

Patrol Data Analysis

Pinal County Sheriff's Office

Board of Supervisors Presentation

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- Introduction
- Data analysis not operations analysis
- Methodology
- Data collected
- Selected results
- No staffing recommendations
- Q & A

Operational Analysis Components

- Documents
- Facility reviews
- Prisoner processing
- Vehicles
- Training
- Personnel—appearance
- Patrol
- Specialized units
- Records
- Investigations
- Community policing
- Compstat and performance measurement

Introduction: CPSM data analysts

- Mathematicians, operations researchers, and statisticians
- Working together since 2008
- 150+ agencies, 100+ clients, 36 states
- 80+ law enforcement agencies
- Numerous county sheriff's offices: (Loudoun VA, Pinellas FL, Kalamazoo MI, Spokane WA, Teton WY, Camden GA)
- Multiple agencies in Arizona:
 - Law enforcement: Casa Grande, Florence, Lake Havasu, Prescott
 - Fire departments: Casa Grande, Queen Creek, Lake Havasu
 - Cities in Pinal County

Methods (Principles)

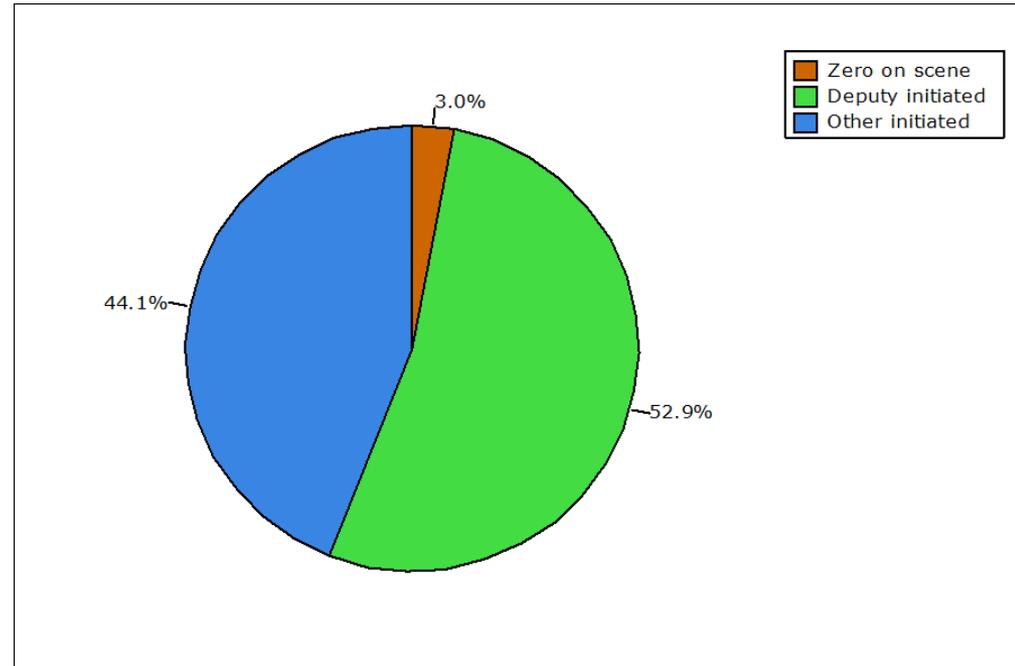
- Comprehensive: system to ensure accuracy
- Timely: to inform data-driven decisions
- Independent: Follow a set of rigorous internal procedures
- Interactive and customized: Constantly engaged with our clients to tailor our analysis to suit their situation
- Open: Solicit input from relevant stakeholders

Data Collection

- Entire year of computer-aided dispatch (CAD) data:
 - July 2013 through June 2014
 - 360 MB of call data
 - 300 MB of unit data → 1.5 million rows of information
- Focus on four weeks in different seasons: August 2013 and February 2014
- All patrol-related activities: calls and non-call
 - 93K calls, 128K units, 11K non-call activities
 - Patrol deployment schedules: 30+ files
 - 90 descriptions → 12 categories → 8 figure categories

Call Volume

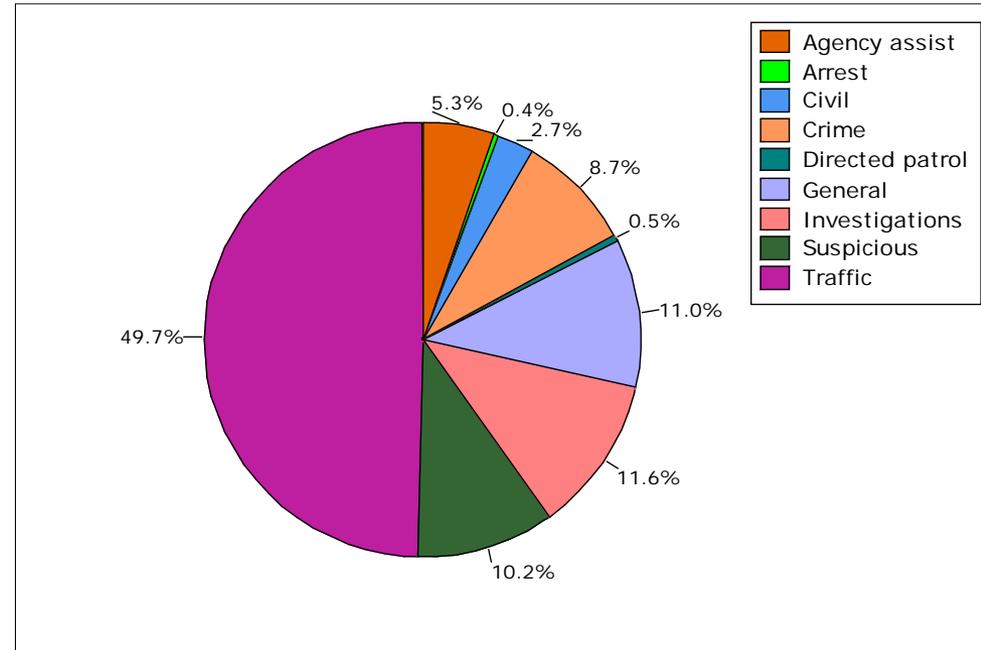
- 93,092 total calls
- 255.0 per day
- Other initiated (911): 44%
- Deputy initiated: 53%
- Zero on scene calls: 3%



Initiator	Total Events	Events per Day
Zero on-scene	2,836	7.8
Deputy-initiated	49,240	134.9
Other-initiated	41,016	112.4
Total	93,092	255.0

Call by Category

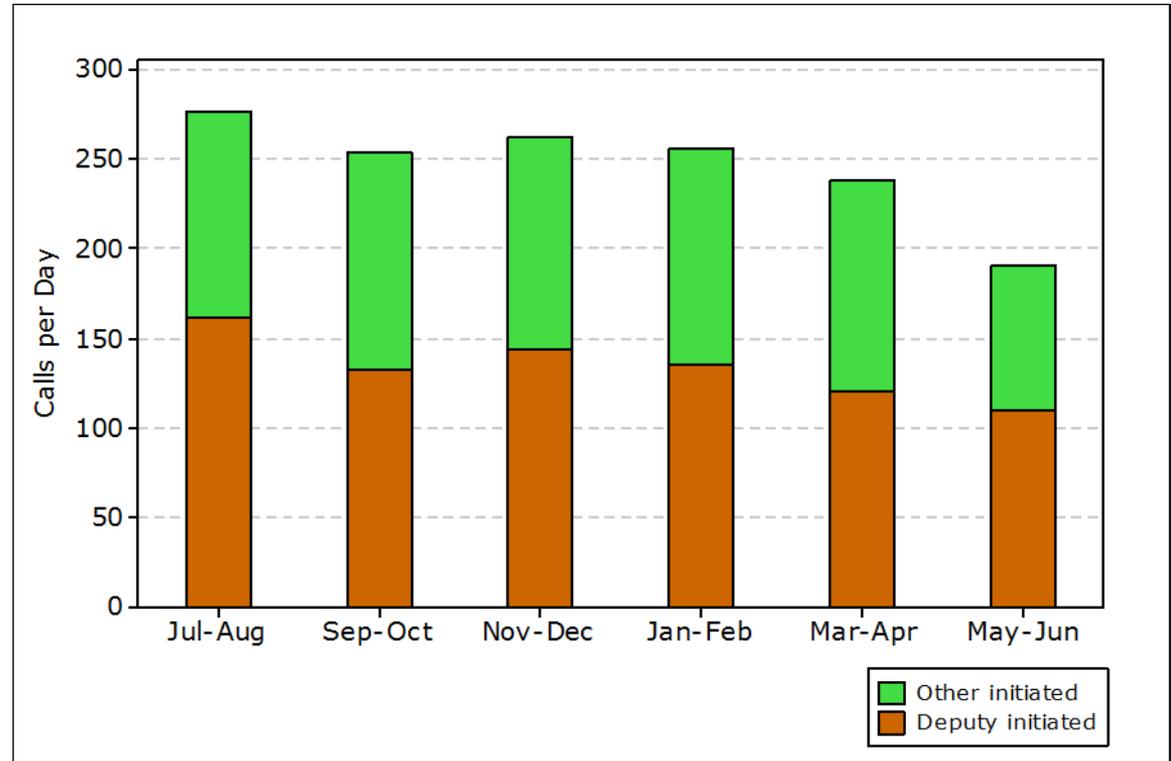
Category	Total Events	Events per Day
Accidents	1,714	4.7
Alarm	3,212	8.8
Agency assist	4,915	13.5
Check/investigation	7,594	20.8
Civil matter	2,516	6.9
Crime-persons	2,653	7.3
Crime-property	5,441	14.9
Directed patrol	425	1.2
Disturbance	5,001	13.7
Miscellaneous	10,240	28.1
Prisoner-arrest	349	1.0
Suspicious person/vehicle	4,489	12.3
Traffic enforcement	44,543	122.0
Total	93,092	255.0



- Top four categories were 82% of calls
- Traffic (enforcement & accidents): 50%
- Crime (person & property): 9%

Calls by Month

- July-August: 276.4
- May-June: 190.5
- Largest is 45% higher than the smallest.

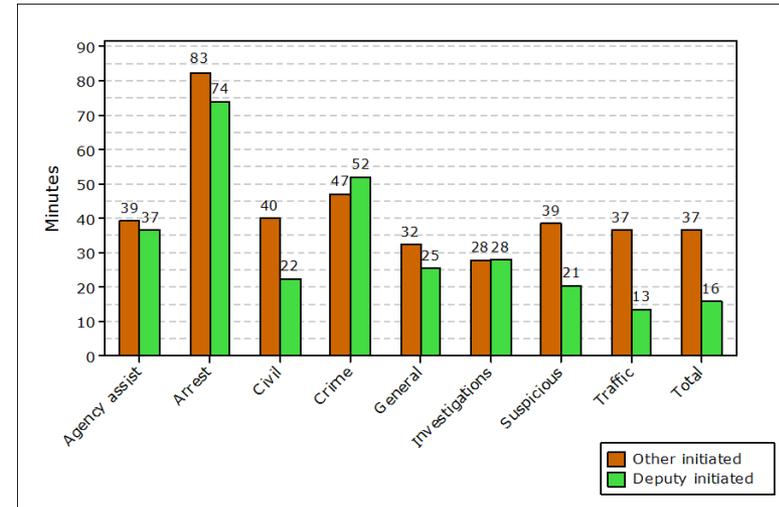


Initiator	Jul-Aug	Sep-Oct	Nov-Dec	Jan-Feb	Mar-Apr	May-Jun
Deputy-initiated	161.4	132.7	143.5	134.6	120.2	109.7
Other-initiated	115.0	120.4	118.7	121.3	118.3	80.8
Total	276.4	253.1	262.2	255.9	238.4	190.5

Occupied Time

- Occupied time: dispatch to clear time
- Deputy-initiated average: 16 minutes
- Other-initiated average: 37 minutes
- Crimes: approximately 47 minutes
- Some calls (62) excluded in this analysis

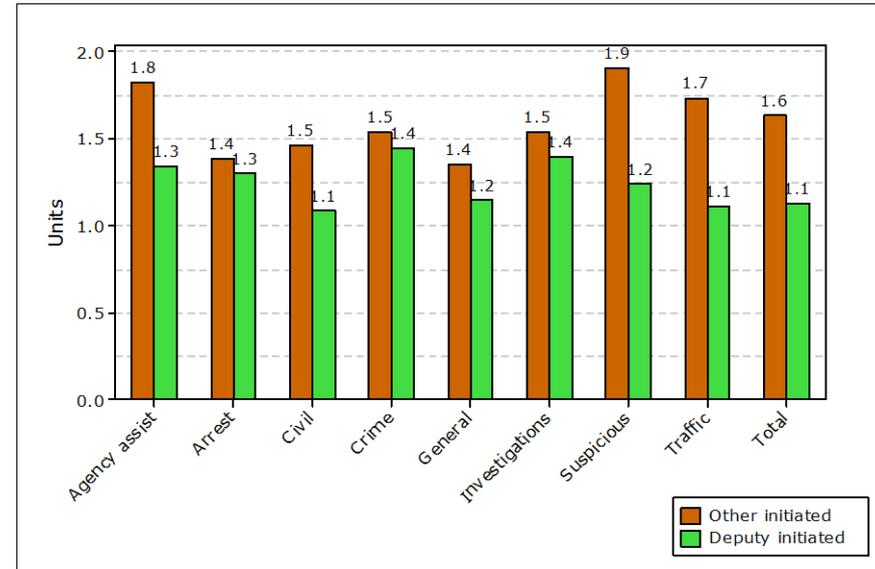
Category	Deputy-Initiated		Other-Initiated	
	Total Calls	Minutes	Total Calls	Minutes
Accidents	151	56.9	1,540	58.2
Alarm	7	14.3	3,141	17.4
Assist other agency	618	36.6	4,137	39.3
Check/investigation	1,307	28.0	5,950	33.0
Civil matter	753	22.4	1,624	40.1
Crime-persons	236	70.9	2,257	48.9
Crime-property	305	37.4	4,852	46.1
Disturbance	56	44.7	4,821	46.0
Miscellaneous	3,083	25.3	6,063	32.3
Prisoner-arrest	185	74.0	145	82.6
Suspicious person/vehicle	563	18.2	3,775	29.1
Traffic enforcement	41,526	13.3	2,677	24.1
Total	48,790	15.7	40,982	36.7



Responding Units

- Account for every responding unit
- Responding units: 128,393
- Other-initiated: 1.6 units
- A call's work is the sum of all occupied time for all responding units

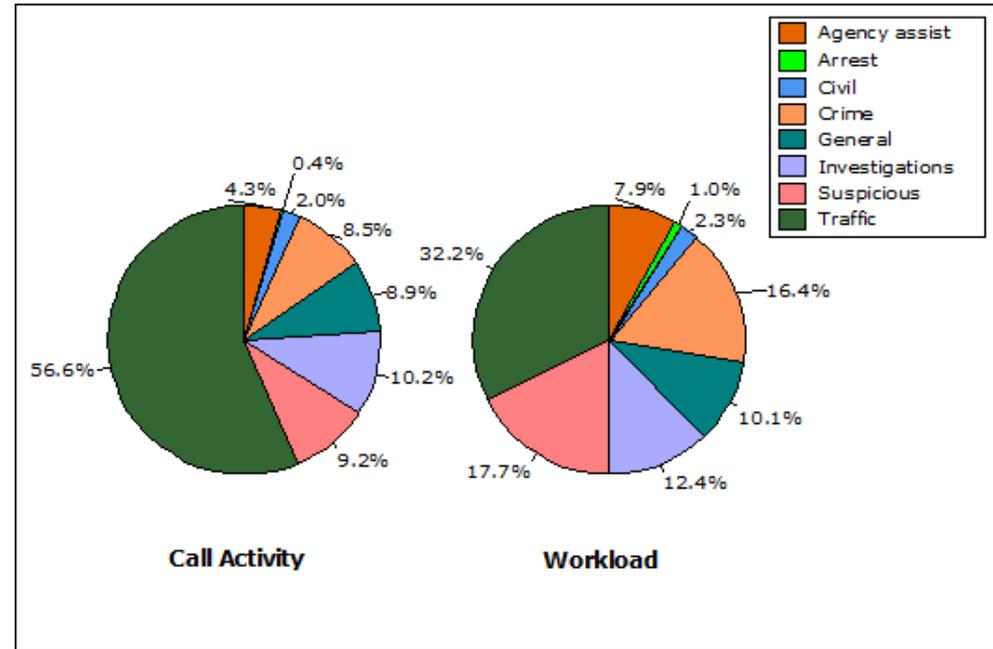
Category	Deputy-initiated		Other-Initiated	
	Avg.	Calls	Avg.	Calls
Accidents	2.0	151	2.2	1,541
Alarm	1.6	7	1.4	3,141
Agency assist	1.3	621	1.8	4,145
Check/investigation	1.4	1,309	1.6	5,956
Civil matter	1.1	754	1.5	1,624
Crime-persons	1.7	239	1.6	2,264
Crime-property	1.3	305	1.5	4,855
Disturbance	1.8	56	2.1	4,824
Miscellaneous	1.2	3,088	1.4	6,066
Prisoner-arrest	1.3	188	1.4	145
Suspicious person/vehicle	1.2	564	1.6	3,778
Traffic enforcement	1.1	41,536	1.4	2,677
Total	1.1	48,818	1.6	41,016



Call and Workload

- Example: August 2013
- Calls: 292 per day or 12.2 per hour
- Workload: 160 per day or 6.7 per hour
- Traffic is 57% of calls and 32% of work
- Crime is 9% of calls and 16% of work
- No staffing recommendations!
- Call and workload also varies by hour

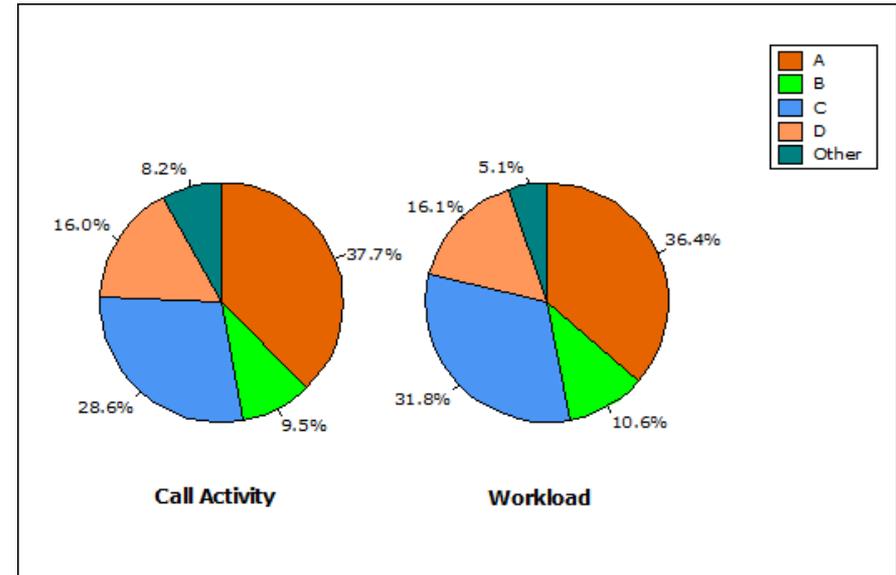
Category	Per Day	
	Calls	Work Hours
Arrest	1.1	1.7
Assist other agency	12.6	12.6
Civil	5.8	3.7
Crime	25.0	26.1
General noncriminal	25.9	16.1
Investigations	29.8	19.9
Suspicious incident	26.9	28.2
Traffic	165.5	51.5
Total	292.4	159.9



Call and Workload by Region

- Entire year, using 4 regions (A to D)
- Calls: 246 per day
- Work: 142 hours per day
- A (largest): calls 38% and work 36%
- B (smallest): calls 10% and work 11%

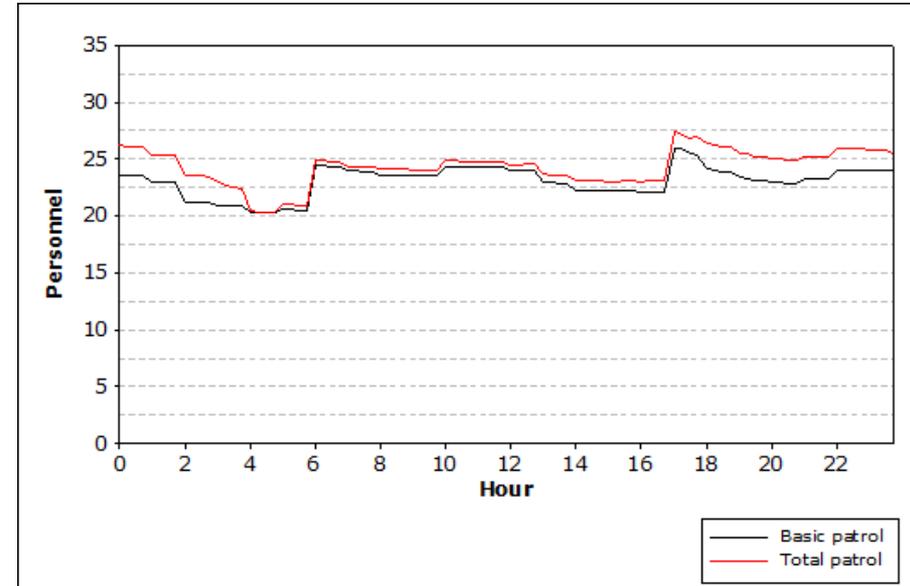
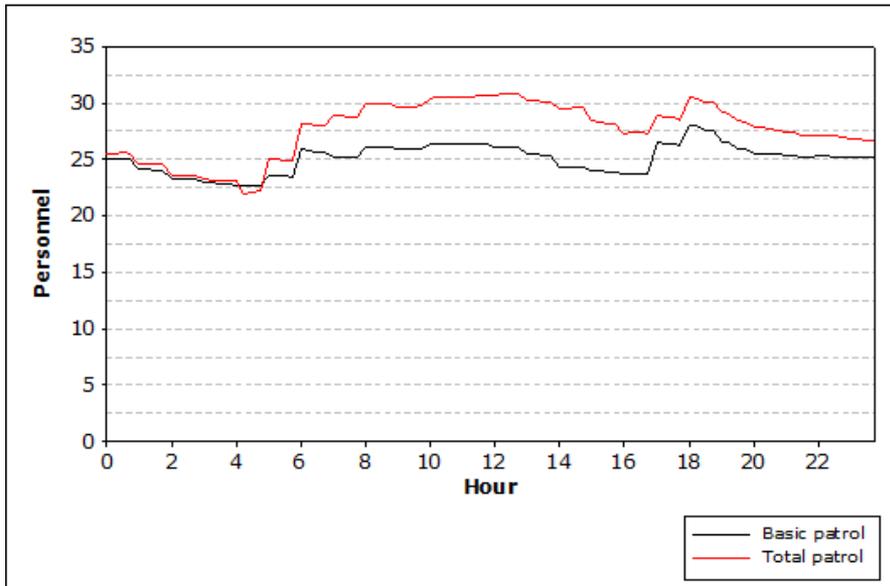
Region	Per Day	
	Calls	Work Hours
A	92.8	51.8
B	23.5	15.1
C	70.5	45.2
D	39.3	22.9
Other	20.1	7.3
Total	246.1	142.3



Deployment: Overview

- Focus on August 2013 and February 2014
- Distinguish weekdays (Monday – Friday) and weekends (Saturday – Sunday)
- Compute average personnel per hour
- Quick examination of total personnel for each day
- Leave reduces the available deputies per hour
- Sources:
 - Biweekly schedules by region (20+ files)
 - Traffic unit schedules (8 files)
 - K9 schedule documentation
 - Payroll records showing hours worked by person and type
 - Dispatch data
 - Conflicts between sources

Deployment Graphs

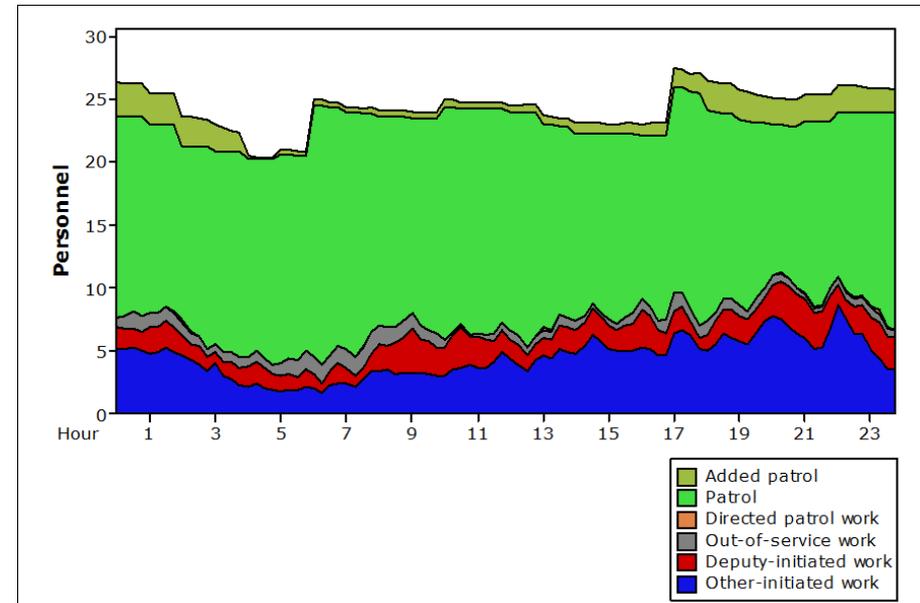
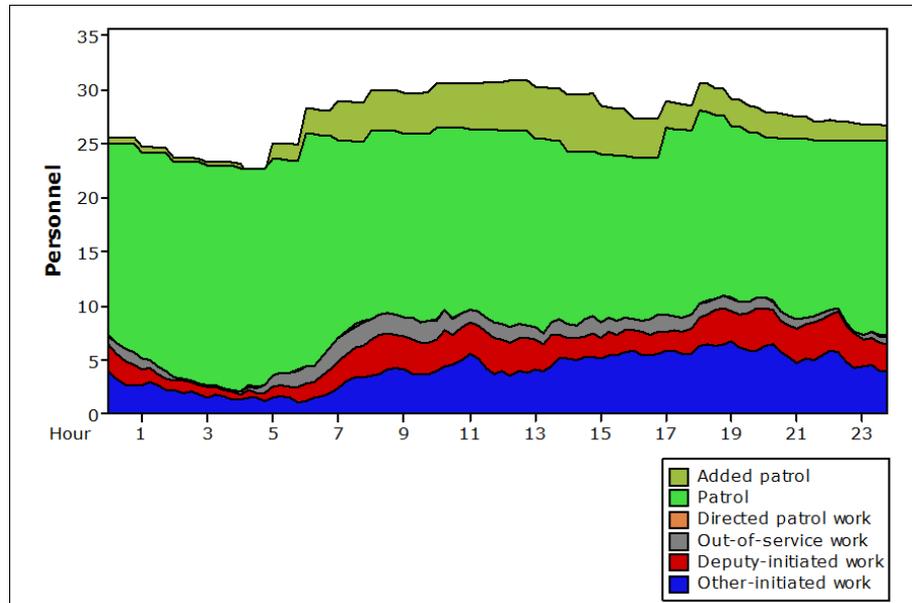


- August 2013, all regions included
- Traffic and K9 are added patrol
- Weekdays (left) and weekends (right)
- Weekdays: Average 28 deputies per hour
- Weekends: Average 24 deputies per hour

Deployment and Workload

- Examine workload throughout the day in 15-minute increments
- Hierarchy of work: other initiated, deputy initiated, out-of-service activities, etc.
- Average daily workload computed as layers are added
- Compute percentages of workload/deployment

Deployment and Workload II



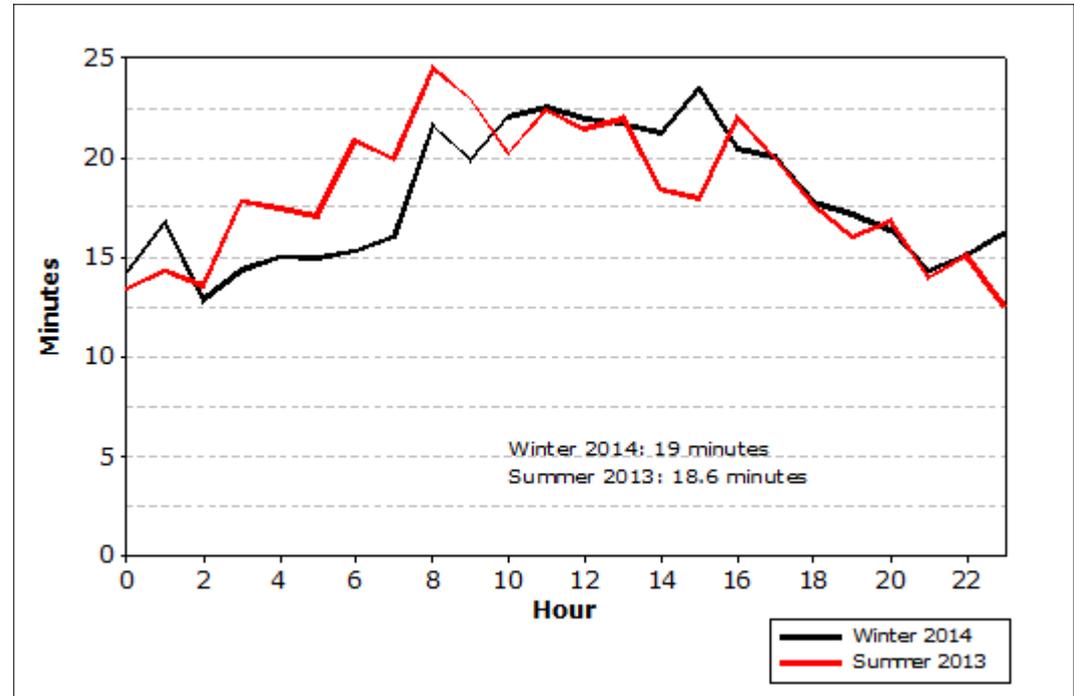
- Workload includes out-of-service activities
- August 2013 weekdays (left) and weekends (right)
- Weekday: 7.7 deputies per hour, 28% of deployment
- Weekend: 7.2 deputies per hour, 30% of deployment
- Weekday peak of 40% of deployment, 8:00-8:15 p.m.
- Weekend peak of 47% of deployment, 8:15-8:30 p.m.

Response Time Methods

- Selective about calls used:
 - Valid dispatch and arrival times
 - Avoid excessively long responses (outliers)
 - Only other-initiated calls
- Relevant factors:
 - Geography
 - Priority
 - Hour of day
 - Category
- Annual 31,651; August 2,563; February 2,622
- Averages and 90th Percentiles
- Sampling is fine

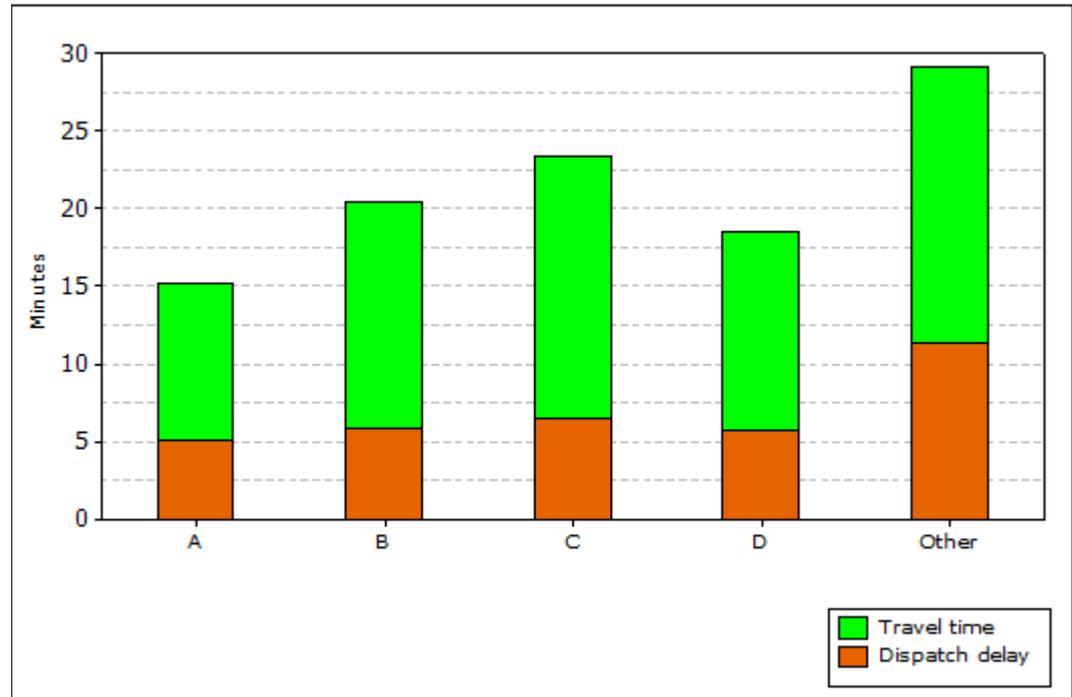
Response Times by Hour

- August average: 18.6 minutes
- February average: 19.0 minutes
- August 2013
 - High: 24.5 minutes; 8:00-9:00 a.m.
 - Low: 12.5 minutes; 11:00 p.m. - midnight
- February 2014
 - High: 23.4 minutes; 3:00-4:00 p.m.
 - Low: 12.5 minutes; 2:00-3:00 a.m.



Response Times by Region

Region	Dispatch	Travel	Response	Total Calls
A	5.1	10.1	15.1	14,666
B	5.9	14.4	19.8	2,999
C	6.4	16.9	22.5	7,692
D	5.8	12.7	19.4	5,297
Other	11.4	17.7	27.3	997
All	5.8	12.8	18.4	31,651



- Significant variation by region
- Total response time: 15.1 to 22.5 minutes
- Travel time: 10.1 to 16.9 minutes
- Dispatch delay: 5.1 to 6.4 minutes

Response Times by Priority

- High-priority response and all calls: 9.8 versus 18.7 minutes.
- Dispatch delay: 2.6 minutes versus 5.8 minutes overall
- For high-priority calls:
 - Longest hourly average was 11.6 minutes between 2:00 and 3:00 p.m.
 - Shortest hourly average was 7.9 minutes between 6:00 and 7:00 p.m.

Priority	Dispatch	Travel	Response	Total Calls
0	2.6	7.2	9.8	903
1	3.2	8.8	12.0	10,814
2	6.3	13.0	19.3	12,629
3	9.0	18.6	27.6	3,349
4	9.9	19.3	29.2	3,843
9	5.9	17.3	23.3	113
All	5.8	12.8	18.7	31,651
Injury accidents	3.0	7.6	10.5	405

Non-call Activities

- Anything recorded for a patrol unit
- Status codes indicating a unit went out of service
- Not much detail provided consistently
- Length of an out-of-service activity not well recorded
- Less reliable than call occupied time
- 11,122 activities for the year
- 9,076 lasted more than 30 seconds
- 24.9 activities per day
- 20.8 work hours per day

Why is this a draft?

- Request for comments:
 - Potential errors, inaccurate assumptions
 - Overlooked data
 - May – June 2014 is “fishy”
- Deployment requires scrutiny:
 - Many sources
 - Different levels of reliability
- Additional requests: agency and SME’s
- Interactivity improves final report’s quality

No staffing recommendations

- Results not finalized
- Level of service discussion required
- Planned workload:
 - What tasks will patrol deputies perform and when?
 - How much uncommitted time is expected?
- Performance measures:
 - What response time targets are realistic?
 - How will this vary by area and population?
- Scheduling realities:
 - What shift patterns have been explored?
 - What are allowed by existing contracts?

END