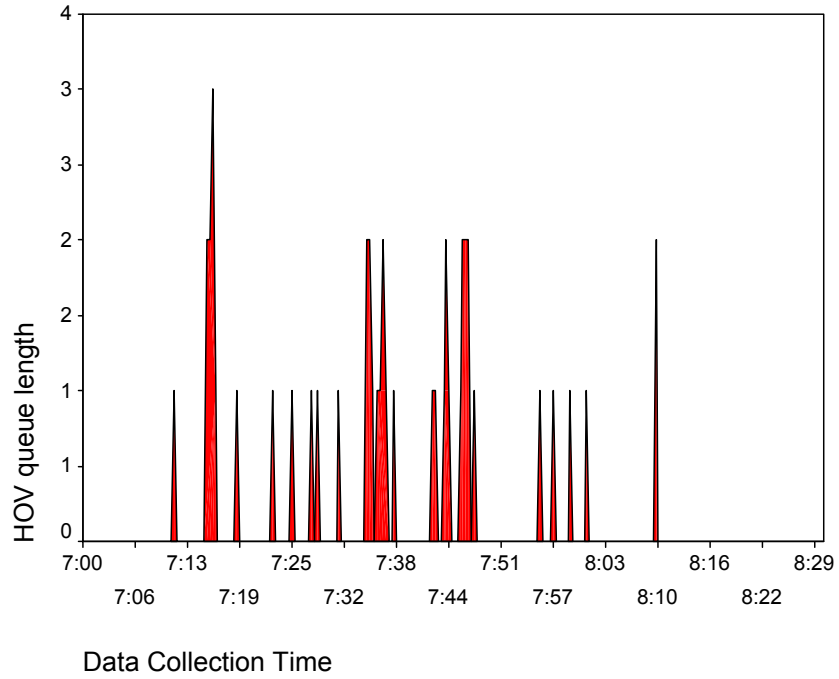
Greenfield Avenue 2/14/2000 PM peak



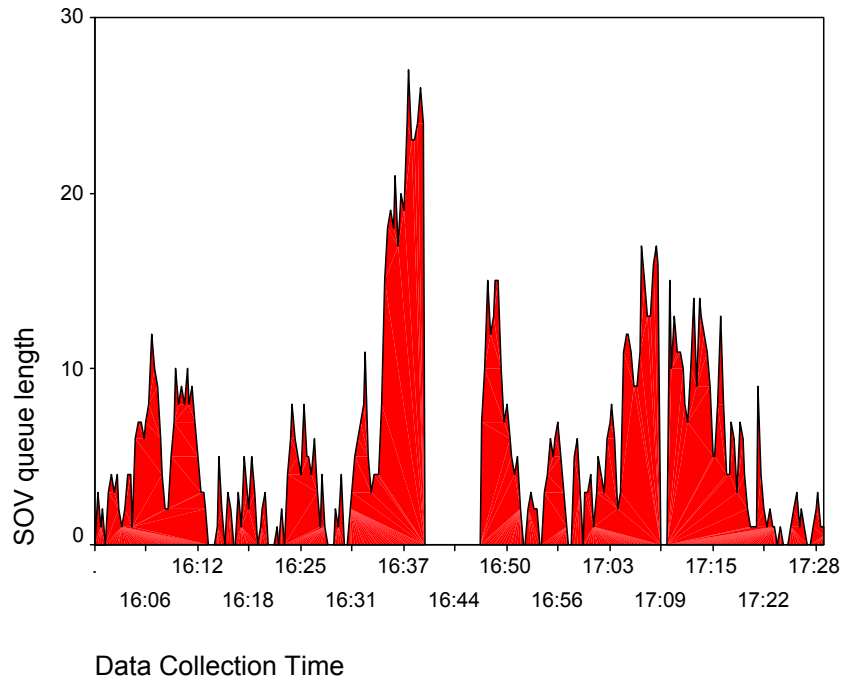
Greenfield Avenue 2/15/2000 AM peak



Greenfield Avenue 2/15/2000 AM peak



Greenfield Avenue 2/15/2000 PM peak



Greenfield Avenue 2/23/2000 PM peak

