Helena Police Department

Patrol Allocation, Schedule Optimization, and Beat Design Study

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Helena Police Department
Patrol Allocation, Beat Design, and Shift Scheduling Study

Conducted by: Etico Solutions, Inc.

In almost every law enforcement agency across our country, the largest budget expense is personnel. Determining proper staffing needs and using existing staff in the most efficient possible manner is a critical skill for effective law enforcement managers. Resource allocation training for law enforcement managers is presented in a few upper management command colleges throughout the country but the process of conducting resource allocation studies is complex, arduous, and very time consuming. After my initial introduction to resource allocation for law enforcement in 1995, I spent nine years teaching resource allocation techniques to law enforcement managers on behalf of the Northwestern University Center for Public Safety's School of Police Staff and Command (SPSC) and for the International Association of Chiefs of Police (IACP). In 2002, I began assisting the IACP's Management Studies Team on large resource allocation studies throughout the country. In 2004, I founded Etico Solutions, Inc. and turned my attention full-time to teaching and conducting resource allocation studies. To date, I have completed over 45 resource allocation studies for state, local, and county agencies and several consolidation studies for 9-1-1 communication centers. Over the course of the last 25 years, through the SPSC program, the IACP, and now Etico Solutions, I have taught tens of thousands of law enforcement managers and continue to teach multiple classes a year.

In May of 2019, the Helena Police Department (HPD) sent three members to a resource allocation course taught by Etico Solutions, Inc. in Bellingham, Washington. As a result of that course, several changes were put in place at the agency to improve data collection practices in preparation for a future staffing study. In May of 2022, the City of Helena requested a proposal for a resource allocation study to include patrol staffing analysis, beat design, and schedule optimization. In June of 2022, the proposal was accepted and work on the study began the following month.

The proposal specified a data-driven study that would be based upon police workload data and officer leave information. The proposed deliverables included a complete report of the findings of the data analysis, the methodologies used throughout the study, and a set of interactive spreadsheets that would allow agency personnel to complete additional analysis in future years. The methodology for this study was based on a nationally recognized model known as the "Police Allocation Manual" (PAM). The results of this study are not based on national averages or benchmark comparisons to other agencies presumed to be similar to the City of Helena. The study results are based on the type of calls received by the HPD, the number of calls of each type, and the time required to handle those calls. Leave time and overtime sums for the agency were analyzed to estimate the average number of hours each officer puts towards the annual reactive workload. The results of the internal data are used to determine proper staffing to meet the expectations of the citizens of Helena as well as the most efficient way to deploy officers by date, time, and location.

The time-period for the data used in this study encompassed the COVID-19 pandemic. Unlike natural disasters and public protests where law enforcement agencies mobilize all available resources into the field, COVID-19 required a response from law enforcement that has never been seen in our lifetime. Officers were instructed not to proactively engage the public through activities such as traffic stops, business checks, and other community policing activities unless necessary for purposes of public safety. Many agencies reduced their number of patrol officers on the street to protect a "second string" of officers in case the "first string" contracted the virus. Non-essential personnel and station-based officers such as detectives, administrative officers, and training personnel were assigned to work from home to prevent exposure. A nation of law enforcement officers who had always been told to be proactive, be visible, and to engage the public were suddenly being told to stay away from the public, don't take unnecessary risks through proactive activities, and engage with people only when you must. Law enforcement, along with the rest of our nation, was fighting an elusive adversary; a pandemic virus that could not be seen, heard, or tracked until it struck.

Workload estimates for this study came from the last six complete calendar years of historical CAD data (2017 through 2022). Leave times, overtimes, and other shift exceptions used to calculate the officer availability were based on the same time frame (2017 through 2022).

The following report provides recommendations for optimal patrol staffing levels, several proposed patrol schedule alternatives to improve efficiencies, a recommendation for a new beat design for improved deployment of officers, and suggested ways to improve current data collection methods. The recommendations being offered are based on the workload and leave data provided by the HPD. Implementation of any recommendations should be carefully considered by the police executive staff for the potential effect upon the culture of the agency, any existing collective bargaining restrictions, and the level of acceptance to change existing within the agency.

This is a new resource allocation and staffing methodology for the HPD 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. With the inclusion of the spreadsheets and the detailed description of the processes used during this study, the methodologies and processes put in place through this study should serve the HPD and the City of Helena for many years to come.

Respectfully submitted,

Timothy J. Freesmeyer, M.B.A.

Etico Solutions, Inc.

Executive Summary

The following report is a culmination of a 12-month study of the Helena Police Department Patrol Division. This is a data-driven study based on six years of Computer Aided Dispatch (CAD) data from the Helena Police Department (HPD) along with six years of leave, overtime, training, and shift exception data. The results of this study are not based on benchmarked statistics from other police agencies or from any national averages. They reflect the workload taking place within the City of Helena and the time required by the patrol officers to provide the quality of service that the citizens of Helena currently enjoy. This executive summary is meant to provide an overview of the major findings of the study. Full details of the study methodology and results can be found in the body of this report.

For 2023, the forecasted staffing need in patrol to keep an even split of reactive and proactive patrol time is 27 fully trained officers who can operate as a solo unit. There are currently 23 fully trained officers and five recruits in the field training program. Basic Academy training in Montana is approximately 12 weeks for someone new to law enforcement. Once a new hire graduates from the academy, they will undergo another 2 to 8 months of field training with a Field Training Officer before they are able to function as a solo officer in patrol. Six years of hiring and training data indicated that approximately 11.44% of officers filling full-time positions in patrol for HPD will be in either the Basic Academy or in field training status at any given time. Therefore, if the staffing need is 27 fully trained officers, the agency should have another 3 officers somewhere in the onboarding process, either in the academy or in the field training program bringing the total staffed positions in patrol to 30 officers. The agency can expect to lose 29.53% of the 54 sworn staff each year due to retirements or departures which will create a vacancy of approximately 13 officers in patrol per year. Therefore, a hiring list of qualified and vetted candidates should be maintained to fill an average of at least 13 vacancies per year as soon as they occur. Agencies that do not stay ahead of the training periods and turnovers can easily find themselves on an overtime dependency until vacancies are properly filled, placing additional fiscal burden on the city and additional fatigue on existing staff.

The Helena Police Department does not have a designated beat plan for the deployment of officers. Absent beat assignments, officers are free to congregate around the areas of high activity within the city. This leads to longer response times to the outer lying neighborhoods and long patrol intervals in areas of light activity. The absence of assigned patrol areas can also lead to increased overtime if calls are not assigned equitably. To improve officer deployment, a new beat plan was developed by establishing a set of 391 individual reporting areas across the city. The reactive workload from 2017 through 2022 was then mapped by latitude and longitude to determine how much workload occurred in each individual reporting area. The individual reporting areas were then aggregated to form 12 sub-beats with a workload disparity of only 0.27% between the sub-beats with the heaviest and the lightest workloads. This new beat plan should create a more efficient use of resources by reducing travel times, reducing response times, and leveling the workload among all officers. The 12 sub-beats can be further

aggregated into a 6-beat plan, a 4-beat plan, a 3-beat plan, or a 2-beat plan simply by grouping the original 12 sub-beats as necessary.

The current patrol schedule for the HPD does not efficiently match staffing to the time the workload is occurring within the City of Helena. The current fixed-day-off schedule does not offer many qualities found in good patrol schedules such as team integrity, unity of command, and schedule equity. A recommendation is provided for improving the efficiency of the current schedule. Two alternative schedules are included that provide a better quality of life for the officers, a better match to the current workload, and a better recruiting tool for new officers. A 12-hour rotating schedule could improve the current efficiency by over 13% before any additional staff is added to the Patrol Division. However, since the process of changing schedules can have a significant impact on the family life of the officers, any schedule change should be approached with careful consideration.

Finally, recommendations have been provided on several data collection practices that could be changed to create more usable data in the future. Specific status codes were created in the CAD in 2019 for capturing report writing times and follow up times. These codes are still present but are not being used consistently to capture data in the most usable way. A second CAD issue discussed in detail in the report is the practice of using officer badge numbers as unit identifiers in the CAD records. Badge numbers do not identify the rank or assignment of the responding unit. A new CAD identification format has been recommended that would simplify data analysis in future years and provide more accurate workload records. For a data-driven staffing model to be effective, these data collection issues need to be addressed and corrected.

High amounts of call-back overtime, long response times, and calls pending until an officer becomes available can all be symptoms of short staffing. However, they can also be caused by an unequitable beat structure and an inefficient patrol schedule. An officer's response time to a serious call for service may be the first impression made upon the citizens by the Helena Police Department. If the recommendations in this report are acted upon, particularly by allocating the optimal number of positions to the Patrol Division, adopting a new patrol schedule, and equalizing the workload among the beats, significant improvements should be possible for timely responses and reduced overtime.

Staffing levels in law enforcement agencies are fluid and numbers quoted in this report may have changed by the time of this reading. The staffing model, beat design model, and scheduling models included with this report should provide the tools needed for the HPD to evaluate staffing needs on an annual basis. The ability to forecast optimal staffing levels for upcoming years enables the creation of a multi-year strategic plan. This study is based on the best statistics available at the time. However, it is up to the command staff of the HPD to review the data and then act in accordance with their experiences and history within the City of Helena. The data cannot stand alone, it must be interpreted and applied through the human filter of experienced law enforcement administrators.

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Jurisdiction and Agency

City of Helena, Montana

The City of Helena serves as the seat of Lewis and Clark County, the seat of the "Helena, Montana Metropolitan Statistical Area", and the capital city for the State of Montana. Situated near the Missouri River, at the eastern foot of the Continental Divide, Helena is surrounded by rolling hills and lofty mountains (Mount Helena and Mount Ascension just to name a few). The area was traversed in 1805 by the Meriwether Lewis and William Clark Expedition. The city gained its prominence in 1864 when a large placer of gold was discovered in Last Chance Gulch, now occupied by the city's main street. Today, the city has a total area of 16.8 square miles according to the United States Census Bureau. The prosperous veins of gold are in the past and the economic base consists primarily of public administration, health care, education, and a variety of service industries. In addition to state government activities, Helena is an agricultural and livestock trade center with some light manufacturing.

The city's population has increased approximately 7.19% since 2020 with a 2023 estimated population of approximately 34,690 people. Dispersed over a 16.8 square mile area, the estimated population density is considered low at only 2,062 people per square mile.[1] Since Helena is the largest city in the geographic area, the city experiences an estimated daytime population increase of 13,650 people per day (+39.3%) due to commuting.[2] The additional work created by such commuters is not reflected in national officer to population ratios erroneously used by some as an indicator of appropriate police staffing. The estimated median resident age is 41.3 years for the City of Helena compared to the Montana median age of 40.5 years. For residents older than 25 years of age in the City of Helena: 96.23% have a high school degree or higher, 49.03% have a bachelor's degree or higher and 19.65% have a graduate or professional degree. Statistics for 2023 show the racial composition of Helena to be 92.62% White, 3.73% two or more races, 1.25% other race, 1.09% Native American, 0.82% Asian, and 0.49% Black or African American. For population 15 years and over in the City of Helena: 42.9% are married, 17.3% are divorced, and 7.5% are either separated or widowed.[2]

The city's estimated number of housing units in 2021 was 16,320 with approximately 42.2% comprised of rental units. The median gross rent in the city was $851 per month.[2] The estimated median house or condo value in 2021 was $314,402 compared to a median price of $322,800 for the entire state of Montana. The median age of houses or condos in the city is 50 years while the median age of apartments is 49 years.[2]

The cost of living in the City of Helena in 2019 was 87.6 compared to the U.S. average of 100. The estimated median household income in 2020 was $81,693, an estimated 44.49% higher than the state average of $56,539. Unemployment for the City of Helena in 2020 was 3.6% compared to the state average of 4.2%.[1]

[1] (World Population Review)
[2] (Advameg, Inc.)

The City of Helena is a charter city organized under the constitution of the State of Montana which follows the Commission-Manager form of government. The Commission is made up of four commissioners who are elected on a non-partisan basis for a four-year term and a mayor who is elected for a four-year term. Every two years, two commissioner positions are replaced through a general election. The City Commission legislates policies, enacts ordinances, approves the budget, and appoints advisory boards and commissions. The City Commission may appoint a City Manager and City Attorney on terms that it specifies to serve at the pleasure of the City Commission. The City Manager appoints and removes all employees on the recommendation of the various department heads, with confirmation of appointment or dismissal of department heads by the City Commission.

Helena Police Department

The HPD is a full-service municipal law enforcement agency staffed by sworn and civilian personnel. As of June 21, 2023, the agency employed 82.5 employees. The agency was subdivided into the following divisions and staffed as shown in Chart 1 and Table 1.

Chart 1.

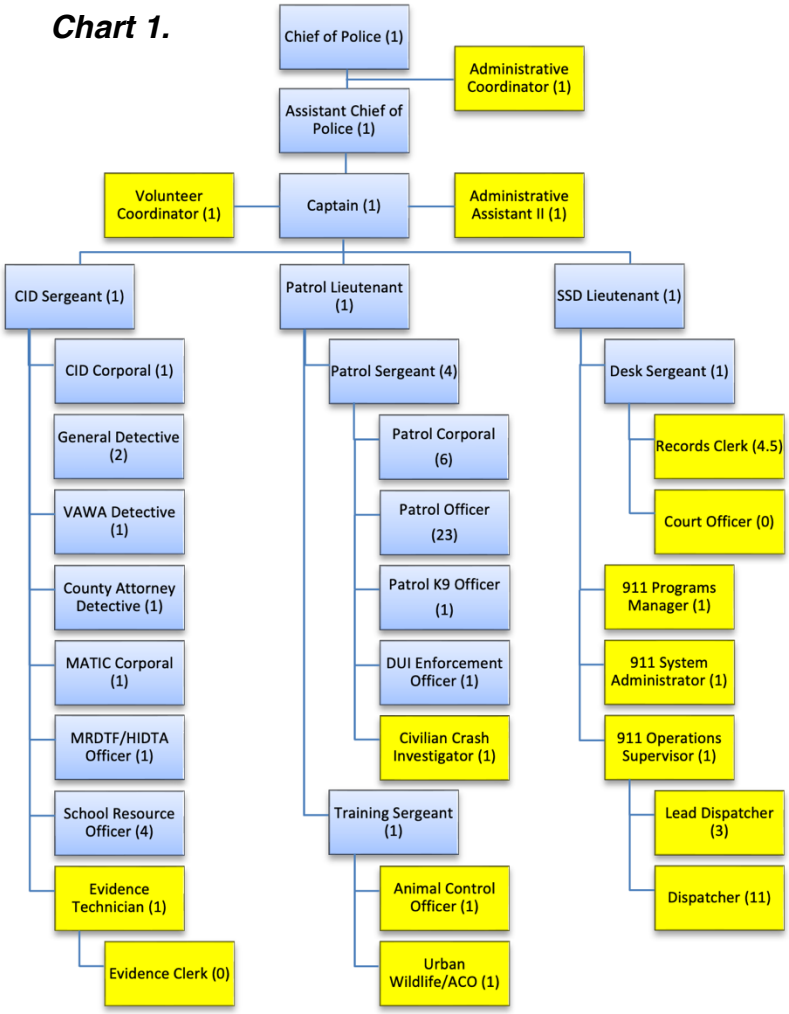


Table 1.	Sworn Personnel	Civilian Personnel	Division Total
Administration	5	3	8
Patrol Operations	36	3	39
Investigations	12	1	13
Support Services	1	21.5	22.5
Totals	54	28.5	82.5

Office of the Chief

The agency is led by the Chief of Police who reports to the City Manager. The Chief of Police is assisted by an Assistant Chief and a civilian Administrative Coordinator. The Assistant Chief is assisted by a Captain, a civilian Volunteer Coordinator, and a civilian Administrative Assistant. The captain directly oversees two lieutenants who supervise the Patrol Division and Support Services Division respectively. In total, the Administrative Division includes five sworn positions and three civilian positions for a total of eight employees.

Investigations Division

The Investigations Division is led by an Investigations Sergeant who reports to the Captain. The Investigations Sergeant, with the assistance of an Investigations Corporal, oversees two general case detectives, a "Violence Against Women Act" detective, a County Attorney Liaison detective, a "Missouri River Drug Task Force" and "Rocky Mountain High Intensity Drug Trafficking Area" Task Force officer, a "Montana Analysis & Technical Information Center" Investigations Corporal, four School Resource Officers, and a civilian Evidence Technician. There is currently a vacant position for an evidence clerk that would report to the Evidence Technician. Currently, a total of eight sworn investigators, four school resource officers, and one civilian are assigned to the Investigations Division.

Patrol Operations Division

The Patrol Operations Division is overseen by a Patrol Lieutenant who is assisted by five patrol Sergeants. The Patrol Division is divided into four 10-hour shifts with one sergeant assigned to each shift. Six patrol corporals, 23 patrol officers, and one K9 team are deployed across the four shifts as the primary call-takers for the city. When the shift sergeant is present, the shift corporals are assigned as call-takers along with the patrol officers and the K9 team. One additional officer in patrol focuses strictly on DUI enforcement but is used occasionally as a back-up for patrol. A civilian crash investigator works within the Patrol Division and is supervised by the four patrol sergeants. The fifth sergeant in the Patrol Division is responsible for training and supervising two civilian animal control officers. At the time of this report, there were 36 sworn officers and three civilians assigned to the Patrol Division.

Support Services Division

The Support Services Division is overseen by a Lieutenant and is assisted by a Desk Sergeant and a civilian 911 Operations Supervisor. The desk sergeant is responsible for four full-time civilian records clerks and a part-time records clerk. The 911 Operations Supervisor oversees three lead dispatchers and 11 full time dispatchers. A 911 Programs Manager and a 911 System Administrator also report to the Support Services Lieutenant. In total, there is one sworn employee and 21.5 civilian personnel assigned to the Support Services Division.

Summary

Within the Helena Police Department, there are many moving parts and officers frequently transfer from one division of the agency to another. The remaining portion of this report will examine only the Patrol Division. The report will detail the findings concerning optimal staffing levels, optimal deployment by time and location, and optimal schedules to maximize the efficient use of patrol personnel.

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, but they must also attempt to staff proportionally to a workload that varies by time of day and day of the week.

Patrol workload is 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 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 without back-up, or hold the calls until a unit becomes available.

Officer-to-Population Ratios

The determination of optimal staffing has been attempted in several 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. 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 upon police employment data from the UCR program. In addition, the data presented in the reports 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 officers assigned to various other duties such as those in administrative and investigative positions and those assigned to special teams."[3]

As an agency creates community policing units such as a Neighborhood Services Team, a Special Enforcement Team, etc., 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 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 consider additional people that commute into a community for work, tourists that are drawn to a community, college

[3] (Federal Bureau of Investigation)

students that claim residency at an alternate home address, or migrant workers that do not appear on any US census report. Although these additional groups may not be reflected in the city's population, they must be afforded police services and protection.

Statistics from the 2019 Crime in the United States Report (the most recent publication of the report) indicate that law enforcement agencies from the "Mountain Region" (Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, and Wyoming), with a population of 25,000 to 49,999 people, had an average of 1.3 officers per 1,000 inhabitants. If civilian police employees are included in the total, the ratio increases to an average of 1.7 employees per 1,000 inhabitants. In the same 2019 CIUS report, the City of Helena declared a population of 32,806 people, 53 police officers and 25 civilians working within the Police Department. This creates a ratio of 1.62 officers per 1000 inhabitants and 2.38 employees per 1,000 inhabitants. Initially, this would suggest that 2019 staffing for the HPD was sufficient. However, when the 13,650 estimated daily commuters are added to the city population the outcome changes. Using a base population of 46,456 people the ratio of officers to population becomes 1.14 officers per 1,000 inhabitants and 1.68 employees per 1,000 inhabitants indicating the staffing in 2019 was insufficient.

Before accepting these ratios as a valid method for police staffing, the reader must be cognizant of the comparable cities that are contained in the calculation database. Helena is not considered to be part of a larger metropolitan area.

- Helena was the only city in the State of Montana to fall into this population category of 25,000 to 49,999.
- There were no cities from the state of Nevada in this population group.
- New Mexico contained one city in this population group, the City of Hobbs. This city was not part of a metropolitan area.
- The state of Wyoming had two cities in this group, neither were in a large metropolitan area.
- Idaho had four cities, one was a suburb of Spokane Valley, and one shared a common border street with a second similar sized city. The remaining two were not part of a larger metropolitan area.
- Colorado had nine cities in this population group, seven were suburbs of Denver, one was a suburb of Colorado Springs, and the final was part of the Fort Collins/Greeley/Littleton metropolitan area. There were no cities that were not part of a larger metropolitan area.
- Arizona had 12 cities in this population group, three were suburbs of Tucson, three were suburbs of Phoenix, and one was a suburb of Yuma. Prescott and Prescott Valley shared a common border taking their combined population over 90,000 people. Three cities were not part of a larger metropolitan area.
- Utah had the most cities in this population group with 21 cities between 25,000 and 49,999 people. Eight of those cities were suburbs of Salt Lake City, six were suburbs of Provo, and five were suburbs of Ogden. The city of Washington shares a common border with St. George which gives them a combined population of over 118,000. This left one city, Cedar City, that was not part of a larger metropolitan area.

Of the 50 cities represented in this population group, only nine are truly like Helena in respect to their proximity to larger metropolitan areas. No other cities are capital cities. To say that the services provided to the citizens of Helena are like the services provided to all other cities with a population of 25,000 to 49,99 people in the western mountain region is a broad assumption. It is also a stretch to assume that crime is the same in all other states and that the other comparable cities are appropriately staffed. While the current officer-to-population ratios for the City of Helena, including commuter influx, indicate a need for staffing, this is not a valid methodology for determining proper staffing needs.

Benchmarking

A second method that is often used is a comparative analysis based on several "similar" agencies. This is referred to as "benchmarking" and differs from the officer-to-population ratios in that only a few comparable agencies are hand selected. 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 reactive 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.

Workload records for other divisions within police agencies are not always as robust as that of patrol. For investigative divisions and other employees that are given a great amount of autonomy throughout the workday, historical 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 Helena Patrol Division was analyzed using the Police Allocation Manual (PAM) model. PAM is an empirical quantitative analysis method based on internal data provided by the HPD. Six years of historical CAD data was analyzed to produce a model capable of predicting future patrol workload. In addition, the agency provided six years of data pertaining to officer leave times, training times, and other shift exceptions. This information was used to determine officer availability.

The historical CAD data was used to determine the current number of minutes spent per hour on reactive calls by the employees assigned to the Patrol Division. This data was used to estimate the number of officers needed on patrol each day. The officer availability data was used to determine how many officers were required to staff one shift position every day of the year. The resource allocation models 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 the CAD was used again to determine the workload distribution throughout the city. The city was subdivided into 391 individual reporting areas and the reactive workload for the last six years was determined for each new reporting area. The reporting areas were then aggregated into twelve new patrol beats with even workloads.

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

Initial Site Visit

The initial site visit was conducted on July 28-29, 2022. The main purpose of this visit was to meet with the command staff 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.

After meeting with the Command Staff on Thursday morning, several hours were spent with the CAD administrator at the airport dispatching center to discuss and acquire the necessary CAD data for the study. Later that afternoon, a larger meeting was held with the Police Association board to discuss their concerns and to explain the methodology that was to be used. On Friday morning, a meeting was held with the training sergeant to discuss the availability of training records for the Patrol Division. Then a meeting was held with the Human Resources and Finance Director for the city of Helena at their office to discuss the leave and overtime records that would be needed for the study. 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 anyone in the agency to ask questions or to voice concerns and all administrators had been briefed on the process to follow over the next 9 to 12 months of this study.

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 the total reactive workload for the Patrol Division and (2) the calculation of officer availability. CAD data for 2017-2022 was analyzed to determine the workload, while leave data, training data, and overtime data for the same period was used to calculate officer availability. Microsoft Excel was used to filter, collapse, and analyze the CAD database, to calculate officer availability, and to display results from the analysis.

Patrol Workload

The workload in this study was calculated by categorizing all work performed by the Patrol Division within each year under study, determining how often each category of work is performed each 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 any additional 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

The Public Safety Systems Administrator for the City of Helena was asked to export the necessary CAD data from HPD’s “LogSys” CAD software. LogSys software is

based out of Missoula, Montana and has been in use by the city for over 20 years. The System Administrator confirmed there were no major platform changes during the previous six years that would affect the CAD data significantly. The System Administrator had a robust working knowledge of the CAD system and most of the necessary CAD data had already been exported by the time of the initial site visit. A series of individual annual files were provided in electronic format for calls for service activity, unit activity, run-time reports, and Incident Report numbers. Overall, the acquisition of CAD data in this study was quick and complete.

General conversation with the command staff and the System Administrator confirmed what would be one of the greatest challenges in the analysis of data for this study, the use of badge numbers as CAD identifiers. Long before CAD software became commonplace in law enforcement agencies, officers used their badge number as a form of identification on police reports and other official documents. When police radios were introduced in the early to mid 20th century, the use of badge numbers instead of officer names saved airtime and expedited communications. In the 1960s, law enforcement began to implement computer systems into their dispatching centers and Computer Aided Dispatch (CAD) systems began to emerge throughout the country. Today, virtually every law enforcement agency uses some form of CAD system to track calls for service, dispatch times, arrival times, cleared times, and dispositions. Many agencies, when implementing their CAD software, have maintained the convention of identifying officers by their badge numbers.

As agencies grow and specialized support units are formed such as investigations, training, recruiting, professional standards, and community policing, the staffing within the agency becomes more fluid as officers move from one unit to another. In addition to lateral assignment changes such as patrol to investigations, many officers move vertically in the agency as they promote to higher ranks. When the agency CAD software identifies an employee's actions based solely on their badge number, there is no historical record of their assignment nor rank at the time of the call. For this study, it was also found that badge numbers were sometimes reissued to new officers after retirements and departures. Therefore, the same badge number in the CAD data could refer to a different assignment, a different rank, or even a different employee depending on the date of the call.

When officers work off-duty details, they are logged into the CAD under a problem code of "off-duty". Since the CAD is identifying them by their badge number, it is impossible to know when a patrol officer is logged in for normal duty or for off-duty work. If the officer is out on a problem code of "off duty", their work is not counted in the total reactive workload for the agency. However, if an officer working an off-duty detail assists a patrol officer on a call due to necessity, the off-duty officer will appear as a scheduled on-duty patrol officer.

"Collapsing" a database is the process of converting the total time for all officers on a single call into a single record containing the aggregated time for each unit type as a separate field. The process starts with the calculation of time spent on every call for service (call) in past years. Since many calls include multiple officers, it is important to capture the time separately for each person on the call. Once the time per employee is

calculated for a specific call, the database can be collapsed by summing the time spent on the call by assignment and rank (all patrol officers, all patrol sergeants, all detectives, etc.). This is the step in the data analysis that is hampered by using badge numbers as a CAD identifier. Before like units can be aggregated (officers, sergeants, detectives), each badge number in the data must be rekeyed based on a "badge history report" that identifies the name, the assignment, and rank of the person represented by each badge number at the time of each call. In other words, a separate database must be created and then referenced that indicates the date and movement of every officer in the agency as they move laterally or vertically within the organization during the entire historical data period. This data is seldom kept or tracked in a single location or file within an organization and requires a great deal of time and effort to assemble retroactively.

While the CAD database holds key information for a workload study, it must be filtered 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 various data tables in a CAD database hold a very large number of fields that may or may not be important in a resource analysis study. Prior to extracting the CAD data from the original 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 beats and emergency service zones, the times associated with the officer's response, the 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 "cfsdata" export during initial conversations with the Systems Administrator.

- *CFS Number
- Event Number
- Incident Code
- Source
- Final Disposition
- Primary Unit
- Address
- Business Name
- Latitude
- Longitude
- X Coordinate
- Y Coordinate
- Priority
- Dispatch Date and Time
- Enroute Date and Time
- On Scene Date and Time
- Closed Date and Time

The following fields were chosen for inclusion in the "unit activity" export during the initial conversations with the Systems Administrator:

- *CFS Number
- Unit Number
- Time Stamp
- Status
- Incident Code
- Message
- UX Field
- Location

Recoding Badge Numbers to Unit Types

After building a badge history matrix, the database was recoded to create a new field for each record which identified the name, rank, and area of assignment for the badge number referenced in each record. The badge numbers recorded for each call response were recoded into the following unit types:

- Patrol Officer
- Patrol Corporal
- Patrol Sergeant
- DUI Officer
- School Resource Officer
- Special Assignment Sgt
- Crash Investigator
- Animal Control Officer
- Investigations
- Evidence
- Lieutenant
- Command

CAD Data Filtering

The unit history files obtained from the agency included several status codes that were unnecessary for this study. All status codes that were not related to a call for service number (CFS#) were filtered out to a new database so they did not interfere with calculating the time on call. The data records that did not relate to CFS#s were later used in an attempt to estimate time spent on report writing and other administrative duties.

The incident files were filtered to eliminate any duplicate records and any records where no patrol units were assigned. Many of these calls were handled solely by the dispatchers (i.e. “911 Hang-ups”) or involved problem types that were advisory in nature such as “Attempt to locate” calls.

Individual Unit On-Call Times

The next step in collapsing the database was to calculate the total time that each officer spent on each call. The LogSys CAD software creates a new record in the unit activity log each time an officer changes status. For a single call, an officer may have as many as 15 or more records in the unit activity log as they go from “dispatched” to “enroute”, then to “on scene”, then to “available”. If officers make an arrest, go enroute to the hospital, change locations, provide a transport, or a host of other activities, the number of records in the CAD for that call continues to grow. In some cases, an officer may be sent back to the same call multiple times which creates more than one dispatch and available timestamp for the same officer on the same call. To calculate the individual time on call for officers, all records in the unit activity database that pertain to the same officer and the same CFS must be filtered by timestamp and then collapsed into a single record with a designated field for each status. The database also had to be keyed to recognize multiple responses to the same call by the same unit. Once this was accomplished, the “enroute time” or the “dispatch time” (when an enroute time is not present) was subtracted from the “available” time to determine the officer’s total time on call.

Call Time Summation

The database was filtered and collapsed once again by aggregating the time spent by units within each unit type and writing that sum to a new field in each record. For instance, if a call had four patrol officers and two sergeants assigned, there would be six records

for that call. The sum of the individual times for all four patrol officers was written to a new value for that record called “patrol sum”. The sum of the individual times for all sergeants was written to a new value for that record called “sergeant sum”. After all similar units were aggregated, the database was collapsed to eliminate duplicate records for the same call ensuring that only one record existed for each CFS. 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 2017 through 2022. Using the frequency of each incident type from the past six years of historical data, a forecasting routine in Microsoft Excel was used to estimate the expected number of calls for 2023 through 2028 (Chart 2 & Table 2).

Chart 2.

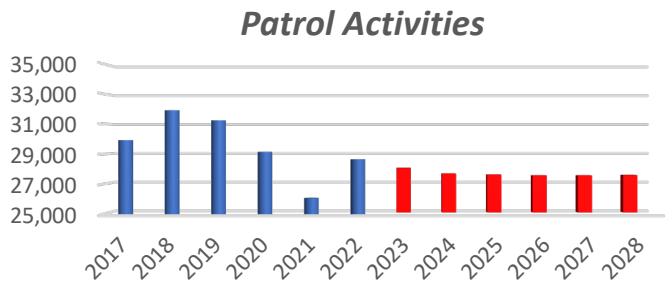


Table 2.

Patrol Activities

Historical		Forecasted	
2017	29,924	2023	28,024
2018	31,897	2024	27,636
2019	31,232	2025	27,568
2020	29,145	2026	27,514
2021	26,084	2027	27,509
2022	28,646	2028	27,539

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. It is important to remember that the activity totals for 2020 and 2021 were accumulated during the COVID pandemic when officers were encouraged to avoid unnecessary interactions with others due to safety concerns. The reduction in self-initiated patrol activities during that time has a significant effect on the number of forecasted patrol activities for future years.

It is also important to note that the numbers in Chart 2 and Table 2 represent the number of events handled by the Patrol Division each year. The workload metric used in this analysis is not the total number of events but the number of hours spent on all reactive events during each year. When agency staffing begins to suffer, there is typically a reduction in proactive activity as officers spend more time on reactive calls for service. This often manifests in a reduction in traffic stops, suspicious persons, and other self-initiated activities that could potentially decrease the total number of activities with a minimal time on call.

Calculating Patrol Workload

While most patrol calls are handled by patrol officers, every call can be unique. Some calls may require assistance from an investigator, some calls may be handled by a school resource officer based on the location of the call, and others may require a supervisor's presence. The units assigned to an individual call could be diverse and could consist of members of various departments within the HPD. To address this variable, the staffing model was built to allow the user to select which unit(s) contribute to the "patrol" workload versus the workload of other divisions. As additional groups are selected in the model, the average time spent on each type of call by members of that group are added to the agency-wide average time spent on each type of call.

The frequency of each call type for each year was multiplied by the average time spent on each call type for that year by patrol. The sum of all call times determines the total number of hours performed by patrol for that year. Calculating an average time on call for each incident type allows the average times to be multiplied by the forecasted call frequencies for future years yielding an estimated workload for projected years.

After selecting the time spent on calls by patrol officers, patrol corporals, and patrol sergeants, the total estimated hours of workload for 2017 through 2022 was determined. A linear regression forecast method was used to estimate future patrol workloads for 2023 through 2028 (Chart 3, Table 3).

Chart 3.

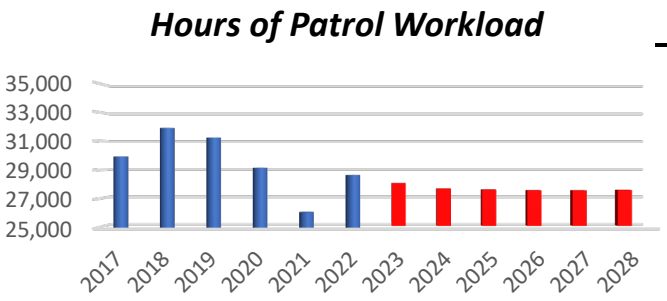


Table 3.

Annual Patrol Hours			
Historical		Forecasted	
2017	20,159	2023	20,568
2018	20,925	2024	20,695
2019	19,343	2025	21,184
2020	18,657	2026	21,493
2021	21,540	2027	21,388
2022	20,778	2028	21,727

Filtering to Obtain Total Reactive Workload

The PAM model, (the methodology being used in this study to determine appropriate patrol staffing for the HPD) is based on the hours of "reactive" workload performed by the members of the Patrol Division during a defined period. In this methodology, all activities performed by the patrol staff are categorized as either "administrative", "proactive", or "reactive".

Administrative activities are best described as "activities that are performed at least once per shift to maintain communication, officer health and safety, and continued operation of the division." Other activities of an administrative nature such as "Administrative Services" or "Critical Incident Stress Debriefing" are performed periodically on an as needed basis and therefore do not fall under the category of "Administrative Time." In this study, the following five activities were defined as administrative activities:

- Briefing
- Meals
- Officer Breaks
- Refueling
- Debriefing

Proactive activities include self-initiated activities performed by officers when they are not responding to reactive calls such as emergency dispatches or citizen requests. Most community policing activities such as foot patrols, business checks, and vacation checks fall into the category as proactive. The following patrol activities were defined as "proactive" for the purposes of this study:

- Administrative Services
- Campground Checks
- Capital Security Walk-Throughs
- Critical Incident Stress Debriefing
- School Police Instruction
- School Safety Drill
- School Walk-Through Security
- Technical Issues
- Traffic

All remaining activities performed by the patrol staff were defined as "reactive" workload. The total number of reactive hours performed by the Patrol Division from 2017 through 2022 are shown in Chart 4 and Table 4. The tables also show the forecasted hours of reactive work for 2023 through 2028 assuming no significant change within the City of Helena.

Chart 4.

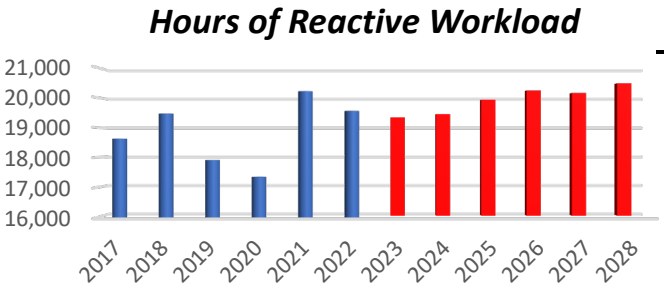


Table 4.

Annual Reactive Hours			
Historical		Forecasted	
2017	18,625	2023	19,354
2018	19,459	2024	19,467
2019	17,914	2025	19,957
2020	17,353	2026	20,275
2021	20,200	2027	20,190
2022	19,547	2028	20,518

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. In most law enforcement agencies, several practices exist that prevent workload data from being entered into the CAD accurately and consistently.

CAD Configurations

The method or process used to capture data in a CAD system can sometimes limit the accuracy and consistency of the data being captured. A plethora of CAD vendors currently exist in the market with a diverse variety of options, costs, platforms, and capabilities. Furthermore, the same CAD vendor could install and configure the same

software differently in various agencies. A "*good*" CAD system isn't merely based on the chosen vendor but also on the capabilities of the product and the practicality of the software installation and configuration.

Most CAD software packages, including LogSys, allow work to be documented as either an "event" in the incident table or by use of a "status" code in the unit history table. The difference in these two methods have important ramifications on the ability to document workload and the ability to effectively use it later for purposes of resource allocation. If follow-up activities (such as a follow up investigation or the preparation of a police report), are performed because of a previous incident (such as a burglary or a domestic disturbance) the follow-up activities should be tracked using a "status code" in the unit history table. This is the method that was implemented at the HPD after Assistant Chief Stinson's return from a resource allocation course in 2019. The HPD created four new status codes for officer use. Two status codes were created for report writing, one that showed the officer as unavailable on the dispatch screen and a second that showed the officer available for calls if a call arrived in their assigned area. Two similar codes were created for follow-up, one showing available and one showing unavailable.

Using status codes for report writing and follow-up activities prevents multiple event numbers for the same incident and can provide better tracking for the total time spent on calls. However, this solution relies on consistent use of the status codes and requires the officers and dispatchers to indicate the case number of the report being written or the follow up activity being conducted. Other activities such as administrative details, lunch breaks, and officer breaks can also be tracked as status codes.

Status codes serve several functions. They provide the location and status of each officer in the field so the dispatcher does not have to remember where each officer is presently located when a new call for service arrives. They 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. While status codes are simple to use and can usually be easily 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 status code. Therefore, if an agency wants to append the time spent writing criminal reports back to the original event using a status code instead of an additional event number, the officer must document the original report number in the text field of the status code entry.

To track case related activities such as report writing and follow-up investigations, another 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 added 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 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.

A third option is to create a follow-up event type and a report writing event type, then record all case related work as events. However, when the total number of events is used for any research purposes, the event types for report writing and follow up should be eliminated from the count since they are sub-events to the original call. It may also be hard to convince officers to call out report writing since it would show them as unavailable in their area.

The final issue involving CAD configurations is the use of badge numbers to identify officers on calls for service. This was discussed in detail earlier in this report, but it merits repeating in this section. An alternative to switching from badge numbers to positional identifiers is to record both. This could be accomplished by creating an additional field in the log-in process for officers (or dispatchers) to enter a positional identifier along with their badge number. This additional field could then be queried and used for data analysis when necessary. The additional field would serve as an auto-generated badge history report.

The System Administrator for the City of Helena has a deep understanding of the CAD software and has been able to make changes to user-defined sections of the system as needed. The current configuration of event codes and status codes provide ample means for officers to document their work if they choose to do so.

Unreported activity

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 traffic stops and suspicious subjects is done to inform the dispatcher of the officer's location in case assistance is needed. 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 to ensure complete workload documentation. 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 between calls-for-service will not be documented. This process of under-reporting work is occurring in the City of Helena based on conversations with supervisors and command staff. 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 in future years is almost certain to increase.

Under-reported Workload

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. Supervisor and command staff indicated that this is also occurring within the HPD. 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 are not always at

fault for this, in many agencies there is an unspoken expectation for officers to address calls quickly and get back to an available status. In this scenario, an officer may advise the dispatcher to clear a disturbance call as soon as the officer arrives on scene with nobody in the area. The officer may then spend 20 minutes patrolling the area 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 officers in such situations are usually 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.

Report Writing

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 often wait to write the report until later in the shift when the activity level slows. In most cases, the officer will pull over somewhere in their assigned beat and write the report while still on an "available" status, primarily so other officers do not get sent into their assigned area to handle "their" calls. On a less frequent basis, officers will call out using a call type of "follow-up", "busy", "out at the station", or some other non-specific call type while writing 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) since there is no record of the report number or the number of reports written at a time. If the average time to write a report is estimated at 30 minutes, and the agency writes 5,400 reports a year (the HPD five-year average in this study), the time spent writing reports could be as high as 2,700 hours per year. This equates to 1.7 full-time equivalent positions, clearly a form of workload that should not be overlooked.

To better estimate the number of hours spent writing reports, a survey was conducted with fourteen officers chosen by the agency. Each officer was given a list of all call types contained in the CAD and asked to independently estimate the length of time required to write a report for each call type on the list based on their own personal experience. The lists were returned to the contact person and forwarded to Etico Solutions. The survey results were combined and analyzed to eliminate outlying results and an average estimated time to complete a written report for each call type was calculated.

Using the CAD database from 2017 through 2022, an annual frequency was determined for the number of times each incident type was assigned a case number in the CAD. The number of times a case number was assigned to a call type was then divided by the total number of calls in that call type. This determined the percentage of times that a report was written for each incident type in each year. Finally, to estimate the

average time spent on report writing per year, (1) the number of occurrences in each incident type, (2) were multiplied by the percentage of time the call type generated a report, and (3) then multiplied once again by the average time to write a report for that incident type. This calculation was done for all call types. The estimated time spent writing reports was then added to the average time spent on-scene by the officers to get a time spent on each incident type.

The limitations of the CAD data, due to unreported and under-reported workload, will cause the total workload for the Patrol Division to be underestimated in this initial study. Most of the under-reporting that is currently taking place can be corrected by consistent use of the report writing and follow up status codes that already exists in the HPD CAD configuration, proper training on reporting protocols, and persistent supervision to ensure that all work is being properly recorded.

Daily Administrative Duties

In addition to answering calls for service and conducting self-initiated activities, there are a few administrative duties that must be performed each day by the patrol officers. These were mentioned earlier on pages 3 and 4. Based on discussions with agency personnel, the average times for briefing, meals, officer breaks, refueling, and de-briefing were estimated and are shown in Table 5.

Table 5.

Administrative Time

Briefing	.5 hours
Meals	.5 hours
Breaks	.5 hours
Refueling	.25 hours
Debriefing	.167 hours
	1.917 hours

The administrative duties listed in Table 5 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.

Minimum On-Duty Officers Fielded per Day

The definition of minimum staffing, as used in this study, is very different than the way the HPD has traditionally defined minimum staffing. In this context, "minimum staffing" is the minimum number of officers required to answer reactive workload only. This definition also assumes that all officers will be responding from call to call with no proactive enforcement time, no leave time used, no training time used, or any other forms of leave. This is a statistical value only used to establish a base for the total staffing needs. Minimum staffing levels are not a recommended staffing level.

The minimum number of on-duty officers required per day can be determined by dividing the annual hours of reactive workload by 365 (days in a year) to get an average daily reactive workload. The average daily reactive workload is then divided by the shift length less the time required for daily administrative duties(10 hrs - 1.917 hrs = 8.083 hrs) 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 6.

Table 6.

Minimum On-Duty Officers Fielded Per Day					
Year	Reactive Hours	On-Duty Minimum	Year	Reactive Hours	On-Duty Minimum
2017	18,625	6.31	2023	19,354	6.56
2018	19,459	6.60	2024	19,467	6.60
2019	17,914	6.07	2025	19,957	6.76
2020	17,353	5.88	2026	20,275	6.87
2021	20,200	6.85	2027	20,190	6.84
2022	19,547	6.63	2028	20,518	6.95

Shift Relief Factor

The numbers reflected in Table 6 depict the minimum 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). 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, benefit leave based on the personnel policies and labor agreement of the agency, shift exceptions such as training and administrative leave, and compensatory time off given for overtime worked. If officers worked every day of the year (i.e., no regular days off, no sick leave, no vacations, and no temporary assignments), 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 in this study is based on averages over a six-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 overtime totals for calendar years 2017 through 2022 were received from the City of Helena. Training times for the same period were provided by the HPD Training Sergeant. The following section will describe the data elements and calculations used to determine the shift relief factor for the HPD Patrol Division.

Regular Days Off

Under the patrol schedule in use at the beginning of this study, patrol officers worked a 4-on-3-off fixed day off schedule with a 10-hour shift length. The 10-hour schedule creates an average forty-hour workweek with 156.43 regularly scheduled days off per year, or 1,564.3 hours off per year.

Benefit Leave

Benefit leave is the average amount of leave time used by an officer each year. Since the amount of benefit leave is determined by the personnel and operating policies of an agency, it is not a calculated value, but rather is based on historical leave data from the agency. The amount of benefit leave used to calculate the SRF only includes time off taken and not the total benefit time earned. In some agencies, unused sick time can be converted to pay upon retirement. This is a fiscal liability and not a resource allocation liability.

Table 7 shows the types of leave used by the patrol officers and the average hours used per employee per year between 2017 and 2022. The average hours off patrol per year per officer due to benefit leave for the HPD is 343.74 hours.

Table 7. **Average Benefit Leave Used Per Year Per Officer**

Type	Hours	Type	Hours
ADMINISTRATIVE LEAVE	6.43	PARENTAL LEAVE	6.37
CITY COVID-19	5.11	PARENTAL LEAVE HOLIDAY	0.07
COVID-10 WK CLD FMLA 2/3R	0.17	POLICE-SCHEDULED DOWN HOL	1.80
COVID-19 (1,2,3,4,5,6)	4.80	POLICE/FIRE WC REG HRS	22.18
FMLA HOLIDAY	0.95	POLICE/FIRE-SICK	54.16
FMLA-NO PAY	1.61	POLICE/FIRE-VACATION	134.82
FMLA-SICK	21.76	SICK	0.00
FMLA-VACATION	3.16	SSD/POLICE/FIRE-HOLIDAY	32.24
HOLIDAY	44.25	VACATION	0.00
LEAVE W/O PAY - HOURLY	0.68	WORKER'S COMP HOLIDAY	0.38
LEAVE W/O PAY - MILITARY	0.00	WORKER'S COMP SICK	0.00
MILITARY LEAVE	2.45	WORKER'S COMP VACATION	0.35

Shift Exceptions

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

For statistical purposes, the total time spent in each category per year by all members of the Patrol Division was divided by the number of officers in the Patrol Division for that given year. Realistically, only one officer per year receives K9 training. To properly calculate the shift relief factor, the total time spent for K9 training must be averaged over

all patrol officers. The only shift exception reported by the agency over the six-year sample was for training. The average amount of training per officer per year over the 6 year sample was 97.7 hours.

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. First, 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. Second, 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 cost to pay for the overtime.

The average patrol officer used 44.16 hours of compensatory leave per year and worked an average of 37.84 hours of overtime for comp and 163.45 hours of overtime for pay within the mission of patrol. Using this information, the net comp time effect for the Patrol Division is -157.13 hours. This means the agency received more work hours from each patrol officer than expected which lowered the Shift Relief Factor.

Time Off Patrol Per Year Per Officer

Summing the total hours from the regular scheduled days off, benefit leave, shift exceptions, and the net comp time off, the total number of hours off patrol per year per officer is estimated at 1848.61 hours.

Calculating the Shift Relief Factor

The shift relief factor was defined earlier as t*he 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 HPD 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 – 1848.61 hours off patrol per year, or 1,801.39 hours). The calculated shift relief factor for the HPD is 2.026. This result is close to a normal range for a 10-hour shift (2.05 - 2.10). The amount of overtime worked is the largest contributing factor to the lower shift relief factor.

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 Helena. 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 most officers have very limited tenure. 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.

From a qualitative perspective, proactive time allows officers to perform the functions that improve the quality of life for the citizens of Helena. 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.

From a quantitative perspective, proactive time has a direct affect 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 for 2023 and the average number of employees working in patrol as call-takers at the end of 2022 (23 counting patrol officers, corporals, and the K9 team), the average employee in the Patrol Division is spending approximately 39.15 minutes per hour on reactive activities (M_R) leaving 20.85 minutes per hour for proactive patrol (M_P).

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 individual 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 residents. Often overlooked, however, is the frequency and duration of time that officers are directed 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*.

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. As the minutes of reactive time per hour per officer increases, the minutes of cross-beat dispatching (M_x) per hour per officer increases at an exponential rate.

At the time of this report, there are no designated patrol beats for the City of Helena. The following section of this report will detail a recommended beat plan containing 12 sub-beats for the city to help optimize the deployment of officers, reduce response times, and improve the quality of service provided to the citizens and visitors of the City of Helena. However, a good beat plan cannot work effectively if the agency experiences continually high reactive times (M_R). For a new beat plan to be effective, the average minutes of reactive time per hour per officer (M_R) for the agency should be 30 minutes or less.

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 lower the patrol interval, the greater the level of visibility and the greater potential crime deterrent. The patrol interval will decrease if either the minutes of proactive time per hour per officer increases or the number of units are increased. By implementing an optimized beat plan, coupled with an average M_R of approximately 30 minutes per hour, the average patrol interval across the city should be within an acceptable range of less than 24 hours.

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 CFS 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.

As with cross-beat dispatching and patrol intervals, the best way to improve the probability of saturation is to implement an optimized beat plan to distribute officers equitably throughout the city, to optimize the patrol schedules to match staffing levels to workload levels, and to maintain sufficient staffing to keep the average minutes of reactive time per hour per officer to 30 minutes or less.

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 proactive time available per hour for each patrol officer. There are three options to improve these performance measures: (1) reduce the patrol workload, (2) reduce the amount of time spent on patrol activities, or (3) increase the number of officers on patrol. The HPD currently has a grant funded position to focus on DUI violators and they staff one proactive position in the Patrol Division under this grant. There are no other proactive or special teams fielded by the HPD. All community policing efforts, follow-up, and proactive work must be accomplished by the patrol officers. This increases the importance of maintaining an appropriate mix of proactive and reactive time per hour per officer.

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 Helena and the resources available to the HPD, 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 and preventative patrol.

At the time of this report, assuming forecasted numbers are accurate for the 2023 workload and a patrol size of 23 fully trained call-takers (6 patrol corporals, 16 patrol officers, and one K9 team)), the call-takers have an estimated M_R value of 39.15 minutes per hour for the 10-hour shifts. 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. 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.

Availability rates for the last six calendar years indicates an average of 10.34% of officers will be in the academy or in Field Training Officer (FTO) status at any given time. To maintain an average M_R value of 30 minutes per hour per call-taker in 2023, the agency would need 27 fully trained call-takers on board with another 3 trainees in the Field Training Program bringing the total patrol staff to 30 call-takers. At the time of this report, there are five trainees in the academy/Field Training Program and 23 fully trained call-takers. Given an average turnover rate of 29.53% for the agency over the last six years, the agency should maintain a certified hiring list of at least 13 potential officer candidates that can be brought on board as soon as a vacancy occurs.

The staffing levels in this summary are dependent on the current overtime expenditures within the Patrol Division. If the City desired to lower the use of overtime for shift shortages and work extension, the staffing numbers in this section would increase. The estimated increases to offset the immediate need for overtime compensation can be determined by changing the user variables in the staffing model.

Table 8 assumes the current overtime dependency, the current amount of administrative time per shift, a similar amount of leave time and shift exceptions, and an accurate forecasted workload for the Patrol Division. Altering any of these assumed variables will change the staffing requirements shown in the table.

Table 8. Total call-takers required per year based on M_R values

M_R Value	2023	2024	2025	2026	2027	2028
60	14.95	15.03	15.41	15.65	15.57	15.82
55	16.31	16.40	16.81	17.07	16.99	17.26
50	17.94	18.04	18.49	18.78	18.69	18.99
45	19.94	20.04	20.54	20.86	20.76	21.10
40	22.43	22.55	23.11	23.47	23.36	23.74
39	23.00	23.13	23.70	24.07	23.96	24.35
35	25.63	25.77	26.41	26.82	26.70	27.13
30	29.90	30.07	30.81	31.29	31.14	31.65
25	35.88	36.08	36.97	37.55	37.37	37.98
20	44.85	45.10	46.22	46.94	46.72	47.47
15	59.81	60.13	61.62	62.58	62.29	63.30
10	89.71	90.20	92.44	93.88	93.43	94.95

Beat Design

The second objective of this study was to create a recommendation for a beat design 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 hours spent on reactive calls for service in the CAD database for 2017 through 2022. At the present time, the HPD does not use designated beats for deployment of patrol officers. Calls are assigned based on the availability of units in the field versus location of the call. In the absence of a dedicated beat design, all officers are responsible for patrolling all areas of the city. This can lead to the possibility of some officers being assigned to significantly more calls for service then others for a variety of reasons (seniority, rank, etc.). The lack of assigned beats can also lead to longer response times in outer lying neighborhoods if officers drift to a particular part of the city during certain hours (downtown during bar closures, etc.). A defined beat design with equitable workloads among the beats can reduce overtime by distributing workload equitably across the shift allowing all officers to finish their work prior to the end of shift. Finally, if officers are assigned to the same beats throughout a rotation cycle, the officer will gain better familiarity with the neighborhoods in their beat leading to more opportunities for community policing.

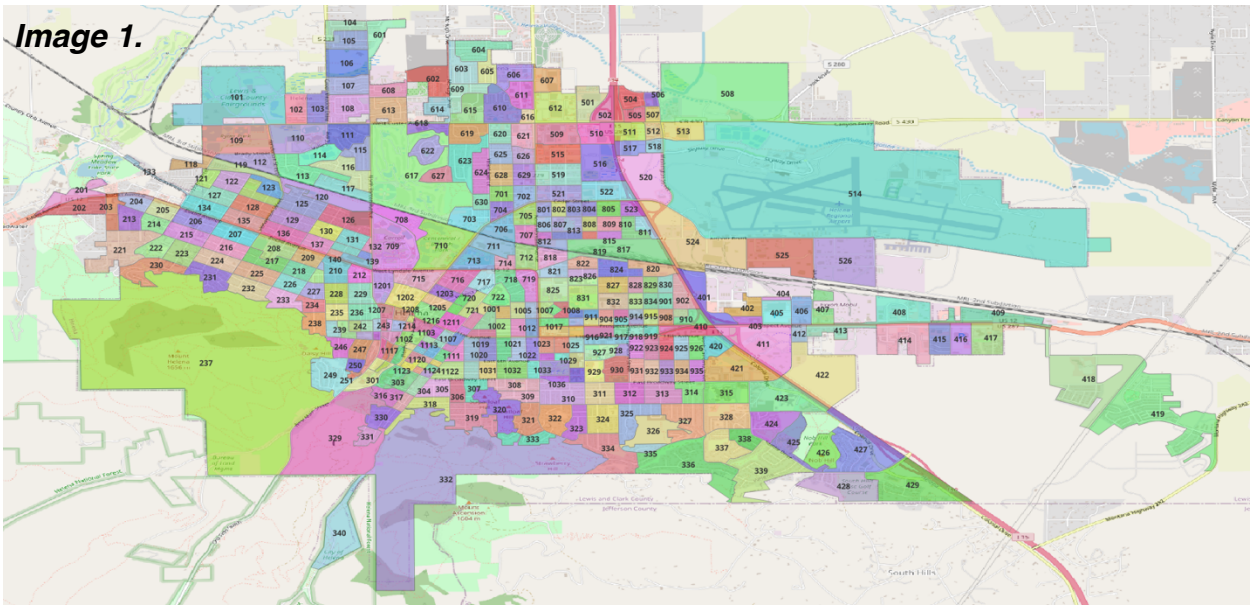
Beat Optimization

To optimize the use of current resources and to better equalize the workload for the patrol officers, a new patrol beat design was created for the City of Helena using a GIS application called QGIS. The beat design subdivided the city into 12 sub-beats, each having approximately the same hours of reactive time over the last six years as the other beats. In mathematics, the number 12 is a “superior highly composite number” which means it has more divisors than any smaller positive integer. Based on the number of officers fielded per shift, the 12 sub-beats can be grouped into six groups of two, four groups of three, three groups of four, or two groups of six. By equalizing the workload in the 12-sub-beats, any grouping configuration will result in equal workload assignments if there is one officer per group. If any additional officers are available once an officer has been assigned to each group, they can be assigned as a relief officer to cover areas when a beat officer is unavailable (processing a custody, writing reports, taking a meal break, etc.).

A GIS shapefile layer was obtained from the City of Helena containing the most recent city boundaries. That file was duplicated, renamed, and then subdivided into 391 smaller geographic polygons labeled as “Individual Reporting Areas” or “IRAs”. The 391 new IRAs cover the entire city and are bordered by major roads, neighborhood streets, property lines, and any other natural or man-made distinctions that would be recognizable by the patrol officers. Within some larger neighborhoods, walking paths, drainage ditches, and business property lines were used when other options were unavailable. This allows a

more granular picture of where work is occurring throughout the city so beats can be equalized to a closer margin. Image 1 shows the new IRA configuration.

Image 1.

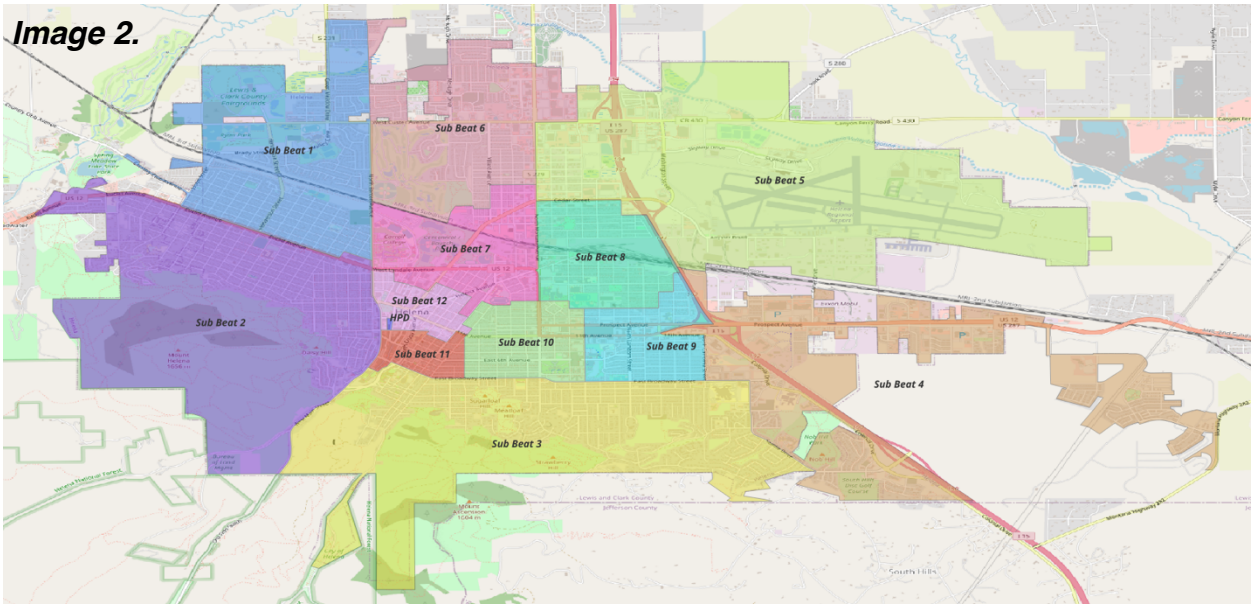


To equalize the workload among the new beats, the final CAD database containing all calls from 2017 through 2022 was imported into the GIS file as a .csv point layer. All calls that contained a verified address with a latitude and longitude value were plotted on the shapefile map. Once all calls were plotted, a join was conducted in the GIS file to identify which historical calls fell within the boundaries of each new IRA. This allowed all usable reactive work from 2017 through 2022 calculated in the CAD database to be credited to the proper IRA in which it occurred. Summing the total reactive workload per IRA over the six years of CAD data provided the total amount of historical reactive workload that occurred in each of the 391 newly formed IRAs.

An excel beat design model was created containing the reactive time for each IRA from 2017 through 2022. The model contains columns for 12 sub-beats and allows for quick summation of workload totals per sub-beat as IRAs are assigned. The model provides immediate feedback on workload percentages among the beats so IRAs can be moved from sub-beat to sub-beat until an equal distribution of workload is achieved. If the new IRA shapefile is incorporated into the CAD, future calls can be mapped to the appropriate IRA by the CAD and the model can be used in future years by the agency to redesign the beats as the need arises.

Using the beat design model, the 391 newly formed IRAs were aggregated into 12 new sub-beats for the City of Helena. The workload among the new sub-beats has a workload variance of only 0.27% between the beat with the least workload and the beat with the most. Image 2 shows the proposed sub-beats and Table 9 show the workloads for the proposed sub-beats.

Image 2.

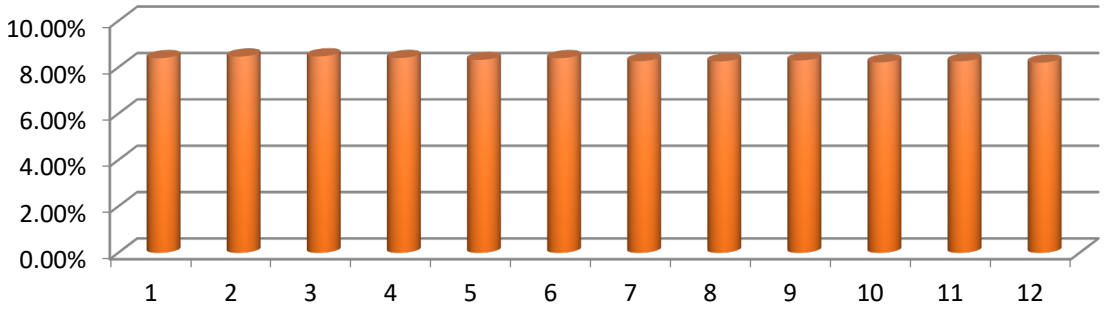


Equalizing the sub-beat workloads will aid in equalizing the workload for the officers that work the beats. This should translate into lower average response times and a more consistent quality of service for the citizens. However, equalizing the beats does not guarantee that all cross-beat dispatching will be eliminated. 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. Chart 5 shows the workload distribution per sub-beat for the proposed beat plan.

Table 9.

Reactive Hours per Sub-beat		
	Reactive Hrs	Overall %
Sub-beat 1	10,248	8.40%
Sub-beat 2	10,329	8.47%
Sub-beat 3	10,340	8.48%
Sub-beat 4	10,253	8.41%
Sub-beat 5	10,155	8.32%
Sub-beat 6	10,246	8.40%
Sub-beat 7	10,088	8.27%
Sub-beat 8	10,075	8.26%
Sub-beat 9	10,125	8.30%
Sub-beat 10	10,028	8.22%
Sub-beat 11	10,082	8.27%
Sub-beat 12	10,012	8.21%

Chart 5.



Since the reactive workload levels in the 12 proposed sub-beats are equal, the 12 beats can be aggregated in a variety of ways to fit the number of officers being deployed on a particular shift and keep uniform coverage. Images 3 through 5 show three patrol beat plans that can be used individually or in combination with each other. Image 3 is a 6-beat plan with beats labeled Beat 61 through Beat 66. Image 4 is a 4-beat plan with beats labeled Beat 41 through 44. Image 5 is a 3-beat plan with beats labeled Beat 31 through Beat 33.

Image 3.

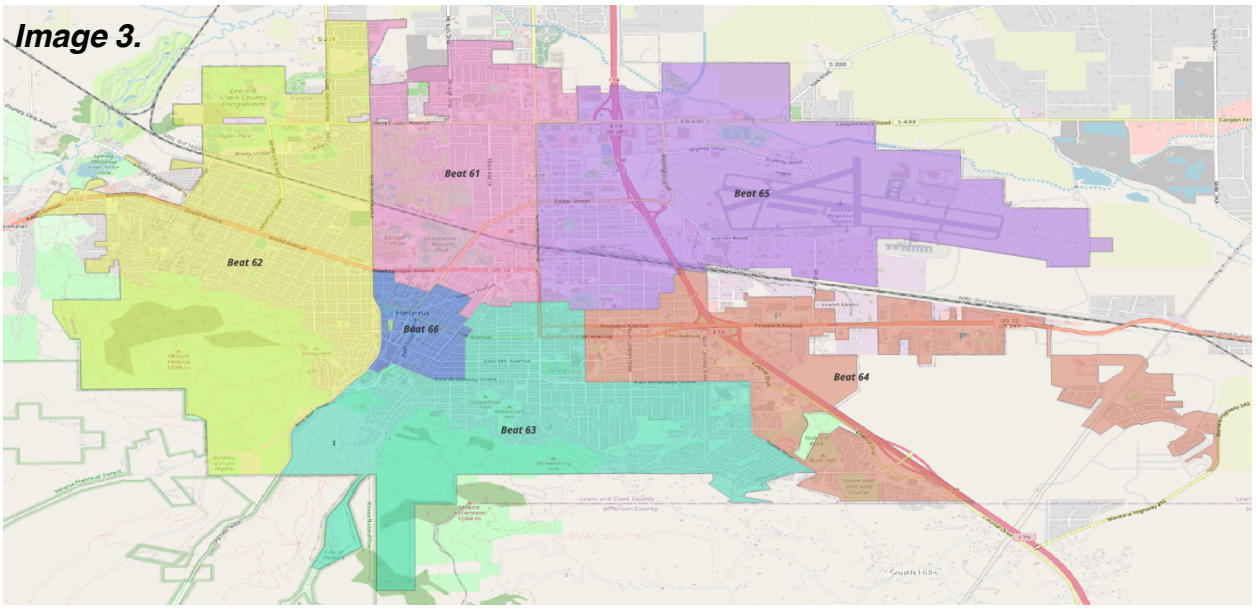


Image 4.

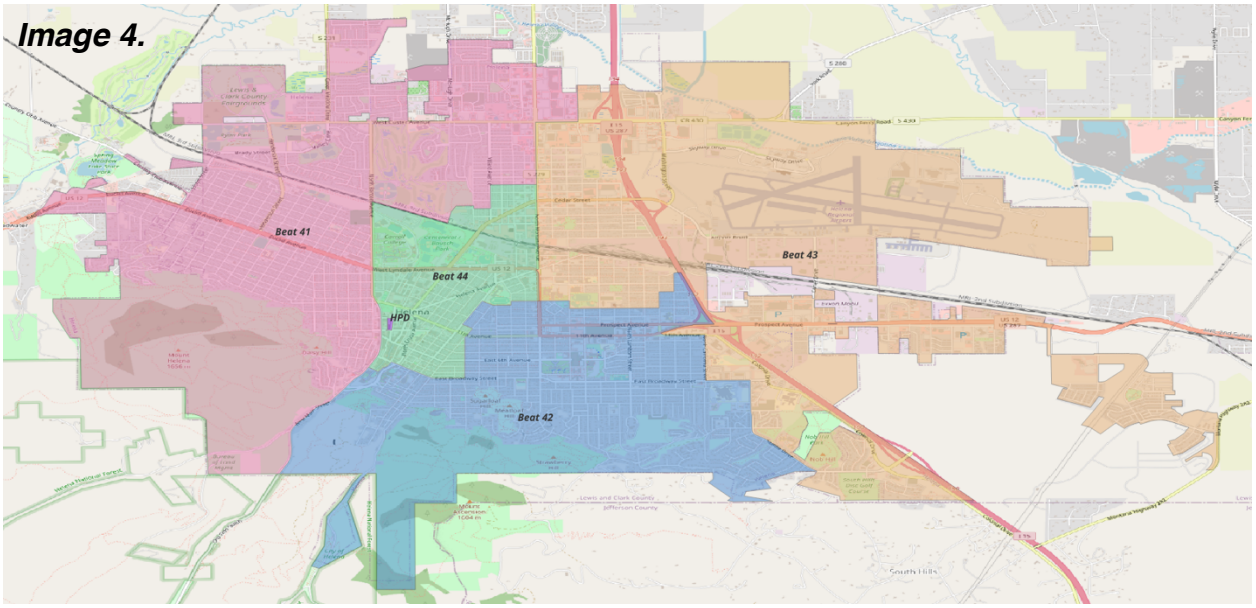
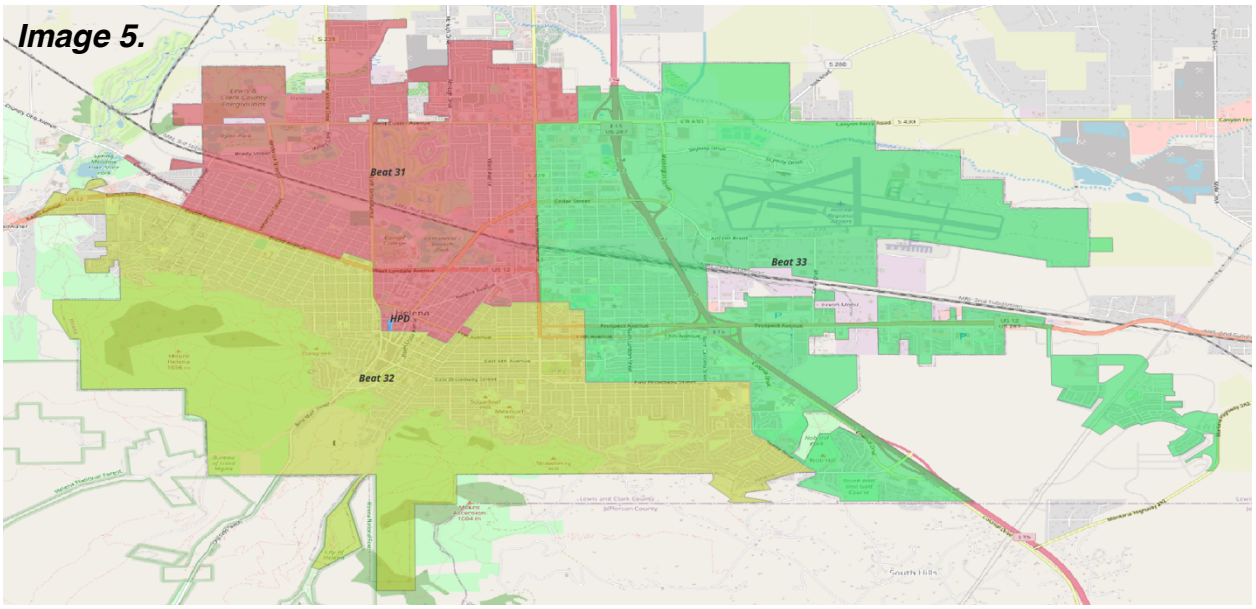


Image 5.



If the HPD chose to switch to an assignment-based CAD identifier instead of using badge numbers, the proposed beat structures could be incorporated into the new format. Patrol identifiers would begin with a number corresponding to the agency ("1" for the Helena Police Department), then an alpha character to identify the shift (in this example, first shift would use "B"), and then two trailing numbers to represent their beat assignment. Table 10 shows a possible format for CAD identifiers for the day shift patrol.

Table 10.

Officer #	12-Beat	6-Beat	4-Beat	3-Beat	2-Beat	City Wide
1	1B1	1B61	1B41	1B31	1B21	1B0
2	1B2	1B62	1B42	1B32	1B22	
3	1B3	1B63	1B43	1B33		
4	1B4	1B64	1B44			
5	1B5	1B65				
6	1B6	1B66				
7	1B7					
8	1B8					
9	1B9					
10	1B10					
11	1B11					
12	1B12					

Supervisors would use the fewest number of beat plans to match the number of officers to be fielded. For instance, with five officers to be fielded they would use a 4-beat plan with the 5th officer assigned city-wide as a relief officer. With seven officers to be fielded they would use a 6-beat plan with the 7th officer assigned city-wide as a relief officer. With eight officers to be fielded they would use a 6-beat plan and a 2-beat plan. With eleven officers to be fielded they would use a 6-beat plan, a 4-beat plan, and a city-wide relief officer. This would be a significant change for the officers and the dispatchers, but hopefully they may adjust quickly to the new format.

Under this nomenclature, Investigators would use a CAD identifier starting with "I" for Investigations followed by a consecutive number based on the number of positions in the division. The K9 team would be identified as "K91".

Schedule Optimization

The patrol workload calculated in the first part of this section was used to determine 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 appropriate number of officers in an agency, and even having the patrol beats 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 HPD 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 several schedule characteristics that should be considered due to their effect upon officer's 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 (s*calar 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 from day to 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 shift rotation period, their evaluation should include input from all supervisors involved. This practice is seldom done 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. This promotes a feeling of "fairness" to all members of the agency when both junior officers and senior officers have equal opportunity to weekend time off.

Training Compatibility

Law enforcement agencies use several 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 and 12-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 amid the incident. This same "situational training" can be done for various topics 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.[4] In the August 2003 edition of the American College of Emergency Physicians newsletter, an article entitled "*Circadian Rhythms and Shift Work*"[5] addressed the issue of rotation periods and consecutive nights states: "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."[6]

Finally, the most comprehensive reference to risk by consecutive night shifts is contained in a study entitled "*Shift work, safety and productivity*" released in 2003.[7] 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,

[4] (Dula DJ)
[5] (Thomas)
[6] (Lewinski)
[7] (Folkard S)

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 five 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 principal findings of the study are assumed to be applicable to law enforcement scheduling.

Workload Efficiency

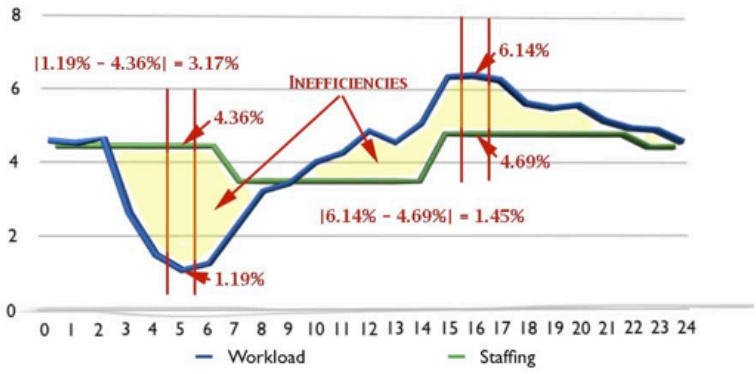
To maximize the efficiency of current staffing, the percentage of available officers fielded at any given time should be matched to the percentage of overall workload that must be completed. For example, if .075% of the agency's estimated workload for 2021 occurs on a Saturday night between 11 pm and 11:30 pm, the agency should be deploying .075% of their available staff at that time. To achieve this level of deployment, the percent of 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 hour 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 6 displays an example of the workload/staffing curve comparison. The green line represents the staffing curve for a hypothetical agency and the blue line represents the workload curve. The light yellow represents areas of inefficiency where one curve deviates from the other.

Image 6.

Efficiency Index =

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



Analysis of Current Deployment

Table 11.

	Hours	Sgts	Cpl	Ofc	Total
Shift 1	6a - 4p	1	2	4	7
Shift 2	10a – 8p	1	1	5	7
Shift 3	4p - 2a	1	1	3	5
Shift 4	8p – 6a	1	2	4	7
DUI Officer	6p – 4a			1	1
		4	6	17	27

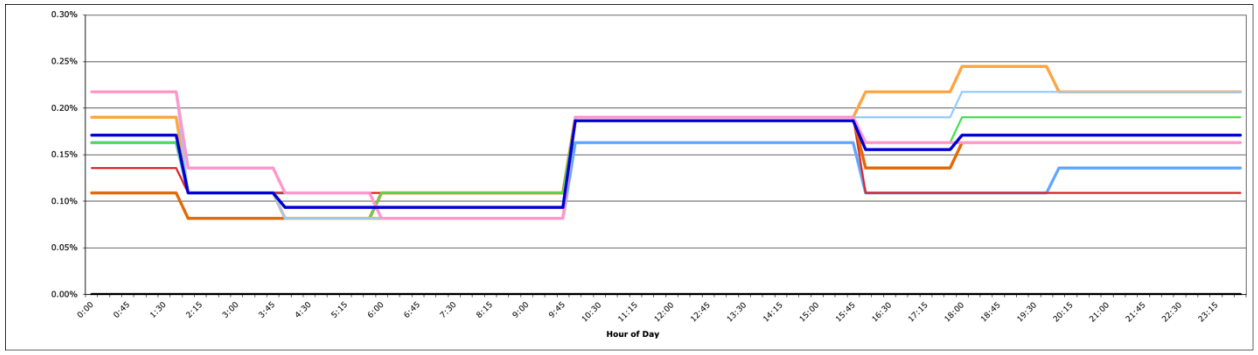
The Patrol Division uses a 10-hour shift length with a 4-on-3-off fixed days off schedule. Officers are divided among four shifts that begin at 6a, 10a, 4p, and 8p. One DUI enforcement grant officer works from 6p to 4a, Wednesday through Saturday. Table 15 shows the current shifts and the number of employees assigned to each shift when this study began.

Every six months the members of patrol go through a shift-bid process. Based on seniority, officers can choose the shift they want to work and their days off for the next six-month period. Sergeants and corporals must stay staggered across the shift, but they can bid their shift assignment based on their seniority in rank.

While the current 10-hour shift schedule has been one of the most common schedules for law enforcement over the last several decades, it can pose a risk of fatigue for the night shift officers. This is particularly true on their last night of the work period due to the number of consecutive night shifts in a row before a day off. Law enforcement and other industries have been using 10-hour shifts for many years due to the 40-hour workweek and its compliance with the Fair Labor Standards Act (FLSA). Fatigue is increased with longer shift lengths, more consecutive days worked before a rest period, and for employees assigned to work early morning hours (night shift). There were no issues raised by the HPD employees about fatigue during the site visits. The possible fatigue risk it poses was not significant enough to serve as a sole justification for changing the schedule.

Daily staffing levels for the Patrol Division as of February 2023 are shown in Chart 6. The three off-duty days each week is different for each member of the shift which leads to a lack of team integrity and causes the staffing by day of the week to vary significantly.

Chart 6. Percentage of Staff Fielded per Hour of Day and Day of Week



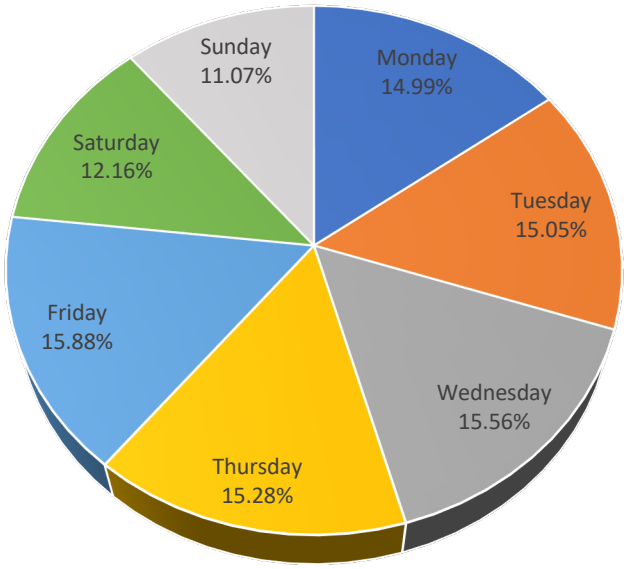
The current schedule lacks unity of command since each person's days off are different on each shift. When the shift sergeant is off duty, the officers report to one of the two shift corporals. A fixed day off schedule eliminates schedule equity since some

officers will get every weekend off and some will work every weekend. The current schedule does not have any training days built into the rotation. Officers are pulled from the shifts for training when staffing allows.

Analysis of Current Workload

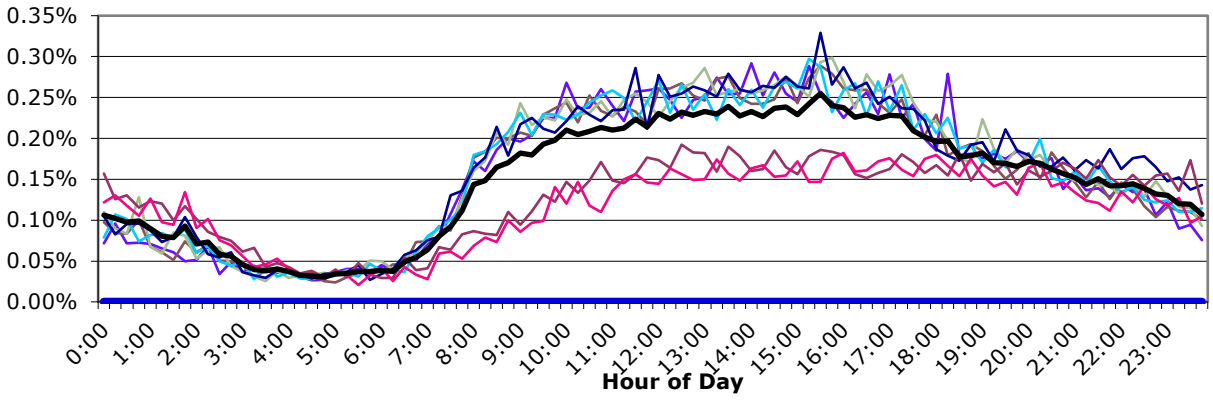
The workload for 2017 through 2022 was sorted by day of the week to compare the average number of reactive hours of work on each day. Proactive activities were removed from the averages so the data only reflected the reactive workload for the agency. The results, shown in Chart 7, showed the workload to be consistent throughout the weekdays differing by less that 0.9% between the busiest day and the least busy. However, weekends were significantly slower by an average of 3.74%. The current fixed-day-off schedule can be adjusted to accommodate the workload difference between the weekdays and the weekends by changing the available days off that are offered on the various shifts.

Chart 7. Reactive Workload by Day



In Chart 8, 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. The heavy black line shows the average percentage of workload for all seven days. The thinner lines show the average percentage of workload for each day of the week.

Chart 8.

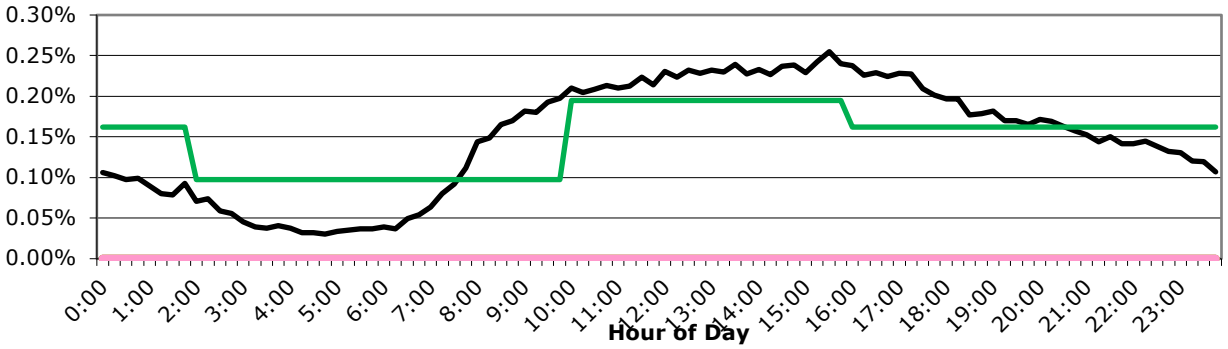


As evidenced in chart 8, the workload curve throughout each day of the week is relatively consistent. Workload reaches the lowest point around 4:30 am and peaks at around 3:30 pm. The workload during the late nights on Friday and Saturday leading into the early morning hours on Saturday and Sunday morning is slightly higher than the average. The workload during the day for Saturday and Sunday is lower than the overall average. The consistency in the workload curve indicates that a fixed-day-off schedule, a locked rotating schedule, or an unstructured schedule would all have the possibility of yielding a high efficiency index.

Efficiency of the Current Schedule

The February 2023 schedule for the Patrol Division was charted across the 24 hours of the day along with the 2017 through 2022 workload curve from the agency CAD data. The average staffing per 15-minute increment across all seven days was compared against the average number of reactive hours per 15-minute increment across all seven days. The closeness-of-fit of the current staffing curve and the historical workload curve is shown in Chart 9. The green line represents the average percentage of overall resources staffed per 15-minute increment and the black curve represents the average percentage of overall reactive workload for 2017 through 2022 per 15-minute increment.

Chart 9. ***Current Schedule: 64.37% Efficient***



The efficiency index of the current schedule is 64.37%. As shown in Chart 9, the agency was proportionally overstaffed between 8:30 pm and 7:30 am and then proportionally understaffed between 6:30 am and 8:30 pm.

Possible Reasons for Change

The current 10-hour shift schedule has been in use by the HPD Patrol Division for many years. The current schedule is only 64.37% efficient in its correlation to the workload curve and does not provide schedule equity, team integrity, or unity of command among the officers. It may be some time before a new officer on the department is able to get to day shift or afternoon shift with weekends off. In a time when competition exists between agencies for possible new employees, an attractive patrol schedule can serve as a recruitment and/or retention tool. Recent surveys and studies have shown that members of the Generation Z population (ages 11-26) want an employer who cares about their well-

being.[8] A shift schedule that offers time with family on the weekends and is mindful of potential fatigue on their body may go far in attracting members of the largest age group currently entering law enforcement.

Simple math hints that 10-hour shifts are not optimal for a 24/7 operation. 10-hour shifts cannot be placed evenly in a 24-hour day like an 8-hr or 12-hour shift. The overlaps that occur are difficult to schedule in a way that optimizes the use of extra resources without creating unappealing starting and stopping times or spikes in staffing that last only a brief time. The HPD was wise to use four 10-hour shifts per day as opposed to only three as it increases the potential overlap hours and provides a better fit to most workload curves.

Schedule Optimization

Serious consideration should be given before changing a work schedule that has been in place for a long time, such as the HPD patrol schedule. Schedules and day off 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 workdays, 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.

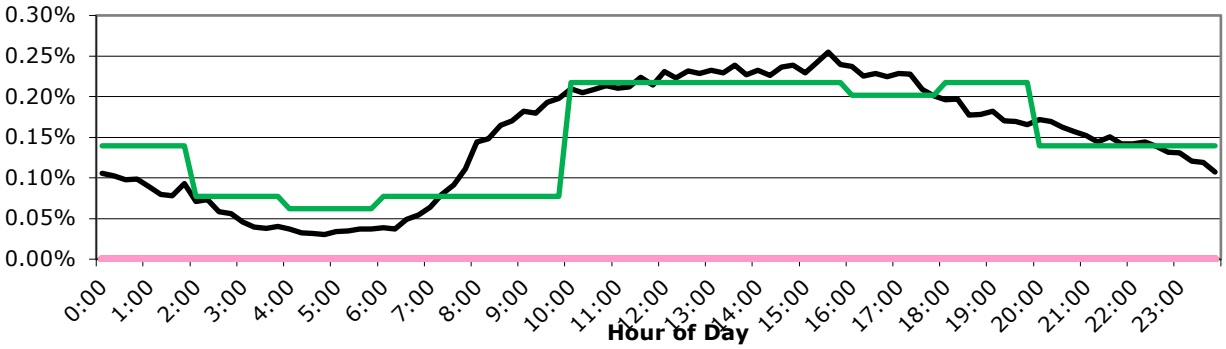
This section presents the actions taken to explore several schedule alternatives, an explanation of new proposed schedules, and any anticipated benefits of the proposed alternative schedules. The first alternative was to reallocate the available patrol officers over the existing shifts to gain a better fit to the workload curve. This involved changing the number of officers on the shifts based on workload demands. This first alternative was the minimum amount of change possible and did not alter the start times or the schedule pattern of on-duty and off-duty days. The next alternative is to move to an entirely different schedule. Two popular schedules were proposed to the HPD: a 4-week rotating shift schedule with a 10-hour and 40-minute shift length, and a 2-week rotating shift schedule with a 12-hour shift length.

Optimized Current Schedule

The first alternative is always to optimize the current schedule without changing the duty cycle schedule, shift length or the current start times. This presents the least disruption to the organization but will not solve any of the inefficiencies brought about by the shift overlaps. It also does not address the lack of schedule equity, team integrity, or unity of command. The current schedule has a disproportionate amount of officers assigned to the first shift and fourth shift based on the current workload estimates. To optimize the current schedule, one officer position was removed from the first shift and two positions (one corporal and one officer) were removed from the fourth shift. Three positions were added to the third shift (one corporal and two officers). The average efficiency index increased from 64.37% to 75.81% (Chart 10 and Table 12).

[8] (O'Boyle)

Chart 10. ***Optimized Schedule: 75.81% Efficient***



This optimization improves the efficiency by almost 11.5% but the problems with shift overlap and the lack of schedule equity, team integrity, and unity of command still exists. After reallocating units from other shifts to the second shift, the span of control for the second shift increased significantly. The maximum span of control is increased from six officers per sergeant to nine officers per sergeant. This alternative represents the best improvement that can be made to the existing schedule and provides an incentive to consider alternative schedules.

Table 12.

	Hours	Sgts	Cpl	Ofc	Total
Shift 1	6a - 4p	1	2	3	6
Shift 2	10a – 8p	1	2	7	10
Shift 3	4p - 2a	1	1	3	5
Shift 4	8p – 6a	1	1	3	5
DUI Officer	6p – 4a			1	1
		4	6	17	27

Four Week Rotating 10:40 Schedule

For some agencies, dedicated training time is a desirable element in a patrol schedule. Many police agencies in the northwest have been using a four-week rotating schedule with a 10-hour and 40-minute shift length. The schedule incorporates one training day per month per patrol officer, maintains a 40-hour average workweek over the four-week cycle, and can be implemented with two equal sized teams per start time. Team A starts in week 1 while team B starts in week 3 and each team moves to the next row of the pattern every Monday. The first Friday of the cycle, Team A trains while Team B works patrol. At the beginning of the third week, the teams have switched places and Team B trains on Friday while Team A works patrol. The duty cycle pattern of “5on - 4off - 5on - 4off - 5on - 5off” is shown in Chart 11.

Chart 11.	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					

In addition to adding team integrity and unity of command, this schedule creates schedule equity for all officers. There are two overlap days per month that can be used for training, and they always occur on a Friday. The shift overlap that occurs is used more effectively using four start times instead of three. Considering the HPD staffing levels at the time of this report, three start times seem more appropriate. Table 13 shows the start times and the number of officers assigned per shift. Notice that this alternate schedule would require six sergeants in order to keep consistent supervision among all teams.

Table 13.

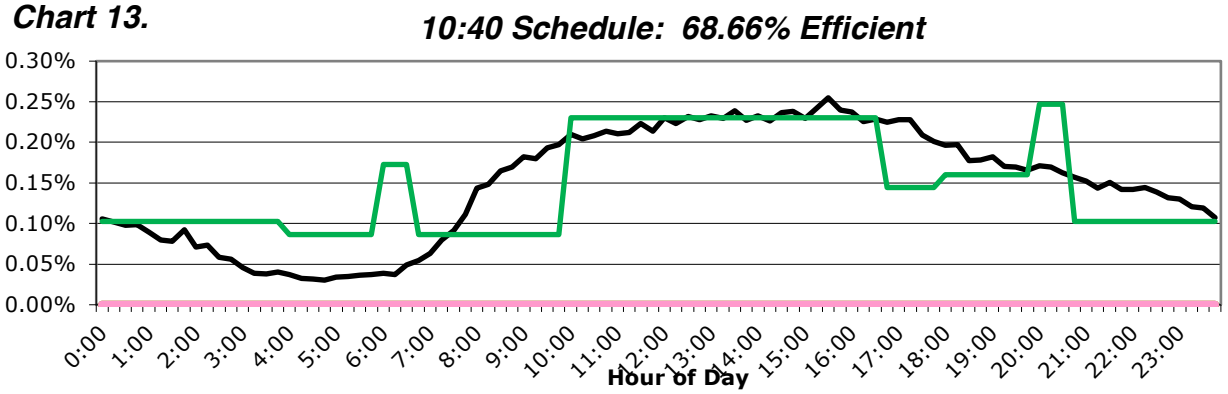
	Hours	Sgts	Cpl	Ofc	Total
Team 1A	6a – 4:40p	1	1	2	4
Team 1B	6a – 4:40p	1	1	2	4
Team 2A	10a – 8:40p	1	1	4	6
Team 2B	10a – 8:40p	1	1	4	6
Team 3A	8p – 6:40a	1	1	2	4
Team 3B	8p – 6:40a	1	1	2	4
DUI Officer	6p – 4a			1	1
		6	6	17	29

The proposed 10:40 schedule as shown in Chart 11 creates the potential for fatigue on the night shift due to five consecutive night shifts before a day off. To reduce the fatigue risk for the night shift officers, the schedule rotation alternative shown in Chart 12 is offered for consideration. The duty cycle pattern is "3on - 3off - 3on - 2off - 3on - 3off - 3on - 3off - 3on - 2off." This night shift alternative retains a 40-hour average workweek and a training day built in once a month on a Friday. It is fully compatible with the previous 10:40 schedule and maintains all schedule qualities such as team integrity, unity of command, and schedule equity. The main difference is that all work periods are limited to 3 consecutive days instead of five.

Chart 12.	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Week 1	Work	Work	Work				Work
Week 2	Work	Work			Train	Work	Work
Week 3				Work	Work	Work	
Week 4			Work	Work	Work		

The efficiency curve for the 10:40 schedule is shown in Chart 13. The schedule efficiency index is unaffected by the alternate night shift rotation. The number of officers staffed per hour per day is the same in Chart 11 and Chart 12.

Chart 13.



This schedule would only be a 4.29% improvement in efficiency over the current schedule. If staff existed to schedule four start times, the efficiency index would increase to approximately 72.44%. The HPD would obtain team integrity, schedule equity and unity of command as long as six sergeants are available. There is a fatigue risk on the night shift unless the alternative schedule in Chart 12 is adopted for the midnight shift. The main benefit of this schedule is that it creates a built-in training day once a month for all officers in patrol. If the night shift fatigue potential is monitored and accommodated, this schedule could provide good benefits to both the officers and the agency.

Pitman 12-Hour Rotating Schedule

One of the most popular 12-hour schedules in use today is a two-week locked rotating schedule that began in the Borough of Pitman, New Jersey (Chart 14). This schedule has been in use for over 30 years by many different agencies and is becoming more common throughout the country.

Chart 14.

	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Week 1	12-hr	12-hr			12-hr	12-hr	8-hr
Week 2			12-hr	12-hr			

The schedule uses two teams per start time like the 10:40 examined earlier. Team A starts in week 1 and Team B starts in week 2. The two teams work each other's days off and switch every week. The schedule provides complete team integrity, unity of command, and schedule equity with every officer getting every other weekend off as a three-day weekend. Since the number of consecutive days worked is limited to no more than a three-day period, the schedule has a low risk of fatigue unless the agency orders officers in on their days off. Increasing the number of start times in a schedule provides a better ability to match the staffing to the workload. Four start times were used as shown in Table 14.

Table 14.

	Hours	Sgts	Cpl	Ofc	Total
Team 1A	6a – 6p	1		4	5
Team 1B	6a – 6p	1		4	5
Team 2A	9a – 9p		2	2	4
Team 2B	9a – 9p		2	2	4
Team 3A	2p – 2a		1		1
Team 3B	2p – 2a		1		1
Team 4A	6p – 6a	1		2	3
Team 4B	6p – 6a	1		2	3
DUI Officer	6p – 4a			1	1
		4	6	17	27

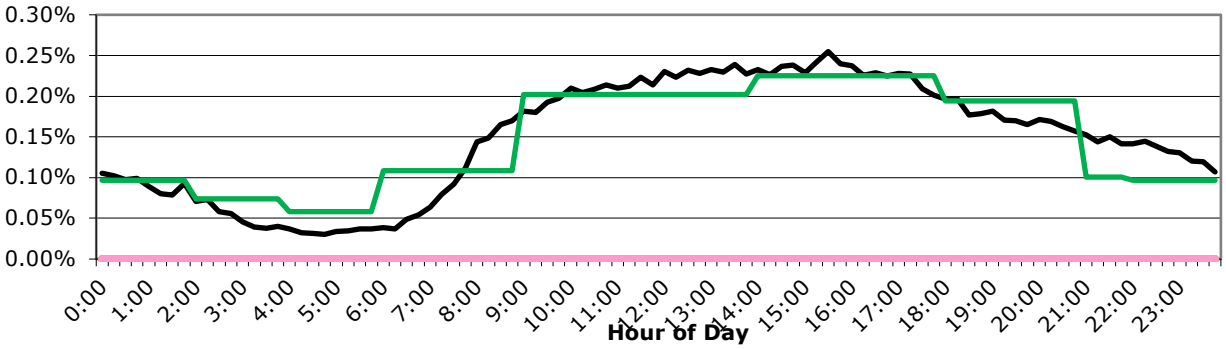
The Pitman schedule has a native average workweek of 42 hours. To remain consistent with any bargaining agreements, the city may wish to shorten the average workweek to 40 hours per week. This can be accomplished with the Pitman schedule by converting all shifts on Sunday to an 8-hour workday. Since officers work every other Sunday, the 8-hour shift will reduce the two-week total from 84 hours to 80 hours. To cover the 24-hour day on Sunday, Team 1 would begin at their normal time of 6 am but would end four hours early at 2. pm. Team 2 would change their start times on Sunday from 9 am to 2 pm so they start at the same time as Team 3. Team 2 and Team 3 would

both work until 10p. Team 4, having just completed two consecutive 12-hour shifts on Friday and Saturday, would get an extra 4 hours of rest and report at 10:00 p on Sunday and work until 6a on Monday morning. This reduces the 3-day 12-hour work period in the Pitman rotation to two 12-hour days and an 8-hour day.

The efficiency curve for the Pitman schedule is shown in Chart 15. The sharp increase in efficiency was gained by moving to a 12-hour shift which fits evenly into a 24-hour day and avoids shift overlaps. The two mid shifts serve as "power shifts" to address the times of greatest activity within the city.

Chart 15.

Pitman Schedule: 77.49% Efficient



The Pitman schedule would provide an efficiency increase of almost 13.12% while also providing complete team integrity and unity of command. This schedule would also provide schedule equity and reduce the potential for fatigue on the night shift. However, the schedule does not have dedicated training days included in the rotation so officers would have to be pulled from shift as training needs arise.

Supervision of the eight teams would require a slight change from past practice. The four existing patrol sergeants would be assigned to Team 1A, Team 1B, Team 4A, and Team 4B. This would provide 24/7 coverage by sergeants when no leave is taken. Two corporals would be placed on Team 2A and two corporals on Team 2B with the senior corporal serving as the team supervisor. The last two corporals would be assigned to Team 3A and Team 3B. This allocation of supervisors would provide an opportunity for corporals to exercise supervision under the watch of a sergeant.

In addition to the benefits in efficiency, the 12-hour schedule would create administrative savings due to fewer appearances per year per officer by those currently working the 10-hour shifts. Fewer appearances mean fewer shift briefings, fewer trips to the gas pump, fewer meal breaks, fewer officer breaks, and fewer debriefing periods at the end of the shift. Each of these administrative duties are paid activities that do not contribute to the fulfillment of the reactive workload. Therefore, reducing the frequency of administrative activities allows more time per officer to put forth towards the reactive workload.

The Pitman schedule provides the greatest benefits for the agency and the greatest efficiencies, but it also presents the greatest change.

Recommendations

Accounting and Accountability

Unreported / Under-reported Workload

The need for better documentation of report writing times was described earlier in this report as a limitation of the CAD data. Currently, the agency has two existing status codes to be used by officers to document the time spent writing reports ("repwritingav" and "repwritingun"). These codes were put into place in 2019 and their use was initially encouraged. However, for the codes to be useful for resource allocation purposes, the CAD entries must be tied to the case number of the report. Without the case number, it is impossible to tell what type of report is being written or how many reports are being written at a time. Over the years, the usage of the status codes declined rapidly until in 2022 less than 3% of report writing times were recorded in the CAD containing the case number of the report. Many officers are using the report writing status codes but only to document the time spent on the activity of report writing and not in a way that can be attributed to a certain call type for future forecasting. Based on the 6-year CAD sample, it appears that a large amount of report writing time is completely unreported.

Two status codes for "follow-up" activities were also created in 2019 and the usage of those codes has been very similar to the report writing codes. The usage of report writing codes can be compared against the total number of reports written since report numbers are tracked in the CAD. Follow-up activities that are not called out by the officer are simply lost. There is no way to go back in previous years to find out what percentage of follow-up activities were documented in the unit history log. Therefore, there is no way to estimate how much follow-up workload is "not" being captured.

The solution to this missing workload has already been implemented back in 2019. The necessary status codes exist today in the HPD CAD configuration and the System Administrator has been able to successfully extract the unit history records associated with these status codes. When an officer went on a report writing status and accurately recorded the report number, the record showed the time they went on report writing status, the time they cleared, and the report number that was entered.

It is highly recommended that the use of out-of-service codes be stressed as an everyday practice for the officers. 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. 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 status code open text field 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 cases to improve future year workload forecasts. The same documentation process holds true for follow-up activities that are completed after already clearing from the initial call.

Consistency is key in this recommendation to ensure that officers are all using the status codes correctly. A 15-minute roll-call training on the proper use of these status codes and then a concerted effort by supervisors to ensure their complete and continued usage is strongly suggested. The report writing codes and follow-up codes were meant to be used in the following manner:

- Report Writing (Available): This code should be used when an officer decides to park somewhere in their assigned area to finish reports but still wants to remain available in case a call comes in within their area.
- Report Writing (Unavailable): This call should be used when officers are trying to finish reports before the end of the shift or are holding over after the shift to finish reports. The use of this code will aid in keeping the officer logged into the CAD even if past their shift times.
- Follow Up (Available): Like report writing, this code should be used when an officer is following up on prior cases but still available to handle calls arriving in their area.
- Follow Up (Unavailable): This case should be used when an officer is following up on a prior case and does not wish to be disturbed.

Because HPD operates their own dispatch center, these calls could also be handled as events. However, there are more fields to complete in the CAD to create an event as opposed to a status entry. In addition, since these follow up activities create additional call ID numbers for the same event, they must be subtracted from the total number of incidents anytime the CAD data is being used for statistical purposes.

For this report, a group of fourteen HPD 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 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.

CAD Identifiers

The use of badge numbers for CAD identification on calls has been discussed at length in this report. If the agency is planning to transition to a data-driven management style, especially in terms of resource allocation, it is highly recommended that a new agency wide CAD identification system be adopted. The current use of badge numbers does not readily distinguish the assignment, rank, or even name of the badge holder since badge numbers of departed officers are sometimes reissued to new employees.

A new system should use identifiers that readily distinguish assignment and rank of the person performing the work. This can be accomplished with a multi-digit radio identifier that uses a pre-defined format. Since the HPD is dispatched by a multi-agency communications center, the first character of the radio identifier should identify the agency. Helena is the largest agency in the dispatch arrangement so their identifiers would begin with “1”. CAD identifiers for the Lewis & Clark County Sheriff’s Office would

begin with “2”. The City of East Helena would begin with “3”. If the Lewis and Clark County Jail uses the services of the Communications Center, their identifier would begin with “4”. EMS providers would begin with numbers from “6” to “9”. To keep the agency identifier to a single digit, all fire department identifiers would begin with a letter starting at “A”.

The second character in the radio identifier should be an alpha character identify the division or bureau inside the agency. For the Helena Police Department, the following alpha characters may be appropriate:

“A”	Administration	“C”	Patrol Shift 1 – A Team
“I”	Investigations	“D”	Patrol Shift 1 – B Team
“S”	Support Services	“F”	Patrol Shift 2 – A Team
“P”	Patrol Services Administration	“G”	Patrol Shift 2 – B Team
“T”	Training & Recruiting	“J”	Patrol Shift 3 – A Team
“R”	Records	“K”	Patrol Shift 3 – B Team
“V”	Volunteers	“N”	Patrol Shift 4 – A Team
“X”	Off-Duty / Extra Duty Assignments	“O”	Patrol Shift 4 – B Team
“K”	K9 Unit		

The third character in the radio identifier should identify the rank of the user. For smaller divisions, the numerical sequence starts with the highest-ranking position in the division. For instance, in the administration division the Chief of Police would be “1A1”, the Assistant Chief would be “1A2”, and the captain would be “1A3”. The Support Services Lieutenant would be “1S1” and the desk sergeant would be “1S2”.

In the larger divisions, the second digit identifies a range of users. For the Investigations Division, the Investigations Lieutenant would be “1I1”. All sergeants in the Investigations Division would be “1I” followed by a range of 2 to 5. Any corporals in the Investigations Division would be “1I” followed by a range of 6 to 9. All investigators would be “1I” followed by a range starting at 10 and going up.

For the Patrol Division, the Patrol Lieutenant would be “1P1”. Any administrative sergeant not assigned as a call taker, such as a training sergeant, would be “1P” followed by a range from 2 to 4. Any administrative corporals not assigned as a call taker would be “1P” followed by a range of 5 to 9. Any administrative officers not assigned as a call taker would be “1P” followed by a range of 10 to 20.

Employees assigned to the patrol teams would use the team alpha character instead of “P” for patrol. Each patrol member would start with the number “1” for Helena, then the alpha character of the team, and then a rank identifier. The rank identifiers would always be 2-4 for sergeants, 5-9 for corporals, and 10 or higher for patrol officers. A Shift 1A sergeant would be “1C2” while two corporals on Shift 1A would be “1C5” and “1C6”. Officers on Shift 1A would be “1C10” through “1C19”.

While it sounds confusing at first, this identifying format allows anyone to look at a CAD record and identify the unit involved immediately by agency, rank, and assignment regardless of the date of the call. “1F23” is a Helena PD patrol officer on Shift 2A. “1I8” is a corporal in the Helena PD Investigations Division. If the other agencies in Lewis & Clark County adopt the same format, identification of units county-wide would be much easier.

Patrol Staffing

A forecast of the Patrol Division's workload and officer availability based on 2017-2022 data indicates that the Patrol Officers will spend approximately 39 minutes out of each hour on reactive activities in 2023. This left an average of 21 minutes remaining in each patrol hour for proactive 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. At the time of this report, the HPD would need 27 fully trained call-takers to reach a 30/30 split of reactive and proactive patrol. Throughout this study, every attempt was made to collect all work performed by the officers on patrol. However, since this staffing method is new to most members of the HPD, it would be naive to believe all work being performed by the officers was captured completely.

According to the historical field training dates for new officers from 2017 through 2022, a forecasted average of 11.44% of the patrol staff in 2023 will be in the academy or in field training at any given time and unable to answer calls for service as a solo unit. Therefore, to reach a 30/30 split between reactive and proactive time in patrol in 2023, the agency would need 30 officers assigned to patrol just to keep an average of 27 officers fully trained and able to answer calls for service.

The turnover rate for the agency indicates that an average of 13 vacancies will occur per year. Since all new employees start in patrol, the agency is encouraged to maintain a list of at least 13 potential candidates that can be onboarded and entered into training as soon as a vacancy occurs.

Patrol Area Realignment

An earlier section of this report entitled "Beat Design" detailed a plan for an optimized beat plan. A new beat design was created with a workload deviation between the heaviest and lightest beats of 0.27%. The agency is encouraged to move to the new beat plan in order to increase agency efficiency, improve the quality of service to the public, and even the workload among the patrol officers. Once the new IRAs have been programmed into the CAD and the 12 sub-beats have been created, the agency can aggregate the 12 sub-beats into a 6-beat plan, a 4-beat plan, a 3-beat plan, or a 2-beat plan for detailed deployment strategies that best fit their needs.

Resource Deployment

This report detailed a method for improving the current patrol schedule by reallocating officers across the existing shifts to better match the workload curve. The current shift has a low efficiency score and does not offer team integrity, unity of command, or schedule equity. Furthermore, the fixed-days-off based on seniority bids will be a hurdle for the agency in recruiting new Generation Z officers.

The 10:40 schedule that was included in the report would improve schedule efficiency, provide schedule equity for all officers, and would provide 10 hours and 40 minutes of

training every month for every officer in the schedule. However, working five consecutive 10-hour and 40-minute shifts creates a significant fatigue risk, especially for officers working the midnight shift.

The final proposed schedule was the 12-hour Pitman rotation. This is a very popular schedule for law enforcement agencies and has the potential to create the highest schedule efficiencies with the agency's workload curve. By reducing each Sunday to an 8-hour shift the agency can maintain a 40-hour workweek, reduce the chance of fatigue for all officers, and possibly gain a valuable recruiting and retention tool. Based on the closeness of fit to the agency's workload curve and the number of benefits with the 12-hour Pitman rotation, it is recommended that the agency pursue a possible change to this schedule at the earliest opportunity.

Summary

The observations and recommendations documented and proposed in this report are believed to be in the best interest of the organization. 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 slightly understaffed. However, it is believed that the lack of a data-based beat design for officer deployment and a patrol schedule that is not tuned to the workload curve could be creating the feeling of understaffing for the employees. Through a new beat design plan and a more structured and efficient schedule, the HPD will be able to more efficiently utilize available resources in Patrol and provide a better quality of service to the citizens of the City of Helena.

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.

Works Cited

Advameg, Inc. *Helena, Montana*. 21 June 2023. <https://www.city-data.com/city/Helena-Montana.html>.

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* 38 (2001): 152-155.

Federal Bureau of Investigation. *2019 Police Employee Data*. 1 August 2019. June 2023. <https://ucr.fbi.gov/crime-in-the-u.s/2019/crime-in-the-u.s.-2019/topic-pages/police-employee-data>.

Folkard S, Tucker P. "Shift work, safety, and productivity." *Occupational Medicine* 53 (2003): 95-101.

Lewinski, B. "Anti-fatigue measures could cut cop deaths 15 percent, researcher claims." *Force Science Institute* (2011).

O'Boyle, Ed. *4 Things Gen Z and Millenials Expect From Their Workplace*. 30 March 2021. 30 June 2023. <https://www.gallup.com/workplace/404693/generation-disconnected-data-gen-workplace.aspx >.

Thomas, HA. "Circadian rhythms and shift work." *Clinical & Practice Management, ACEP* (2003).

World Population Review. *Helena, Montana*. 21 June 2023. <https://worldpopulationreview.com/us-cities/helena-mt-population#>.