JOPLIN CITY COUNCIL
WORK SESSION
MONDAY, APRIL 25, 2022
5TH FLOOR COUNCIL CHAMBERS
602 S. MAIN ST.
5:30 P.M.

Notice is hereby given that the City Council of the City of Joplin, Missouri, will hold a work session beginning at 5:30 p.m. on Monday, April 25, 2022 in the 5th Floor Council Chambers, 602 S. Main Street to discuss the topics below. This meeting can be viewed via livestream at http://www.joplinmo.org/182/Video-Multimedia

AGENDA

1. Police Department Resource Allocation Study
2. Adjourn

Notice posted at 3:37 pm. on this 22nd day of April 2022. (RSMo 610.020)

The City of Joplin is committed to comply with the Americans Disability Act. The Joplin City Council Chambers is wheelchair accessible. Request for reasonable special accommodations must be made 48 hours prior to the meeting. Please email the City Clerk's office at hnagy@joplinmo.org or call (417) 624-0820 ext. 1220 for assistance.

Ad Omnia Parata

Joplin Police Department

Patrol Allocation, Beat Design, and Shift Scheduling Study



Honor
without compromise

Courage
with compassion

Commitment
to community

Service
with understanding

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Joplin Police Department
Patrol Allocation, Beat Design, and Shift Scheduling Study
Conducted by: Etico Solutions, Inc.

On January 22, 2021, the City of Joplin issued a Notice of Request for Proposal for a Police Department Resource Allocation Study. Etico Solutions was one of several responders to the request and was officially awarded the contract by the Joplin City Council on March 15, 2021. The first on-site visit to initiate the study was conducted on March 30th and 31st, 2021 with this final report being submitted in mid-April of 2022.

A variety of hurdles were encountered throughout this study, some anticipated and some not. The majority of the Joplin Police Department (JPD) administration are graduates of the Missouri Police Chiefs Association Command College and have been former students of mine in a 40-hour block of instruction on Resource Allocation. The JPD administrators were well aware that many of the time-keeping practices within the department were antiquated which could make data acquisition and analysis difficult. The agency anticipated that accurately determining the time spent on training, leave, and other shift exceptions was going to be difficult based on hand-written timesheets and other record-keeping practices.

An unexpected hurdle came shortly after the initial site visit when the city experiences a network security incident in July. Among many other things, the department's Computer Aided Dispatch (CAD) data was affected as well as the human resources and payroll databases. The acquisition of data for analysis was immediately blocked until the databases could be restored in mid to late August. Many existing data queries and reports that were available before the network security incident were no longer usable which created additional work in exporting and analyzing data.

Despite the set-backs, the data was eventually obtained and the desired staffing models were able to be created. Anticipated difficulties, such as the acquisition of training data and report-writing times, were compensated by other methods and many hours of manual research by both JPD staff and Etico Solutions. The final results come with a high confidence level in the accuracy of the findings.

The following report is the culmination of an exhaustive study which examined the recommended staff size for the JPD Patrol Division, potential changes to the patrol beat configurations, modifications and alternatives to the existing patrol schedule, and recommended staffing for the Investigations Division. Six years of CAD data were carefully examined along with five years of payroll data focusing on leave times and overtime. This historical data provided the basis for an interactive Excel staffing model to determine staffing levels based a variety of administrative input. An improved beat design was created as well as options to optimize or replace the current patrol schedule. This final report now details the methodologies used in each step, the data that was obtained and used in the models, and the final results of the analysis.

This is a new resource allocation and staffing methodology for the JPD and should not be expected to be 100% accurate within the first year. As data collection methods improve within the police department and members of the agency become more conscious of accurately reporting the work that is being performed, the outcomes from this methodology

should progressively improve. The methodologies and processes put in place through this study should serve the Joplin Police Department and the City of Joplin for many years to come.

Respectfully submitted,

Timothy J. Freesmeyer, MBA
Etico Solutions, Inc.

Executive Summary

The Patrol Division of the Joplin Police Department is significantly understaffed to handle the reactive workload within the city while still providing a sufficient level of proactive policing to maintain Joplin's quality of life. Strategic changes within the department to optimize the current deployment plan and improve the efficiency of the patrol schedule will bring some relief to existing staff. However, without a sizable increase in patrol staffing, immediate improvements will only be capable of producing limited results. Furthermore, an average turnover rate over the last four years of 34.32% in the Patrol Division indicates an obvious retention problem for the agency.

This report is the result of a 13-month examination of the Patrol Division of the JPD and a staffing assessment of the department's Investigative Division. The data used to support the Patrol Division recommendations in this study were obtained directly from JPD and do not represent national averages or historical benchmarks. Workload for the Patrol Division was taken directly from six years of patrol activity frequency data as well as the average times spent on patrol activities by officers assigned to patrol duties. Officer availability was determined based on a five-year sample of leave data, training data, overtime data and compensatory leave data.

The study began with a two-day initial site visit on March 30-31, 2021. A series of meetings were held with department personnel who would be responsible for providing data. Patrol schedules and beat maps were obtained as well as GIS shape files used to establish beat designations. At the conclusion of the initial site visit, the origin of all necessary data streams for this study had been identified and agency personnel began actively gathering and compiling the information needed. A second on-site visit was made on October 4, 2021, to explore additional data gathering options and review some early hurdles in the data analysis.

After receiving the workload and leave data, the information was reviewed, analyzed, and compiled into a variety of spreadsheets to form an interactive staffing model. A third on-site visit took place on February 28, 2022 to present the preliminary results of the data analysis to the JPD Command Staff. At that meeting, various subjective settings in the staffing model were determined, a new beat proposal was presented and discussed, and potential alternative schedules were discussed.

A thorough analysis of the agency's workload revealed that the average officer assigned to the patrol shifts in 2022 will spend approximately 40.28 minutes out of each patrol hour on reactive activities. This leaves approximately 19.72 minutes per hour for proactive enforcement, traffic enforcement, and all other community policing activities. When possible, an agency should strive for an even split between proactive activities and reactive activities. This was the standard used by the author of the Police Allocation Manual (PAM) and is consistent with the recommendations of the International Association of Chiefs of Police during their use of the PAM model. In order to reach an even split of proactive and reactive time per hour, the agency would need 62 authorized positions in the Patrol Division. The division is currently staffed with 36 fully trained officers, eight recruits in the field training program, and three recruits currently in the academy.

The five-beat deployment plan currently in use shows an 8.21% difference in workload between the busiest beat and the least busy beat. A new 12-beat plan was created for the city that has only a 0.74% difference in workload between the busiest and least busy beat.

As explained later in the report, a 12-beat plan allows for more deployment options based on the number of officers per shift. Improved beat design reduces overtime, response times, and provides better officer familiarization with their assigned beats.

According to an analysis of the data provided by the Joplin Police Department, the current patrol schedule is not consistent with the days and times that the reactive workload is occurring. This report will detail alternatives to modify or replace the current patrol schedule in order to allocate JPD patrol resources in a more efficient way. A modification to the existing schedule and two alternative schedules were created and each is described at length in this report. The suggested alternative schedules would increase the schedule efficiency from its current level of 51.99% to as high as 80.74% before adding any additional personnel.

Although careful attention was given to accurately cleaning the database for analysis, there were some forms of workload that had not been effectively captured in the past. The most egregious example of this is the lack of documentation for the time spent writing police reports. This hurdle and the methodology used to account for the missing workload will be discussed in greater detail later in this report.

Total reactive time in future years is certain to increase as data collection processes improve and patrol officers become more consistent in documenting report writing times, follow-up times, and other activities that have been either unreported or underreported in the past. This researcher is convinced that patrol area configuration changes, deployment changes, and schedule changes within the JPD Patrol Division will increase the efficiency of the organization as well as offering benefits to the officers through equalized workload. While the recommended deployment and schedule changes can be implemented without the addition of any officers or supervisors to the Patrol Division, the full benefit of the changes will not be possible without additional patrol staff.

All spreadsheets created during this study have been submitted to the agency along with this report. By following the methodology explained in this report, the agency should be able to repeat this study on a three-year interval as crime patterns change and demographic shifts take place throughout the city.

The Patrol portion of this study is not based on officer-to-population ratios or benchmark comparisons to other cities, the limitations and assumptions of which will be discussed in greater detail within the report. This study is the first step towards a data-driven methodology that is specific to the needs of the City of Joplin. The results of this study are based on the “hours of reactive workload” encountered by the Patrol Division. By using an internal driver of “reactive hours,” the agency can obtain a greater degree of accuracy and specificity concerning the work that is being completed. In addition to showing how much work is present, the study results also show “when,” “how,” “why” and “where” the work is occurring.

This report and the accompanying models and spreadsheets are not designed to be a definitive answer to the question of “how many officers do we need?” Instead, they are meant to be a management tool to help the police administration and city leaders determine the number of officers required to meet specific performance objectives. The model is built to allow a great deal of interaction and manipulation. Each form of leave can be included or excluded with the click of a button to see how each category affects the total staffing requirements. The amount of proactive time per hour provided to the officers for community

policing can be set by the user. As proactive time increases, performance variables improve but the total staff size required will increase as well.

This report is meant to provide understanding of the principles contained in the models and to describe the data upon which the models operate. A written report can only provide static answers known at the time the report is written. The accompanying models are dynamic and will provide updated answers with every change in the variable settings. Therefore, the reader is encouraged to read this report with the staffing models available for review and to make time to understand how the models work. With the included forecasting routines, the staffing and deployment models can aid in improving performance and efficiency within the department for years to come.

The Detective Division was reviewed by examining historical workloads and using a benchmarking methodology against the metrics of comparable agencies. Members of these divisions are not CAD-driven and the majority of their work is not recorded in the agency CAD database.

The Detective Division provided six years of previous annual reports and monthly workload statistics. There was nothing contained in the historical data that led directly to staffing recommendations. After careful review, there were no significant trends for cases assigned, total staff, or clearance rates. In addition, there were no significant correlations found between staffing changes and performance changes.

A benchmarking method was used to compare the Investigations staffing levels to 30 other benchmark cities throughout the country. A detailed description of that process is contained in the report. The results of the regression analysis indicated that the current staffing levels in the Investigations Division are appropriate and consistent with the trend line from the sample of benchmark cities. As the number of sworn staff for the agency increases, the agency is encouraged to add one investigator for every 8.3 sworn positions added.

This is an in-depth process that prompts an agency to re-examine how they operate in order to produce greater efficiencies and improved data management. Results of this study are based on historical data. The results of the first year's analysis are going to be underestimated until better data collection methods have been implemented and the concept of workload reporting has been ingrained throughout the ranks. This model is not easy, but the benefits of greater management data, better efficiency, and enhanced ability for future planning far outweigh the additional work required.

Sustainable quality service cannot continue without a long-term vision. More than any other benefit, this model provides the JPD administration with a way to forecast needs. With proper planning time, the JPD can make the necessary preparations to ensure the quality of life that the citizens of Joplin expect from their city government.

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Jurisdiction and Agency

City of Joplin, Missouri

According to 2020 Census Bureau data, the City of Joplin had a population of 51,762 people over a 35.69 square mile area. The city has experienced a 3.2% growth rate over the past ten years. During that ten-year span the City of Joplin experienced the devastating EF-5 multiple-vortex tornado of May 22, 2011. Various estimates reported that 10% to 25% of the city was destroyed, including roughly 2000 buildings. The National Weather Service estimated damage to 75% of the city with nearly 7,000 houses destroyed and over 850 others damaged. Even with the loss from one of America's deadliest tornadoes and the most costly single tornado in US history, the city's population has increased.

The Joplin, MO Metropolitan Statistical Area (MSA), as defined by the United States Census Bureau, is an area now consisting of three counties, all anchored by the City of Joplin. In April of 2013, the extreme northwest county of Ottawa County, OK was added to Jasper and Newton counties in southwest Missouri. This increased the estimated 2013 population of the MSA to 207,488. Joplin and Miami, OK serve as the only two principal cities within the MSA with four other cities of 5,000 to 20,000 people, ten places with 1,000 to 5,000 people, eight places with 500 to 1,000 people, 28 places with less than 500 inhabitants, and 16 unincorporated places. Based on the most recent ProximityOne data from 2010, the City of Joplin's daytime population is estimated to increase by 40.4% due to incoming commuters.[1] Recent migration trends studied by U-Haul ranked Missouri as having the 7th highest migration growth in the country in 2020[2].

In addition to the standard population and daily commuters, Joplin is home to two residential institutions of higher education, Missouri Southern State University (MSSU) and Ozark Christian College (OCC). Spring 2021 enrollment for MSSU was 4,289 students with approximately 950 students living on campus in one of the twelve dorm buildings. The university has its own POST-certified police force consisting of one police chief and six police officers. Dispatching services for the MSSU Police Department are contracted through the Joplin Police Department. Ozark Christian College (OCC), a four-year private Christian college, is also located within the City of Joplin. OCC had a fall 2020 enrollment of 628 undergraduate students located on their 60 acre campus. In 2017 Kansas City University opened the doors of the Farber-McIntire Campus in the City of Joplin. This four year osteopathic medical school was the first medical school opened in Missouri in 46 years. The university partnered with many local corporations and organizations within Joplin to repurpose the temporary Mercy Hospital, built after the tornado in May 2011, as a fully-equipped medical facility, with housekeeping, security, and food service to compliment the medical staff. The university anticipates a total enrollment of 600 students, at least two dozen faculty members, and 60 staff members. In 2023, the university intends to open a

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[1] *Daytime Population City County State | ACS 2010*. (n.d.). Retrieved March 22, 2022, from http://proximityone.com/daytime_population.htm

[2] U-Haul International. "2020 Migration Trends: U-Haul Ranks 50 States by Migration Growth | U-Haul." Accessed March 25, 2022. https://www.uhaul.com/Articles/About/2020-Migration-Trends-U-Haul-Ranks-50-States-By-Migration-Growth-22746/.

College of Dental Medicine at the Joplin Campus with an estimated enrollment of 320 students when fully operational.

Joplin is center of what is regionally known as the Four State Area: Oklahoma, Arkansas, Missouri, and Kansas. The city is served by the mainline of the Kansas City Southern (KCS) Railroad as well as by branch lines of the Burlington Northern Santa-Fe (BNSF) Railroad and the Missouri and Northern Arkansas (MNA) Railroad. Interstate 44 connects Joplin with Springfield and St. Louis to the east and Tulsa and Oklahoma City to the west. Business 44 running through Joplin connects to Interstate 49 running north to Kansas City and south to Fort Smith, Arkansas. The Joplin Regional Airport provides daily roundtrip flights to Chicago and Denver by United Express. The proliferation of industry among the Interstate 44 corridor south of the city is evidence of the transportation opportunities that Joplin has realized.

According to the realtor.com[3], the median listing home price in Joplin was $155,900 in February 2022, trending up 11.4% year-over-year. Data received from the Joplin Planning, Development, & Neighborhood Services Department shows the number of residential construction permits for the city have been increasing steadily since 2015, reflecting ongoing demand for housing throughout the area. While the increase in the number of permits changes from year to year, the average increase since 2015 has been 8.26% per year. Within that same time period, the number of commercial permits issued has increased an average of 7.62% per year.

The economy of Joplin is not solely dependent on any single employer or industry. According to the city's 2019 Comprehensive Annual Financial Report[4], the top six employers in Joplin - with 1,000 or more employees - represented the health care industry (Freeman Health Systems and Mercy Hospital), the retail sales industry (Walmart), the public sector (Joplin School District), the service industry (Tri-State Motor Transit), and the production industry (Tamko Building Products). Other industries making the list of top 20 employers included public utilities (Liberty Utilities), education (Missouri Southern State University), and the communication industry (AT&T Mobility).

With the annexations underway by the Joplin Industrial Development Authority, a relatively low labor rate, Missouri's status as a right to work state, and the transportation possibilities, there is substantial reason to believe that Joplin's growth will continue.

Joplin Police Department

At the time of this report, the Joplin Police Department has 110 sworn personnel and 11 non-sworn personnel assigned to five divisions. In addition, the Dispatch Center is staffed with 11 full-time and 3 part-time civilians and the Joplin City Jail is staffed with 16 full-time civilians.

The *Administrative Division* is staffed by the Chief of Police, the Assistant Chief of Police, and a civilian Administrative Assistant. The Internal Affairs Unit, staffed with one sergeant, operates out of the Administrative Division to create a direct line of

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[3] *Joplin, MO Real Estate Market | realtor.com®*. (n.d.). Retrieved March 22, 2022, from https://www.realtor.com/realestateandhomes-search/Joplin_MO/overview

[4] "Joplin 2019 Comprehensive Annual Financial Report". Retrieved March 25, 2022, from https://www.joplinmo.org/Archive/ViewFile/Item/13579

communication to the Chief. The Chief and Assistant Chief are assisted by four captains who each oversee one of the remaining four divisions within the department. In total, this division has three sworn personnel and one civilian. There is an unfilled corporal position within the Internal Affairs Unit.

The *Uniform Operations Division* is the largest division within the JPD with a current staff of 61 sworn personnel and one civilian. This division consists of five uniform patrol teams responsible for answering calls for service and conducting all routine patrol. Members of this division are primarily the first responders throughout the city and therefore serve as the most visible members of the JPD. Every new officer starts within the Uniform Operations Division until they have proven their ability as a solo police officer. New specialty units created within the agency or promotions within the agency typically create a vacancy in the Uniform Operations Division. The Uniform Operations Captain oversees the division and is assisted by six sergeants. Each sergeant is assisted by a shift corporal and oversees the patrol officers assigned to their respective shift. Five shifts are assigned to uniform patrol duties, the sixth shift is the Traffic Unit. Since this division is the main focus of this study, more details on individual team staffing will be provided in later portions of this report. There are currently 16 unfilled positions in this division; one DWI officer, one K9 officer, four traffic officers, and ten patrol officers.

The *Support Services Division* houses a mix of sworn and civilian units. The Support Services Captain, who is assisted by a sergeant, oversees four School Resource Officers (sworn), three Crime Free officers (sworn), and two civilian radio technicians. The Dispatch Center, led by a civilian manager and three civilian supervisors, exists within this division and is staffed with seven full-time civilian dispatchers and three part-time civilian dispatchers. The City Jail, also within this division, is led by a civilian manager and four civilian supervisor who oversee ten full-time civilian detention officers, two part-time civilian detention officers, and a civilian cook. In total, this division has nine sworn personnel, 32 full-time civilians and five part-time civilians. A corporal position and a Crime Free officer position in this division is currently unfilled as well as seven full-time positions within the Dispatch Center.

The *Professional Standards Division* has a total of four sworn personnel and six civilian personnel. The Professional Standards Captain oversees a sergeant and two sworn officers in the Training Unit. The captain also oversees four records clerks in the Records Unit, a civilian crime analyst (who is also the agency's CALEA coordinator), and a civilian police service assistant who staffs the police department's front lobby for walk-in reports and phone inquiries.

The *Investigations Division* is led by an Investigations Captain and is staffed with a total of 19 sworn personnel and one civilian secretary. The division is split into a Property Unit and Persons Unit. The Property Unit is staffed with a sergeant, and five sworn investigators. The Property Unit Sergeant also oversees two investigators assigned to the Southern Missouri Cyber Crimes Task Force. The Persons Unit is staffed with a sergeant, a corporal, and four sworn investigators. The Persons Unit Sergeant also oversees one US Marshal task force investigator and a corporal and investigator assigned to the Ozark Drug Enforcement Team. A final FBI task force investigator reports directly to the division captain. There is currently one corporal position and five detective positions unfilled in this division.

At the time of this report, the Joplin Police Department has 25 unfilled positions. The Investigations Division has five investigator positions and one corporal position unfilled. The

Support Services Division has one corporal position one patrol officer position on the Crime Free Unit unfilled. The Uniform Services Division has one patrol officer position, one DWI officer position, one K-9 position, four traffic officer positions, and ten patrol officer positions unfilled. Among the 48 patrol officer positions filled in the Uniformed Services Division, eight of those positions are filled by trainees who are not yet eligible to patrol as a solo unit and three positions are filled by new hires still in the academy.

The JPD provides additional services to the City of Joplin and neighboring agencies through specialty teams. These teams are staffed by patrol and investigations personnel in addition to their normal assignment (referred to as collateral duties). Current specialty assignments include the Special Weapons and Tactics (SWAT) Team, Crime Scene Investigators (CSI), Honor Guard, and drone pilots. Many officers also serve collateral roles as instructors in various disciplines such as firearms instructors, field training officers, defensive tactics instructors, taser instructors, emergency driving instructors, and less lethal instructors.

Table 1 shows the current staffing levels and division assignments for sworn, civilian, and unfilled positions within the department as of April 19, 2022. The table includes staffing for the Joplin City Jail and the Joplin Dispatch Center since they fall under the supervision of the Police Department.

Table 1.	**Administration**	**Uniform Operations**	**Support Services**	**Professional Standards**	**Investigations**	
Chief of Police	1					1
Assistant Chief	1					1
Captain		1	1	1	1	4
Sergeant	1	6	1	1	2	11
Corporal		6			2	8
Officer		37	7	2	14	60
Unfilled - Sworn	1	16	2		6	25
						110
Trainees		11				11
Civilian	1	1	35.5*	6	1	44.5
Unfilled - Civilian			7			7
	*Includes 17 full-time jail staff, 2 part-time jail staff, 14 full-time dispatch center staff, and 3 part-time dispatch center staff					***62.5***

Staffing Methodologies

The law enforcement profession presents a unique challenge to those responsible for staffing and scheduling public safety staff. Not only must they schedule a 24-hour operation that operates every day of the year, they must also attempt to staff proportionally to a workload that varies by time of day and day of the week.

Patrol workload can be best described as “non-uniform but predictable." Calls-for-service are not received uniformly in consistent intervals. Furthermore, the time required to handle a call-for-service can vary greatly depending on the nature of the call. Although it is not possible to know what type of call will happen at what time, police agencies can reliably predict, based on past history, the times of highest and lowest call volumes.

Call-for-service levels are important but they are not the only considerations when determining staff sizes and scheduling employees. Minimum staffing levels must sometimes be considered. Even at times when call volume is expected to be low, agencies may need to staff additional employees to ensure the ability to answer sudden spikes in calls safely and promptly.

Law enforcement agencies operate in a volatile environment that often requires dealing with complex problems. Many facets of the agency function in an environment that is void of walls, roofs, or fences. Working conditions and workload is affected by weather, national events, political activities, natural disasters, demographic shifts, and numerous other environmental, economic, and social factors that affect a community. When the volume of work begins to exceed the available number of officers, a police agency cannot close its doors or stop answering the phone. It must prioritize the calls, respond with a bare minimum of units to ensure safety, or hold the calls until a unit becomes available.

Officer-to-Population Ratios

Determinations of optimal staffing have been attempted in a number of ways over the last several decades. A common method of estimating adequate staffing is using officer-to-population ratios published each year by the FBI in a report entitled "Crime in the United States" (CIUS). The CIUS report provides a plethora of tables, one of which is a table displaying the number of sworn officers per 1000 population (Table 71).[5] The ratios provided in the table are based on two criteria, the population range in which the agency falls, and the geographic location of the agency within the United States. The ratios are not particularly useful for individual police agencies since they do not take local criteria into account. The chart does not consider local demographics, socioeconomic status, crime rates, geographic size, or a host of other important considerations.

It should be noted that the authors of the CIUS report specifically state that the statistics provided are not to be used as staffing guidelines. The report states:

> "Because of law enforcement's varied service requirements and functions, as well as the distinct demographic traits and characteristics of each jurisdiction, readers should use caution when drawing comparisons between agencies' staffing levels based on police employment data from the UCR program. In addition, the data presented here reflect existing staffing levels and should not be interpreted as preferred officer strengths recommended by the FBI. Lastly, it should be noted that the totals given for sworn officers for any particular agency reflect not only the patrol officers on the street, but also the officers assigned to various other duties such as those in administrative and investigative positions and those assigned to special teams."[6]

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[5] FBI. "Table 71." Accessed March 28, 2022. https://ucr.fbi.gov/crime-in-the-u.s/2019/crime-in-the-u.s.-2019/tables/table-71/table-71.xls.

[6] FBI. "Police Employee Data." Accessed March 28, 2022. https://ucr.fbi.gov/crime-in-the-u.s/2019/crime-in-the-u.s.-2019/topic-pages/police-employee-data.

When an agency creates specialty policing units such as School Resource Officers, Bicycle Units, Street Crimes, and Crime Prevention Units, those officers are most often drawn from the patrol division. This leaves fewer officers to answer calls-for-service and conduct routine patrol. This reduction in the patrol staffing is not recognized by the officer-to-population ratios since the officers in the specialty units would still be counted as a sworn officer for purposes of the FBI statistics. Thus, the creation of specialty units to respond to specific requests of the community works against the agency when using officer-to-population ratios to estimate optimal staffing in patrol.

Population as a Workload

Population is an external workload that does not change based on the goals and self-motivation of the employees within the comparative divisions. More importantly, population does not adequately measure the amount of work created for the various divisions of the agency. Cities typically have a diverse demographic profile among residents. The amount of work created for a police department by a particular neighborhood can be affected by many variables such as the neighborhood's socioeconomic status, unemployment rate, or demographic composition just to name a few.

Census populations only include the people who live in the community as residents. Ratios and comparisons based on population do not take into account additional people that commute into a community for work, tourists that are drawn to a community, college students that claim residency at an alternate home address, or migrant workers who may not appear on any US census report. Although these additional groups are not reflected in the city's population, they must be afforded police services and protection.

Benchmarking

A second method that is often used is a comparative analysis based on a number of "similar" agencies. This is referred to as "benchmarking." This process, like officer-to-population ratios, is also fraught with inherent assumptions and limitations.

The first assumption is that the similar agencies used in the comparison are truly "similar." Agencies must be found that share similar populations, agency sizes, and geographic locations. Other considerations such as demographics, socioeconomic status, geographic size, crime rate, and population density must also be considered. The list of comparable characteristics could be endless as an agency seeks to find the ultimate set of comparable agencies.

Benchmarking processes assume that the comparable cities are operating under the same philosophy and mission as the agency under study. Some communities applaud an agency that uses strict enforcement and zero tolerance to maintain a safe community while others would view such tactics as oppressive and overzealous. One community may be willing to fund more officers per population to gain greater visibility and officer presence while another community may feel adequate police protection exists.

A third assumption is that the chosen similar agencies are staffed appropriately. If an agency chooses four similar agencies that are all understaffed, the entire exercise becomes futile. If inquiries were to be made to the similar agencies about the appropriateness of their current staffing, one may receive many different answers, all dependent on who is answering the question.

Empirical Quantitative Analysis

The assumptions and limitations associated with population-based studies or benchmarking attempts can be overcome using internal workload measures that reflect the actual demands placed on the various divisions within an agency. By using available internal workload measures collected and analyzed over a multi-year history an agency can determine an optimal staff size for each division that is based on the unique characteristics of the community.

For most police patrol divisions, an appropriate internal workload already exists in the form of historical Computer Aided Dispatch (CAD) data. CAD systems typically capture each activity that an officer performs along with important dates and times such as dispatching times, arrival times, and cleared times. By carefully analyzing an agency's CAD data over past years, a forecast can be made of the total hours of work that a patrol division can expect in the current year and years to come.

This workload measure, the total hours of expected work, can be used as the basis of an empirical quantitative staffing and allocation study. Once the workload is accurately determined, an agency can set performance levels for patrol based on the minutes of proactive patrol time each hour that is allotted to the average patrol officer. After determining the officer availability ratios for the agency based on current time-off policies and schedules, an administrator can determine the optimal patrol staffing for the community being served.

This method is not a one-size-fits-all methodology for staffing. It is unique to the agency under study and driven by data. The method can be replicated in future years and does not rely on the assumptions of comparative methods. Most importantly, the process is easily modified based on data within the agency to meet special circumstances that may arise within the community.

Workloads for other divisions within police agencies are not always as easy to determine as that of patrol. For investigative divisions and other employees that are given a great amount of autonomy throughout the work-day, quantitative workload data may be limited or non-existent. In these situations, less reliable methodologies may have to be used temporarily until a valid workload determination can be made.

Methodologies Used

The Joplin Patrol Division was analyzed using the PAM model (Police Allocation Manual). PAM is an empirical methodology based on internal quantitative data provided by the Joplin Police Department. Six years of historical CAD data was analyzed to produce a model capable of predicting future patrol workload. In addition, the agency provided data pertaining to officer leave times, training times, and other non-patrol days. This information was used to determine officer availability.

The historical CAD data and officer availability ratios were used to determine the current number of minutes spent per hour on reactive calls by the officers assigned to the Patrol Division. The spreadsheets provided to the agency, along with this report, can be used to determine the necessary staff sizes needed to meet a desired balance of proactive and reactive time per hour for the division.

The same workload data from CAD was used again to determine the workload distribution among the five existing patrol beats. The city was divided into 533 individual

reporting areas (IRAs) and the workload in each IRA was determined. Using the workload in each IRA, a new patrol beat structure was created using twelve patrol areas with even workloads.

Finally, the CAD data was charted by hour and day to create a set of workload curves depicting when the workload was occurring within the city. These workload curves were compared with the current work schedule to measure the efficiency of the existing schedule and to explore the existence of more efficient alternatives to the existing schedule.

Initial Site Visit

The initial site visit at the Joplin Police Department was conducted on March 30th and 31st, 2021. The main purpose of this visit was to meet with the Command Staff and the Patrol Division administration to discuss their operational concerns and the methodology to be used for the study. A second objective for the first on-site visit was to meet with all agency representatives who would be responsible for providing workload and leave data to be used in the analysis. A brief overview of the staffing study methodology was presented to each patrol shift and to the members of the Investigations Division during their respective shift briefings to address any questions or concerns anyone might have had about the study. A ride-along was conducted with a second shift officer to get a first-hand look at the city from the perspective of a JPD patrol officer.

By the end of the two-day visit, all necessary data for this study had been identified and meetings had been held with all personnel responsible for collecting the data. Numerous opportunities had been provided for questions or to voice concerns and all administrators had been briefed on the process to follow over the next 12 months of this study.

Collection of Workload Data

The majority of the information used to estimate patrol workload was extracted from the Joplin (CAD) database. Joplin currently uses a CAD software suite from “Central Square”. The CAD software integrates the dispatching software in the Dispatch Center, the in-car software used by the patrol officers and the Records Management Software (RMS) used within the agency.

During the initial site visit, a meeting was held with the Crime Analyst to discuss the data extractions that were needed from the Central Square database. Five years of historical data including incident data and unit history data from 2016 through 2020 were requested. The combination of these extractions would provide information on all calls for service handled by the Patrol Division as well as the time spent on each call by every officer assigned to the call. Activities could then be sorted by individual employee, day of the week, hour of the day, or activity type.

Due to a network security incident experienced by the City of Joplin shortly after this study began, the initial set of incident files could not be submitted to Etico Solutions until late August of 2021. The JPD provided five incident files containing all calls per year for each calendar year from 2016 through 2020. The incident files provided information on every call that was dispatched through the CAD software including call dates and times, the nature of each call, report numbers, CAD event numbers, and locations by latitude and longitude.

In early September, the JPD provided a set of 154 unit history files containing information for every officer that responded to every call from 2015 through 2020. Each record contained the event number, the date, the nature of the call, the officer's dispatch time, enroute time, arrive time, cleared time, and the hours spent on the call. In addition, each record also showed the street address, the officer's disposition, the report number if one was issued, and the unit number of the responding officer.

Once the files were cleaned and merged into a single unit history database and a single incident database, the initial analysis could begin. After many weeks of data analysis, it was discovered that the latitude and longitude fields in the incident files did not match the street locations provided in the unit history files due to an error in the initial query. This meant that new queries had to be conducted to correct the incident files and a large portion of the analysis had to be redone. The corrected files were received in November of 2021 and the analysis resumed. By the time the databases had been corrected, it was nearing the end of 2021. In order to provide the most up-to-date recommendations, a decision was made to run the queries once again after January 1, 2022 in order to include 2021 data in the resulting models. JPD provided another 114 unit history files for calendar year 2021 on January 7, 2022 and another 12 incident files were received on January 12, 2022. Once all files were received and merged, there were 493,608 records in the 2016-2021 incident data and 1,025,825 records in the 2015-2021 unit history data before any data cleaning, collapsing, or analysis began.

Collection of Officer Leave Data

Officer availability was the second major piece of information necessary for this study. To calculate officer availability, it was essential to determine the average annual hours per officer for regularly scheduled days off, time spent in training, leave time taken, overtime worked, and time spent on special assignments away from their primary duty. This data was challenging to obtain. The number of regularly scheduled days off was easily calculated based on the agency's duty cycle schedule. However, the record-keeping process for leave times, overtime, training, injury/light duty assignments, and other shift exceptions is primitive and limited in the absence of a robust server-based personnel tracking application.

The JPD makes every attempt to assign officers on light-duty to various positions within patrol when positions are available. Officers on such duty are assigned to take cold reports over the telephone or assist the Patrol Division with other tasks that are within their temporary capability. On rare occasion, an officer will be assigned outside of the Patrol Division during an extended term injury. The decision of assignments for light-duty officers can have an effect on patrol staffing needs. If a light-duty officer can fill a position that would otherwise be staffed by full-duty patrol officers, such as a desk assignment, the light-duty status will not affect staffing. However, if the light-duty officer is reassigned outside of patrol, to detectives or training for instance, the time that is spent outside of patrol must be captured and included in the average amount of time off patrol.

A final consideration that must be analyzed is the number of patrol officers that are assigned to temporary detachments outside of the Patrol Division such as "military leave" or special assignments. Each day that a patrol officer is assigned to some other division or an assignment outside of their regular assignment, it increases the reactive workload of those remaining in patrol. This affects the total number of officers that must be assigned to

patrol to meet desired performance levels. Reassignments in the Patrol Division are not common but when an officer is reassigned, the time-frame is often significant. Exact dates and times for such reassignments were not consistently tracked by the JPD, once again due to the absence of a robust personnel tracking application.

Initial Observations

The amount of workload data found in a CAD database is highly dependent on the reporting practices within the Patrol Division and the dispatching center. Work that is not reported by the patrol officers or not entered into the CAD by the dispatchers skews the amount of estimated workload for the Patrol Division.

As with most agencies in past studies, patrol supervisors at JPD confirmed that patrol officers are not consistently documenting all activities that are being performed. In other cases, officers are advising the dispatchers to clear a call out of the CAD system prior to the call being handled completely. This practice of “prematurely clearing a call” is often done in an attempt to keep the call-for-service queue empty and response times to a minimum. When work is performed and not called into the dispatcher, that work is not recorded and credited to the agency as patrol workload. This often occurs during times of high radio traffic when the radio channels become saturated. This issue will be addressed later in this report. It was also determined that time spent writing police reports would not be accurately represented in the CAD data. An alternative method for accounting for report writing times will be discussed in a later section of this report.

When this study commenced, the City of Joplin relied on paper time sheets submitted every two weeks by all personnel. Hours worked, hours of leave taken, and the hours of overtime worked per pay period are being tracked but the process is prone to error. Furthermore, a very limited number of overtime and leave codes cause the data to be captured in very generic “buckets” (“14 comp time earned”, “15 call back pay”) instead of specific documentation of the various causes of overtime. This is valuable management information that should be available to the police administration as needed.

Documentation of time spent on shift exceptions that do not affect payroll was an even larger challenge to obtain. The amount of time spent on training, in lieu of a regularly assigned workday, effects the number of personnel needed in the Patrol Division. When officers are pulled from their typical patrol assignment to train, their pay is unaffected and the training times do not appear on their time sheets. If an officer trains on overtime, it appears in the timesheet as overtime but there is no specific code to indicate that the overtime was spent on training. This same dilemma occurs for all shift exceptions such as special assignments, light duty assignments, and extended illnesses. After several months of document review, meetings, and conversations, it was determined that the only way to estimate training times per officer per year was to establish a sample of patrol officers for each calendar year that were in patrol for the entire calendar year. Once the sample was confirmed, a deep review of all training courses per officer had to be conducted manually to determine an overall training average per officer. A web-based personnel tracking application would solve this issue and provide one central database in which to store all overtime, leave, and shift exceptions accurately and consistently.

Resource Analysis

The process of determining appropriate staffing size is referred to as “Resource Analysis.” There are two distinct parts to this analysis; (1) the determination of total workload for the Patrol Division and (2) the calculation of officer availability. CAD data for 2016-2021 was analyzed to determine the total workload while leave data, training data, and overtime data was used to calculate officer availability.

Patrol Workload

Total workload in this study was calculated by categorizing all work performed by the Patrol Division, determining how often each category of work is performed in a given year, and then calculating an average time to complete each category of work. The most logical and reliable method of identifying workload for an agency’s patrol division is using the agency’s CAD data to catch the bulk of activity and then identifying other workload that is not available through the CAD. Additional workload includes report writing, shift briefings, patrol vehicle maintenance, and other tasks that must be completed as part of an officer’s normal duties.

CAD Filtering and Collapsing

To better explain the process used, it is important to define several key terms concerning the CAD database. The CAD database looks like a large table. The rows in the table are called records while the columns in the table are called fields. Each time a patrol activity (event) is created in the database, the system assigns a unique “Call” number to that activity. All officers responding to that event (primary units, assisting units, supervisors, command staff, etc.) will have their own record in the CAD but will share the same unique “event number” related to that event.

If an event has two or more officers responding, the event number for that event will appear in numerous records in the database. Therefore, when looking at the number of event numbers assigned during a given time period in an unfiltered CAD, the activity of the agency may be underestimated due to the number of events requiring a multiple officer response. Conversely, counting the number of records in an unfiltered CAD database will overestimate the frequency of each call type since the unique event number will be duplicated for every officer responding on each call.

While the CAD database holds key information for a workload study, it must be filtered in a number of ways and collapsed before the information becomes useful for accurate analysis. The following steps detail the general process in filtering and collapsing the CAD data for analysis.

Selecting appropriate fields

The *incident* table in a CAD database holds a very large number of fields that may or may not be important in a resource analysis study. Prior to extracting the incident data from the CAD database, a careful selection of fields was made. The selection criteria included any field that provided insight into the type of activity being handled, the location of the activity relative to different districts and reporting areas, the times associated with the original call, the particular unit or employee responding, and any unique identifiers that would allow the various databases to be cross-referenced. If a field could possibly hold

information of value, it was included in the list and could always be deleted later if found to be unnecessary. The following fields were chosen for inclusion in the *incident* table exports:

- CAD Event #
- Call Date & Time
- Report #
- Call Nature
- Call Source
- Primary Unit
- Latitude
- Longitude

The Unit History table provides all information on the individual units that responded to each event. The following fields were chosen for inclusion in the *unit history* table exports:

- CAD Event #
- Call Date
- Report #
- Call Nature
- Unit ID
- Dispatch Time
- Enroute Time
- Arrival Time
- Clear Time
- Total Time on Call
- Street Address
- Disposition
- Comments

Filtering by Unit IDs

Once the databases were extracted, they were provided to Etico Solutions in electronic format. The six years of incident data were merged into a single file to facilitate analysis. A new field was written to each record to identify the area of assignment for the Unit ID referenced in the record. This allowed the ability to separate the time on call spent by each classification of employee (patrol officers, detectives, K9, etc.). The following assignments were used to differentiate the type of responding unit:

- Patrol Officer
- Patrol K9
- Patrol Corporal
- Patrol Sergeant
- Patrol Captain
- DWI Officer
- Traffic Officer
- Traffic Corporal
- Traffic Sergeant
- Telephone Reporting Officer
- School Resource Officer
- Reserve Officer
- Crime Free Officer
- Investigations
- Support Services
- Professional Standards
- Administration

Call Time Summation

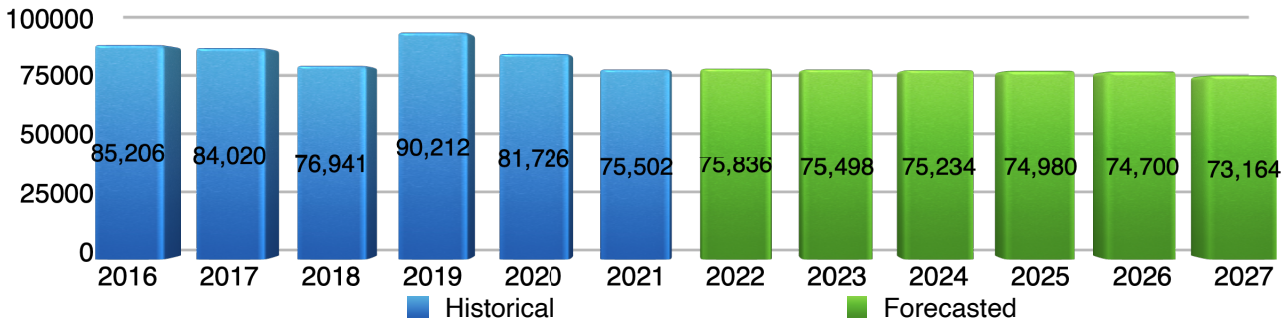
To determine workload, the total amount of time spent on each event by each unit was written to a new field in the database based on their assignment. The total of all officers in each unit assignment (investigations, patrol, K9, etc.) was then summed for each unique event and written to a new field in the database. After aggregating the call times listed above, the database was collapsed to show only one record for each event. Each record reflected the total time on that call by all officers assigned to the incident sorted by the type of unit. In other words, for each call, the database showed the total time spent by patrol officers, the total time spent by detectives, the total time spent by traffic officers, etc. The analysis of the call-for-service data could now begin.

Call-for-Service Forecasting

An Excel pivot table was created to show how many events of each event type were recorded in 2016 through 2021. Using the frequency of each event type from the past six

years of historical data, a linear regression forecasting routine in Microsoft Excel was used to estimate the expected number of events for 2022 through 2027 (Chart 1).

Chart 1. ***Annual Number of CAD Events***



The accuracy of this estimation gets lower as the estimate gets farther from the historical data. This estimate is based solely on the existing CAD data. The numbers reflected do not include potential annexations, infill, or other future developments. It is expected that future patrol activity totals will increase over time as officers begin to document more of their activities and as activity tracking procedures improve within the police department.

Calculating Patrol Workload

The desired workload for patrol is not the number of incidents or calls-for-service that patrol officers respond to, but the total number of hours required to meet the obligations of the Patrol Division. An average time on call was determined for each patrol activity using data from 1/1/2016 through 12/31/2021. The frequency of each patrol activity type for each year was then multiplied by the average time required to handle that activity type.

All patrol activities were categorized as either reactive or proactive. Reactive activities include calls for service at the request of a citizen, activities that are considered to be criminal in nature, on-view events that require an officer's immediate attention, or any other activity that an officer would be expected to address when it is brought to their attention. Proactive activity include the self-initiated activities performed by officers when not on a call for service. Proactive activities would include administrative details, alcohol stings, bar/building checks, car stops, pedestrian checks, foot patrols, and house checks. The sum of all reactive patrol activity times determines the total number of reactive hours that patrol is responsible to meet.

By calculating an average time on call for each incident type, the average times can be multiplied by the forecasted incident frequencies for future years yielding an estimated workload for projected years.

Current Limitations of CAD Data

Law enforcement CAD software encompasses a vast amount of data that can be used for managerial decision making within an agency. However, the usefulness of the data is highly dependent on the quality and the quantity of the information being entered into the CAD. A number of situations exist that prevent workload data from being entered into the CAD accurately and consistently.

It is important to educate the officers in the Patrol Division about the need to call in all work being performed in an accurate and consistent manner. The average patrol officer has little to no exposure to the concepts of resource allocation and how patrol workload is used to determine appropriate staffing levels. Many patrol officers believe that calling out self-initiated activities such as criminal traffic stops and suspicious subjects is done to inform the dispatcher of the officer's location in case assistance is needed.

If the officer's perception of documenting self-initiated activities in the CAD is based on officer safety, the officer is likely to only call out activities that have anticipated risk. Park checks, business checks, report writing, evidence processing, and many other self-initiated activities that are done in between calls-for-service are less likely to be documented. This process of under-reporting work is occurring in the City of Joplin. To correct this, all officers need to be exposed to the concept of "patrol workload" and how the work they document in the CAD is used to determine proper staffing for the division. Once the perception of documenting workload is changed from an "officer safety" activity to a "workload documentation" activity, the amount of data collected in the CAD is almost certain to increase.

A second limitation to the amount of data reaching the CAD is the method or process of documenting activities. In past studies with other agencies, officers have acquired the habit of calling the communication center on the radio and asking the dispatcher to "put them out" at a particular location on "available" status. The officer specifies an available status so that any calls coming into their assigned area will still be sent to them while they are out at that designated location. When the officers ask to remain available, the dispatcher does not create an event nor change the officer's status, they simply make a comment in the unit log of their location. Any activities conducted by the officer will not be recorded in the CAD and cannot be used later as patrol workload. Unlike the first situation, where the officer is not calling out their activity, the officer is now calling out their activity but due to the desire to remain available for calls, the activity is not being entered in a way that can be used for workload. Conversations with JPD administrators did not indicate that this practice is occurring with any regularity in Joplin. However, the scenario is included in this report as a scenario to watch for as the agency continues in a data-driven allocation model.

A similar variation of this problem is also commonly seen in law enforcement agencies throughout the country. Periodically, officers will notify the dispatcher that they are "out at the station" or "busy." While this status may have the ability to be tracked and the frequency of this status can be counted, the status in use generically represents a myriad of activities. When examining data to determine reactive workload and proactive workload, categories such as "out at the station" and "busy" provide little insight into the nature of work being done. A few activities of this nature were found in the Joplin data. "Check own satisfaction" is currently available as a type code and was used an average of 2531 times per year over the six years of analyzed data. "Lobby call" is currently available as a type code and was used an average of 1,353 times per year. These two examples provide very little indication of the nature of the call and could have been used to represent a combination of proactive and reactive activities.

The JPD is currently using a single event type of "car stops" to capture all traffic related stops. Criminal traffic offenses such as driving while intoxicated (DWI), driving while license suspended/revoked (DWLS), fleeing and eluding, and careless driving are all included in this event type. When calculating the average time on call, including criminal traffic events

with routine traffic skews the average time spent on call. Industry practice is to always track criminal traffic offenses under independent event types.

Out-codes are not found in all CAD applications. Within the Central Square CAD, an activity can be documented under an *incident type* with a designated incident number or the activity can be logged in the unit history log with the officer's unit ID under a *status code*. If a call is received from a citizen with a request for assistance, the call will certainly be documented under an incident type and given an incident number. However, if an officer is stopping by the station to complete an administrative task that is not related to a particular call for service, they may notify the communications center of their location and ask to be put "out" on a "station detail" or "out of service" status. The officer's status in the CAD system will be changed and a record will be entered into the *unit history log* with the officer's unit ID, the updated status, and a time stamp of the date and time the officer began the new status. When the officer completes the task at the station, they will notify the communication center that they are "clear" and their status in the unit history log will be changed back to "available" with another timestamp of the date and time.

Out-codes serve several functions. They provide the location and status of each officer on the shift so the dispatcher does not have to remember where each officer is presently located when a new call for service arrives. Out-codes also allow other officers and supervisors to quickly see how many available officers are remaining on the street. If there are only a few officers available, other officers will sometimes limit their proactive efforts to remain available for calls. A second, less obvious function of out-codes is to document officer and supervisor activity that is not directly case related. Many proactive activities such as bar checks, foot patrols and house checks can be tracked using out-codes without the need to create an event in the *incident* file. While out-codes are simple to use and can usually be added to a CAD configuration, they cannot be easily traced back to a particular event if the original event number is not consistently recorded in the comment field of the out-code. Therefore, if an agency wants to append the time spent writing criminal reports and conducting follow-up activities back to the original event, out-codes will require some additional steps by officers.

To track case related activities such as report writing and follow-up investigations, the second option is to reopen the original case and place the officer back on the original call. This second option is not without consequences. In most CAD applications, when a call is reopened to allow officer activity to be appended to a call, the "closed" time for the case gets re-written with the new close time from the follow-up activity. For example, if an officer is dispatched to a burglary call on Friday night at 8 pm and clears the call at 8:30 pm, the time spent on that call in the CAD will be recorded as 30 minutes. If the officer returns to work the next day and reopens the call at 4 pm, writes the report, and re-closes the call at 4:30 pm, the time spent on the call has actually increased to one hour. However, the CAD will show the initial time on call as Friday at 8 pm and the time closed as Saturday at 4:30 pm, an erroneous total of 20.5 hours spent on the call.

Another limitation that has been observed in other agencies is the tendency of officers to prematurely clear a call from the CAD before the work has been completed. Many officers place a higher emphasis on keeping the call-for-service queue clear than on properly documenting the actual amount of work being performed. The officers may not be at fault for this as there is sometimes strong encouragement by administration, supervisors, and other officers to address calls quickly and to maintain a minimal response time. In this

scenario, an officer may advise the dispatcher to clear a disturbance call as soon as the officer arrives on scene. The officer will then spend 20 minutes patrolling the area in an attempt to locate the cause of the disturbance before leaving the area and resuming routine patrol. The officer's intention is to get the call out of the call-for-service queue quickly so that other calls can be addressed. However, by asking the dispatcher to clear the call prematurely, the CAD data reflects a call that takes three minutes when, realistically, the call may have consumed 20 to 25 minutes of the officer's time. Advising back-up units to disregard when assigned to a two-officer call creates a similar problem. A two-officer alarm call which may require a total of 20 minutes of patrol officer time only reflects a ten minute response when the secondary unit is called off prematurely. The officer is not trying to skew the workload reporting times, they are trying to free up the back-up officer for other calls and will often "advise" if they need the second unit upon arrival.

The largest loss of workload data in most agencies is unreported or under-reported time spent writing police reports. During times of high call volume, most officers will respond to a call for service, obtain information for a report, and then clear the call. If calls are holding in the call for service queue or if there is an opportunity for proactive patrol, the officer will wait to write the report until later in the shift when the activity level slows. In the majority of cases, the officer will either write the report while still on an "available" status or they will call out using any number of status codes including "admin detail", "out of service", "station detail" or "reports." This practice prevents the agency from being able to accurately estimate the average time spent writing reports for the various call types (burglary, assault, DUI, theft, etc). Currently, the agency has a status code for "reports" but it is only used an average of 1,798 times per year. The average number of police reports written per year from 2016 to 2021 was 12,135 reports per year. If the average time per report is estimated at 30 minutes, the agency could be losing over 5,000 hours per year in under-reported or unreported work. The need to document this workload should not be overlooked.

To better estimate the number of hours spent writing reports, a blind survey was conducted with 20 officers chosen by the agency. Each officer was given a list of current event types found in the CAD. The officers completed the survey by estimating the length of time spent writing a report for each incident type based on their own personal experience. The lists were returned to the contact person and forwarded to Etico Solutions. The survey results were aggregated and an average estimated time to complete a written report for each incident type was calculated.

Using the CAD database from 2016 through 2021, the annual frequency was determined for the number of reports taken for each event type based on the presence of an assigned case number in the record. The number of reports taken per event type was then divided by the total number of incident for that type in that year. This determined the percentage of time that a report was written for each event type in each year. Finally, to estimate the average time spent on report writing, (1) the number of occurrences in each event type, (2) were multiplied by the percentage of time a report number was issued for that event type, and (3) then multiplied once again by the average time to write a report for that event type. This calculation was done for all 143 event types. The estimated time spent writing reports was then added to the average time spent on-scene by the officers to get a total time spent on each event type.

The limitations of the CAD data, due to unrecorded workload, will cause the total workload for the Patrol Division to be underestimated in this initial study. However, most of

the under-reporting that is currently taking place can be corrected with new activity codes and status codes in the CAD, proper training on reporting protocols, and persistent supervision to ensure that all work is being reported to the dispatcher.

Daily Administrative Duties

In addition to answering calls for service and conducting self-initiated activities, there are a number of administrative duties that must be performed each day by the patrol officers. Based on discussions with agency personnel, the average time for briefing at the start of each shift and debriefing at the end of the shift was estimated. Time spent on meals, breaks and refueling was determined from the unit history records. The estimated daily administrative time per shift is as follows:

Table 2.

Type of Activity	Minutes per shift	Hours per shift
Briefing & Shift Prep	30.0	0.500
Meals	28.2	0.470
Breaks	11.4	0.190
Refueling	10.0	0.140
De-briefing	15.0	0.250
Total	94.6	1.550

The administrative duties listed in Table 2 occur daily for every officer fielded in patrol. The time spent performing these administrative duties is time taken away from the ability to answer calls for service. Thus, each administrative duty increases the need for officers in the Patrol Division. Many of these administrative duties are unavoidable either due to labor agreements or practicality. However, they should be reviewed continuously due to their direct effect on patrol staffing.

Total Reactive Workload

Bringing all of these activities together, the total reactive workload for the Patrol Division consists of: the total time required to handle reactive activities reported in the CAD; the time required for report writing and any other activities that are not currently being captured by the CAD; and the time required for the daily administrative duties of the officers. It is important to remember that the total reactive workload assumes that officers will be responding from call to call with no proactive time in between. Therefore, using only the reactive workload will determine only the minimum number of officers required to meet minimum expectations.

This report is accompanied by an Excel spreadsheet that contains the historical and predicted number of activities for each incident type. The spreadsheet also contains the average time on-scene calculated for each incident type and the average time required for daily administrative duties of the officers. From the spreadsheet calculations, the total hours of reactive workload for the Patrol Division from past years and forecasted into previous years are graphed in Chart 2 and listed in Table 3.

The numbers reflected in Chart 2 are yearly totals. The minimum number of on-duty officers required per day can be determined by first dividing the annual totals by 365 (days in a year) to get an average daily reactive workload. The daily workload is then divided by

the shift length (10-hours less time required for daily administrative duties) to determine the minimum number of on-duty officers that must be fielded every 24 hour period. The minimum on-duty officers required per day, each working one shift, is shown in Table 4.

Chart 2.

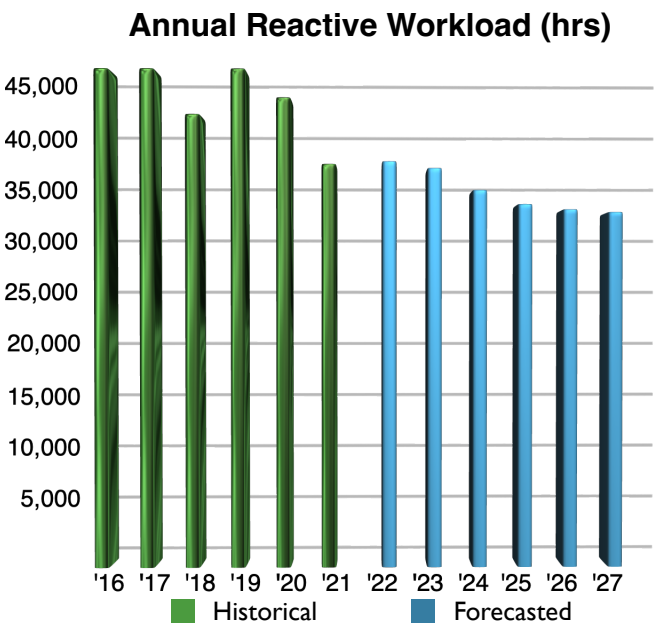


Table 3. ***Reactive Workload (Hrs)***

2016	45,503	2022	36,686
2017	50,033	2023	36,085
2018	40,912	2024	34,108
2019	48,127	2025	32,847
2020	42,415	2026	32,376
2021	36,441	2027	32,140

Table 4. **10 Hour Shifts**

Minimum On-Duty Officers per Day

2016	14.75	2022	11.89
2017	16.22	2023	11.70
2018	13.26	2024	11.06
2019	15.60	2025	10.65
2020	13.75	2026	10.50
2021	11.82	2027	10.42

Shift Relief Factor

The numbers reflected in Table 3 depict the number of officers that have to be fielded on a daily basis. Because officers do not work every day of the year, a multiplying factor must be calculated to convert the number of officers needed per day to the number of officers needed on the entire patrol staff. This multiplier is referred to in this study as a *Shift Relief Factor* (SRF). By definition, the shift relief factor is *the number of officers required to staff one shift position every day of the year*.

The SRF for an agency is affected by the amount of time off patrol given to each officer. Time off includes regularly scheduled days off determined by the work schedule of the agency, administrative and benefit time off based on the personnel policies and labor agreement of the agency, and compensatory time off given for overtime worked. Time off also includes special assignments and training that takes an officer away from their regular assignment for an extended period. If officers did not take any time off (i.e., never received regular days off, got sick, took a vacation, or were temporarily reassigned), the SRF for an agency would be 1.00 (i.e., the agency would only have to hire one officer for each shift position to be covered). However, since officers do take time off, the actual SRF for an agency is always greater than 1.00; the more time off an officer receives, the higher the SRF value.

It is important to note that the shift relief factor is based on averages over a one-year duration and is used to calculate the overall staff size for the division under study. Using the average amount of officer leave, the average amount of training, and the average number of days off per year does not guarantee that the appropriate number of officers will appear

for duty each day. The actual number of officers that will be on-duty each day will vary due to both scheduled and unscheduled time off (e.g., vacation leave and sick leave).

To determine the SRF for the Patrol Division, the leave times and training times provided by the agency for calendar years 2017 through 2021 were used. The following section will describe the data elements and calculations for this process.

Regular Days Off

Currently, patrol officers work a "4 on - 3 off" fixed day off schedule with a 10-hour shift length. The schedule creates a forty-hour workweek and officers receive 156.43 regularly scheduled days off per year for a total of 1,564 hours off patrol.

Benefit Time Off

Benefit time off is typically provided for officers as part of an employment package. Since the amount of benefit time off is determined by the personnel and operating policies of an agency, it is not a calculated value, but rather is based on time off data from the agency. The amount of administrative and benefit time used to calculate the SRF only includes time off taken which may be less than the total administrative and benefit time earned. Realistically, only a relatively small number of officers per year receive certain types of leave such as military leave or FMLA leave. However, those reassignments could last for six to twelve months, or longer. To properly calculate the shift relief factor, the total time spent in each leave category must be averaged over the entire sample.

The JPD Patrol Division experiences a very high turnover rate of 34.32% per year. On average, over 15% of the officers filling authorized patrol positions are either still in the academy or in FTO training and unable to answer calls as a solo unit. In addition, officers are transferred throughout the year from patrol to fill openings in other divisions such as Investigations and Support Services. With almost unlimited fluidity in staffing, calculating an average amount of leave time per officer per year becomes challenging.

To reach this determination, a careful examination of payroll records and CAD log-ins was conducted for all officers assigned to the Patrol Division for 2017 through 2021. For each year, a list was made of all officers who worked the entire fiscal year according to payroll and who were within the Patrol Division based on CAD data. For each year, a vetted list of names meeting both criteria was made for patrol officers, traffic officers, K9 officers, patrol corporals, and patrol sergeants. An average was then calculated for each year for each form of leave based on the vetted lists of employees within each group. The average administrative times and benefit time off, forecasted for 2022, is shown in Table 5.

Table 5. Benefit Time Off

Leave Type	Avg. hrs per Employee
Floating Holiday Pay	16.76
FMLA Comp Taken	0.00
FMLA FFCRA Expansion	0.00
FMLA Floating Holiday	0.00
FMLA Holiday Pay	0.89
FMLA Sick Leave	10.00
FMLA Vacation Leave	0.00
Funeral Leave	2.43
Injury Leave	1.18
Military Leave	9.08
Sick Leave	32.40
Vacation Pay	78.82
Holiday Pay	72.57
COVID Vacine Incentive	0.00
COVID-19 Emerg Sick	36.14
COVID-19 Time Taken	43.22
Total	**303.49**

Shift Exceptions

Shift exceptions include any on-duty time which the officer spends away from their normal assignment. Shift exceptions include time spent on extended training, special assignments, reassignments due to injury or light-duty, and any other detail that takes them away from their normal duty assignment. Similar to benefit time off, the average amount of non-patrol time is based exclusively on data obtained from the agency.

The shift exceptions for the Patrol Division were determined from the same annual vetted lists of officers who worked each fiscal year and who were assigned to the patrol division for the entire year based on CAD data (Table 6).

Table 6. Shift Exceptions

Leave Type	Avg. hrs per Employee
Absent for city business	0.00
Absent without pay	8.09
Administrative leave	1.89
Training	157.34
Total	***167.32***

Net Compensatory Time Off

The last component that must be included in the shift relief factor is the net compensatory time off patrol. Net compensatory time off measures the net gain or loss in work for an agency due to the amount of overtime worked and compensatory leave taken. There are two important observations concerning the net comp time effect:

1. All comp leave taken by patrol officers is included in the calculation because regardless of where the overtime is worked, the leave is taken from patrol.
2. Only overtime worked in furtherance of the patrol mission is included in the calculation since patrol gains no benefit from overtime worked on a non-patrol assignment.

If an agency adopts a policy of paying for all overtime as it is worked instead of giving compensatory leave at a later time, the net comp time value may be negative. A negative net comp time value indicates that the agency has gained more hours of work in overtime than it has granted in comp leave. As a result, the total hours worked per year per officer will be higher, producing a lower SRF and a lower total staff requirement. The advantage of a lower staff requirement, however, is offset by an immediate increase in the cost to pay for the overtime.

Data for the net comp time calculation was obtained from the leave and overtime records of the annual vetted lists of employees mentioned earlier in this section. The average patrol officer used 11.41 hours of compensatory time off per year and worked an average of 54.88 hours of overtime within the mission of patrol. Using this information, the net comp time effect on the Patrol Division is -43.47 hours. This means the agency received more work hours from each patrol officer than expected which lowered the Shift Relief Factor (Table 7).

Table 7. Net Compensatory Time Off

Overtime Worked	Hrs per year
On Call - Comp	-0.22
Call Back - Comp	-0.41
General Overtime - Comp	-25.58
On Call - Pay	-2.02
Call Back - Pay	-26.65
General Overtime - Pay	0.00
Comp Leave Taken	11.41
Total	***-43.47***

Time Off Patrol Per Year Per Officer

Summing the total hours from the regularly scheduled days off, the benefit time off, the shift exceptions, and the net comp time off, the total number of hours off patrol per year per officer is estimated at 1,991.63 hours (Table 8.).

Table 8. Time Off Patrol Per Officer

Leave	Hrs per year
Regular Scheduled Time Off	1564.29
Benefit Time Off	303.49
Shift Exceptions	167.32
Net Comp Time	-43.47
Total	***1991.63***

Calculating the Shift Relief Factor

The shift relief factor was defined earlier as *the number of officers required to staff one shift position every day of the year.* Therefore, the shift relief factor is the total hours needed per year to cover one position, divided by the number of hours worked by the average officer.

The shift relief factor for the JPD is determined by dividing the number of hours required to cover one shift position (365 days per year x 10-hours per day, or 3650 hours) by the average number of hours worked per year per officer (365 days per year x 10-hours per day - 1,991.63 hours off patrol per year, or 1658.37 hours). The calculated shift relief factor for the JPD is 2.20. This result is higher than the average for a 10-hour shift (2.05 - 2.10). The amount of training provided to the patrol officers and the amount of COVID-19 leave taken per year per officer in 2020 and 2021 are most likely the largest contributing factors to the elevated shift relief factor.

How can one unit, fielded 24 hours a day, require 6 or 7 officers?

Unlike most other municipal divisions, the Patrol Division requires consistent and continuous staffing 24 hours a day, seven days a week. In many cases, when a patrol officer takes a day off, for any reason, the position cannot be left vacant. The absence must be filled with another patrol officer.

The shift relief factor dictates that in order for the Police Department to put one unit on the street, working one 10-hour shift per day, every day of the year, they must have 2.20 officers on the total patrol staff.

If the agency chooses to put one unit on the street, around the clock, this number would be multiplied by three (the minimum number of 10-hr shifts needed in a 24-hr period). This second factor, called a daily relief factor, indicates that for each unit the Police Department puts on the street around the clock, they will require 6.6 officers on their total patrol staff.

Improving Patrol Performance with Proactive Time

To the casual observer, it might appear that to achieve maximum patrol efficiency, officers should be engaged in reactive activities every minute of every hour. In fact, quite the opposite is true. Including an appropriate amount of proactive time provides benefits for

the agency, the officer, and the citizens of the jurisdiction. To properly explain the benefit of proactive time, it may be helpful to view its necessity through a variety of perspectives.

From an administrative perspective, proactive time reduces the need for officers to respond call-to-call. Agencies that operate in such a manner report several drawbacks. The most obvious being the inevitable officer burn-out that can occur.

Less obvious is the loss of information that may help to reduce crime. It is an accepted axiom for police investigations that the solvability of a case begins to deteriorate from the moment the incident occurs. If the initial responding officer is rushed to move on to the next call, there is a greater chance that important follow-up opportunities and information will not be collected, diminishing the solvability of the case.

Operating call-to-call limits the opportunities for on-the-job training. In agencies where shift assignments are based on seniority, it is possible to have shifts where the majority of officers have very limited experience. When corrective action is needed by the supervisor, proactive time must be available. If officers are clearing calls and going directly to the next call throughout the shift, the supervisor will not have the training opportunities needed to help officers avoid future mistakes. This is especially true for the JPD due to their high turnover in patrol and a relatively young patrol force.

From a qualitative perspective, proactive time allows officers to perform the functions that improve the quality of life for the citizens of Joplin. Proactive traffic enforcement helps to reduce crash rates, reduce risk-taking driving behaviors and creates a safer city in which to live and work. Directed patrols are conducted during an officer's proactive time. Directed patrols are a way of addressing known trouble spots within an officer's assigned patrol area. Directed patrols are also conducted during community gatherings and special events to increase officer visibility to deter crime before it is committed.

When a citizen is in need of police services, a short wait can feel like an eternity. Response times are reduced as proactive time per officer per hour increases. The following quantitative perspective will provide more detailed information on the inverse relationship between proactive time and response times.

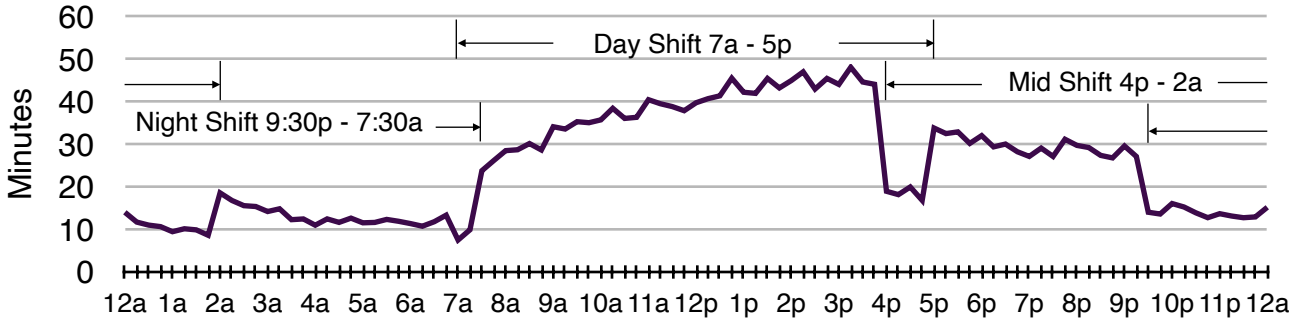
From a quantitative perspective, proactive time has a direct effect upon several accepted measures of patrol performance. These performance measures include: (1) cross-beat dispatching, (2) patrol intervals, and (3) the probability of saturation. All three measures are discussed in the next section. Each measurement is dependent on the variable "M_R" which refers to the average number of minutes spent during each patrol hour on reactive activities. The remaining minutes of each patrol hour are spent on proactive activities. Consequently, "M_P" refers to *the average number of minutes spent during each patrol hour on proactive activities.* For purposes of staffing calculations, M_R and M_P should always sum to 60 minutes (one hour).

Proactive time per hour per officer (M_P) is hard to calculate directly. Instead, the total reactive time per officer per hour (M_R) is calculated from the frequency of calls and the average time per call. Given the forecasted workload in 2022 and the number of designated call-takers assigned to patrol at the time of this report (39), it is estimated that the average officer in the Patrol Division spends approximately 40.28 minutes per hour on reactive activities (M_R) leaving 19.72 minutes per hour for proactive patrol (M_P). The graph in Chart 3 shows the estimated reactive time per hour spent <u>*on-scene*</u> on calls for service based on 2021 data. A quick estimation of the chart may indicate an average of about 25 minutes per hour on reactive time over the 24 hour period. However, additional reactive hours spent on

court, report writing, case follow-up, station details and out of service times are not included in the chart totals. In addition, this chart does not show the time spent on proactive duties which include, but are not limited to: administrative details, alcohol stings, bar checks, building checks, car stops, foot patrols, house checks, training, and pedestrian checks.

In 2021, the officers were deployed over five patrol teams with three start times. The staffing varied slightly per team and the frequency of calls for service and time spent on calls differed throughout the day. This leads to a significant difference in the average M_R values across the 24-hour clock (Chart 3).

Chart 3. **Estimated Average M_R Per Officer**



Cross-Beat Dispatching

A main tenet of community-oriented policing is the need to have officers become familiar with a small geographic area of the jurisdiction. In many agencies this is accomplished by assigning officers to patrol beats. By working in the same area for extended periods of time, officers can develop ownership of the area and, equally important, build relationships with the local residents. Often overlooked, however, is the frequency and duration of time that officers are removed from their assigned beat to answer a call-for-service (CFS) in another beat. Dispatching an officer from their assigned beat to respond to a call in another beat is referred to as *cross-beat dispatching*.

When cross-beat dispatching occurs, quality of service is diminished in several ways. Officers are required to respond from a farther distance which increases the overall response time for calls. Most calls that are cross-beat dispatched are higher severity calls requiring a higher speed response. When officers are traveling above the normal speed of traffic with lights and sirens activated, the officer and the citizens are at a higher risk for accidents. Since most case followup is done on proactive time, an officer may not conduct as much followup on a call in another officer's beat as opposed to a call in their own beat.

Using probability theory, the amount of time an officer spends on cross-beat dispatches per hour, designated as "M_X," can be estimated if the number of minutes of reactive time per hour per officer (M_R) and the number of patrol beats (N) are known. Assuming one patrol unit per patrol beat and approximately the same level of M_R in each beat, the formula for cross-beat dispatching is:

$$M_x = \frac{M_R^{\,2}}{60}\left(1 - \frac{1}{N}\left(\frac{M_R}{60}\right)^{(N-1)}\right)$$

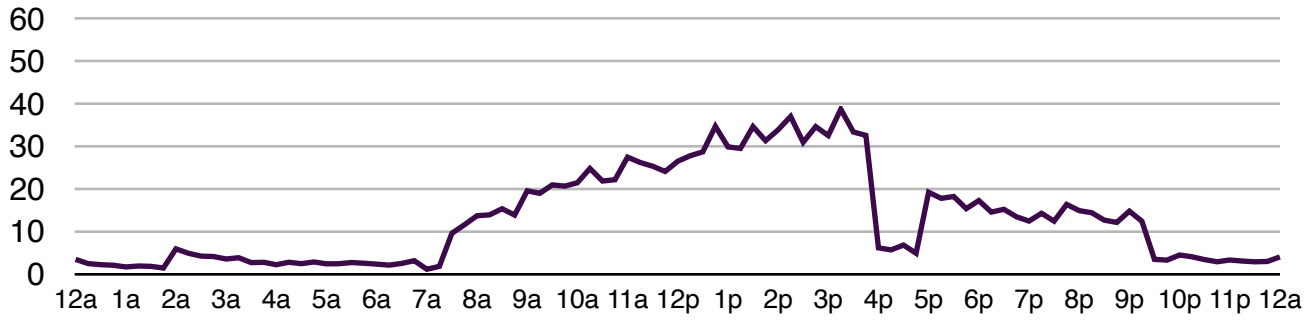
As the number of districts increases, M_x can be estimated as:

$$M_x = \frac{(M_R)^2}{60}$$

Notice that in both formulas, M_R is squared (i.e., multiplied by itself). As the minutes of reactive time per hour per officer increase, the minutes of cross-beat dispatching (M_X) per hour per officer increase at an exponential rate.

The average level of cross-beat dispatching for the City of Joplin in 2021 is illustrated in Chart 4. The curve is based on historical CAD data and the number of officers in patrol in 2021. This value assumes that one officer is assigned per beat with no additional cover units. Since JPD assigned cover units on most shifts, the actual cross-beat dispatching level for the agency will be lower. As seen in chart 4, as long as the M_R value is kept to 30 minutes or less, the level of cross-beat dispatching experienced by the agency is acceptable.

Chart 4. **Minutes Spent Per Hour Per Officer on Cross-Beat Dispatches**



Patrol Intervals

A second patrol performance measure that is directly related to proactive time is the *patrol interval* (PI). A patrol interval is defined as *the average time interval between two consecutive passes by the same location by police units while on random patrol.* The patrol interval is a measure of how much visibility the patrol force provides in the community. The shorter the patrol interval, the greater the level of visibility and the greater potential crime deterrent. The patrol interval is calculated based on:

- the number of street miles in a defined area,
- the average patrol speed,
- the number of proactive minutes per hour per officer (M_P), and
- the number of units on patrol.

The formula is given by:

$$PI = \frac{Street\ \ miles\ \ in\ \ the\ \ jurisdiction}{Average\ \ patrol\ \ speed * \left(\frac{M_P}{60}\right) * Units\ \ fielded}$$

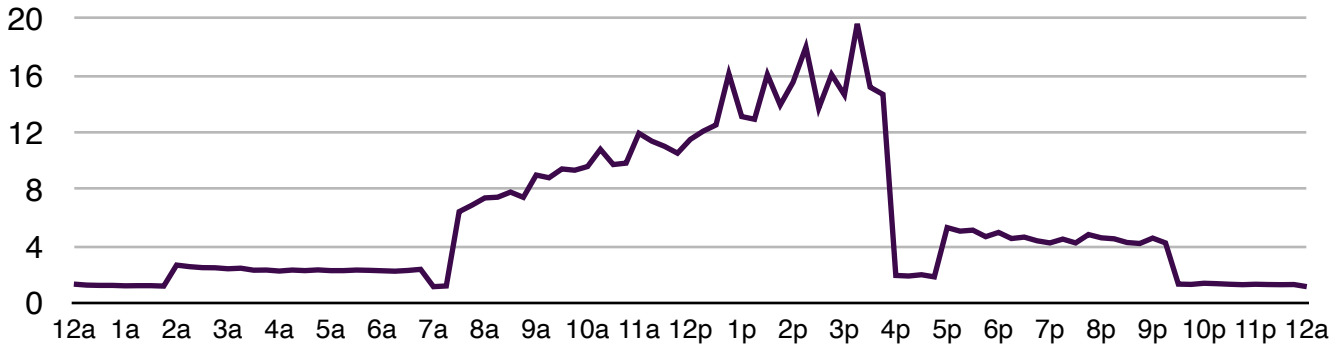
The formula indicates that the patrol interval will decrease if either the minutes of proactive time per hour per officer increases or the number of units are increased. Chart 5 shows the average patrol interval for the agency by hour of the day, using the average reactive minutes per hour per officer from Chart 3 and the following average patrol speeds:

- 7:30 am to 4 pm: 20 mph
- 4 pm to 9:30 pm: 25 mph
- 9:30 pm to 2 am: 30 mph
- 2 am to 7:30 am: 35 mph

The differences throughout the day reflect the difference in patrol speeds, the difference in the average reactive time per officer per hour and the difference in the number of on-duty officers. According to the City of Joplin GIS Office, the city has approximately 825 lane miles of streets and state routes inside the city limits.

Based on the current M_R value of the agency, the patrol interval for the agency increases significantly during the hours of 7:30 am to around 4 pm. This is due to the higher M_R value during the day and a lower patrol speed. The patrol interval reaches an estimated high of 41.81 hours at approximately 3:15 in the afternoon causing a significant decrease in visibility of patrol officers in the afternoons.

Chart 5. **Patrol Interval By Hour of Day**



Probability of Saturation

The *probability of saturation* (POS) is defined as the probability that when the next call-for-service arrives at the dispatching center, there will be no free units available to take the call. The POS is directly related to: (1) the average number of calls-for-service per hour, (2) the average time required to complete each call-for-service, and (3) the number of units on patrol. These three variables are the same variables that determine the average number of reactive minutes per hour per officer (M_R). As a result, as M_R increases, the POS also increases; that is, as time spent per hour reacting to calls-for-service increases, the likelihood that a call-for-service will have to be "stacked" at the dispatching center increases. POS values for an agency are constantly changing as call volumes fluctuate, as the time required to handle calls changes, and/or as the number of units in the field is altered.

One way to reduce the POS value is to field additional units. The consequence of this option is the cost of paying for additional personnel and equipment. A second option is to reduce the CFS workload handled by patrol by using call screening or by implementing alternative ways to handle low priority calls such as telephone response units or Internet reporting. A third option is to reduce the amount of time officers spend on each call. Call screening and reducing the amount of time on call could have the potential for negative reactions from the community if they get a perception that their call is not important to the police department.

By reallocating officers across the shifts in proportion to the workload, the probability of saturation would be equalized throughout the day. With an M_R of less than 31 minutes, the probability of saturation would not be significant.

How Much Proactive Time is Needed?

The three patrol performance measures just described (cross-beat dispatching, patrol intervals, and the probability of saturation) are all directly related to the amount of reactive and proactive time available per hour for each patrol officer.

To reduce cross-beat dispatching, lower patrol intervals, and reduce the probability of saturation, an agency has three options: (1) reduce the patrol workload, (2) reduce the amount of time spent on patrol activities, or (3) increase the number of officers on patrol. Many departments have instituted programs to reduce the patrol workload but at the same time instituted community-oriented policing initiatives which emphasize the need for officers to spend more time with citizens.

The JPD currently staffs a three-person Crime Free unit that is tasked with community policing efforts, crime prevention, and crime awareness programs. The agency staffs a six-person Traffic Unit for traffic enforcement, accident investigation, and traffic control throughout the city. Within the Traffic Unit, the agency has two grant officers that focus on the detection and apprehension of intoxicated drivers. These specialty units operate in a predominately proactive nature focused on community-oriented policing initiatives and increasing the amount of contact between the JPD and the general public.

With the presence of the proactive units just listed, how much proactive time per hour should the patrol officers have while they are on routine patrol? Based on the level of police presence and service expected by the citizens of Joplin and the resources available to JPD, the department will have to decide how many minutes out of each hour the average patrol officer should have available for proactive activities such as community-oriented policing, traffic enforcement, foot patrols, and other self-initiated activities.

At the time of this report, assuming forecasted numbers are accurate for the 2022 workload and a patrol size of 39 fully-trained call-takers, the patrol officers have an estimated M_R value of 41.9 minutes per hour for the 10-hour shifts. The spreadsheets that accompany this report illustrate the impact of various changes to these M_R values by showing the changes in various patrol performance measures. As the number of reactive minutes per hour per officer (M_R) decreases and the number of proactive minutes per hour per officer (M_P) increases, the probability that no units will be available when the next CFS arrives (POS) and the time spent by units on cross-beat dispatches (M_X) will decrease. Patrol visibility, as measured by the patrol interval, will increase. All of this is accomplished, of course, by an increase in the number of on-duty officers required per day, and the total number of patrol officers assigned to the Patrol Division.

When feasible, Etico Solutions recommends an even split of proactive and reactive time per hour per officer, or an average M_R value of 30 minutes. To maintain this goal in 2022, the agency would need a total staff of 52.36 fully trained officers. Forecasted staffing needs for 2023 indicate a need for 52.39 fully trained officers in patrol to maintain an M_R value of 30 minutes. This value is very likely to increase as the agency begins to collect more workload data than the amount collected in the past and as future annexations, infills, and population growth leads to a greater need for staffing.

Agency Availability Rate and Turnover Rate

Jim Collins, in his best selling book "Good to Great", identified several key actions that made the difference between good companies and great companies. He wrote:

> "Look, I don't really know where we should take this bus. But I know this much: If we get the right people on the bus, the right people in the right seats, and the wrong people off the bus, then we'll figure out how to take it someplace great."

Most law enforcement agencies make a diligent effort to get the right people on the bus by prescreening potential employees through written exams, psychological exams, drug screens, physical exams, background investigations and sometimes multiple oral interviews. Furthermore, through promotional testing and promotional interviews, most agencies attempt to get the right people in the right seats. Getting the wrong people off the bus is problematic in some states and in some areas of the country for a variety of reasons. For the JPD, the larger issue appears to be keeping the right people on the bus once they have been selected and trained.

The process of replacing a tenured employee is lengthy for most law enforcement agencies. The hiring process for police candidates, described above, is a three to four month process. Successful candidates with no prior police experience (non-P.O.S.T. certified) are sent through a 600-hour training academy spread over a five-month period. The next phase is a seven-week in-house training academy at the Joplin Public Safety Training Facility before they enter into a sixteen-week field training program for "on the job" training. The entire process of filling a vacant authorized position with a non-P.O.S.T. certified candidate can take over a year from initial testing to a solo-performing officer. A successful candidate with recent law enforcement experience is sent through the seven-week in-house academy followed by a shortened period in the field training program. This places a P.O.S.T. certified candidate on the street as a solo officer in as little as six to seven months.

The effort to properly train is worth the time, especially given the current scrutiny placed on law enforcement officers in today's society. When determining appropriate staff sizes, the time to initially train new recruits cannot be ignored. Furthermore, losing an officer to another agency after spending over a year of preparation and training, is costly to the agency and creates a revolving void in the Patrol Division. There is a significant incentive to the agency to make any changes that may "keep employees on the bus."

The JPD provided information for all employees who worked in the Patrol Division for any period of time between January 1, 2018 and December 31, 2021. The information contained the employees' original hire dates, the date they completed initial training and were eligible to assume solo patrol, promotion dates for all corporals, sergeants, and captains, departure dates for any employees that transferred out of the Patrol Division, return dates for any employees that transferred back into patrol, and final termination of employment dates. This data was entered into another Excel model to calculate officer availability and turnover for the agency. The model calculated annual availability and turnover rates for calendar years 2018 through 2021. Table 9 shows the results of this analysis.

According to the data provided, over the last four years an average of 15.57% of the people filling patrol positions were in the academy or in the field training program and were unable to operate as a sole responder. Therefore, if the JPD needs 52.36 fully trained patrol officers in the Patrol Division to reach an even split of proactive and reactive time, and each officer must be able to handle calls for service as a solo unit, they would actually need to employ 62.01 officers (52.36 call takers divided by the 4-year average availability: 52.36/.8443 = 62.01).

Table 9.

	Availability	Turnover
2018	88.07%	22.66%
2019	80.15%	32.41%
2020	85.44%	31.57%
2021	84.07%	50.63%
4-Year Average	84.43%	34.32%

Since all new employees start at the rank of patrol officer, every time an employee departs the agency, a vacancy is created at the bottom. When a commander or supervisor position becomes vacant, an officer is promoted to fill the vacancy and another officer must be hired. Therefore, the turnover rate for officers is the sum of all vacancies over the year in question. The rank of the person leaving is irrelevant, it will always be filled from the bottom up. The agency saw departures of 12, 18, 20, and 23 employees annually in 2018 through 2021 respectively. This led to a 4-year average turnover rate of 34.32%. If the JPD must have 62.01 officers in the Patrol Division just to keep 52.36 fully trained officers on the street to answer calls, they must be prepared to on-board 32.54 additional officers throughout the calendar year. (62.01 officers divided by (1- the agency turnover rate): 62.01/(1-.3432%) = 94.55)

Staffing Summary

At the time of this report, the JPD has 29 patrol officers, six patrol corporals, four K9 units and five patrol sergeants. If the agency desires to free sergeants from taking calls in order to better supervise, the patrol officers would be operating at approximately 40.28 minutes per hour on reactive time. To reduce the reactive time per hour to 30 minutes per hour per officer, the total staff would have to be increased to 52.36 fully trained patrol officers. Given the availability of officers over the last four years due to the academy and the field training process, the agency would need 62.01 officers on the patrol division staff to keep 52.36 fully trained and able to work independently. Given the turnover rate for the last four years, the agency should prepare to onboard an additional 32.54 officers within the year to keep up with attrition (retirement and departures).

With three officers in the academy and eight officers in the field training program at this time, the agency is still 12 patrol officer positions short of recommended staffing. However, additional growth within the city, improved accounting methods for workload data currently not being captured, any increase in departing employees, or not remaining diligent in bringing new employees in the front door could easily increase that number.

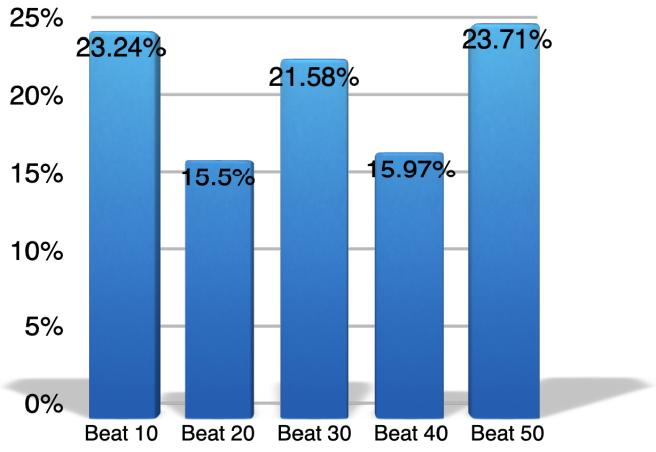
Patrol Deployment

The second objective of this study was to examine the current patrol beat design to determine if the workload could be distributed more equitably. After analysis of the existing patrol plan, it was found that the workload among the existing five beats varied by 8.21% between the heaviest beat workload and the lightest. This caused a potentially higher level of cross-beat dispatching, longer patrol intervals, longer response times, and a higher probability of saturation in some beats than others. The objective was to create a new 12-beat patrol plan that would equalize the amount of reactive time per beat across the entire jurisdiction. The analysis for this section was completed based on the number of reactive hours spent on calls for service in the CAD database for 2016 through 2021.

Current Patrol Beat Configuration

At the time this study began, the City of Joplin was subdivided into 5 beats (10,20,30,40, and 50). Calls for service were recorded in the CAD based on the latitude and longitude of each call and the beat in which it occurred. Chart 6 provides comparative information about the amount of reactive workload in the patrol beats as they initially existed at the beginning of this study.

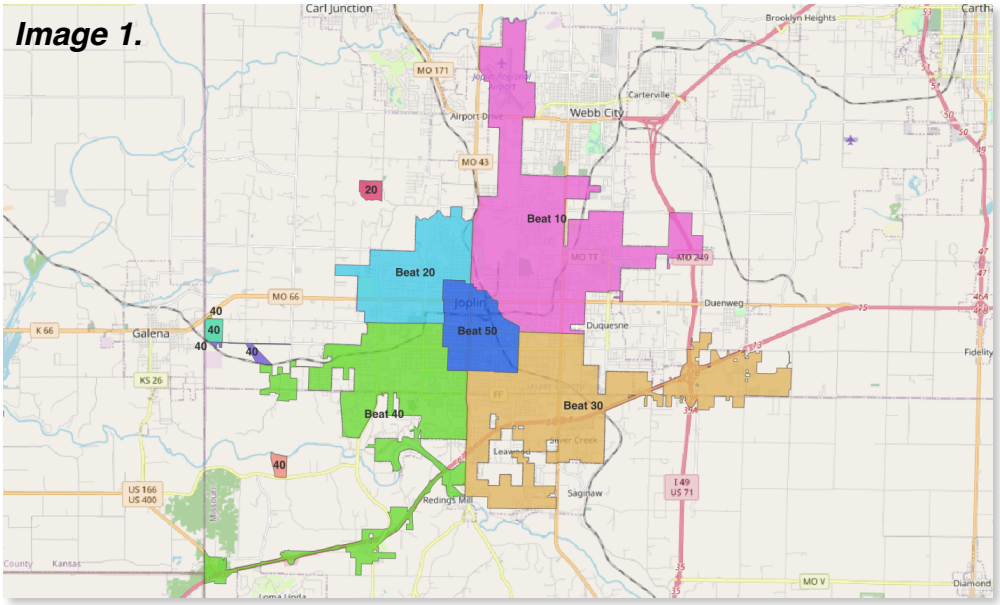
Chart 6. Current workload by beat



The number five is a prime number and is only divisible by itself. Even if the reactive workload would have been equal in each zone, to assign officers evenly among areas, the number of on-duty officers would have to be evenly divisible by five.

Image 1 shows the size and location of the current patrol zones at the beginning of this study.

Image 1.

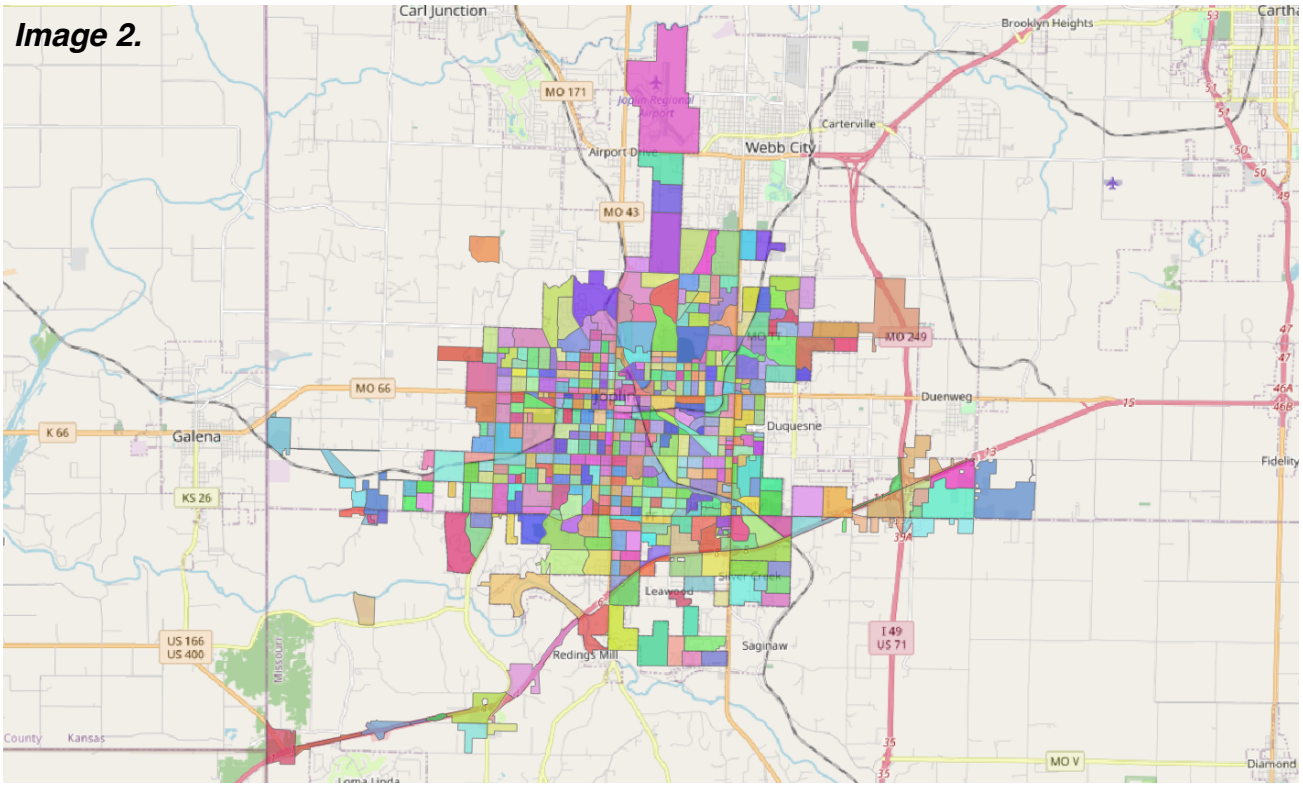


Deployment Optimization

To optimize the use of current resources and to better equalize the workload for the patrol officers, a new patrol area structure was created for the City of Joplin consisting of 12 patrol beats. An “Individual Reporting Area” (IRA) map was created which subdivided the City of Joplin into 533 smaller geographical areas (IRAs). The newly created IRAs covered the entire jurisdiction of the city and did not overlap at any point. IRAs located in areas that experienced higher reactive hours of workload were geographically smaller than most outer lying areas that experienced less reactive workload.

In order to equalize the workload among the new beats, the total number of reactive hours from 2016-2021 were determined for each IRA throughout the city. Image 2 shows the 533 IRAs that cover the City of Joplin. The IRAs are primarily bound by major streets and natural and man-made boundaries such as rivers, creeks, interstates and railroad tracks.

Image 2.



A template for beat design was created in Microsoft Excel containing the label and reactive workload total for all 533 IRAs. Twelve pairs of columns were created, one pair for each new beat. As an IRA label was added to the first column in a beat pair, the total hours of reactive workload that occurred in that IRA from 2016 through 2021 was added to the second column in the beat pair. The template kept a running sum of total workload per beat as well as the total workload percentage per beat as individual contiguous IRAs were added to the columns one at a time. The process started at the outer edges of the city and worked toward the center. After all 533 IRAs had been initially added to one of the 12 new

beats, the total workload percentage of each beat was examined in light of the new geographic shape of each beat. An efficient beat design should not only allocate workload equitably amongst the beats, it should also form beats that reduce long drive times from one end of the beat to the other and should avoid wrapping one beat around part of another. To create the most efficient beat plan possible, the IRAs were shifted numerous times amongst the 12 beats to create the best combination of workload equity and geographic shapes. It was also important to form beat boundaries on major streets and boundary lines so they could be easily learned and remembered by officers. Image 3 shows the proposed 12-beat plan for the JPD. Chart 7 shows the workload for the twelve newly created patrol beats.

Image 3.

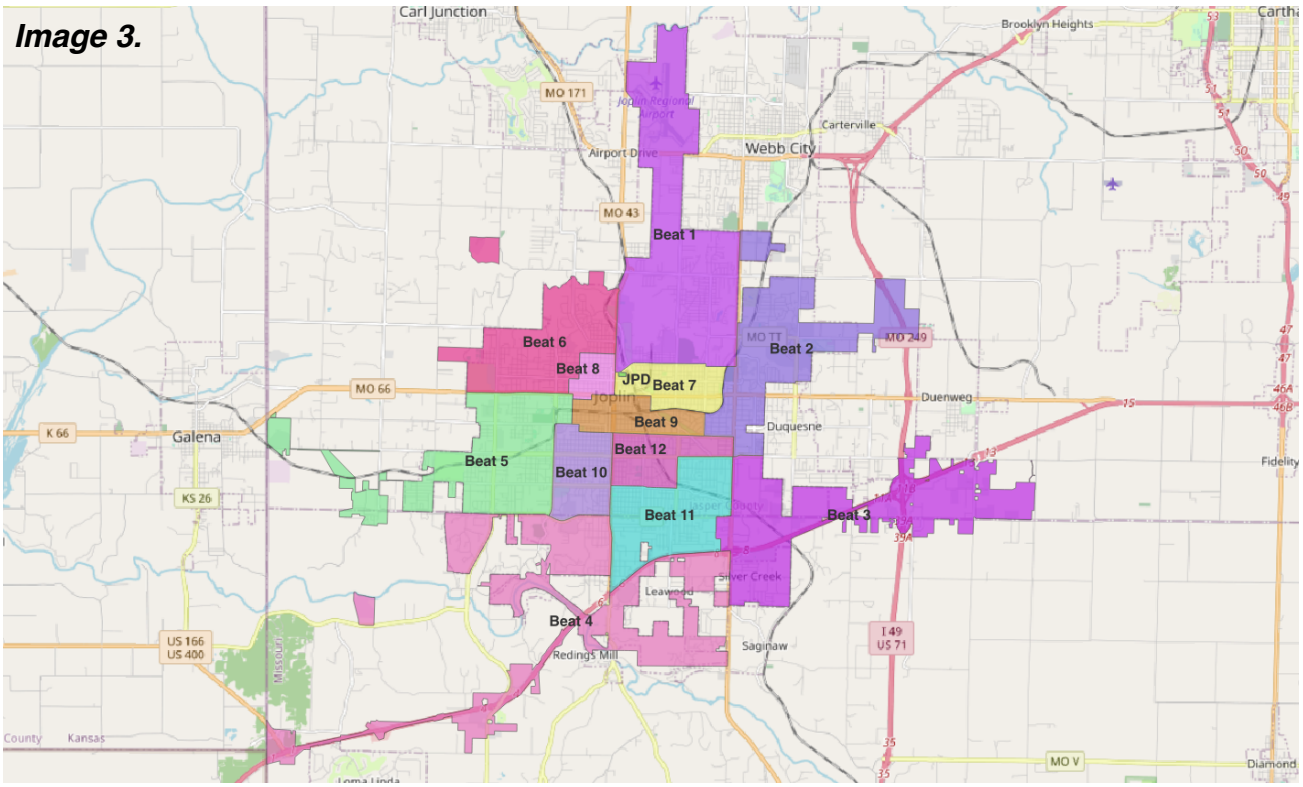
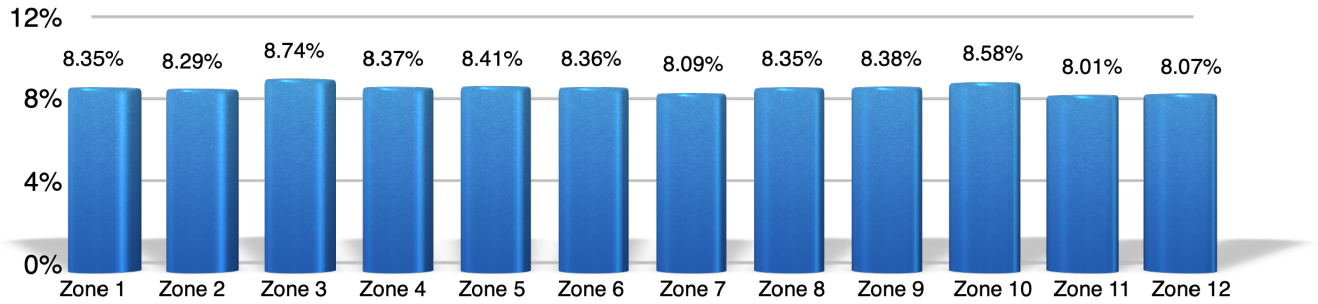


Chart 7. Proposed workload by beat



A comparison between charts 6 and 7 shows the difference between the workload in the highest and lowest beats decreased from an 8.21% variance to a 0.74% variance. Equalizing the beat workloads will aid in equalizing the workload for the officers that work the beats. This should translate into lower average response times and a more consistent

quality of service for the citizens. However, equalizing the beats does not guarantee that all cross-beat dispatching will be eliminated since cross-beat dispatching is dependent on the minutes of reactive time per officer per hour. Until the agency reaches an appropriate staffing size, cross-beat dispatching will continue to occur routinely throughout the city. Optimizing the beats will cause the cross-beat dispatching to happen more uniformly throughout the city instead of being more concentrated to certain current beats. It should be noted that this beat plan does not account for report writing times or evidence processing times since they were not found in the CAD database. Therefore, reactive time for this beat design means dispatch time to clear time for all reactive events.

One advantage to a 12-beat plan is that the number twelve is a “highly composite number.” Twelve has more divisors than any whole number that proceeds it, a total of six divisors (1,2,3,4,6, and 12). By creating a 12-beat plan with equal size beats, officers can be equally assigned based on any combination of 2, 3, 4, 6, or 12 officers per shift. If a shift has six officers, each officer is assigned to cover two beats. If a shift has four officers, each officer is assigned to cover three beats. If a shift has nine officers, the first six officers each cover two beats and the remaining three officers are assigned as a relief officer (or secondary officer) for four beats each. Equitable assignment of workload then becomes an exercise of logic based on the number of officers available at the time.

A final advantage to the new beat structure is the availability of 533 individual reporting areas throughout the city. Once the new IRAs are programmed into the CAD, all calls for service can be automatically recorded into their corresponding IRA. This creates the ability for more granular crime analysis and the ability to better pinpoint problem areas within the city for increased patrol or prevention efforts.

Patrol Scheduling

The patrol workload determined in the first part of this section was used to make a determination of the necessary patrol staffing size to meet a desired performance level. In this section, the same workload data will be used again to temporally compare the call for service load of the Patrol Division to the current staffing practices.

Police departments are fluid entities. Officers transfer in and out of patrol and total staff sizes for patrol divisions often fluctuate as conditions change within the department and within the city they serve. Staffing levels that were provided at the beginning of this study may have changed by the time this report was prepared. However, the process remains consistent and can be repeated whenever necessary with updated numbers from patrol.

Optimal deployment is highly contingent on an effective work schedule. Having the optimal number of officers in an agency, and even having the patrol areas balanced and properly configured, cannot create high efficiencies if the schedule in use by the agency is not compatible with the workload curve and/or not implemented wisely. This final section of the report addresses the current scheduling practices of the JPD Patrol Division in light of the hourly and daily demands of the citizens, the various needs within the division, and the known characteristics of good schedules based on research and study.

Characteristics of Police Work Schedules

When analyzing a police work schedule, there are a number of schedule characteristics that should be considered due to their effect upon officers’ lives and the ability to maintain

proper supervision and communication within the agency. Some characteristics, such as the compatibility between the workload curve and staffing curve, can be quantitatively measured on a sliding scale. Other characteristics, such as team integrity, schedule equity, or unity of command, are either present or absent.

Unity of Command

Unity of command is the fourth of Fayol's *14 Principles of Management* published in 1916. Henri Fayol is considered to be among the most influential contributors to the modern concept of administrative management. Fayol's principle simply states that "employees should have only one direct supervisor." This principle provides three important benefits to the operation of the Patrol Division; a clear chain of command, consistent lines of communication, and comprehensive supervision. Past studies in large agencies have shown that an unclear chain of command can lead to increased stress on the officers and a lack of unity within the police department. The military has recognized the need for a clear chain of command as a necessity for improved performance and job completion.

A clear chain of command, which is also Fayol's ninth principle of management (*scalar chain*), leads to consistent lines of communication. When officers work a portion of their workweek under one supervisor and the remainder of their week under another, it is very easy for the officer to get two separate messages concerning the goals of the agency. Patrol priorities may differ among the two supervisors leaving the officer guessing the expectations upon them each day.

Comprehensive supervision is obtained when an officer consistently reports to one supervisor. Under such a scenario, the supervision and evaluation of that officer can be completed in a more thorough manner. If officers report to multiple supervisors over the course of a single bid period, their evaluation should include input from all supervisors involved. This practice is sometimes skipped and noteworthy accomplishments or deficiencies in the officer's performance can be overlooked. Unity of command provides the greatest opportunity for a supervisor to provide meaningful and comprehensive feedback concerning an officer's overall performance.

Team Integrity

Team integrity is another valuable benefit to the operation of the Patrol Division. Fayol's 14th principle, *Espirit de Corps*, states: "Organizations should strive to promote team spirit and unity." When analyzing work schedules, team integrity is promoted when officers work with the same group of officers each day and take their days off with the same group of officers. When officers work in a unified team, their comfort level in the expectations of each other and non-verbal communication improves. This can lead to increased productivity for the agency and increased safety for the officer. Team integrity also aids with consistent area assignments. Each member of the team can be assigned a particular area of the city more consistently when they all work the same days of the week.

Schedule Equity

Fayol's eleventh principle, *equity*, states "managers should be fair to staff at all times, both maintaining discipline as necessary and acting with kindness where appropriate." In terms of police scheduling, the concept of "schedule equity" means that every officer in patrol gets the same opportunity for weekend time off or long off-duty periods. Some

schedules will offer complete schedule equity while others will offer little to no schedule equity.

Training Compatibility

Law enforcement agencies use a number of methods to schedule training for officers. Agencies using 10-hour fixed days off may overlap one day every week for training which can provide an overabundance of training time and reduce the resources on the street for routine patrol. Agencies using 8-hour shifts typically do not build training into the schedule, choosing to pull officers from various shifts as manpower allows and as training necessitates. Some agencies will train officers in "blocks" of one or two weeks during slow periods of the year and will change their work schedule for those weeks to an 8-hour, Monday through Friday, schedule.

Many agencies with high-risk teams such as SWAT teams, bomb teams, and K9 teams prefer to train as a team. This is important for law enforcement since many critical responses require a team approach with each responder fulfilling a specific role. When an entire shift can train as one team, they gain a better understanding of each person's role and each shift member's strengths and weaknesses. Consistent training leads to consistent behavior which enables shift members to anticipate other officer's actions in potentially dangerous situations.

Training as a shift allows officers to train under the conditions in which they work. For instance, if all night shift officers receive range training at the same time, the range training can be scheduled to take place during their normal work hours to simulate the environment in which they normally work. Responding to an incident that requires the use, or potential use, of a firearm at 3 am creates a different set of challenges and skills than a response at 3 pm. Lighting is different, background identification is different, shoot/don't shoot decisions are harder to make, and some officers may even have to work through early morning fatigue issues in the midst of the incident. This same "situational training" can be done for a number of topics in order to train the officers to perform optimally under their usual working conditions. Training during normal work hours is less disruptive to the officer's sleep schedule opposed to changing their work hours for one day a week to train.

Fatigue Risks

A critical property of any law enforcement schedule is the amount of fatigue that it places on the officers. Agencies differ greatly on the amount and type of fatigue placed on their staff. High call loads, early morning hours, rotating shifts, split shifts, random court appearances, and personal obligations at home are just some of the things that can lead to increased fatigue and reduced productivity or alertness on the street.

Studies indicate that one of the main contributors to police fatigue is the number of consecutive nights worked on the night shift before a period of rest. Medical studies conducted on night-shift physicians indicate that cognitive ability decreases after three consecutive night shifts.[7] In the August 2003 edition of the American College of Emergency Physicians newsletter, an article entitled "*Circadian Rhythms and Shift Work*"[8] addressed

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[7] Dula DJ, Dula NL, Hamrick C, Wood GC. The effect of working serial night shifts on the cognitive functioning of emergency physicians. *Ann Emerg Med*. 2001;38:152-155.

[8] Thomas HA., Circadian rhythms and shift work. *Clinical & Practice Management*, ACEP 2003

the issue of rotation periods and consecutive nights stating “Working 4 to 7 night shifts in a row is universally condemned.” Bryan Vila, a noted expert on the issue of police fatigue, participated in a keynote address to police psychologists at the IACP National Conference in October of 2010. He expanded on his remarks in an interview with Force Science News in 2011 stating: “The more night shifts you work in a row, the less and less resilient you become to being tired. After about 3 consecutive night shifts, you’ll start to see a substantial problem and you need time off so you can catch up on your sleep.”[9]

The most comprehensive reference to risk by consecutive night shifts is contained in a study entitled “*Shift work, safety and productivity*” released in 2003.[10] The authors combined the results of seven different studies that reported incident (accidents and injuries) frequencies separately for each night over a span of at least four successive night shifts. The summed results of the seven studies were then expressed relative to the first night. “On average, risk was approximately 6% higher on the second night, approximately 17% higher on the third night, and 36% higher on the fourth night.” This same study found that fatigue increases as shift length increases with a 10-hour shift posing greater risk than an 8-hour shift and a 12-hour shift posing more than a 10-hour shift. A third result of the research showed that the highest levels of fatigue appear on the night shift hours when our bodies are used to sleeping. When we combine these three findings, we find that officers working extended hours, on the night shift, for four or more consecutive nights can experience a synergistic effect that compounds the effects of fatigue. While the study subjects were not law enforcement officers, the principle findings of the study are assumed to be applicable to law enforcement scheduling.

Workload Efficiency

To maximize the efficiency of current staffing, the percentage of available officers fielded at any given time should be matched to the percentage of overall workload that must be completed at that time. For example, if .17% of the agency’s estimated workload for 2021 occurs on a Saturday night between 11 pm and 11:15 pm, the agency should be deploying .17% of their available staff at that time. To achieve this level of deployment, the percent of total reactive hours for an agency are charted across the days of the week and quarter-hours of the day to build a “workload curve”. Likewise, the staffing levels created by the current schedule are charted across the days of the week and quarter-hours of the day to build a “staffing curve”. The two curves are then compared and an “efficiency index” is created.

The efficiency index is a measure of “fit” or “closeness” between the agency’s workload curve and the staffing curve. The area between the curves is measured by calculating the absolute value of the difference between the percentages of the two curves for each 15-minute increment of the day. Summing the absolute values of the differences for all 24 hours and subtracting that sum from 100% produces an overall efficiency index for the set of curves being evaluated. Under this methodology, if the two curves are perfectly aligned, the efficiency index would be 100%. Image 4 displays an example of the workload/staffing

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[9] Lewinski B., Anti-fatigue measures could cut cop deaths 15 percent, researcher claims. Force Science Institute. March 2011

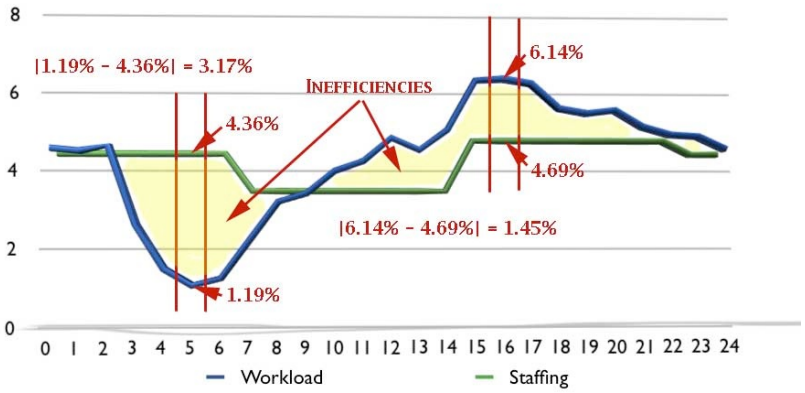
[10] Folkard S, Tucker P., Shift work, safety and productivity. *Occupational Medicine* 2003; 53:95-101

curve comparison. The green line represents the staffing curve for a hypothetical agency and the blue line represents the workload curve. The light yellow represent areas of inefficiency where one curve deviates from the other.

Image 4.

Efficiency Index =

$$100\% - \left[\sum_{i=0}^{23} |\text{Workload}_i - \text{Staffing}_i|\right]$$



Analysis of Current Schedule

The department is currently using a 10-hour shift length with a “4 on - 3 off” fixed day off schedule. The Patrol Division uses 5 patrol teams with three different start times and a Traffic team. Each team is led by a patrol sergeant and a patrol corporal who answer to the Patrol Captain. All team members share the same days off each week which provides complete team integrity and unity of command for the team. There are 21 shifts that need to be covered per week (days, mids, and nights, seven days per week) and five patrol teams that each work four days per week. This leaves one shift per week that must be covered by the Traffic Unit officers and the Crime Free officers (day shift on Wednesdays). Team 1 has every weekend off but their start time changes mid week when they go from day shift to mid shift. Teams 2 and 3 have consistent start times each day but work every weekend. Team 4 works every weekend and starts on mid shift on Friday before changing to night shift for the remaining three workdays. Team 5 has a consistent start time for all days worked with every weekend off, but they have to work through the early morning hours which creates the most fatigue. Due to fixed days off, there is no schedule equity among the shifts since some work every weekend while others get every weekend off. The current schedule is shown in Table 10.

Table 10.

	Mon	Tue	Wed	Thu	Fri	Sat	Sun
7a - 5p	Team 1	Team 1	Traffic Team	Team 2	Team 2	Team 2	Team 2
4p - 2a	Team 3	Team 3	Team 1	Team 1	Team 4	Team 3	Team 3
9:30p - 7:30a	Team 4	Team 5	Team 5	Team 5	Team 5	Team 4	Team 4

A shift bid process is conducted every six months allowing officers to choose their team assignment based on their seniority within the agency. There is not an option for a team schedule with consistent day shift hours and weekends off. If an officer wants weekends off they will have to work either a split shift on Team 1 or the overnight hours on Team 5. If they choose to work a consistent day or mid shift to spend time with young children at home, they will be working every weekend on Team 2 or Team 3. If they are lowest in

seniority, they may find themselves on Team 4 working every weekend with a split shift and three overnight shifts.

Research on chronobiology indicates that it takes a young and healthy person approximately 45 days for their circadian rhythm to fully resynchronize after a major disruption of their daily pattern (such as rotation from one shift to another). For older employees or employees who are not in top physical condition, the time to resynchronize could be considerably longer. A six-month bid process which allows more senior officers to stay on a particular schedule is a recommended practice and one that JPD is encouraged to continue. However, the practice of split shifts where an employee reports at different times during the week is in opposition to known research on circadian health. Varied start times can lead to varied sleep patterns can disrupt a person's quality of sleep, cell growth, digestion, cognitive ability, and other health related issues. Split shifts over two start times each week, combined with four consecutive 10-hour shifts each week, could create a potential concern for fatigue within the current schedule.

Other employees appear on the Patrol Division roster who are not considered to be first responders to calls for service. The agency has four officers, a corporal, and a sergeant assigned to a Traffic Unit to conduct proactive traffic enforcement and crash investigations. The traffic personnel work primarily Monday through Friday during dayshift and afternoon shifts and are not responsible for taking calls as first responders unless all patrol officers are unavailable. Their workload was excluded from the reactive workload calculations since they are not considered to be first responders. A two person DWI Unit works afternoon and early morning hours and are designated as a proactive unit, not responsible for handling calls for service as a first responder.

Staffing levels for the five patrol teams and the Traffic Unit as of 4/16/2022 are shown in Table 11. Keep in mind that the Traffic Unit and Crime Free officers only serve as first responders on Wednesday day shift. The Traffic Unit is dedicated to proactive enforcement all other days of the week unless they are needed for reactive obligations such as traffic crashes.

Table 11.

	Sergeant	Corporals	Officers	K-9 teams	Total
Team 1	1	1	5	1	8
Team 2	1	1	6		8
Team 3	1	1	6		8
Team 4	1	1	5	1	8
Team 5	1	1	6	1	9
Traffic Unit	1	1	4		6
	6	6	32	3	47

Chart 8.

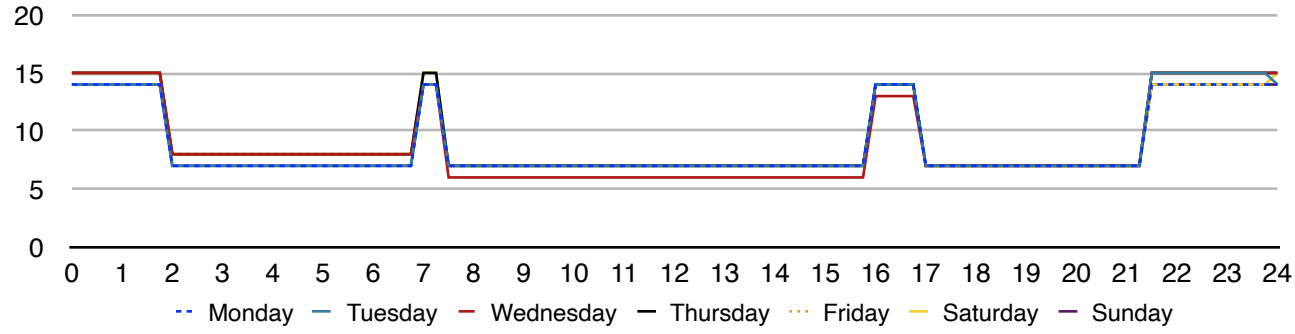
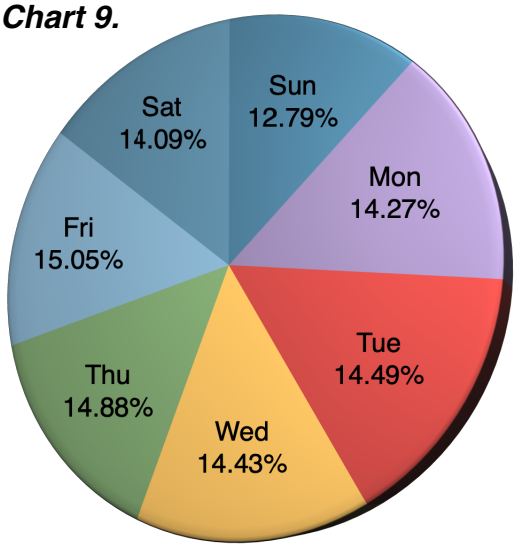


Chart 8 shows the number of officers scheduled in an average 24 hour day in 15 minute increments. The spikes represent the six hours of shift overlap created by the 10-hour shift length from 7 am - 7:30 am, 4 pm - 5 pm, and 9:30 pm - 2 am.

Analysis of Current Workload

Chart 9.

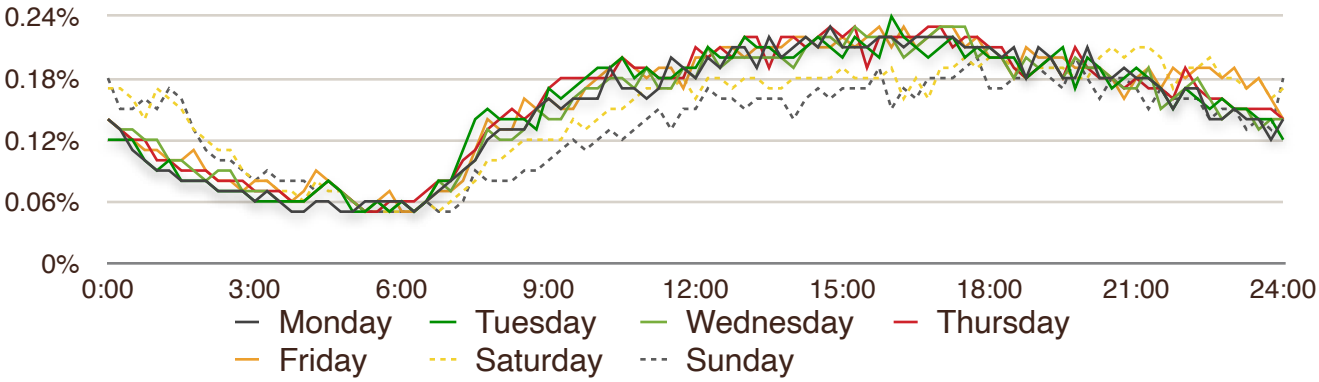


The workload for 2016-2021 was sorted by day of the week to compare the average number of reactive hours of work on each day. Proactive activities were removed from the totals so the data only reflected the reactive workload of the agency. The results, shown in Chart 9, revealed a slight difference in reactive workload throughout the week. Reactive hours on Saturday and Sunday are the lowest at 14.09% and 12.79% respectively. Workload steadily rises throughout the week with a maximum of 15.05% on Friday. The variance in the workload from the heaviest to the lightest day was only 2.26%.

In Chart 10, the workload throughout the day for each day of the week is charted to check for consistency. The workload is charted in 15 minute increments throughout the day. The “y” axis shows the average percentage of the total workload that is occurring on each day within each 15 minute segment. As evidenced in chart 10, the workload curve throughout each day of the week is fairly consistent from day to day. The lightest workload each day occurs around 5 am and the heaviest workload occurs around 3:15 pm each day. The workload during the day for Saturday and Sunday is lower than the overall average. This chart confirms that the agency could effectively use a rotating schedule that provides uniform staffing by day of the week.

Chart 10

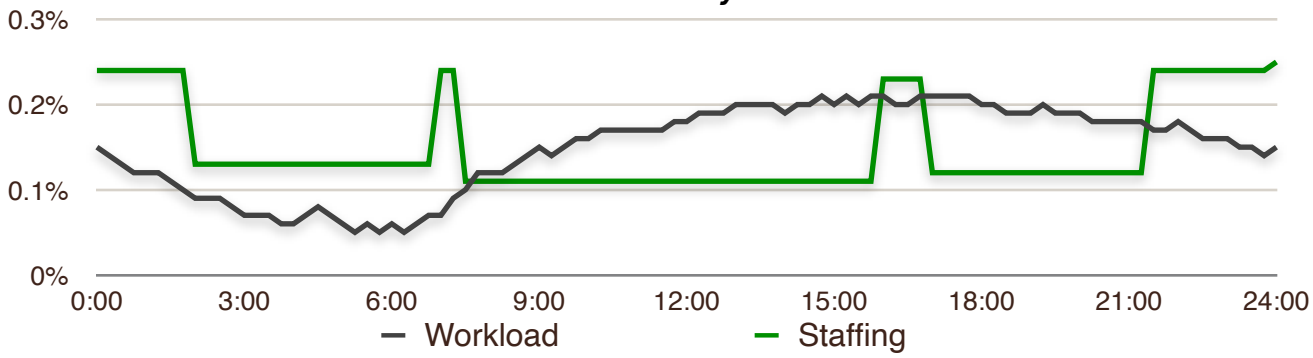
Workload per hour by day of week



Efficiency of the Current Schedule

The current patrol schedule for the Patrol Division was charted across the 24 hours of the day along with the 2016-2021 workload curve from the agency CAD data. The average staffing percentage per hour across all seven days was compared against the average percentage of overall reactive workload handled by the agency across all seven days. The closeness-of-fit of the current staffing curve and the historical workload curve is shown in Chart 11. The green line represents the average percentage of staff on-duty per hour and the dark brown curve represents the average percentage of 2016- 2021 reactive time per hour.

Chart 11. ***Current Schedule Efficiency: 51.99%***



The initial schedule had an average efficiency index of 51.99%. As shown in Chart 11, the agency was proportionally overstaffed between 9:30 pm and 7:30 am and then proportionally understaffed between 7:30 am and 9:30 pm. There are a number of issues with the current schedule that are contributing to the low efficiency rating.

- The spikes in the staffing curve are the result of scheduling three 10-hour shifts in a 24-hour day creating six hours of overlap per day.
- The agency is currently using equal staffing across all three shifts. Due to the varying workload throughout the day, this leads to proportional overstaffing at night and proportional understaffing during the day.
- The largest shift overlap of the day, a 4.5-hour block, is scheduled at night instead of the late afternoon when the peak activity is occurring.

Schedule Optimization

Serious consideration should be given before changing a work schedule that has been in place for a long time, such as the JPD patrol schedule. Schedules and rotations have a major impact upon the health and family life of those officers who work them. Changing the length of the shift, the number of consecutive work days, or the frequency of off-duty weekends can affect childcare arrangements, off-duty jobs, contract overtime opportunities, and continuing education plans. More than anything else, moving from one schedule to another presents a *major change* for the officers and is not always greeted with open anticipation.

This section presents the actions taken to explore alternative schedules, an explanation of the new schedules that are being proposed, and the anticipated benefits of the proposed alternative schedules.

Methodology

Given the impact of work schedules on officers' private lives, schedule considerations can be volatile topics. In many agencies, employees will attempt to hold onto their current schedule in fear that the alternative will be worse. This "better the devil you know than the devil you don't" perspective can often be pervasive. A schedule change can mean an infinite number of things to different people including: new start times, new shift lengths, new rotation patterns, new days off, inconsistent days off, constant weekends, free weekends, etc. When the *other side* of the change is undefined or unclear, the anxiety of those affected tends to increase. The first method of optimization was to optimize the current schedule without changing start times or schedule patterns. The second alternative was to find alternative schedules with a similar shift length. The third option was to abandon the current schedule and adopt a completely different type of schedule.

Optimized Current Schedule

In an attempt to increase the efficiency of the current 10-hour schedule, the number of officers assigned per shift were changed to reflect the workload per shift. Start times remained the same and the current days off were kept. The optimized schedule raised the schedule efficiency from 51.99% to 65.60% without the addition of any officers. The new schedule curve compared to the workload curve is shown below in Chart 12. Table 12 shows the proposed distribution of officers among the five patrol teams.

Chart 12. ***Optimized Schedule Efficiency: 65.60%***

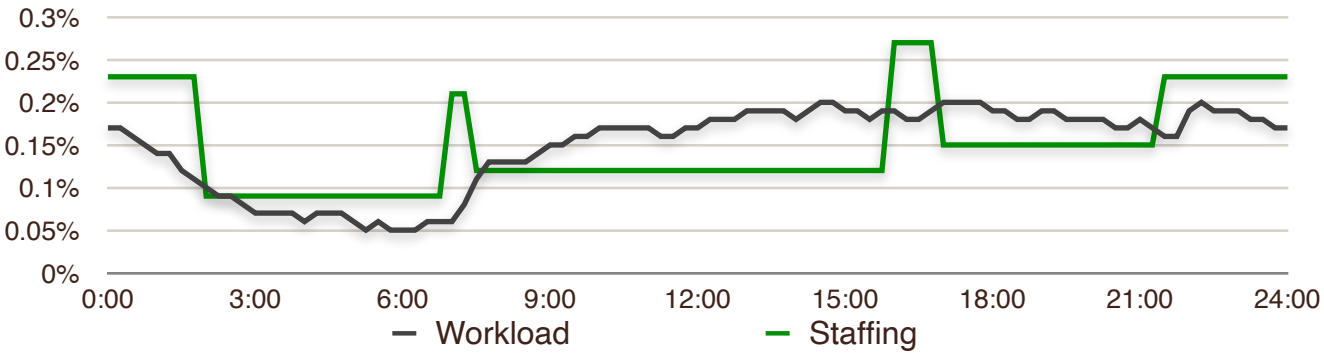


Table 12.	Sergeant	Corporals	Officers	K-9 teams	Total
Team 1	1	1	7	1	10
Team 2	1	1	7		9
Team 3	1	1	8		10
Team 4	1	1	3	1	6
Team 5	1	1	3	1	6
Traffic Unit	1	1	4		6
	6	6	32	3	47

This schedule change would greatly reduce the number of officers on duty during the early morning hours and would have to be vetted by the night shift supervisors for issues regarding officer safety. The schedule would still have team integrity and unity of command but schedule equity has still not been obtained. Teams 1 and 4 would still be working split shifts creating a potential for additional fatigue. However, the workload on the day shift and afternoon shifts would be more manageable with the additional staff. The Traffic Unit officers would still be required to cover the day shift on Wednesdays. The current schedule is simply not a good fit for the demands of the JPD. Adding additional officers into a bad schedule does not miraculously make it a good schedule, it simply wastes more resources.

Alternative Schedule: 10:40 Shift-length

Many agencies in the northwest are using a four week rotating schedule with a 10-hour and 40-minute shift length. This schedule is simply referred to as the "10:40" schedule. The duty cycle schedule for this pattern is "5on - 4off - 5on - 4off - 5on - 5off" with the fifth day in the first week serving as a training day. Chart 13 shows the duty cycle pattern for the 10:40 schedule.

Chart 13.	***Mon***	***Tue***	***Wed***	***Thu***	***Fri***	***Sat***	***Sun***
Week 1	Work	Work	Work	Work	Train		
Week 2			Work	Work	Work	Work	Work
Week 3					Work	Work	Work
Week 4	Work	Work					

Agencies who use this schedule assign one squad to Week 1 of the schedule and an equal size squad to Week 3. At the end of the week, each squad moves down to the next week. When a squad finishes Week 4, they move back up to Week 1 and start again. This schedule creates complete team integrity and uniform staffing by day of the week as long as both squads are of equal size. If a supervisor is assigned to each squad, there is complete unity of command. The schedule creates an average work week of 40 hours over the 28 day period making it compliant with the Fair Labor Standards Act. Each officer gets two full weekends off (Saturday and Sunday) in every four week cycle.

The Friday of Week 1 is a designated training day. The squad in week 3 works Friday while the squad in Week 1 trains as a team. The schedule provides approximately 13 training days per year at 10 hours and 40 minutes each for a total of 138.66 hours of training per year per officer.

While this schedule has many positive features, there is serious potential for fatigue problems on the night shift. This schedule would increase the existing shift length by 40 minutes and add a fifth consecutive workday during each work period before a day off. A possible modification to avoid the potential fatigue on the night shift is a "3on - 3off - 3on - 2off - 3on - 3off - 3on - 3off - 3on - 2off" duty cycle pattern.

Chart 14.	***Mon***	***Tue***	***Wed***	***Thu***	***Fri***	***Sat***	***Sun***
Week 1	Work	Work			Train	Work	Work
Week 2				Work	Work	Work	
Week 3			Work	Work	Work		
Week 4	Work	Work	Work				Work

The duty cycle pattern shown in Chart 14 would reduce the maximum number of consecutive workdays to three as the shift length is increasing to 10 hours and 40 minutes. Night shift workers would get one full weekend off (Saturday and Sunday) and two partial weekends (Saturday or Sunday but not both) in every four week cycle.

The new schedule curve compared to the workload curve is shown below in Chart 15. The schedule efficiency would improve from 51.99% to 78.87%. Table 13 shows the proposed staffing levels per team under this alternative.

Chart 15.

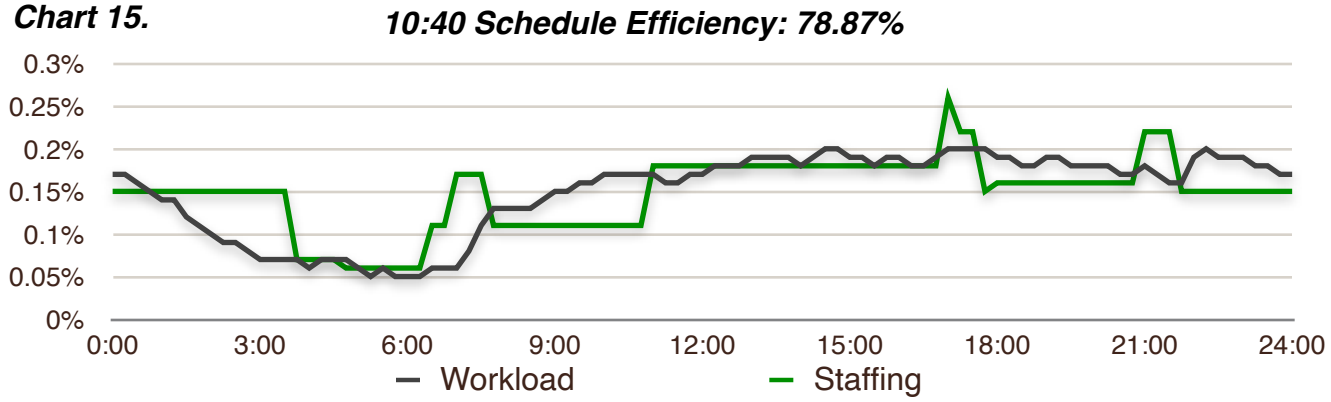


Table 13.

Team #	Shift	Hours	Shift Length	# Officers
A-1	Day Shift Squad 1	7:00 am - 5:40 pm	10:40	4
A-2	Day Shift Squad 2	7:00 am - 5:40 pm	10:40	4
B-1	Early Mids Squad 1	11:00 am - 9:40 pm	10:40	5
B-2	Early Mids Squad 2	11:00 am - 9:40 pm	10:40	5
C-1	Late Mids Squad 1	5:00 pm - 3:40 am	10:40	5
C-2	Late Mids Squad 2	5:00 pm - 3:40 am	10:40	5
D-1	Night Shift Squad 1	9:00 pm - 7:40 am	10:40	4
D-2	Night Shift Squad 2	9:00 pm - 7:40 am	10:40	4
Traffic-1	Traffic Unit	6:30 am - 5:10 pm	10:40	3
Traffic-2	Traffic Unit	6:30 am - 5:10 pm	10:40	3
DWI	DWI Officer	6:00 pm - 4:40 am	10:40	*1*
				43

Alternative Schedule: Pitman 12-hour

A second alternative schedule for consideration is a two-week locked rotating schedule which uses a 12-hour shift length. This schedule, known as the Pitman Schedule, is becoming increasingly prevalent in law enforcement agencies throughout the country in the last 25 years. The duty cycle pattern of “2on - 2off - 3on - 2off - 2on - 3off “ provides a short number of consecutive workdays before a day off and allows every officer on the schedule to have every other Friday through Sunday off as a three-day weekend. The schedule has a native average work week of 42 hours if the pattern is unaltered. Many agencies will convert the third on-duty day in the pattern, which always falls on Sunday, to an 8-hour day making a 40-hour average work week over the two week cycle. The duty cycle pattern for the Pitman Schedule is shown in Chart 16.

Chart 16.	***Mon***	***Tue***	***Wed***	***Thu***	***Fri***	***Sat***	***Sun***
Week 1	12-hour	12-hour			12-hour	12-hour	8-hour
Week 2			12-hour	12-hour			

If an officer takes two leave days in the second week, they are able to get seven days off in a row. Agencies assign two squads of equal size to each start time with one squad assigned to each row. At the end of the week the two squads switch. This provides uniform staffing by day of the week and complete schedule equity for the officers. Unity of command is present if a supervisor is assigned to each squad. Because of the small number of consecutive workdays, this schedule has been shown to create less fatigue on officers than the traditional 4on - 3off 10-hour schedules.

When this schedule was compared to the Joplin workload curve, using four start times, the efficiency rose to 80.74%, the highest of all optimization attempts. This is due to the ability to fit 12 hour shifts evenly into a 24 hour schedule. Chart 17 shows the staffing curve for this alternative. Table 14 shows the proposed staffing levels per team under this alternative.

Chart 17.

Pitman Schedule Efficiency: 80.74%

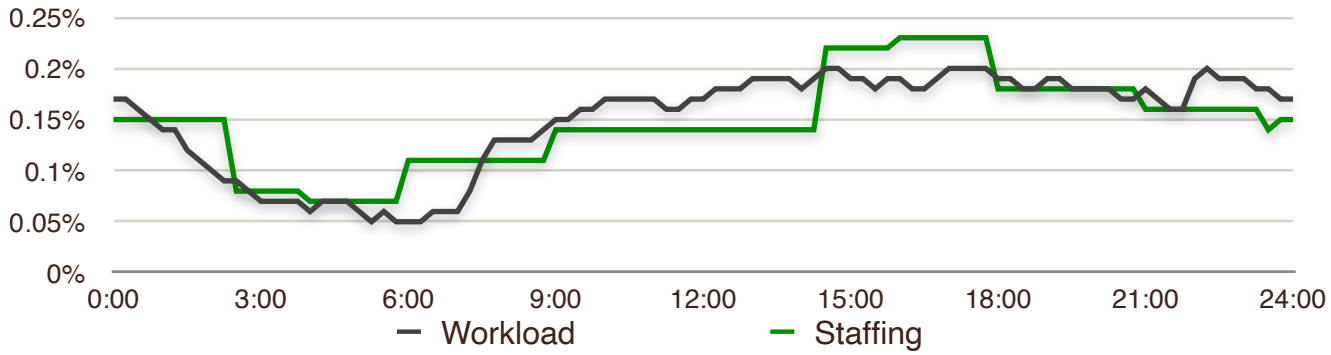


Table 14.

Team #	Shift	Hours	Shift Length	# Officers
Team 1A	Day Shift Squad 1	7:30 am - 7:30 pm	12:00	5
Team 1B	Day Shift Squad 2	7:30 am - 7:30 pm	12:00	5
Team 2A	Early Mids Squad 1	9:00 am - 9:00 pm	12:00	2
Team 2B	Early Mids Squad 2	9:00 am - 9:00 pm	12:00	2
Team 3A	Late Mids Squad 1	2:30 pm - 2:30 am	12:00	6
Team 3B	Late Mids Squad 2	2:30 pm - 2:30 am	12:00	6
Team 4A	Night Shift Squad 1	7:30 pm - 7:30 am	12:00	5
Team 4B	Night Shift Squad 2	7:30 pm - 7:30 am	12:00	5
Traffic A	Traffic Unit	6:00 am - 6:00 pm	12:00	3
Traffic B	Traffic Unit	6:00 am - 6:00 pm	12:00	3
DWI	DWI Officers	4:00 pm - 4:00 am	12:00	***1***
Team 1	Sunday	7:30 am - 3:30 pm	8:00	
Team 2	Sunday	3:30 pm - 11:30 pm	8:00	
Team 3	Sunday	3:30 pm - 11:30 pm	8:00	
Team 4	Sunday	11:30 pm - 7:30 am	8:00	
Traffic	Sunday	10:00 am - 6:00 pm	8:00	
DWI	Sunday	6:00 pm - 2:00 am	8:00	
				43

The Pitman schedule can be used with the native 42-hour average workweek which would provide an extra two hours per week per existing officer. This would increase the officer's base wage towards retirement and provide additional hours towards patrol for the agency. According to the FLSA, police officers can work an average of 43 hours per week before overtime pay is mandated. Keeping the 42-hour native workweek could be a win/win decision.

Investigations Division

At the time of this report, the Investigations Division is staffed with 19 sworn members and one civilian. Members of the division receive one of three assignments; to investigate crimes against persons, to investigate crimes against property, or to serve on one of several multiagency task force positions. The division is led by an Investigations Captain, assisted by a civilian administrative assistant. The crimes against persons (Persons) unit is staffed with a sergeant, a corporal, and four detectives. The property crimes (Property) unit is staffed with a sergeant and five detectives with a vacant corporal position. There is one corporal and five detectives assigned to a variety of interagency task forces that operate in and around the City of Joplin.

The Investigations Section is responsible for investigating cases most often initiated by the Patrol Division. In some situations, additional cases may originate from the investigators. Very few support divisions within law enforcement agencies document their workload in the agency's CAD database and the Investigations Division is no exception. Investigators are expected to schedule their day based on the cases they are currently working. If investigators are leaving the office on an activity that could place them at risk, such as an arrest or to execute a search warrant, they will often notify the dispatcher ahead of time and then check in with them on a limited basis once they arrive at their destination. Other activities such as custodial transports and on-view traffic stops may also be found in the CAD database. However, since investigators often switch from one case to another throughout the day, the majority of their work is never captured in real time. Most agencies will track the number of cases assigned to investigators and may keep record on the number of cases currently assigned to investigators at the end of the month, but the number of hours spent per investigation or the number of hours spent per year on investigations is never captured.

In the absence of historical workload data, stringent quantitative analysis must be put aside in favor of a more subjective and qualitative style of analysis. Two steps were used in this endeavor.

- The first step was to review any available historic records that may have been kept by the agency such as: case assignments, case closures, staffing levels, and unassigned cases. If such records are available, a general review is conducted in search of any historical trends taking place within the division.
- The second step was to conduct a benchmark analysis using available metrics from other law enforcement agencies. A number of correlation analyses with the comparable agencies were conducted using various metrics. After finding the metrics with the strongest correlation coefficients, a histogram was created and a recommended staffing level for the division was derived from the equation of the trend line.

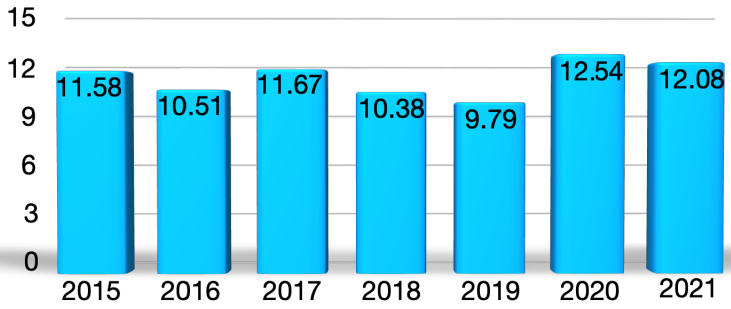
Review of Historical Records

The Investigation Division annual summaries from 2015 through 2021 were provided for review. The summaries included, but were not limited to, the average number of investigators and supervisors in each area, the number of days worked per investigator, number of cases assigned, number of open cases at the end of the month, and average case clearance rates.

According to the provided data, staffing within the Investigative Division has been fairly consistent since 2015. The division has been led consistently by a captain and aided by an administrative assistant and an evidence technician. The Persons Unit has been led consistently by a sergeant and a corporal and staffed with an average of four detectives. The Property Unit has been led consistently by a sergeant and a corporal. From 2015 through 2019, there were an average of five detectives assigned to the Property Unit. That average increased to six for 2020 and 2021. An average of one corporal and five detectives have been assigned to the various task forces since 2015. These numbers have varied occasionally as positions have been vacated and refilled or as major cases have required additional temporary resources. In addition, some members of the division have been moved from one unit to another over time due to workload needs.

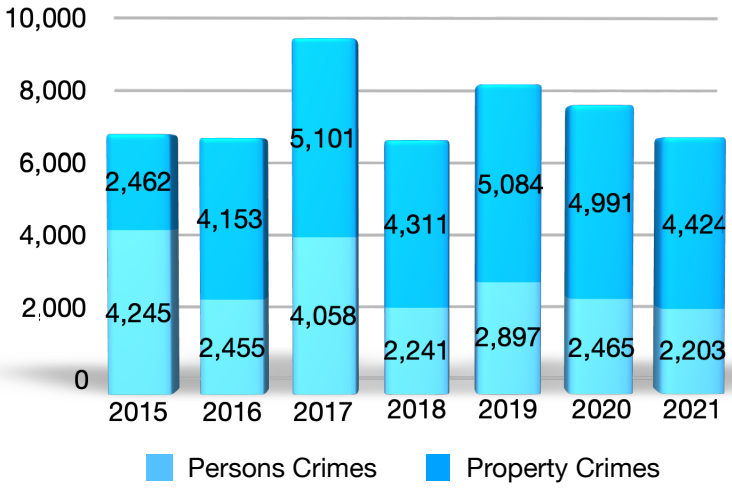
Not including the division captain, unit sergeants, or officers assigned to the various task forces, the number of case assignable corporals and detectives (Persons and Property) averaged 11.22 per year since 2015 (see Chart 18).

CHART 18. Case Assignable Detectives



The annual number of cases assigned to detectives was another metric tracked in the annual summaries provided by the Investigations Division (Chart 19). This metric is often referenced in annual reports for agencies and will sometimes be used for elementary benchmarking purposes. As a foundation for recommended staffing, the number of cases assigned per year is a one-dimensional metric. The stats give no indication of the time spent by investigators per case, the type of cases being investigated, the seriousness of the cases or the societal impact of the cases being assigned. There was no significant correlation found between the number of detectives per year, the number of cases assigned, or the total number of patrol activities per year.

CHART 19. Cases Assigned

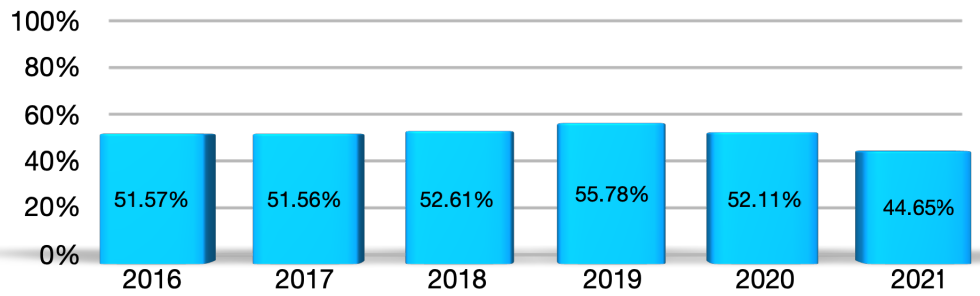


Case clearance rates per year was another metric provided in the annual summaries. The JPD Investigations Division calculates clearance rates as the percentage of total cases assigned that are *cleared by arrest*, *exceptionally cleared*, or *completed* per the following definitions:

- Cleared by Arrest - An arrest has been made in this case.
- Exceptional Clearance - The identity and address or exact location of the culprit is known and enough evidence to obtain a warrant exists. However, due to some reason outside the control of the police, no arrest will be made. Examples: Complainant will not prosecute; prosecuting attorney will not prosecute; perpetrator is dead; subject arrested by another jurisdiction and the department will place no charges.
- Case Completed – this disposition may be used to close a case when the case is complete, but none of the other dispositions would be suitable. Examples may include, death investigations (other than criminal homicide), drug overdoses, runaways, missing persons, information reports, investigative reports for other agencies, etc.

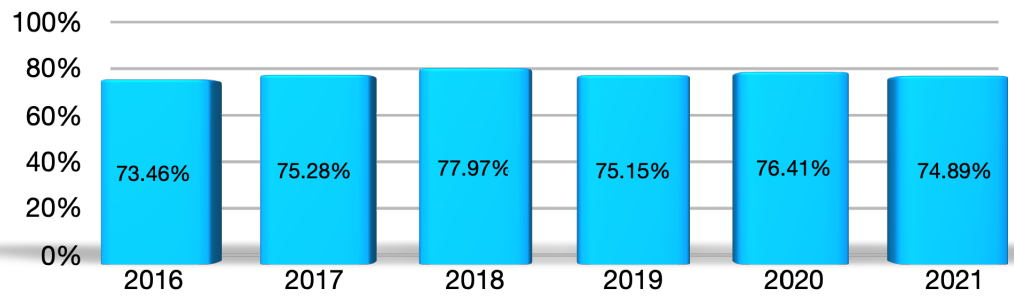
Chart 20 shows the annual clearance rates for all case-assigned detectives from the provided annual summaries. There does not appear to be any correlation between the case clearance rates and the number of investigators assigned to the division per year, the number of cases assigned per year within the Investigations Division, or the total number of patrol activities per year.

Chart 20. Investigations Division Clearance Rates



It should be noted that an agency's clearance rates are highly dependent on the cases that are being assigned for investigation. Some agencies will assign every case that comes from patrol that is not already exceptionally cleared. Other agencies will only assign cases with workable leads such as a known suspect, traceable property, or significant evidence.

Chart 21. Percent of Reactive Patrol Activities Assigned



From 2016 to 2021, the Investigations Division assigned an average of 75.53% of all reports taken by patrol to a detective for further investigation (Chart 21). It is unknown what percentage of the remaining 24.47% of reports were cleared by the initial patrol officer and therefore required no further action.

While internal workload measures can potentially show trends in staffing, case assignments, and/or clearance rates, the data does not provide the type of information needed to quantify how many additional resources may be needed. In addition, case assignment metrics do not indicate how much time is being spent on case investigation by current staff. It is impossible to estimate the time spent in past years on investigations due to the varied nature of each case and the solvability factors that come into play in each situation.

Benchmarking with Trend Line Analysis

In 1997, a group of cities from across the country began to compare benchmark metrics on staffing levels, performance measures, city characteristics, and a host of additional quantitative data. This group eventually became known as the "Benchmark Cities" and their annual data report is known as the "Benchmark City Survey." This group currently consists of 30 law enforcement agencies from 17 different states. The agencies range from a total authorized strength of 122 officers up to 528 officers. The population range of cities served ranges from 94,699 people to 330,367 people. Square mileage of the cities represent a range from 24 square miles up to 353 square miles. Etico Solutions has completed staffing studies for two of these agencies and has taught members of the command staff for many others on the list. Thirteen of the 30 agencies are currently CALEA certified (*) with one in the self-assessment phase(**). The agencies represented in the 2020 Benchmark City Survey (the most recent publication) include:

- Bellevue, WA *
- Boca Raton, FL
- Boise, ID
- Boulder, CO*
- Broken Arrow, OK
- Carlsbad, CA
- Cedar Rapids, IA*
- Chesapeake, VA *
- Chula Vista, CA
- Columbia, MO*
- Coral Springs, FL *
- Edmond, OK
- Fort Collins, CO*
- Fremont, CA
- Garland, TX
- Grand Prairie, TX
- Henderson, NV *
- Irving, TX
- Lawrence, KS
- Lincoln, NE*
- Naperville, IL *
- Norman, OK
- Olathe, KS
- Overland Park, KS *
- Peoria, AZ *
- Plano, TX *
- Reno, NV
- Richardson, TX
- Rochester, MN
- Savannah, GA**

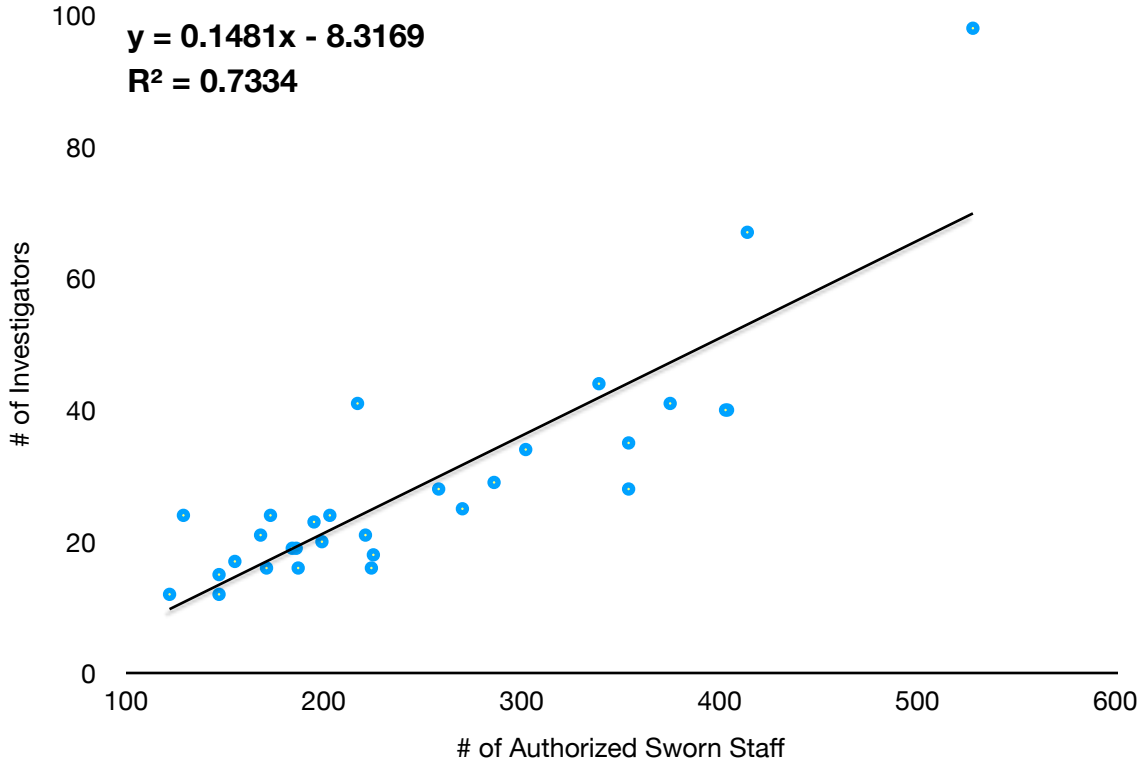
Selecting Suitable Metrics from "Benchmark Cities"

The choice of metrics was limited by the data available in the Benchmark City Survey as well as the logical applicability of each metric to the Joplin Police Department. While the goals of all law enforcement agencies may be similar, the way in which they accomplish those goals can vary widely. The JPD may perform some services for their citizens that are not available in many of the benchmark cities. While measures could be taken to quantify such special services within the JPD, comparable metrics for the same activity may not be available from the benchmark cities rendering the metrics unusable.

Multiple metrics contained in the survey that might have a correlation to the investigative workload were selected and tested for application. To calculate the reliability of each metric to determine staffing needs, an interactive scatterplot was used. The scatterplot allows each applicable metric in the database to be plotted against the investigative staffing levels of each agency in the 2020 Benchmark City Survey.

In the following chart, the number of investigators in 30 benchmark cities were plotted against their number of authorized sworn staff. The resulting scatterplot contained 30 points showing the relation of investigators to authorized sworn staff for each agency (Chart 22).

CHART 22. Investigators : Authorized Sworn Staff



The line shown in the middle of Chart 22 is a linear regression line, or sometimes called a “best-fit” line between all points on the chart. For any “X” value, which in this case is the number of authorized sworn staff, the trend line indicates the average number of investigator positions among the 30 benchmark agencies. The equation of the line is shown in the upper left area of the chart, y=0.1481x - 8.3169. This equation will yield the number of investigators required (y) based on the number of authorized sworn staff (x) if the agency wished to staff consistently with the average of the 30 benchmark cities in the sample.

The second variable (R^2) in the upper left corner of the chart is the coefficient of determination, a key output of regression analysis. It is interpreted as the proportion of the variance in the dependent variable that is predictable from the independent variable. The R^2 variable ranges from 0 to 1. An R^2 value of 0 means that the dependent variable, in this case the number of required investigators, cannot be predicted from the independent variable, the number of authorized sworn staff. An R^2 value of 1 means the dependent variable, the number of required investigators, can be predicted without error from the

independent variable, the number of authorized sworn staff. In Chart 22, the R^2 value is 0.7334 meaning 73.34% of the variance in investigators from one police department to another is predictable by the number of authorized sworn staff. For this study, comparable metrics were not considered valid unless the R^2 value met or exceeded 0.8.

Four different metrics were tested against investigator staffing using an interactive regression analysis model similar to Chart 22. For each metric tested, an initial regression analysis was run to determine the starting R^2 value for the metric and to identify any data points that were found to be two or more standard deviations from the anticipated value. For each analysis result, the largest outlying point was removed and the analysis was repeated until all remaining values fell within two standard deviations or less. If the R^2 value was greater than or equal to 0.8 once all outliers were removed, the metric was accepted as a viable predictor of recommended staffing. Regression analysis was conducted comparing total case-assigned investigators to authorized sworn positions, first responders, part I crimes, and calls for service. The following three outputs are provided for each metric tested.

- ***R^2*** - This value, also known as the "Coefficient of Determination" gives an indication of the overall regression accuracy by indicating how well the regression line approximates the real data. A threshold of 0.8 (80%) was set for this study.
- ***r*** - The Correlation Coefficient indicates the strength of the linear relationship. For example, a value of 1 means a perfect positive relationship, a value of -1 means a perfect inverse relationship, and a value of zero means no relationship at all. Values closer to 1 or -1 are preferred over values near 0. For this analysis, values of .9 or higher are deemed acceptable.
- ***P-value*** - The P-Values of the variables provide the likelihood that they are real results and did not occur by chance. The lower the P-Value, the higher the likelihood that the coefficient is valid. For example, a P-Value of 0.016 for a regression coefficient indicates that there is only a 1.6% chance that the result occurred only as a result of chance. P-Values less than 0.001 are acceptable in this analysis.

When benchmarking against other agencies, caution must be given to ensure that metrics are interpreted uniformly among all comparable agencies. The metrics published each year by the Benchmark Cities can be very useful but only if they are validated as accurate. Law enforcement agencies structure their employees in a way that best accomplishes their mission and goals. Any number of "units" could exist within an Investigation Division and the purpose of each unit could be different from one agency to the next. If the Benchmark City Survey is completed by someone outside of the Investigation Division, the numbers representing case-assigned detectives, task force officers, forensic examiners, evidence techs, and a number of other specialty positions can be blurred and/or blended.

To validate the investigative staffing numbers found in the Benchmark City Survey, a telephone conversation was attempted with an administrator or supervisor from the Investigations Division of each benchmark city. After numerous calls and messages with all 30 cities, 21 administrators/supervisors accepted or returned the call and provided exact numbers for case-assigned investigators, first line supervisors, task force officers, narcotics

officers, and specialty teams. The vetted numbers created a significant difference in the linear regression results opposed to the initial numbers contained in the 2020 survey results. The original survey numbers were replaced with the vetted results obtained from the contacted agencies and used in the results of this analysis. The following agencies could not be reached for data validation after numerous attempts and messages:

- Boca Raton (FL)
- Carlsbad (CA)
- Chesapeake (VA)
- Chula Vista (CA)
- Henderson (NV)
- Olathe (KS)
- Reno (NV)
- Plano (TX)
- Savannah (GA)

Investigative Positions : Authorized Sworn Positions

The number of investigator positions for the 30 Benchmark Cities were plotted against their number of authorized sworn positions. Nine cities among the benchmark cities produced results found to be more than 2 standard deviations away from the trend line. The cities of Savannah (GA), Plano (TX), Boca Raton (FL), Reno (NV), Carlsbad (CA), Lincoln (NE), Fort Collins (CO), Naperville (IL), and Cedar Rapids (IA) were excluded from the sample respectively by largest deviation and the analysis was repeated after each exclusion. The results from the remaining 21 comparable cities produced the scatterplot shown in Chart 23. According to the R^2 value, 94.66% of the variance in authorized investigator positions among the 21 remaining benchmark cities can be predicted by their number of authorized sworn positions. The R^2 and r values shown in Table 15 indicate that the regression model has a high degree of accuracy using the sample data and that a strong linear relationship exists between the dependent and independent variables used. The low P-value of the independent variable (authorized sworn positions) indicates practically no chance that the regression output was merely a chance occurrence.

CHART 23. Investigators : Authorized Sworn Staff

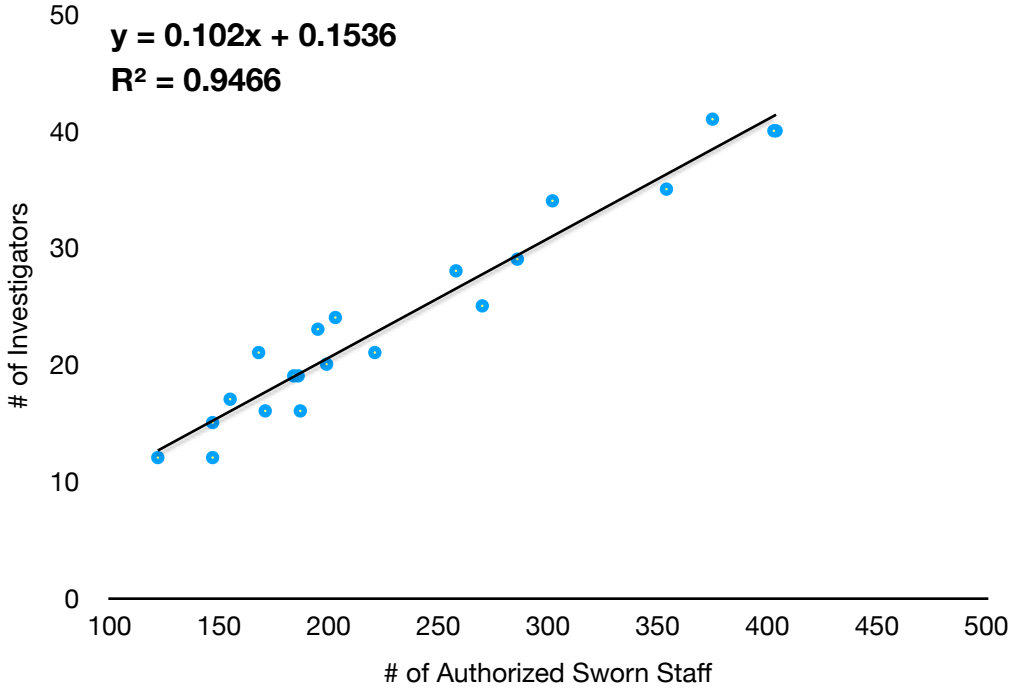


Table 15.	Observed Value	Status
Coefficient of Determination (R^2)	0.9466	Acceptable (> 0.8)
Correlation Coefficient (r)	0.9729	Acceptable (> 0.9)
P-Value of metric	1.51656E-13	Acceptable (< 0.001)
	Regression Model Accepted as Valid	

Using the equation for the regression line and the number of authorized sworn positions within the Joplin Police Department (110), the number of recommended authorized investigative positions can be determined as followed.

y = 0.1020x + 0.1536 where “x” is the number of authorized sworn positions (110).

y = (0.1020 * 110) + 0.1536 (substituting 110 for “x”)

y = 11.22 + 0.1536 = 11.38 or 11 authorized investigative positions

From 2015 through 2021, the Investigations Division has averaged 11.22 case-assigned detectives. This number does not include the captain, sergeants, or task force officers. Based on the current number of authorized sworn positions on the agency, the Investigations Division would appear appropriately staffed when compared with the selected 21 benchmark cities. If the agency adds additional sworn positions, one investigative position would be needed for every 8.3 sworn positions added in order to maintain the current ratio of the comparable cities.

Investigative Positions : First Responders

The number of investigator positions for the 30 Benchmark Cities were plotted against their number of first responders. In the Benchmark City Survey, first responders are defined as commissioned police officers below the rank of first line supervisor whose primary responsibility is handling dispatched calls for service. This is interpreted differently for most agencies in the survey group and cannot be determined by any set position definitions. Seven cities among the benchmark cities produced results found to be more than 2 standard deviations away from the trend line. The cities of Savannah (GA), Reno (NV), Plano (TX), Boca Raton (FL), Carlsbad (CA), Henderson (NV), and Naperville (IL) were excluded from the sample respectively by largest deviation and the analysis was repeated after each exclusion. The results from the remaining 23 comparable cities produced the scatterplot shown in Chart 24. According to the R^2 value, 87.91% of the variance in authorized investigator positions among the 23 benchmark cities can be predicted by the number of first responders. The R^2 and r values shown in Table 16 indicate that the regression model has a high degree of accuracy using the sample data and that a strong linear relationship exists between the dependent and independent variables used. The low P-value of the independent variable (first responders) indicates practically no chance that the regression output was merely a chance occurrence.

CHART 24.

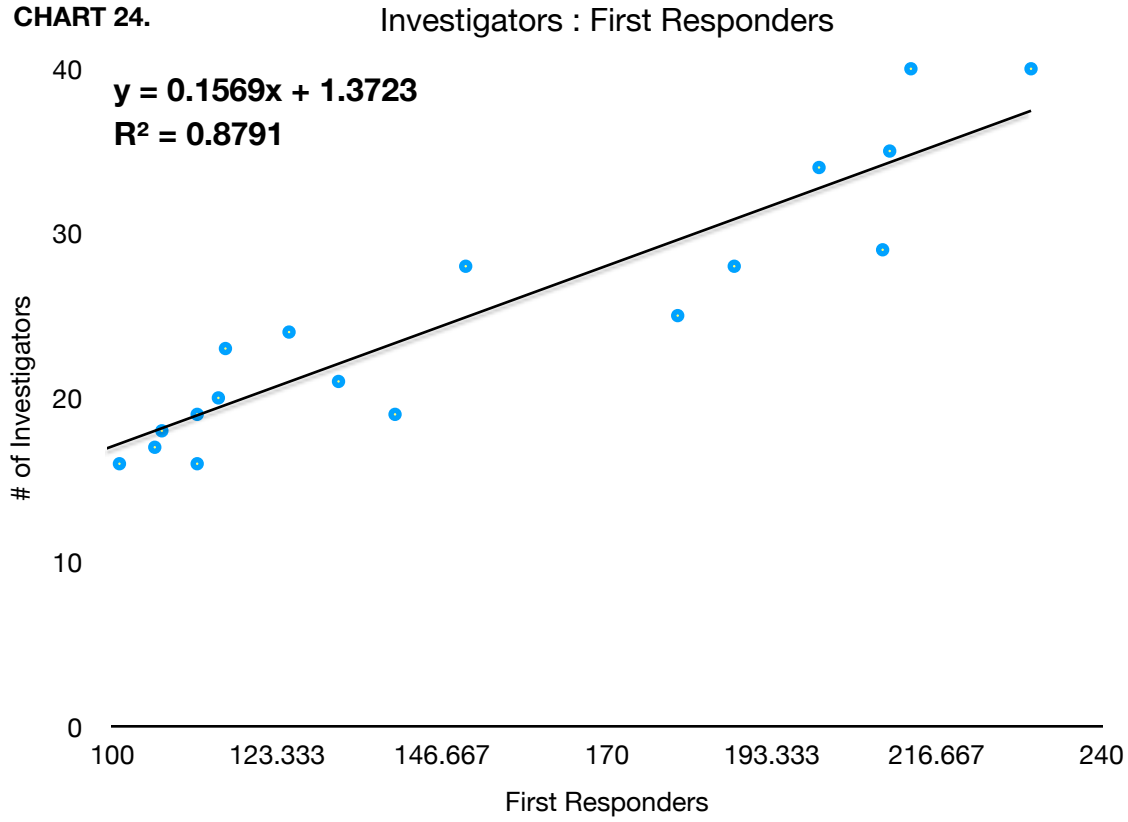


Table 16.	Observed Value	Status
Coefficient of Determination (R^2)	0.8791	Acceptable (> 0.8)
Correlation Coefficient (r)	0.9376	Acceptable (> 0.9)
P-Value of metric	4.24423E-11	Acceptable (< 0.001)
	Regression Model Accepted as Valid	

Using the equation for the regression line and the number of first responders within the Joplin Police Department (41), the number of recommended authorized investigative positions can be determined as followed.

y = 0.1569x + 1.3723 where “x” is the number of first responders (41).

y = (0.1569 * 41) + 1.3723 (substituting 41 for “x”)

y = 6.4329 + 1.3723 = 7.81 or 8 authorized investigative positions

The confidence level of this result is not as strong as the regression based on authorized sworn. The metric of “first responders” can be defined in a number of different ways by different agencies reducing the reliability of the metric.

Investigative Positions : Part 1Crimes

Seven of the Benchmark Cities use the NIBRS crime reporting system and therefore did not submit information on Part I crimes. These cities include: Boise (ID), Boulder (CO), Columbia (MO), Grand Praire (TX), Irving (TX), Olathe (KS), and Reno (NV). The number of investigator positions for the remaining 23 Benchmark Cities were plotted against their number of Part I Crimes. A footnote in the survey states: "Part I Crimes Include: Aggravated Assault/Battery, Arson, Auto Theft, Burglary, Homicide, Rape, Robbery, and Theft." Five cities among the benchmark cities produced results found to be more than 2 standard deviations away from the trend line. The cities of Savannah (GA), Plano (TX), Boca Raton (FL), Henderson (NV), and Chesapeake (VA) were excluded from the sample respectively by largest deviation and the analysis was repeated after each exclusion. The results from the remaining 18 comparable cities produced the scatterplot shown in Chart 25. According to the R^2 value, 29.40% of the variance in authorized investigator positions among the 18 benchmark cities can be predicted by the number of Part I crimes. The R^2 and r values shown in Table 17 indicate that the regression model has a very low degree of accuracy using the sample data and that a very weak linear relationship exists between the dependent and independent variables used. The P-value of the independent variable (Part I crimes) indicates a high probability that the regression output was merely a chance occurrence.

CHART 25.

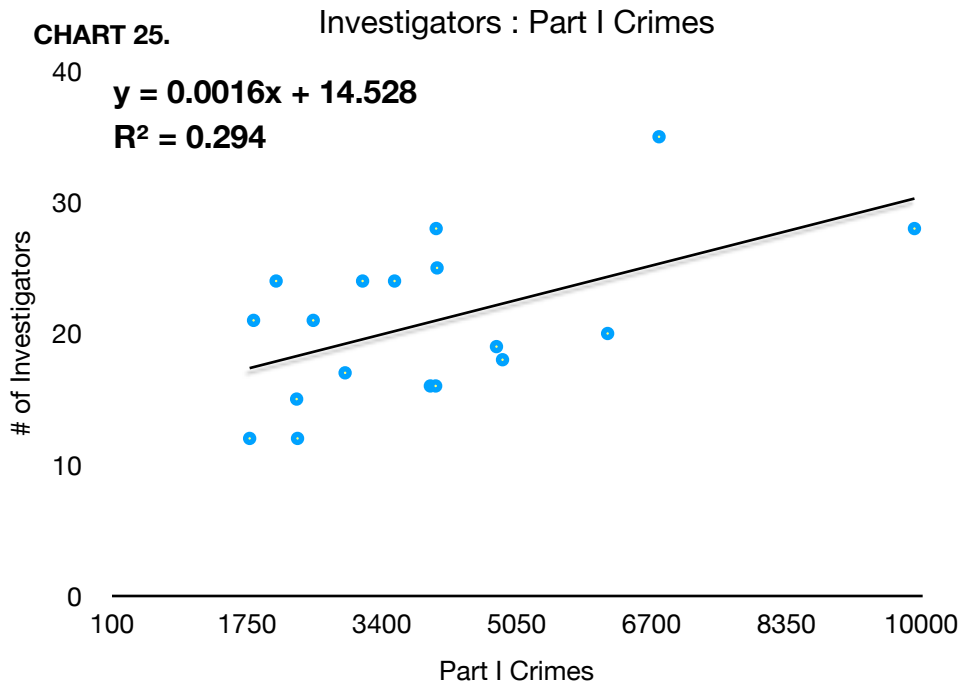


Table 17.	Observed Value	Status
Coefficient of Determination (R^2)	0.2940	Not Acceptable (< 0.8)
Correlation Coefficient (r)	0.5422	Not Acceptable (< 0.9)
P-Value of metric	0.020090953	Not Acceptable (> 0.001)
	Regression Model Not Accepted as Valid	

Investigative Positions : Calls for Service

The number of investigator positions for the 30 Benchmark Cities were plotted against the number of calls for service for each agency. The survey states: “Calls For Service include only calls where someone telephoned to request police response, not officer-initiated calls.” Six cities among the benchmark cities produced results found to be more than 2 standard deviations away from the trend line. The cities of Savannah (GA), Plano (TX), Boca Raton (FL), Reno (NV), Chesapeake (VA), and Henderson (NV) were excluded from the sample respectively by largest deviation and the analysis was repeated after each exclusion. The results from the remaining 24 comparable cities produced the scatterplot shown in Chart 26. According to the R^2 value, 45.01% of the variance in authorized investigator positions among the 24 remaining benchmark cities can be predicted by their number of authorized sworn positions. The R^2 and r values shown in Table 18 indicate that the regression model has a low degree of accuracy using the sample data and that a weak linear relationship exists between the dependent and independent variables used. The P-value of the independent variable (calls for service) is acceptable but much higher than the P-values for authorized sworn positions or first responders.

CHART 26. Investigators : Calls for Service

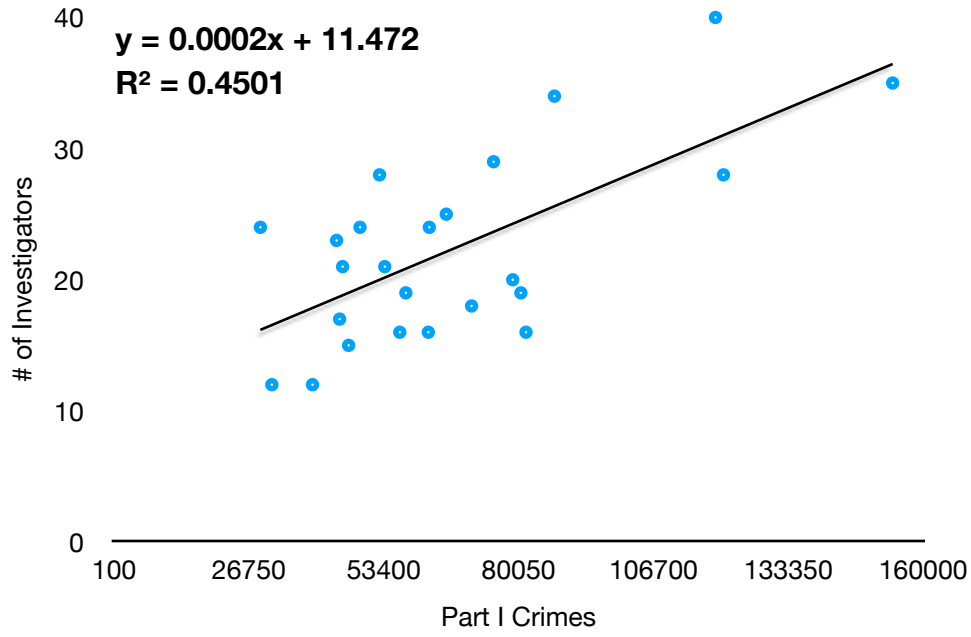


Table 18.	Observed Value	Status
Coefficient of Determination (R^2)	0.4501	Not Acceptable (< 0.8)
Correlation Coefficient (r)	0.6709	Not Acceptable (< 0.9)
P-Value of metric	0.000332641	Acceptable (< 0.001)
	Regression Model Not Accepted as Valid	

The number of task force officers were recorded separately in the Benchmark City Survey. The final number of authorized positions were for criminal investigators only. All available metrics were tested in an attempt to find a usable metric for determining the number of task force officers but none could be found. The results of all metrics tested returned R^2 values of less than 0.5 which was deemed unreliable.

Summary

This analysis looked at the workload of the Investigations Division from two separate perspectives.

- Staffing levels within the division have been consistent with no significant increase in staffing in the last seven years (Chart 18). The case assignment metrics provided by the division supervisors showed the percentage of cases assigned to detectives for investigation has been inconsistent over the last seven years with no apparent correlation to staffing levels or patrol activities (Chart 19). Charts 20 and 21 show that the clearance rate for cases and the percentage of patrol generated reports assigned to detectives for further investigation have been relatively consistent over the last six years and show no correlation to changes in staffing or the number of cases assigned. While the metrics show that work is being done, there is no indication of how much work or that the workload is trending in any consistent direction. No indication of future staffing needs could be gleaned from the available historical workload.
- The second perspective used for evaluation of the Investigation Division staffing was a benchmarking analysis. Four different metrics were used to draw comparisons between the investigative staffing of the JPD and the average investigative staffing of the 30 Benchmark Cities. Two metrics, authorized sworn staff and first responders, were found to be statistically reliable in predicting staffing levels for detectives. However, the reliability of the definition of “first responders” by the 30 Benchmark Cities is questionable leading to a reduced confidence level when using first responders as a basis for staffing. The results of the regression analysis based on authorized sworn staff provided the most confident predictor of appropriate staffing. At the present time, it appears that the JPD Investigations Division is staffed appropriately compared to the Benchmark Cities. However, as additional staff is hired, one investigative position should be created for every 8.3 positions added.
- The ratio of task force officers to total investigative staff is high for an agency the size of JPD. However, Joplin is the hub of the tri-state metropolitan area and their participation in the various inter-agency task forces serves as a force multiplier. As the largest area agency involved in many of the task forces, the City of Joplin undoubtably enjoys a cost return on the officer assignments.

Recommendations

Accounting and Accountability

Unreported / Under-reported Workload

The need for better documentation of report writing times and follow-up times was described earlier in this report as a limitation of the CAD data. The Central Square CAD software used by JPD contains out-of-service codes for report writing, follow-up, and many other activities being performed by the officers that is currently being under-utilized. In order to properly estimate the time spent by patrol officers on the various types of calls to which they respond, an accurate time spent on report writing and follow-up for each type of call must be properly documented.

It is highly recommended that the use of the report writing out-of-service code be stressed as an everyday practice for the officers. The agency is encouraged to modify the existing report writing out-of-service code to “Report Writing - Available” and to create a second out-of-service code for “Report Writing - Unavailable”. The two status codes should be configured in the CAD so that the first shows the officer as “available” on the CAD Unit Status screen if another call came into their assigned beat. The second should show them as “unavailable” for dispatch. The report-writing-available code would allow the officer to place themselves on an out-of-service status to document report writing times without the concern of other officers being sent into their beat to handle their calls. The report-writing-unavailable could be used if an officer had to stay past the end of their shift to finish reports and wished to remain in the CAD to document the time spent report writing. Prior to starting a police report, the officer should either contact dispatch and request to be placed on “report writing” status or they should place themselves on “report writing” status over their mobile computer. If they intend to drive to the station to complete the report, the drive time to the station and back to their assigned reporting area should be included in the report writing time. In order to differentiate the time spent writing reports for different types of calls, the case number for the report being written must be recorded in the out-of-service log entry so that it can be associated back to the type of call at the end of the year. This type of detailed accounting not only documents how much time is being spent writing reports but it can also tie report writing times to specific types of events to improve future workload forecasts.

The data analysis for this report indicated that patrol officers are documenting their time with the “report writing” out-of-service code on less than 15% of the total reports being written. To correct this user-reported work, a group of approximately 20 JPD employees were asked to assist in providing estimated times for report writing. If this data is collected accurately over the next several years, the estimated report times in the spreadsheets can be replaced with actual CAD averages in order to improve the accuracy of the calculated needs. It is recommended that the agency continue to encourage the documentation of all work activities after this study is completed. Most importantly, the need for documenting report writing times should be emphasized with the officers and the proper format for recording time spent on report writing should be monitored to reduce unusable results.

Currently, the agency has an out-of-service code for “follow up” and an event type for “follow up.” The out-of-service code was used an average of 391 times per year between

2016 and 2021. The “follow up” event code was used an average of 3,428 times per year during the same time period. Each time a new event is created for “follow up”, a second event number is being created for an event that has already been handled by patrol. The agency is encouraged to modify the existing “follow up” out-of-service code to “follow up Available” and create a second out-of-service code for “follow up Unavailable” for the same reasons as report writing. Many officers will clear from a call upon arrival when no immediate activity is present simply to make themselves available in the computer once again. Giving the officer the option of remaining in the area on a “follow up available” status will allow the officer to document any additional time spent checking the immediate area before they move to other parts of their assigned beat. The agency is encouraged to eliminate the current “follow up” event code so officers will begin using the out-of-service option instead.

Personnel Tracking Software

While tracking unreported workload in the CAD has been stressed several times in this report, there is a second side to the coin that needs to be addressed. The current process used by JPD to track hours worked, hours spent on training, hours spent on leave, overtime hours, light-duty hours, etc. is antiquated and inefficient. Officers are still completing hand-written bi-weekly time sheets and submitting them to their supervisors for approval and submission to payroll. This places an unnecessary administrative workload on officers and supervisors that could be handled much more efficiently through a city-wide server-based human resources software such as Kronos. Anecdotally, a sample of six timesheets were provided to Etico by the agency for review to better understand the current process. Four of the six timesheets received had mathematical errors in the officer’s attempts to total up their various hours of work. The current hand-written timesheets are prone to error and even the best supervisors cannot be expected to know every hour worked by every subordinate over the last two week period to make the approval process valid.

Attempts at determining the amount of time spent training in lieu of a normal workday for purposes of this study were arduous. Record keeping for training days included the names of those officers in attendance but the time spent at the training and whether the officer was there in lieu of a normal workday or on overtime was inconclusive. This documentation is typically done in other agencies within a server-based human resources software.

When a patrol officer on light-duty status is placed on a temporary reassignment in another division, it increases the minutes of reactive time per hour of the remaining patrol officers and creates a need for a higher shift relief factor and a larger patrol staff size. It is recommended that whenever possible, officers on light-duty should be reassigned within the Patrol Division on tasks that are still within the patrol mission. If such positions are not available within patrol, the time spent on reassignment to other divisions must be properly documented. In a similar fashion, the time that officers spend on reassignments to other divisions, not related to light-duty, must also be properly documented for use in future staffing studies. Reassignments such as these are not always tracked in a payroll system since the total hours worked remains the same regardless of division assignment. This documentation is typically done in other agencies within a server-based human resources software.

Every agency administrator faces the daily challenge of maximizing resources and minimizing overtime. The JPD has a very limited number of overtime codes available on the paper timesheets being completed by officers to document a large number of overtime causes. Hand-written notes are periodically written in by officers to explain the reasons for overtime but hand-written notes are not conducive to analysis when over 2800 timesheets are being submitted per year. A server-based human resources software application would enable an unlimited number of overtime codes that can be accessed and reviewed easily for consideration. Better data enables better decisions and may enable the administration to organize and coordinate resources to most effectively manage overtime needs.

CAD Data

Unclear or "generic" event types or codes within an agency's CAD can be problematic when calculating workload for the agency. There were seven event types in the historical CAD data that raised questions or problems during the analysis.

- *"Car Stop"* - As stated earlier in this report, the JPD is currently using a single event type of "car stop" to capture all traffic related stops. Criminal traffic offenses such as driving while intoxicated (DWI), driving while license suspended/revoked (DWLS), fleeing and eluding, and careless driving are all included in this event type. When calculating the average time on call, including criminal traffic events with routine traffic skews the average time spent on call. Industry practice is to always track criminal traffic offenses under independent event types. This is the most used event type in the CAD with over 13,000 average uses per year. It is recommended that a new CAD event type be created for each criminal traffic offense listed above.
- *"Officer needs to call"* - This is the second most used event type in the CAD with an average of almost 8,000 uses annually. The title of this event type does not indicate the nature of the activity and cannot be classified precisely as proactive or reactive unless each record is examined individually for notes that may have been made by the dispatcher or officer. It is recommended that this code be eliminated from the CAD to force a more appropriate event type to be used in its place.
- *"Check own satisfaction"* - This CAD event type provides no information on the type of event being addressed and whether it is proactive or reactive in nature unless the actual event is examined for any additional comments added by the dispatcher or officer. The JPD used this event code over 2500 times per year on average making a manual lookup of every event impractical for data analysis. It is recommended that this code be eliminated from the CAD to force a more appropriate event type to be used in its place. "Check own satisfaction" may be more appropriately used as the priority of this call and not the type of event.
- *"Follow up"* - The fifth most-frequently used code in the CAD, this type code generates an incident number in the CAD and is used when an officer is conducting follow up investigations on a prior call. While this type code is useful for documenting an officer's time on investigations, its use as a type code creates duplicate incident numbers in the CAD since an incident number has already been created for the initial event that is being investigated. If the agency uses benchmarking practices based on the total number of incidents per year, the use of this type code is artificially inflating that total. It is recommended that the agency cease using "Follow Up" as a type code and begin to capture the time spent on follow-up investigations

as an out-of-service status instead. CAD could capture the time in the unit history log without a duplicate incident number being generated. As with the *reporting writing* out-of-service code, the officers would need to reference the case number they are investigating in the comment field when generating the out-of-service code so it could be referenced back to the original call during analysis.

- *"Lobby Call"* - Similar to "Officer needs to call" and "Check own satisfaction", this event code tells very little about the nature of the call for service. Classifying this as proactive or reactive cannot be done precisely since the nature of the actual incident is unknown. This event was used an average of 1,353 times per year during the six years of analyzed data. It is recommended that this code be eliminated from the CAD to force a more appropriate event type to be used in its place. "Lobby" (the street address of the Police Department) should actually be used as the location of the call, not the event type of the call.
- *"Text to 911"* - This event code is rarely used with an average of only nine uses per year. Like so many other calls described above, this call gives little information concerning the nature of the call itself or the type of event. "Text to 911" may be better used as the source of the call but it would be better classified under a more descriptive event type. It is recommended that this code be eliminated from the CAD to force a more appropriate event type to be used in its place but a source option be added for "Text" or "Text to 911."
- *"Unknown Trouble"* - This CAD event was used an average of 317 times per year over the six years analyzed. Again, the CAD event type does not provide information on the nature of the call and is difficult to definitively classify it as proactive or reactive. It is recommended that this code be eliminated from the CAD to force a more appropriate event type to be used in its place.

A disconnect appears to exists between the event types identified in the CAD and the Offense Descriptions used in the JPD Record Management System (RMS) There are a number of offense titles used in the Uniform Crime Reporting (UCR) System that are not found within the list of CAD event types. An officer may have to chose the next best option among CAD event types to match the offense description of a report they are preparing. Data analysis and reporting may be greatly simplified if all offense descriptions from the RMS were included as CAD event types. UCR offenses that are not currently available in the CAD include, but are not limited to:

- Murder/Homicide
- Arson
- Robbery (simple)
- Aggravated Assault
- Embezzlement
- Possession of stolen property
- Possession of a weapon
- Prostitution
- Elder abuse
- Driving While Intoxicated
- Careless Driving
- Driving while Suspended/Revoked
- Fleeing and Eluding Police
- Etc.

The agency is strongly encouraged to form a small committee of four to six people to thoroughly review the current event types in the CAD as well as those that may need to be added. Members on this committee should represent the Dispatch Center, the Patrol Division, the Records Unit, and a member of Administration. Each event type should be

discussed in depth to ensure that all members of the agency are using each particular event type for the same reasons and under the same circumstances. Committee members must be able to classify each activity as proactive, reactive, or administrative. Once the committee has finished the review and any changes that result, a list of the newly formed CAD event types should be printed on a colored card stock, dated, and provided to every member of the department. If the CAD event list is modified in the future, the modified version should be printed on a different color card stock, dated, and distributed to all members of the department with the direction to discard the previous colored list.

Comprehensive training on workload documentation is highly recommended for the officers and the dispatchers. If the officers and dispatchers understand why the data is being collected and how it will be used in the future, there is a greater chance of successfully improving the collection process.

It is strongly recommended that the agency contact Central Square to inquire about the availability of an “Initial Type / Final Type” configuration for the CAD. The event type chosen for use when a call is received by the dispatch center is based on the circumstances given by the caller and is entered into an “Initial Type” field. A Final Type (or similarly named) field provides a placeholder for a dispatcher to enter an event type at the end of the incident after officers are on scene and more information is known. If an officer arrives on call and the nature of the call is different from the description given by the caller, the Final type field can be used to enter a more accurate event type. This is standard in many modern CAD software packages and may be an available option in the Central Square software in use at JPD. The use of an Initial Type/Final Type configuration would greatly enhance the accuracy of call-for-service tracking and forecasting.

Patrol Staffing

A forecast of the Patrol Division’s workload and officer availability based on 2016-2021 data indicates that the Patrol Officers will spend approximately 40.28 minutes out of each hour on reactive activities in 2022. This leaves an average of 19.72 minutes remaining in each patrol hour for proactive enforcement, traffic enforcement, community oriented policing, and routine patrol.

In keeping with the practices of Northwestern University’s Center for Public Safety and the International Association of Chiefs of Police, Etico Solutions consistently advises agencies to strive for an even split of proactive and reactive time per hour. To reach an even split of proactive and reactive time per hour in the current year, the agency would need to add approximately 23 additional patrol officers. Forecasted values for future years are provided in the staffing model but are subject to change if data collection methods improve. As additional positions are added in patrol, the workload will also begin to increase based on the additional enforcement time provided by a larger staff. Coming off a two year pandemic which reduced proactive enforcement and citizen engagement, the forecasted numbers in this study should be considered to be highly conservative.

The agency is encouraged to look deeply into all positions currently occupied by sworn personnel to see if any sworn positions could be returned to the Patrol Division pending training completion for new hires. One sworn position is being occupied by an equipment custodian. That sworn position could be converted to a civilian position and the authorized sworn position returned to patrol. The agency has a sergeant position assigned to training with direct supervision of only two sworn training officers. If the Patrol Division moves to an

alternate schedule, it may be prudent to move the training sergeant position back to a patrol sergeant position and a third training officer be appointed. Direct supervision of the Training Unit would then fall under the Professional Standards Captain.

Finally, officer retention is an obvious problem for the Joplin Police Department. The turnover rate determined in this study is the highest seen by this researcher in over 18 years of conducting studies. The City of Joplin is spending enormous resources in training new recruits only to see them leave shortly after completing training for other law enforcement agencies. Although officer pay was not a focus of this study, it became a red flag when the turnover and availability rates were found to be so high.

Patrol Deployment

An earlier section of this report entitled “Patrol Deployment” detailed a plan for replacing the current 5-beat deployment plan in use by the agency. A new 12-beat plan was created with a 0.74% deviation in workload among the heaviest and lightest districts. The agency is encouraged to implement the proposed beat plan and then to revisit the new 12-beat plan in two years to evaluate the distribution of workload to ensure that it is still equitable.

Patrol Scheduling

An earlier section of this report entitled “Patrol Scheduling” detailed a modification to the existing schedule and two alternate proposed schedules for the Patrol Division that would reduce overtime and increase the level of staffing on the streets during times of need. The schedules maintained qualities that were important to the agency such as team integrity and unity of command. The two proposed alternate schedules provide schedule equity and eliminate the split shifts currently being used. The proposed schedules also improved the schedule efficiency with the workload curve of the agency. The proposed 12-hour Pitman schedule would provide every officer in patrol with every other weekend off, creating a potential recruitment and retainment tool for the patrol officers. The Pitman rotation has also been shown to create less fatigue than the traditional 4 on3 off 10-hour schedule.

As a final note, if the agency decides to move forward with the 10:40 proposed schedule, there is strong encouragement to closely monitor the night shift employees for signs of excessive fatigue under the 10:40 schedule. Five consecutive nights at 10 hours and 40 minutes is beyond the recommended work period based on fatigue studies and circadian research. If the initial fatigue does not subside after two to three months, the agency is strongly encouraged to look at the alternate schedule for the night shift described in Chart 14 of this report.

Investigations Staffing

A thorough analysis of data submitted by the Investigations Division revealed no significant growth tends or correlations between staffing levels and performance levels. Staffing in the Investigations Division has been fairly consistent over the last six years and case closures and case assignment have not changed significantly. Regression analysis with 30 other agencies who participate in the “Benchmark City Survey” showed the number of case-assigned detectives could best be predicted based on the total authorized sworn staff of an agency. After plotting the number of case investigators versus authorized sworn positions for all 30 agencies and then eliminating outliers in the data set, an equation of the

regression line for the remaining data points was determined. Based on 110 authorized sworn positions within the JPD, the average staffing required to staff JPD similarly to the other agencies was 11.38 case investigators. At the present time, the agency has a six-year staffing average of 11.22 case investigators. Current staffing levels in the Investigations Division appear correct at this time. As the agency increases in size, one investigator will be needed for every 8.3 new sworn positions in order to stay at the average benchmark staffing level.

A staffing recommendations cannot be given for the five task force officers and the task force corporal working from the Investigations Division. Participation in task force operations are at the discretion of the Chief of Police and there were no benchmark metrics suitable for estimating recommended staffing levels. In many cases, participation in an inter-agency task force is a "force multiplier" for larger agencies. An investment in one or two positions on the team, often funded through outside grant funding, gives an enforcement return of an entire team. According to the annual summaries provided by the agency, the task force members as a whole cleared more cases by arrests than either of the other two units in the Investigations Division in 2016, 2018, and 2019. Work is being performed and a return on investment is being provided to the City of Joplin but the nature of their work makes staffing numbers difficult to quantify.

Summary

The observations and recommendations documented and proposed in this report are believed to be in the best interest of the organization as a whole. Viewed from an individual perspective, a single recommendation may bring relief to one employee and perceived hardship to another. Andrew Carnegie once wrote, "teamwork is the ability to work together toward a common vision. The ability to direct individual accomplishments toward organizational objectives. It is the fuel that allows common people to attain uncommon results."

The results of the study showed that the Patrol Division is significantly understaffed for the identified workload. The deployment by geographic area and time was not consistent with the locations and times when the workload was occurring. Through a new 12-beat deployment plan and a more structured and efficient schedule, the Patrol Division should be able to see some minor relief in the staffing levels on the street when needed most and to equalize the workload for the officers throughout the city. However, reorganization of existing personnel can only go so far. Additional positions in patrol are greatly needed.

This study looked at staffing needs in a way that is probably quite different from past methods of determining staffing. Some of the data that was needed for this study was not available at the time this study was conducted. Methods to obtain such data have been included in this report. The path has been paved to repeat this study in future years using the included spreadsheets and the methodology explained in this report. With time and careful attention to developing collection needs, the results of this process will get increasingly more accurate. The agency is encouraged not to abandon the process. When resources are challenged, this staffing methodology can create a firm foundation on which to build a cause for adequate patrol staffing but only if the officers are continually required to document their work.

In times of economic scarcity, “that’s the way we have always done it” is no longer a viable management model. This research study, with its accompanied results, should serve as a model for future data-based staffing studies.