**Response Time in the Los Angeles Police Department:**

**Medians, Means, and Geometric Means**

**White Paper #3**

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**June 2016**

**Introduction**

This report is the third in a series of white papers that examine calls for service and response times in the Los Angeles Police Department (LAPD). White Paper #1 (Swatt 2015) examined response time for calendar year 2014, focusing on missing data, missing values, the distribution of response time, and outliers. White Paper #2 (Swatt, Wooditch, & Uchida, 2015) considered how response time performance changed over a five-year period, 2010-2014. In that paper, we examined three important aspects of the LAPD’s total response time: 1) evaluated the performance of the 1 percent trimmed geometric mean response time, 2) identified trends in yearly and monthly response time, and 3) showed yearly changes in response time across the 21 LAPD geographic divisions.

In this paper, we analyzed Code 3 calls from November 1, 2014 to March 31, 2016. These are data that were provided to *Los Angeles Times* reporter Ben Poston. We replicate the analysis that we conducted for data covering 2010-2014 and we follow the methodology described in both white papers. We provide findings for geometric means using the 1 percent trimmed mean citywide and by division. In addition, we provide findings for medians, arithmetic means, and trimmed arithmetic means.

**Background**

The LAPD receives about 1.8 million calls per year. These calls include emergency calls (911), non-emergency calls (7-digit calls), and officer-initiated calls. Many of the 911 calls are for information purposes and do not require an officer to be dispatched. Others are more serious and take priority over less serious calls. A Code 3 call has the highest priority (crime in progress or has occurred within 10 minutes), followed by a Code 2, which is used for crimes that occurred in the last 15-30 minutes.

Calls are processed through the Computer Aided Dispatch (CAD) system. An operator takes the call and enters information into the system for the dispatcher. The dispatcher prioritizes the call and notifies the patrol unit regularly assigned to the area. Officers respond through their mobile digital terminals or verbally to the dispatcher. Throughout the process of the call, the officers record the time. A timestamp is recorded when: the officer acknowledges the call they are dispatched to, the officer is en croute, the officer arrives on scene, and the officer completes the dispatched call. A disposition code is also used to identify the outcome of the dispatched call. If a crime has occurred, then a police report is filed, if not, the call may be noted on the officer's daily activity form. Response time is the duration of time between when the officer acknowledges the dispatched call and when the first unit arrives on scene.

**Data**

For the current study, we used Code 3 calls recorded in CAD from November 1, 2014 to March 31, 2016.  These data include traffic calls.

**Methods: The 1 Percent Trimmed Geometric Mean**

In White Papers 1 and 2 (Swatt 2015 and Swatt, et al., 2015), we determined that a 1 percent trimmed geometric mean is appropriate for measuring performance across the entire LAPD over a one-year period. *Importantly, White Paper #2 demonstrated that the 1 percent trimmed geometric mean can be used as a general metric for assessing response time performance* (Swatt et al., 2015)*.* The process for calculating the trimmed geometric mean response time is as follows: 1) transform response time using the natural logarithm; 2) trim the top 1 percent and bottom 1 percent for each priority; 3) find the mean of the logged data; and 4) transform (exponentiate) the logged mean result.

In our analysis, we noticed some differences between the 1 percent trimmed geometric mean and the median over time, but these differences were not very substantial. This suggested that the 1 percent trimmed geometric mean and the median would be similar in magnitude. Since this is the case, the gain in efficiency of the 1 percent trimmed geometric mean supports its use over the median. Second, we observed that the 1 percent trimmed mean does not differ substantially from other reasonable choices for trimming (such as a 5 or 10 percent trimmed mean) across months. This is important because it suggests that maintaining the same proportion of trimmed data does not lead to insufficient protection against outliers nor does it result in too large a proportion of data trimmed from the sample. Further, the 1 percent trimmed geometric mean was usable for monthly data from separate divisions across the LAPD. Taken together, these results suggest that the 1 percent trimmed geometric mean can be used as a general metric for evaluating response time performance.

**Summary of Police Response Time (Nov 2014 to Mar 2016)**

Response time was calculated for 165,492 of the 169,347 citywide Code 3 calls recorded in CAD from November 1, 2014 to March 31, 2016. A total of 3,855 calls were not included in the calculations because they had an illogical response time value (n=3,742), an invalid call type (n=14), and the division of occurrence was missing (n=99).[[1]](#footnote-1) Since these data include 36,480 Code 3 traffic calls, response time totals were also computed separately for non-traffic related Code 3 calls (n=128,927 without divisions missing). Response time is computed citywide and then by division. Annotated syntax for 'R', which was used to compute these estimates, is available in Appendix 1. A list of calls excluded from the analysis during the 1% trimming process is available in Appendix 2.

Citywide total response time is presented in Table 1. During the period of interest, the response time for all Code 3 calls citywide has an arithmetic mean of 10.51 minutes. Traffic-related calls slightly skew total response time; the arithmetic mean is 9.37 minutes when these events are excluded from the calculation. Eliminating extreme low and high response time values slightly reduces the mean response time for all calls and when traffic-related calls are excluded (8.66 and 7.40 minutes respectively).

The geometric trimmed means are slightly higher than the median response times for all Code 3 calls (6.72 versus 6.60 minutes) and when traffic-related ones (5.89 versus 5.85 minutes) are excluded. The most frequently observed response time during the period is 4.23 minutes (the mode).

**Table 1: Citywide Response Time for Priority 3 Calls (in Minutes)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Geometric Trimmed** **Mean (1%)** | **Trimmed Mean (1%)** | **Mean** **(No Trim)** | **Median** | **Mode** | **Number** |
| *Including Traffic*  |  |  |  |  |
| 6.72 | 8.66 | 10.51 | 6.60 | 4.23 | 165,492 |
| *Excluding Traffic*  |  |  |  |  |
| 5.89 | 7.40 | 9.37 | 5.85 | 4.23 | 128,927 |

A summary of citywide response time by percent of data discarded (low and high response times removed) is presented in Table 2. The arithmetic mean response time is 10.51 minutes for all Code 3 calls and 9.37 minutes for non-traffic related Code 3 calls. Trimming the highest and lowest response times at least 1% reduces overall response time considerably when using the arithmetic mean. Trimming the top and bottom 1% of response times reduces the arithmetic mean response time by approximately 2 to 3 minutes. The geometric mean without trimming closely approximates all trimmed geometric means.

The median response times for all calls and non-traffic related calls (6.60 and 5.89 minutes respectively) most closely approximate the geometric means that are trimmed 25% (6.61 and 5.84 minutes respectively).

**Table 2: Comparison of Citywide Trimmed Means (in Minutes)**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Type** | **No Trim** | **Trim 1%** | **Trim 5%** | **Trim 10%** | **Trim 25%** |
| *Including Traffic Calls* |  |  |  |  |
|  Arithmetic Mean | 10.51 | 8.66 | 7.85 | 7.42 | 6.84 |
|  Geometric Mean | 6.78 | 6.72 | 6.67 | 6.65 | 6.61 |
| *Excluding Traffic Calls* |  |  |  |  |
|  Arithmetic Mean | 9.37 | 7.40 | 6.72 | 6.41 | 6.02 |
|  Geometric Mean | 5.97 | 5.89 | 5.85 | 5.84 | 5.84 |

Next, a summary of observed response times was computed for each division when traffic calls are included (see Table 3) and excluded (see Table 4).

In Table 3 the arithmetic mean response time across divisions ranges from a low of 7.60 minutes in Central Division to a high of 12.07 minutes in Northeast Division. Trimming the high and low arithmetic mean response times slightly reduces the range of overall response times (6.22 minutes in Central Division to 10.59 minutes in West Los Angeles Division). The range of trimmed geometric mean response times was notably lower across divisions in comparison to overall mean and trimmed mean response times, ranging from 4.98 to 8.54 minutes. Four divisions had a trimmed geometric mean response time lower than 6.00 minutes.

The median response time across divisions ranged from 4.92 (Central Division) to 8.75 (West Los Angeles Division). Higher response times tend to be divisions with a higher number of Code 3 calls, which ranged from 6,015 (Foothill Division) to 14,116 (77th Street division) during the observation period.

**Table 3: Summary of Response Time Including Traffic Calls by Division (in Minutes)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Division** | **Geometric Trimmed Mean** | **Trimmed Mean** | **Mean** | **Median** | **Mode** | **Number** |
| Central | 4.98 | 6.22 | 7.60 | 4.92 | 4.48 | 7,803 |
| Rampart | 5.48 | 7.04 | 9.19 | 5.25 | 3.00 | 7,751 |
| Southwest | 6.88 | 9.01 | 11.18 | 6.68 | 5.70 | 11,237 |
| Hollenbeck | 7.01 | 8.99 | 10.72 | 7.10 | 6.05 | 6,643 |
| Harbor | 6.69 | 8.66 | 10.34 | 6.62 | 4.63 | 7,524 |
| Hollywood | 5.66 | 7.47 | 8.94 | 5.50 | 2.83 | 7,482 |
| Wilshire | 6.32 | 7.83 | 9.16 | 6.17 | 4.40 | 7,515 |
| West Los Angeles | 8.54 | 10.59 | 11.59 | 8.75 | 7.75 | 7,423 |
| Van Nuys | 6.34 | 7.98 | 9.80 | 6.20 | 4.17 | 7,206 |
| West Valley | 6.84 | 8.53 | 9.95 | 6.76 | 3.87 | 6,608 |
| Northeast | 7.80 | 9.89 | 12.07 | 7.88 | 5.20 | 7,173 |
| 77th Street | 6.80 | 9.20 | 12.01 | 6.63 | 3.23 | 14,116 |
| Newton | 7.03 | 9.14 | 11.16 | 6.88 | 4.47 | 8,695 |
| Pacific | 7.22 | 9.34 | 11.68 | 7.17 | 5.72 | 7,372 |
| North Hollywood | 6.93 | 8.83 | 10.72 | 6.73 | 4.80 | 7,422 |
| Foothill | 7.41 | 9.31 | 10.38 | 7.43 | 4.02 | 6,015 |
| Devonshire | 8.08 | 9.87 | 11.05 | 8.13 | 7.45 | 6,602 |
| Southeast | 6.55 | 8.80 | 11.10 | 6.28 | 3.23 | 9,955 |
| Mission | 6.95 | 8.94 | 10.66 | 6.87 | 4.27 | 7,513 |
| Olympic | 5.76 | 7.39 | 9.16 | 5.55 | 4.33 | 7,144 |
| Topanga | 7.37 | 9.30 | 10.54 | 7.12 | 4.67 | 6,293 |

Table 4 shows that the mean response time across divisions excluding traffic-related Code 3 calls ranged from 6.93 minutes in Central Division to 11.45 minutes in 77th Street Division. The median response time across divisions ranged from 4.48 (Central Division) to 7.62 (West Los Angeles Division). Trimming the high and low response times slightly lowered the range of overall response times (5.45 minutes in Central Division to 9.15 minutes in West Los Angeles Division).

The geometric trimmed mean across divisions ranged from 4.50 to 7.48 minutes, with 10 divisions having geometric mean response times lower than 6.00 minutes. The number of Code 3 calls during the observation period ranged from 4,497 (Topanga Division) to 11,698 (77th Street Division). Higher response times occur in divisions that comprise a large geographic area (e.g., West Los Angeles, Northeast, Devonshire, Foothill, and Hollenbeck).

**Table 4: Summary of Response Time Excluding Traffic Calls by Division (in Minutes)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Division** | **Geometric Trimmed Mean** | **Trimmed Mean (1%)** | **Mean** | **Median** | **Mode** | **Number** |
| Central | 4.50 | 5.45 | 6.93 | 4.48 | 4.48 | 6,407 |
| Rampart | 4.87 | 6.05 | 8.41 | 4.77 | 3.12 | 6,386 |
| Southwest | 6.20 | 7.89 | 10.14 | 6.10 | 5.02 | 8,977 |
| Hollenbeck | 6.39 | 8.16 | 10.00 | 6.40 | 4.48 | 5,384 |
| Harbor | 5.96 | 7.47 | 9.19 | 6.02 | 4.63 | 6,052 |
| Hollywood | 4.99 | 6.40 | 7.87 | 4.88 | 2.83 | 6,002 |
| Wilshire | 5.36 | 6.36 | 7.30 | 5.32 | 4.40 | 5,505 |
| West Los Angeles | 7.48 | 9.15 | 10.01 | 7.62 | 7.75 | 5,367 |
| Van Nuys | 5.46 | 6.61 | 8.36 | 5.43 | 3.12 | 5,435 |
| West Valley | 5.71 | 6.77 | 8.10 | 5.83 | 3.28 | 4,698 |
| Northeast | 7.04 | 8.89 | 11.32 | 7.12 | 5.20 | 5,727 |
| 77th Street | 6.19 | 8.37 | 11.45 | 6.10 | 3.23 | 11,698 |
| Newton | 6.25 | 8.04 | 10.13 | 6.13 | 3.48 | 6,752 |
| Pacific | 6.09 | 7.69 | 10.39 | 6.07 | 5.72 | 5,470 |
| North Hollywood | 5.96 | 7.31 | 9.30 | 5.92 | 4.80 | 5,554 |
| Foothill | 6.46 | 7.88 | 8.98 | 6.55 | 4.02 | 4,708 |
| Devonshire | 7.00 | 8.21 | 9.17 | 7.22 | 7.45 | 4,616 |
| Southeast | 5.90 | 7.75 | 10.28 | 5.77 | 3.23 | 8,343 |
| Mission | 6.17 | 7.76 | 9.68 | 6.13 | 2.67 | 5,985 |
| Olympic | 4.92 | 6.05 | 7.71 | 4.80 | 2.82 | 5,364 |
| Topanga | 6.12 | 7.35 | 8.67 | 6.07 | 4.52 | 4,497 |

**References**

Swatt, Marc L. (2015). Understanding the CAD Data Generating Process (White Paper #1). Justice & Security Strategies, Inc. (JSS)

Swatt, Marc L., Alese C. Wooditch, and Craig D. Uchida. (2015). Response Time in the Los Angeles Police Department: Changes and Trends, 2010-2014 (White Paper #2). Justice & Security Strategies, Inc. (JSS)

1. Please refer to White Papers 1 and 2 for more detail on these dropped cases. [↑](#footnote-ref-1)