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Evaluation of a Four-platoon Work Schedule

for the Redmond Fire Department

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Certification Statement

I hereby certify that this paper constitutes my own product, that where the language of others is set forth, quotation marks so indicate, and that appropriate credit is given where I have used the language, ideas, expressions, or writings of another.

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Abstract

The Redmond Fire Department (RFD) currently uses a three-platoon shift schedule. In recent years the use of sick leave has continued to rise, as well as the associated overtime costs. The problem is staffing related overtime costs are placing significant pressure on RFD's operating budget. The purpose of this research was to evaluate a four-platoon schedule and determine the associated overtime costs. Evaluative research was used to answer four research questions relating to: (a) four-platoon schedule formats, (b) the number of personnel required in the four-platoon schedule, (c) personnel and overtime costs associated with the four-platoon schedule, and (d) the workgroup's interest in moving to a four-platoon schedule. Research procedures included a review of fire service publications and previous research on shift schedules, as well as interviews with local fire service leaders whose organization had changed to a four-platoon schedule. Hypothetical four-platoon schedules were constructed using past RFD data. The projected sick leave use and overtime costs were then evaluated against data from previous years. A questionnaire was provided to the RFD workgroup to determine their interest in a four-platoon schedule. Results from this research revealed a reduction in sick leave and overtime hours based upon the hypothetical four-platoon schedules. There is also interest within the work group to move to a four-platoon schedule. The results of this research and evaluation of the data however, were inconclusive in suggesting that a change to a four-platoon shift schedule would provide ongoing savings in personnel costs. Data provided from other fire agencies also indicated cost savings from the four-platoon schedule, but these were not long term results and showed some increase over specific time periods. The author recommends that additional four-platoon schedules be built based upon previous data and that the results from other agencies continue to be evaluated.

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Evaluation of a Four-platoon Work Schedule for the Redmond Fire Department

Introduction

The Redmond Fire Department currently operates with a three-platoon system utilizing daily minimum staffing to adequately staff suppression companies, emergency medical services (EMS) units and command units. This staffing approach requires a minimum number of personnel on duty each day to fill the required number of riding positions of each apparatus placed in service. With this approach, there are also days when more personnel are on duty above the minimum required and other days when there are an insufficient number of personnel scheduled to work, which creates a need to fill the minimum positions with personnel hired back on overtime.

The problem is staffing related overtime costs are placing significant pressure on Redmond Fire Department's operating budget which in turn may affect employment levels, service delivery and other programs. The purpose of the research is to evaluate a four-platoon work schedule and determine the associated overtime costs related to staffing and how that affects our operating budget. The research questions to be answered are: (a) What format of a four-platoon schedule is most suitable for the Redmond Fire Department?, (b) What is the number of personnel required in the four-platoon schedule to maintain our current staffing?, (c) What are the personnel costs and overtime costs associated with the four-platoon schedule?, and (d) What is the interest and willingness of the workgroup to move to a four-platoon schedule?

Evaluative research will be used to correlate personnel costs and overtime costs associated with the four-platoon work schedule. Literature review along with personnel interviews within various fire departments will be used to identify the format of four-platoon

work schedules currently utilized in the fire service and to help determine the most suitable format for Redmond Fire. An analysis will be made to determine the number of personnel, or full time equivalents (FTE), required for a four-platoon schedule in order to maintain our current daily staffing and level of service to the community. Additionally, personnel and overtime costs in the Redmond Fire Department over the past several years will be evaluated against hypothetical four-platoon schedules applied to those same years in Redmond, considering the same time off and sick leave usage that actually occurred respectively in those years. Management and labor from select fire agencies that have changed shift schedules in the recent past will be interviewed to determine the impacts of their schedule change on personnel costs and overtime. A questionnaire will also be used internally to measure the level of interest and willingness of the employee workgroup in changing to a four-platoon schedule.

Background and Significance

The Redmond Fire Department (RFD) provides fire and basic life support (BLS) services to the City of Redmond and neighboring King County Fire District 34, through an annual fire services contract. In this capacity, RFD continuously staffs four engine companies, one ladder truck, four aid cars and one battalion command unit. There are several other aid cars and a rescue unit that are housed in the same station as other suppression units and are cross-staffed with that station's suppression personnel. With minimum staffing of three personnel on all engines and the ladder truck, two personnel on aid cars, and one battalion chief, the total daily minimum staffing for these activities is 24 personnel.

Redmond Fire also provides advanced life support (ALS) service to the northeast region of King County through the King County Medic One program and an operating contract with King County EMS (KCEMS). The City of Redmond provides this service as the lead agency of

Northeast King County ALS Consortium, which is made up of five agencies in the area served by the Medic One program and governed by an interlocal agreement (ILA) among consortium members. These include the City of Kirkland, City of Redmond, King County Fire District 36 (City of Woodinville), King County Fire District 45 (City of Duvall) and Fall City.

Under contract with King County, RFD continuously staffs three paramedic units, each with two paramedics. In addition, and following best practices throughout King County, a medical services officer (MSO) is also continuously on duty, overseeing and administrating the day-to-day activities of the paramedics. This level of service accounts for seven paramedics continuously on duty.

It should be noted that suppression staffing and paramedic staffing are currently handled separately, such that paramedics do not cross over to suppression and staff fire apparatus or BLS aid cars, nor do suppression personnel staff paramedic units. Such arrangement is based partly on sources of funding and on history. Suppression personnel are funded through the City of Redmond whereas paramedic personnel are funded solely by King County through a contract with Redmond. It is the City's responsibility to maintain this separation of funds such that King County funds do not subsidize the City's fire department operations, and that City funds are not used to subsidize the King County Medic One program.

Historically, the Medic One program in Northeast King County was operated by a local hospital under contract with King County. It was the decision of the hospital to no longer be an ALS service provider, so in 2003 Redmond Fire Department became the ALS provider through the ILA previously described and under contract with King County. With Redmond becoming the lead agency of the consortium, paramedics employed by the hospital became City of Redmond employees in 2003, working as firefighter/paramedics (FF/PM) in the Redmond Fire

Department. Over time, the firefighter/paramedics were not required to maintain their firefighter skills and qualifications such that none are currently firefighter qualified and therefore are unable to be assigned fire suppression duties.

The separation of suppression and ALS staffing creates some unique pressures on both budgets by not allowing FF/PMs to ride on suppression apparatus. There are occurrences when ALS is overstaffed by one or more medics and suppression is understaffed, thus requiring overtime. This creates inefficiencies such that ALS is paying for additional people to be on duty and suppression is paying overtime to meet minimum staffing requirements. With overtime pay at 1.5 times regular pay, this staffing can effectively create a situation where we are paying approximately 2.5 times regular salary and benefits, for one or more positions, in order to achieve minimum staffing.

Sick leave use and the amount of overtime associated with covering absences has been a budget focus for years in RFD. Historically, under a three-platoon system, each platoon in the department worked three 24-hour shifts. The first and second shifts were each followed by 24 hours off. The third shift was followed by four days off. The configuration is illustrated as:

ON OFF ON OFF ON OFF OFF OFF OFF.

In 2007 the RFD labor group proposed changing their work schedule from a 24-hour shift to a 48-hour shift. The proposal was to move to two consecutive days on followed by four days off, illustrated as:

ON ON OFF OFF OFF OFF.

One of the benefits presented by the labor group was an expected decrease in sick leave use and consequently a decrease in the overtime associated with covering unscheduled absences.

Beginning in the 2nd quarter of 2008, fire suppression personnel moved to the new schedule for a trial period which was to last through 2009; ALS personnel remained on the old schedule format. The trial period ended, perhaps a bit unnoticed, and suppression remained on the new schedule. ALS personnel eventually changed to the new schedule and began full implementation on January 01, 2010.

Unfortunately the perceived benefits of the new schedule were based principally on literature review showing the results of other fire departments and contained no analysis specific to RFD. One might say there were a lot of emotions rather than data used to present justification for a change. Consequently, the fire department has been under increased scrutiny from the City's Finance and Human Resources Departments pertaining to its sick leave use. It has been reported that RFD's sick leave use is now "three times higher per person than the average of all other City department personnel" (anonymous). With this continued level of sick leave use, there is overture from the City to have RFD move back to its previous schedule.

One measure developed by the previous Fire Administration to alleviate overtime was to allow personnel to fill an unscheduled vacancy and receive two days off in the future rather than receive overtime pay at 1.5 times regular salary. This two-for-one concept was widely used for close to one year and generated a tremendous amount of time-off liability for the RFD. Very few parameters were put in place regarding how a person could redeem this time-off and consequently there was greater overtime incurred later in the year and in the subsequent year. Furthermore, the two-for-one concept was not completely vetted with Finance and Human Resources prior to implementation and that decision process has had lasting consequences for the Fire Department.

The uncertainties associated with the schedule change from a 24-hour shift to a 48-hour shift, along with the impacts of the two-for-one program and other past practices, has created a skepticism among some personnel in other departments when RFD proposes new programs or suggests changes to current processes and procedures. Our current RFD staff now works diligently with representatives from other City departments to thoroughly review and completely vet any new changes. It is through this format and the results of this applied research project (ARP) that the author will evaluate a four-platoon schedule for the RFD. Results from this ARP, specific to the Redmond Fire Department, will help our staff determine the viability of a four-platoon schedule and the potential for future efficiencies in staffing, considering time off, sick leave use and overtime costs.

Upon completion of the National Fire Academy (NFA) course, Executive Leadership (United States Fire Administration [USFA], 2011), it is apparent that such change in work schedule affects not only the fire department members but also many others throughout the city; Payroll, Human Resources, and Information Services to name a few. Understanding this larger system as a whole, including its various subsystems, was the focus of Unit 3: Thinking Systematically (p. SM 3-1). When thinking about systems, knowing the implications of structures, culture and default responses, and in this case particularly, attitudes toward risk-taking, provides for a better understanding of the pressures exerted on an adaptive problem (Heifetz, Grashow, & Linsky, 2009). Furthermore, as we move forward in considering and perhaps proposing a schedule change, a solid understanding of “Influence and Persuasion” (USFA, 2011 p. SM 8-1) will help guide the RFD in working with other stakeholders throughout the city who may be impacted by such a change.

This research is also directly linked to two of the operational objectives outlined in the *United States Fire Administration; Strategic Plan, Fiscal Years 2009-2013* (2009). Objective 5.1 "Maintain a positive work environment to ensure the organization's well-being and productivity" and Objective 5.2 "Continuously improve our business systems and processes" support the goal to "Lead the Nation's fire and emergency services by establishing and sustaining USFA as a dynamic organization" (p.15). By evaluating our business processes, in this case a personnel staffing model, we continuously seek efficiencies through innovation and data analysis to become better stewards of our limited community resources. Such is always the case for responsible management, particularly now with our current global and local economies under extreme financial pressure. Any changes made to the status quo have to ensure the organization's well-being and productivity, and maintain a positive work environment through cooperation between labor and management.

Literature Review

There are many employee staffing models used throughout the fire service to meet the needs of a community and balance the revenue available for personnel costs. Having responsibility to adequately staff the appropriate resources, fire chiefs have continuously evaluated staffing models to determine the most efficient use of limited tax dollars (Cote, 1997). Staffing models for continuous service delivery can be very complex when considering consecutive hours worked, shift rotation and how to fill vacancies due to paid time off. Add to this the requirements of state and federal laws and collective bargaining agreements (CBA) and it becomes obvious that there is no *one-size fits all* approach.

Some of the more popular work cycles utilize 10-hour and 14-hour rotations during a 24-hour period, a continuous 24-hour work period or a continuous 48-hour period. Some research

indicates that almost 75% of the American fire service works a 24-hour schedule, with the remaining 25% working a 10/14 schedule (Gregg, 2009). However in one study, Rule (1999) calls into question the 24-hour shift and asks if it is truly the most economical way to deliver fire and EMS service. Rule challenged this notion and evaluated the 10/14-hour rotation as a more economical and viable option citing benefits of improved safety, reduced sick leave and increased productivity.

As budgets are reduced during current economic times, many fire departments continue to evaluate their work schedules and propose changes leading to efficiencies and reduced personnel costs. In the Washington D.C. Department of Fire and Emergency Medical Services, Chief Kenneth Ellerbe is proposing a change from the current 24-hour work schedule where firefighters work one day followed by three days off, to a 12-hour 3-3-3 work schedule where firefighters work three consecutive 12-hour day shifts, followed by three consecutive 12-hour night shifts and then three consecutive days off. Similar evaluations are taking place throughout the country as more agencies and cities take a closer look at the 24-hour shift (Mower, 2012; Phillips, 2012).

In contrast, Gregg (2009) provides research in favor of the 24-hour shift and moving away from the 10/14-hour schedule. Gregg reported on a recommendation from Management Partners Incorporated of Cincinnati, Ohio, that suggested the Lancaster, PA Bureau of Fire change from a 10/14-hour work schedule to a 24/48 hour schedule. He claimed “Management Partners estimated that the same level of service could be achieved with the 24-hour schedule with 15% less overall staff” (p. 10). This research however, is unclear as to whether the annual hours to be worked by each employee will increase or remain the same.

In conjunction with a defined work period, a determination must be made about how to rotate personnel through that schedule. Most commonly this is with a three-platoon or a four-platoon system. Just as with the wide variety of opinions and research regarding the most appropriate and efficient work period, there is a similar variation as to which platoon system to use. One of the main differences between the two schedules is the number of annual hours worked by each employee. In a three-platoon system each employee works approximately 2920 annual hours per shift, derived by annual hours = [(365.25days/year) x (24hours/day)]/3shifts. In a four-platoon system each employee works approximately 2190 hours; annual hours = (365.25x24)/4.

Agencies often adjust the annual hours worked by employees to be less than the 2920 hours in a three-platoon system or greater than the 2190 hours in the four-platoon system. In the three-platoon system this is accomplished by each employee being granted a number of days off to reduce the annual hours worked; these may be referred to as Kelly days. In the four-platoon system the employee works additional days during the year, commonly called debit days. The number of Kelly days or debit days is often negotiated through collective bargaining agreements. There is a perception that in the three-platoon system the employer owes the employee additional time off, whereas in the four-platoon system the employee owes the employer additional work time. In either method the goal is to achieve an appropriate number of annual work hours that provides adequate and efficient staffing.

In evaluating methods to become more efficient or reduce costs, many agencies look at scheduling as a means of controlling personnel costs associated with regular work hours, sick leave hours and overtime hours. In Anne Arundel County, Maryland, County Executive John R. Leopid proposed moving the county firefighters from a four-platoon system to a three-platoon

system in 2013, indicating savings of about $7 million a year and requiring the firefighters to work extra shifts due to the change (Bourg, 2012).

Savings may be reported by moving from any shift format to another. The literature supports movement from a four-platoon to a three-platoon as well as from a three-platoon to a four-platoon system. In switching from a three-platoon to four-platoon configuration, Cobb (1999) reported “overtime once ranged from 7-10% each 28-day period before D shift. Overtime now ranges from 0.5%-2.5%, even though total hours worked are essentially unchanged” (¶ 25). Another unique option was developed as Dick (2009) looked at alternative staffing strategies for the purpose of reducing personnel costs in the Tallahassee Fire Department. With the constraint of not compromising service delivery or firefighter safety, Dick examined the creation of a supplemental shift in the current three-platoon configuration. Her implementation of a pilot program showed that the creation of the supplemental D Shift decreased overtime by 51% in the first quarter of fiscal year 2009 as compared to the same quarter for 2008.

Several fire departments in the local Seattle Metropolitan area have recently transitioned from a three-platoon to a four-platoon schedule. The Valley Regional Fire Authority (VRFA) in Auburn, Washington changed to a four-platoon schedule in January, 2011 from the 48/96 schedule with three platoons. For the six month period ending June 30, 2011 VRFA reported a decrease in both overtime expenses and sick leave use (M. Horaski, B. Swearingen, personal communication, July 18, 2012). Horaski went on to report that for the twelve months ending December 31, 2011, sick leave hours continued to decrease whereas overtime expenses increased. Swearingen remarked that this increase in overtime was attributed to a requirement in the collective bargaining agreement to have all captain’s positions filled by promoted positions and to not have any acting officers fill those positions. That created situations with the daily

staffing where there was overtime needed to fill the captain's position even though doing so would create additional staffing.

The Lynnwood (WA) Fire Department (LFD) also moved to a four-platoon schedule in 2011, changing from a 24/48 three-platoon schedule. In comparing the month of June, 2011 to June, 2010, G. Sieloff (personal communication, February 29, 2012) stated the LFD had a 60% decrease in overtime expenses, or approximately $50,000 savings. The month of June was reported as being one of the months of the year with traditionally high overtime costs.

There are several other fire departments in the local area who are currently working a four-platoon schedule but have no data from their agency for comparison to a three-platoon schedule. King County Medic One (KCM1) has been on a four-platoon schedule "as far as can be remembered" (J. Herbert, personal communication, October 14, 2011) and has no data from ever having worked a three-platoon schedule. Snohomish County Fire District 7 changed to a four-platoon system in January, 2003. The department grew rapidly since that time and has nearly tripled in size according to E. Andrews (personal communication July 31, 2011). Consequently Andrews did not have what he believed would be meaningful data from which to make a comparison of overtime and sick leave use between the three-platoon and four-platoon schedule.

When determining the appropriate level of staffing for a defined level of service, Adams (2006) found that there is an acceptable level of overtime that is more cost effective than hiring additional employees. This takes into account the cost of advertising, testing, training and providing equipment for a new employee as compared to that of an experienced employee. In addition, staffing with overtime is only used on an as-needed basis and avoids having additional staffing on duty above that which is required for service delivery.

The choice between minimum staffing and constant staffing is not an easy one and must be evaluated for specific use by an agency. In the minimum staffing model enough personnel are hired to fill shift vacancies created by paid time off so that all employees are paid regular salary when on duty. However, when there are more employees scheduled to work on a given day in excess of the riding positions and paid time off vacancies, the employer pays salaries and benefits for personnel not needed on duty. This creates overstaffing with extra people for that shift. In the constant staffing model a minimum number of employees are hired to fill all of the riding positions and any vacancies created by paid time off are filled with employees receiving overtime pay. Martin (2008) evaluated both of these models and suggests that the constant staffing model can have significant and ongoing savings. However, Martin further comments:

> A weakness in the constant-staffing model is its susceptibility to over-work employees if department staffing is not managed. That is, too many vacancies drive more overtime as employees begin to de-select from voluntary overtime or use leave on regularly scheduled shift days in order to recover from too much overtime. The anecdotal assessment seems to be that if vacancies are over 5% of the total staffing level, overtime will drive more overtime. (p. 62)

The fire service is not the only profession with employees working nontraditional schedules different from the common 8:00 a.m. – 5:00 p.m. Monday through Friday work week. Closely related fields are the physician, nurse and dispatcher professions. It is no coincidence there is an abundance of literature describing these schedules, regulations affecting shift hours and studies of fatigue impacting alertness and decision making. Such research can be found through a search on the internet or local library and is beyond the scope of this research.

The literature review for this research was further expanded outside of the public service and medical sectors to include the railroad industry and airline industry. Both professions have a similarity to the fire service not just in nontraditional work schedules, but also in the requirement for quick, skilled, and decisive action where the consequences of inaction or incorrect action may immediately endanger the lives of many people. It is interesting that both professions have federal regulations which limit the number of continuous hours an employee may work.

In the railroad industry, train conductors, brake operators and switch operators can work a maximum of 12 continuous hours and are then required to have 10 hours off duty (Federal Railroad Administration (FRA), Department of Transportation (DOT), 2011). The FRA further specifies that the "10 consecutive hours of time off duty [be] free from any communication from the railroad likely to disturb rest" (p. 3). Commercial airline pilots are limited by Federal Aviation Regulations (FAR) to working a maximum of either eight or nine continuous hours depending on the time of day that the flight duty period (FDP) commences (Federal Aviation Administration (FAA), 2010). If a flight segment is greater than this time period, accommodations away from the cockpit must be made for the pilot to receive rest. FAA requirements further stipulate rest periods for cumulative FDPs over several days. These and other work period restrictions limit either profession from even approaching a 24-hour work cycle, as is most common in the fire service.

In summary, the findings of the literature review and results presented by other researchers indicate that any work cycle or schedule evaluation must be done relative to each department's needs. Staffing must be defined in accordance with the level of service provided to the community, level of funding available and legal requirements impacting employment. The

literature review supports a wide range of schedule types, each justified by their researcher and author. As stated earlier, it is clear that there is not a one size fits all schedule for the fire service.

One area of consideration, influenced by the literature review, is the potential fatigue factor related to extended work periods, specifically those greater than 24 hours. Although not the subject of this research, it is evident that there is considerable attention being given to fatigue, performance levels and liability associated with prolonged work periods (Craig, 2005; Croom, 2011; McCallion, 2012; Poole, 2012).

Information gained from the recommendations presented by Dick (2009) also influenced this research through the idea of running hypothetical scenarios by recreating staffing demands under the proposed four-platoon schedule. Dick advised that "such research would be much more tedious and….any reductions evidenced by the hypotheticals, however, should be representative of the actual results" (p 31).

Procedures

The procedures used to answer the four research questions included historic data analysis, personnel interviews, a questionnaire, and modeling hypothetical schedules based upon sick leave and time-off used in prior years. Combining these procedures together with resulting data, evaluative research was used to assess the applicability of a four-platoon schedule in the RFD.

A literature review was conducted at the National Fire Academy Learning Resource Center (LRC) when the author attended the Executive Leadership course. Several searches were conducted using the LRC's subject, title and keyword searches. Terms used alone and in various combinations included schedule, platoon, shift schedule, staffing, overtime, sick leave, 48/96, work schedule, 24-hour shift, and firefighter schedule. Surprisingly, a large volume of literature was not obtained using these searches.

Following these searches, the staff at the LRC was consulted for input on suggested searches which may broaden the literature review. Their suggested searches included the additional terms manning, workload, circadian rhythm, job rotation and rotational or rotating shifts. Using these terms and expanding my literature review onto the internet, a more expansive compilation of material was obtained for review. Much of the literature obtained from all searches related to work schedules and sleep cycles, their effect on alertness and fatigue, recovery cycles and employee burnout.

Interviews were conducted with personnel from various fire departments in the local region to gain insight from their experience of either (a) working a four-platoon shift, (b) having recently moved from a three-platoon to a four-platoon schedule, or (c) having evaluated a four-platoon schedule and planning a change to that schedule. The personnel interviewed included representatives from both labor and management. None are considered subject matter experts (SME) in staffing models, but were selected based on their ability to report on the impacts of the four-platoon system to their department, and their evaluation of data relative to their department staffing model. Table 1 lists the interviews that were conducted and the individuals present.

Information from the interviews, along with that from the literature review, was used to help determine what format of a four-platoon schedule would be most suitable for Redmond Fire. Additionally, information from the interviews illustrated the financial impacts of a schedule change on the respective organizations and any implied effects on personnel use of sick leave attributed to a schedule change.

Table 1

Meetings with Local Agencies to Discuss Four-platoon Schedules

Meeting Date and Jurisdiction	Attendees	Title/Rank	Department
August 19, 2011 Valley Regional Fire Authority (VRFA)	Bill Mack Kevin Johnson Bob Oliver Russ Albertson Bill Newbold	Fire Captain Battalion Chief Deputy Chief – Operations Deputy Chief – Services Deputy Chief – EMS	VRFA VRFA Redmond Redmond Redmond
October 14, 2011 King County Medic One (KCM1)	John Herbert Bill Newbold	KCM1 Chief Deputy Chief – EMS	KCM1 Redmond
February 29, 2012 Lynnwood Fire Department	Gregg Sieloff, Joe McGrath Bill Newbold	Deputy Chief – Operations Finance Officer Deputy Chief – EMS	Lynwood Redmond Redmond
July 17, 2012 South King Fire and Rescue (SKF&R)	Alan Church Ed Plumlee Bill Newbold	Fire Chief Deputy Chief – Operations Deputy Chief – EMS	SKF&R SKF&R Redmond
July 18, 2012 Valley Regional Fire Authority (VRFA)	Mike Horaski Brent Swearingen Bill Newbold	Finance Officer Deputy Chief – Operations Deputy Chief – EMS	VRFA VRFA Redmond
July 31, 2012 Snohomish County Fire District 7 (SCFD7)[a]	Eric Andrews Bill Newbold	Deputy Chief – Operations Deputy Chief – EMS	SCFD7 Redmond

[a]Telephone interview.

Determining the number of personnel required in the four-platoon schedule to maintain our current staffing levels was partially based on RFD's contract with KCEMS to place three medic units in service, each staffed with two paramedics. Our collective bargaining agreement (City of Redmond, 2008) was consulted to ensure that the number of annual hours worked under the four-platoon system remained consistent with those worked under the current three-platoon system. These required annual work hours determined the number of debit days that would be required per individual in lieu of Kelly days provided under the three-platoon schedule. To

maintain the same level of service that is currently provided to the region, a medical services officer (MSO) was also considered to be in service as part of minimum daily staffing. These items were used together to determine the total number of personnel, or FTEs, required to operate with a four-platoon schedule.

Several factors were taken into consideration in determining the personnel costs and overtime costs associated with the four-platoon schedule. Salary and benefits were directly calculated based on the number of personnel required to operate with a four-platoon system in comparison to the current three-platoon schedule. This was completed using the number of personnel determined necessary to maintain the current level of service. Next was an analysis of overtime costs and sick leave usage from previous years in comparison with projected overtime and sick leave with a four-platoon schedule.

Information obtained during the interviews with other agencies that had changed from a three-platoon to four-platoon schedule was considered. Data was relative to their organization only, but could be used to demonstrate actual events and report data resulting from such a change. Specific to Redmond, our payroll department provided annual data for years 2008-2011 for fire department employees assigned to shift work. This data was collated to show actual salary and benefits, sick leave and overtime pay on an annual basis for the paramedic group under consideration for a pilot study.

In order to evaluate the costs of a four-platoon schedule relative to Redmond, the data on annual sick leave use and overtime pay for 2008-2011 was first determined and analyzed relative to ALS personnel and fire suppression personnel. The 2011 ALS schedule was then rebuilt using a hypothetical four-platoon model that was constructed using actual sick leave dates and time off data from 2011. This method would demonstrate the cumulative effect of sick leave, vacation,

holiday and injury-leave resulting from a four-platoon schedule as compared to that incurred with the three-platoon schedule.

The CBA between the City of Redmond and members of the International Association of Fire Fighters (IAFF) Union, Local 2829, indicates each employee works 2528 hours annually and has 16 Kelly days annually under the current three-platoon schedule. To be consistent with the CBA an equivalent number of debit days was determined that would yield the same 2528 annual work hours. The following formula yielded 14 debit days required annually:

Debit days = [2528 hr/yr – ((365.25 dy/yr × 24 hr/dy) ÷ (4 platoon))] ÷ (24 hr/dy)

Specific assumptions were made in modeling the four-platoon schedule based on historic data. Three separate four-platoon schedules were built by three separate employees. The author and another paramedic employee each built one schedule for 2011 and a third paramedic built a four-platoon schedule for 2009. The purpose for this was to determine the impact of assumptions made by each individual when creating their hypothetical schedule. Assumptions made by the author in building a 2011 four-platoon schedule were:

1. Keep current A, B, and C shifts with current personnel.
2. Build fourth platoon, or D-Shift, by pulling personnel as equally as possible from A, B and C shifts to balance seniority.
3. Build four-platoon schedule with the format: ON off ON off off off off off.
4. Require 14 debit days annually per employee. Maintains 2528 annual hours.
5. Assign 13 debit days per employee with one debit day, 24-hours, paid back by the employee through training hours in lieu of overtime.
6. 28 day cycle created, with each employee having one debit day per cycle.
7. Debit days designated as a1, a2… a7, b1, b2… b7, c1, c2… c7 and d1, d2… d7.

8. Starting with highest seniority on each shift, assign a1, a2…, b1…, c1…, d1… etc.
9. The four-platoon shift pattern with assigned debit days is shown in Appendix A. The schedule shown identifies an eight week pattern that is repeated continuously throughout the year.
10. Personnel added to shift work in 2011 due to staffing changes were duplicated in the four-platoon model: (a) paramedic in training worked one 24-hour shift per week, on a weekday, beginning May 23 through June 30, (b) paramedic in training moved out of training and added to B-shift for complete months of July and August, (c) reassignment of acting paramedic deputy chief moved to C-shift July 16 – August 31, then permanently assigned to B-shift beginning September 1, 2011. Debit days were assigned accordingly in the next available sequence, i.e. b1, etc.
11. Identify all injuries that occurred in study year and remove those personnel from duty for defined duration and place on sick leave in four-platoon schedule. This includes known injuries or any sick leave use lasting three or more consecutive shifts. Duration of sick leave time off on new schedule will span at least the number of total days off on three-platoon shift from last shift worked to first shift back to work.
12. Apply sick leave on same day between three-platoon and four-platoon schedules for occurrences of two consecutive shifts or less.
13. Remove all Kelly day time off from the three-platoon schedule.
14. Provide one person off shift each day for vacation or holiday leave on the new four-platoon schedule. This is randomly selected as desired days off and personal methods for selecting time off during vacation selection can not be modeled.

15. Fill vacated slots due to sick leave, vacation and holiday time off with personnel assigned to debit days and with extra personnel added in the calendar year.
16. Identify remaining vacancies to fill with overtime in order to maintain seven person minimum staffing per day.

The assumptions and procedures above were not required of each of the other two persons when constructing their hypothetical four-platoon schedule. The only requirements were to maintain the same number of ALS employees and the 2528 annual work hours stipulated in the CBA.

A questionnaire was developed and distributed to the paramedic group to determine their interest and willingness to change to a four-platoon schedule. This group contained 30 paramedics and was selected based on the feasibility of utilizing the group in a pilot study if such a change were to be adopted. Additionally, the paramedics are all aware of the pressures on the ALS budget, the limitations on budget funding and long term impacts to staffing if no measures are taken to reduce personnel costs associated with sick leave and overtime. This questionnaire is shown in Appendix A along with the email the author sent requesting completion of the questionnaire.

Several limitations impacted the results of this research. The accuracy of building a hypothetical schedule based on historic data alone does not take into consideration the behavior of individuals when selecting time off, or even their use of sick leave throughout the year. Vacation and holiday time selected on the three-platoon schedule may be considerably different than that selected on a four-platoon schedule where debit days are added rather than having Kelly days as additional days off in the three-platoon schedule. Although the number of annual hours remains the same between the two schedules, perceptions and behaviors will influence

how individuals select their vacation and holiday time to best fit their new schedule. This cannot be predicted or modeled when building a hypothetical schedule on historical data alone.

The timing of this research also had a limitation on the results. Currently the City of Redmond is in contract negotiations with the fire labor union. Consequently some individuals were hesitant to provide their response to the questionnaire for concern that the information may be misused in negotiations. This not only reduced the number of questionnaires that were completed and returned, but may have skewed or influenced some employees' responses. Question 1c on the questionnaire was not clearly worded and may have yielded responses based on different interpretations. The question could be read as relating to either satisfaction with level of fatigue at work or level of satisfaction of the 48-hour shift considering the amount of fatigue over the 48 hours.

Furthermore, the timing of this research in relation to contract negotiations between the City and the Union, limited the author's ability to conduct a trial time-off selection scenario among the paramedic work group. Such a trial process would have taken into account some of the behavioral aspects and seniority implications of picking time off under the four-platoon schedule. This process could have provided a comparison between the current 2012 time off schedule and that developed for a hypothetical 2012 four-platoon schedule. However, due to this timing it was apparent that conducting a trial process would not yield reliable results and could produce completely invalid results.

Another limitation stems from the parameters placed on the ALS budget under contract with KCEMS. This contract requires that three medic units be placed in service with a minimum staffing of two paramedics on each unit. It is also an implication of the contract that money is provided for staffing a field MSO, although it is not specific that the MSO be a separate resource

in addition to the three paramedic units. These parameters create the condition of maintaining the current service level. Consequently, the research is limited by not being able to consider different service levels to the community through a change in the number of paramedic units in service daily.

Results

There are several formats of the four-platoon schedule that are currently being used locally, as were identified from the interviews with several fire department personnel in the Seattle region. Each of these schedules yields the same number of annual hours which is then typically reduced by a defined number of debit days per the agency's CBA. There was a wide range in number of debit days, typically ranging from 8 to 14. Listed below are the various four-platoon schedule types currently being used:

1.	ON	off	ON	off	off	off	off	off
2.	ON	off	off	ON	off	off	off	off
3.	ON	ON	off	off	off	off	off	off

Each of the schedules listed above cycle through an eight day period; the word *ON* is capitalized for clarity and easy recognition. For the purposes of this research and application to the Redmond Fire Department, the first schedule listed was used to build the hypothetical four-platoon schedules; 24-hours on duty, 24-hours off duty, 24-hours on duty, followed by five consecutive days off duty. This schedule provides the greatest number of days available, three days, to which debit days can be assigned without scheduling employees to work more than 24 continuous hours.

The four-platoon schedule is built around a constant staffing model versus a minimum staffing model for three-platoon schedules, in that a determined number of personnel are on duty

each day with little or no occurrences of understaffing or overstaffing. To maintain RFD's current staffing in ALS and the same level of service to the community, seven paramedics are to be on duty each day. This requires two paramedics staffing each of three medic units and one MSO in a command vehicle. In the four-platoon system for RFD this would require seven paramedics for each shift, totaling 28 paramedics. Currently, RFD has 29 paramedics assigned to shift work in the three-platoon system. Vacation time selected by employees is designed to be covered by other employees working debit days, whereas sick leave and injuries are mostly covered by personnel hired back on overtime. This balance between the number of days off due to vacation, holiday or illness as compared to number of days paid back by employees depends on the number of debit days determined for the organization.

Two different scenarios were analyzed using the procedures defined above for creating the 2011 four-platoon schedule. In one scenario all 29 employees were utilized as well as those placed on shift throughout the year. In the second scenario only 28 employees were used as suggested by the formula for constant staffing. To comply with this scenario would require a reduction in shift personnel from the current 29 down to 28. This would save the annual salary and benefits pay to one paramedic, which averages approximately $145,000. To consider a reduction in the number of employees the current age profile of the paramedic workforce in RFD (see Figure 1) and the number of personnel at or near eligible retirement age would need to be evaluated against the training costs for a new paramedic and the timeframe in which to complete paramedic training. Current paramedic training costs in the King County Medic One program are estimated at $130,000 with a timeframe spanning nearly one year.

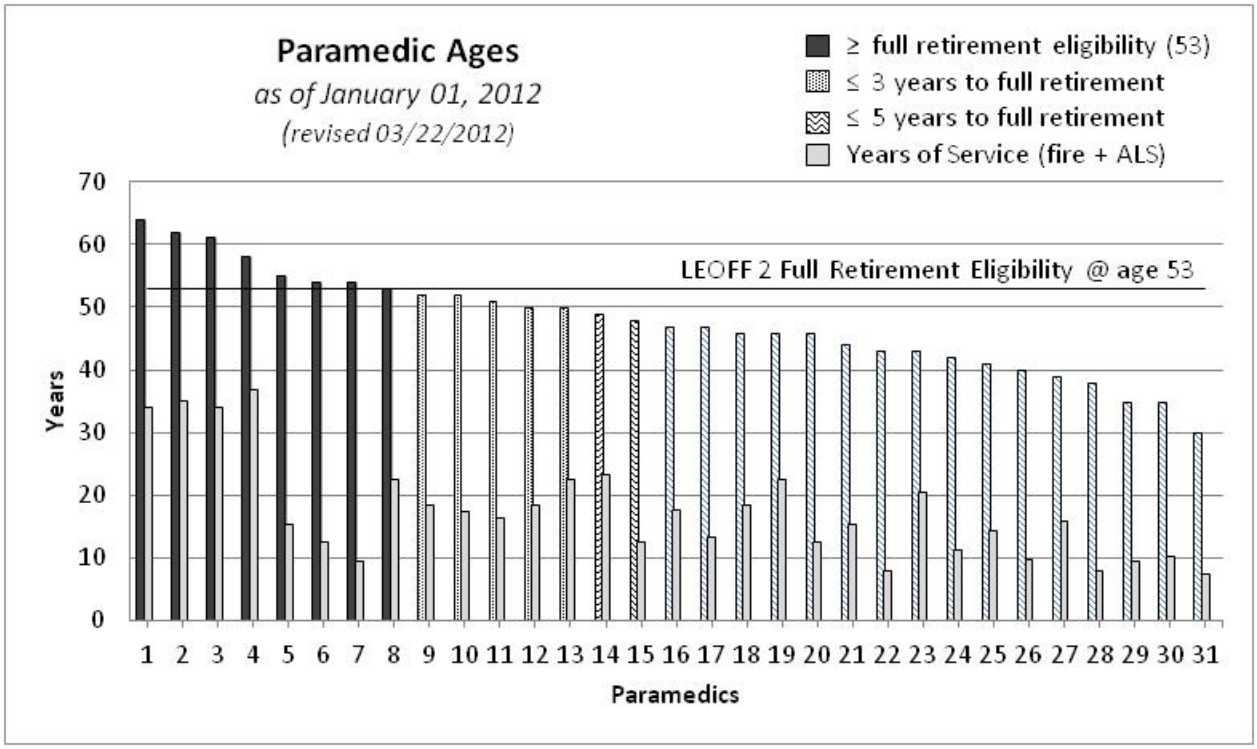

Figure 1. Age profile and retirement eligibility of Redmond paramedics.

Prior to any evaluation of actual schedules from previous years and hypothetical four-platoon schedules built upon that data, sick leave use and overtime expenditures were analyzed for the years 2008 – 2011 for ALS personnel. These years were chosen to represent two years of data on the previous three-platoon in 2008 and 2009, and two years of data on the three-platoon 48/96 shift schedule in 2010 and 2011. This data, obtained from the payroll department and summarized in Table 2, is presented in annual hours of sick leave and overtime as well as annual expenditures on each. All data is for exactly the same number of personnel each year.

Looking at Table 2 one can see that the annual sick leave decreased in 2010 after switching to the 48/96 schedule. However, one year later the sick leave hours increased back to nearly the same level in 2009, prior to the schedule change. Despite increasing sick leave, the overtime hours and expenditures continued to decrease annually from 2008 to 2011. This was a result of measures put in place to control overtime allocated to travel, training, and meetings as

well as from placing day staff from the training division onto shift work to reduce overtime expenditures.

Table 2

Total Annual Sick Leave and Overtime for Redmond Paramedics

Year	Sick Leave		Overtime	
	Hours	Amount	Hours	Amount
2008	5,744	$169,909	7,652	$405,611
2009	6,222	$196,469	6,443	$366,515
2010	5,230	$176,091	5,597	$323,022
2011	6,148	$204,682	4,425	$261,637

Rebuilding the 2011 schedule under a four-platoon format was an extremely tedious task. The steps identified in the Procedures section of this research were completed using Microsoft® Excel software. The three-platoon schedule data for 2011 showing occurrences of sick leave and overtime was obtained from the annual staffing schedule used by the MSOs. This staffing schedule was also developed on Microsoft® Excel rather than a commercially available employee scheduling program such as Telestaff™. Consequently, there is room for human error in both the actual 2011 three-platoon schedule and the constructed four-platoon schedules.

The data from payroll shown in Table 2 was converted from total annual hours to 24-hour shifts for the purpose of evaluation with the results from the 2011 schedules. The converted payroll data, the data from the three-platoon 48/96 schedule and the data from the hypothetical four-platoon schedules are shown in Table 3. The data is represented in the number of 24-hour shifts. All data presented for the three-platoon schedule is actual data retrieved from 2011.

Table 3

Comparison of 2011 Three-platoon and Four-platoon Shift Data

2011	**Sick Leave** (24-hour shifts)	**Overtime** (24-hour shifts)	**Extra Staffing** (24-hour shifts)
3 – Platoon (48/96) from payroll	256	184	---
3 – Platoon (48/96) from shift schedule	291	138	99
4 – Platoon from shift schedule	222	122	75
4 – Platoon with 28 employees	218	218	0

As shown in Table 3, there is no data from payroll that would indicate when there were extra personnel on duty above minimum staffing. This can only be obtained from the staffing schedule which shows personnel assigned to apparatus and how many employees are on duty for any given day. Some unexpected findings are the discrepancies between the data from payroll and the data from the shift schedule when comparing sick leave shifts and overtime shifts.

The reason for the difference in sick leave hours, or shifts, is undetermined but may be due to how payroll tracks personnel on duty-related injuries that qualify as state Labor and Industry claims and how employee's hours are accounted for when they are assigned to modified duty on a 40-hour work week. The shift schedule shows 35 shifts, or 840 hours, of additional sick leave. This explanation would be consistent with the injuries identified in the shift schedule.

Differences in the data for overtime shifts, between payroll and the shift schedule, are more understandable. There is a difference of 44 shifts, or 1056 hours, of overtime. Payroll includes all overtime hours but does not differentiate between hours worked on a full shift or those due to training, meetings, special events or time where an employee is on an extended call

beyond shift exchange. When considering these factors, the payroll overtime would be expected to be higher than that shown on the shift schedule, because the shift schedule does not account for these factors. Dividing the 1056 hour difference by 29.5, the number of paramedics in 2011, yields approximately 37 hours of overtime per employee. The 0.5 employee was used to reflect the placement of additional staff onto shift work for July – December, 2011. Each paramedic is required to obtain 50 hours of continuing medical education each year for their paramedic certification. Some of that training is completed on shift with no overtime incurred, thus the difference of 37 hours of overtime per employee is appropriate. Presuming the assumptions on sick leave and overtime are correct, the data from payroll and the shift schedule are consistent with each other within a margin of error created by the users in developing and maintaining the shift schedule.

Analyzing the four-platoon schedule that was built with 2011 three-platoon schedule data reveals that there is a reduction in both sick leave hours and overtime hours. As illustrated in Table 3, there is a reduction of 69 shifts in sick leave use, or 23%, and a reduction of 16 overtime shifts, or 11%. Also shown in Table 3, is a reduction in the number of occurrences where additional personal were on duty beyond the minimum staffing, shown as a reduction of 24 shifts in extra staffing. This four-platoon model also included the addition of shift personnel in July through December as was the case for the actual three-platoon schedule.

A second four-platoon shift schedule was developed using the same procedures as outlined in this research for the first four-platoon schedule, with the exception of not adding additional shift personnel throughout the year as was actually done in 2011. This provided a true schedule built on constant staffing where there are just enough employees to fill the number of riding positions for each shift. For RFD and our current ALS service level, this would allow for

seven personnel per shift or 28 paramedics total. Any vacancies created by sick leave, vacation or holiday time-off would be filled with employees hired back on overtime. Table 3 shows that overtime shifts increased by 58%, from 138 shifts on the three-platoon schedule to 218 shifts on the four-platoon schedule with 28 employees. The increase of 80 shifts would amount to approximately $128,000 in increased overtime expenditures based on an estimate of $1600 for salary and benefits for a 24-hour overtime shift. The 28 personnel, however, reflected a decrease of 1.5 employees for the year. Based on a salary and benefits estimate of $145,000 per employee, this reduction provided a savings of $217,500. When offset by the increase in overtime expenditures, there is a net annual savings of approximately $89,500. It must also be recognized that in adding a fourth shift to the current schedule, there is an additional promotion in each rank for line personnel, in order to fill the new shift. Limiting this to the ALS group in this research would add an additional MSO position only, amounting to approximately $12,000 annually.

The amount of overtime incurred in 2011 with the three-platoon schedule and the amount derived by building the four-platoon schedule was evaluated in terms of overtime hours per employee to gauge the added workload per employee. Based on the 2011 schedule there were 138 shifts of overtime, or 3312 hours, yielding an average of 112 hours of overtime per employee, or 4.4% increase in annual work hours beyond the 2528 regular hours. There was a decrease in overtime on the four-platoon schedule with 29.5 personnel, amounting to 3.9% additional hours worked annually per employee, in the form of overtime. When building the four-platoon schedule with 28 personnel, the amount of overtime increased to an average of 187 hours of overtime per employee, or an increase of 7.4% in annual hours worked. All of these results are obtained from the data presented in Table 3 and the procedures listed for constructing the hypothetical four-platoon shifts.

The assumptions used in this research did produce a plausible four-platoon schedule based off of 2011 data. This was not the case with another model that was attempted by an RFD employee in which no results were produced. The assumptions used in building that schedule were not disclosed. Another employee built a four-platoon schedule based on similar assumptions used in this research, however that schedule did not include the additional personnel assigned to shift work in the last half of 2011, and also contained slight variations in how the sick leave from 2011 was applied. Results from that four-platoon schedule showed overtime increased to 160 shifts. These results are consistent with having fewer personnel and incurring increased overtime.

The questionnaire was distributed to measure the willingness and interest of the paramedics in considering a four-platoon schedule and perhaps conducting a trial period of working on such a schedule. Results were obtained that measured the paramedics' overall satisfaction with the current 48/96 schedule and to get a sense of the actual or perceived level of fatigue when working 48 continuous hours. Appendix C contains the detailed responses to the questionnaire. The questionnaire was emailed to 30 paramedics and 22 of those were completed and returned, for a 73% response rate.

It is apparent from the responses to Question 1 that the majority of personnel favor the 48/96 work schedule. With regard to their personal schedule away from work, 18 of the 22 respondents, or nearly 82%, reported an above average level of satisfaction. Some of the comments provided however, contradict this and indicate that the "48-hour shift is too long for children and family" (anonymous). Question 2 revealed that more than half of the respondents, 14 of 22, prefer the 48-hour shift when compared to the 24-hour shift. When asked about returning to our previous 24-hour shift, nearly 100% of respondents had a low level of interest in

doing so. Only one respondent indicated an interest in such a change back to the previous schedule.

It appears from the results of the questionnaire that the paramedic work group would be willing to move to a four-platoon schedule. More than half of the respondents, 72%, indicated an average or above average interest in changing to a four-platoon, with the 48 continuous hour schedule being favored, that is, two consecutive days on duty followed by six consecutive days off duty. There is however some uncertainty from the respondents as to whether or not the four-platoon schedule will actually save money. Comments such as “show me how the four-platoon saves money” (anonymous) and “better staffing model – cost savings for the organization” (anonymous) or “need more information to evaluate” (anonymous) can be in direct conflict with each other but nonetheless indicate a need for appropriate research and evaluation.

When considering the benefits and drawbacks of the 4 platoon schedule, many respondents cite the elimination of problems associated with Kelly days on the three-platoon as a benefit, yet clearly see the nature of having to work debit days as a drawback of the four-platoon. Respondents commented that they felt there would be less ability to schedule time off than they currently have with the three-platoon schedule. Regardless of a three-platoon or four-platoon schedule, it was very clear from responses to the questionnaire, 21 of 22, that there is little or no interest in working a shift cycle less than 24 hours in length. Overall, the paramedics seem to favor the 48-hour work shift and would prefer to continue that work schedule, whether on a three-platoon or a four-platoon system.

It is inconclusive from the results of this research and evaluation of the data that a change to a four-platoon shift schedule will provide on-going savings in personnel costs. There is no evidence in the literature reviewed that suggests one schedule format is fundamentally more or

less costly than another. Three-platoon schedules are built around Kelly days which have benefits and drawbacks, and four-platoon schedules are built around debit days which also present benefits and drawbacks. The data obtained from rebuilding the 2011 schedule in a four-platoon format is subject to error and does not capture the actual paid time off that would be selected by the employee. This inherently removes the human behavior part of time off selection and an individual's preference as to the time of year preferred for vacationing.

Discussion

The format of the four-platoon schedule used to evaluate and model for RFD is 24-hours on duty, 24-hours off, 24-four hours on, followed by five consecutive days off duty. This format was selected because it offers the greatest number of opportunities for employees to work a debit day during their five day period off work, without being scheduled to work more than 24 hours consecutively. This is identical to the four-platoon schedule that King County Medic One (KCM1) operates and has found to be successful for that very reason (J. Herbert, personal communication, October 14, 2011). KCM1 is not a fire-based ALS service, providing paramedic services exclusively, and does not allow personnel to be scheduled for 48-hour work periods. This four-platoon schedule avoids having employees work 48-hour shifts, which have become more scrutinized in the EMS professions as providing a greater risk for medical errors due to fatigue. McCallion (2012) points out how "skills that are essential to EMS responders: critical thinking, multi-tasking, fine motor function and rapid response, are all effected by fatigue," which lead to concerns regarding the safety of our patients.

There were also implications specific to Redmond which led to the selection of this four-platoon format over the other two, which either inherently has a 48-hour work period or poses greater chances of employees working 48 hours on call back. Following Redmond's change to

the 48/96 schedule in 2008, there has not been a detailed analysis completed to determine the effect of the 48-hour shift on unscheduled sick leave. Consequently, there are suggestions that it may have led to an increase in sick leave use.

The sick leave use for the ALS group, shown in Table 2, decreased immediately after the change to a 48/96 schedule in 2010. However, the hours of sick leave began to trend upward again in 2011 as had been the case annually, prior to the schedule change. In contrast, the overtime hours and associated costs showed a continued annual decrease over the four year period. This was attributed to a reduction in overtime spending for training, meetings and special events. Such decreases in these areas can jeopardize communications through appropriate meetings and present challenges to provide critical training with limited funds. Reducing overtime costs through a reduction in unscheduled sick leave is far more favorable than eliminating or reducing vital meetings and training opportunities.

The number of personnel required in the four-platoon schedule to maintain our current daily staffing would be 28 employees, when assuming a constant staffing model. The results of the four-platoon model with 28 employees showed a reduction of approximately $89,500, as compared to actual staffing level of 29.5 employees in 2011. This equates to a 2% reduction in annual salary and benefits costs, based on an employee annual average of $145,000. These results are consistent with what Martin (2008) reported in his research on constant staffing versus minimum staffing. This reduction from 29.5 to 28 employees also increases the amount of overtime created and moves the average overtime worked per employee from 4.4% to 7.4% annually. Martin cautions against this, indicating that if the vacancies to be filled are more than 5% of annual base staffing, overtime itself may begin to create more overtime.

The data obtained from the hypothetical four-platoon schedules suggest there may be some savings in personnel costs associated with salary, benefits and overtime. To properly analyze this data, the assumptions upon which that data was derived must first be thoroughly evaluated. An initial assumption was made in matching time off by individual employee based on their Kelly time and vacation time used in 2011. This however, produced too much time off per employee and ultimately exceeded each individual's annual time off accruals. An adjustment was made to randomly select one person off per day as indicated in step 14 of the procedures for building the schedule.

Placing one person on paid time off each day of the year may have been an overestimate and produced results that provided a maximum amount of overtime due to this type of scheduled leave. The overtime incurred could actually be less than that obtained through this modeling. Each employee in the ALS group accrues an average of 10 vacation shifts per year. With 29.5 employees, this produces a total annual accrual of 295 vacation days. Historical data shows that an average of 9.5 vacation shifts per employee are used annually. This produces approximately 280 days of scheduled vacation time. By placing one person off duty each day of the year, implies that the remaining 85 days of the year are utilized by an employee's vacation bank or holiday time. All employees earn 5.5 shifts of holiday time annually. However, unused holiday hours are eligible for payout at the end of the year and thus very little holiday time is scheduled, with many employees using none at all. In reality, it is likely that there will be days during the year when no employee is scheduled for vacation or holiday. With an additional employee available on a debit day, this in turn may reduce the number of overtime shifts and inversely increase the number of shifts with overstaffed personnel.

The questionnaire identified a willingness of the work force to consider the four-platoon schedule, with just over half of the respondents supporting a one year trial. The many comments provided however, show different reasons for supporting or not supporting the four-platoon. These mixed results are not unlike the results other departments have encountered when considering a change in work schedules, which in some cases may impact work hours, as reported by Bourg (2012) and Mower (2012). Experience has shown that people get accustomed to what they have and may resist any disruption to their norm. It was strongly suggested in the personal communications with fire service leaders in the region (Sieloff, February 29, 2011; Church & Plumlee, July 17, 2012; Horaski & Swearingen, July 18, 2012) that any change in the work schedule be defined for a set trial period with the ability to return to the previous schedule if performance targets are not achieved.

Building the four-platoon schedules was extremely tedious and time consuming. Consequently only one previous year was evaluated in this research due to time limitations. Such tedious work was also recognized by Dick (2009) in her research on alternative staffing strategies. Developing hypothetical schedules based upon historical data, without the use of specialty software designed for staffing needs, is inherently cumbersome and subject to human error.

Recommendations

To fully understand the potential implications of changing to a four-platoon system, further analysis and data evaluation from past years is required. Rebuilding only the 2011 schedule does not provide data conclusive enough to suggest making a permanent change to a new scheduling format. Several future recommendations are made based on these results.

It will be beneficial to continue to learn from other agencies in the region as to how any changes in their work schedule continue to impact them annually. To accomplish this, it is recommended that the author meet again with personnel from each agency listed in Table 1 that has completed a schedule change. This is anticipated to be near the end of the first quarter of the year in order to review annual data from the previous year. The data can then be used to see any trends that take place over several years that may be a result of the schedule, and can be compared to data from an equivalent number of years prior to any schedule change.

More data is needed from previous years to evaluate those years on the three-platoon schedule versus a hypothetical four-platoon schedule built on the same data for a given year. It is recommended that the author next build four-platoon schedules for 2008, 2009 and 2010. Doing so will allow RFD to not only evaluate four individual years but will also provide data to compare to trends identified in Table 2. Evaluating the years spanning 2008 – 2011 will also provide a comparison of the four-platoon schedule to our previous three-platoon schedule from 2008 and 2009, as well as a comparison against the 48/96 work schedule of 2010 and 2011. It is believed that completing an analysis of additional years will also test the assumptions made in building the four-platoon schedule as to their validity and repeatability under different conditions. These evaluations will allow a more comprehensive comparison of personnel costs and staffing related overtime costs, and how each affects our operating budget.

From the results of this research it appears that a constant staffing approach should be used to determine the number of personnel when considering a four-platoon system. This would put our ALS staffing at 28 employees assigned to shift work, as compared to 29 employees currently in 2012. Considering the age profile of our current paramedic workforce as shown in Figure 1, it is recommended that this level of staffing be achieved through attrition.

If a change to a four-platoon schedule is decided upon for the Redmond Fire Department, it is recommended that a one year trial period be established with an option to extend for one additional year. This will allow actual data to be evaluated against previous years prior to the schedule change as well as data comparison between years on the same schedule to identify any trends or anomalies.

If the data analysis from previous years in RFD, as recommended through this research, remains inconclusive as to a defined benefit in making a change, it is recommended that any trial period first be conducted with the ALS group rather than the entire RFD workforce. If however, data suggests the likelihood of on-going savings, it would benefit the entire organization for all employees to switch to the same schedule in order to maintain shift continuity and established working relationships. These steps would limit the risk of the organization entering into a binding agreement that may not produce desirable financial results or results desired by the organization with regard to personnel relations, training opportunities, communication and regional compatibility with neighboring jurisdictions.

Future researchers desiring to conduct an evaluation of different shift schedules are recommended to evaluate data from multiple years within their own department. It is evident that there is not one schedule that is suitable for every department. The agency must consider the size of their workforce, the number of promoted positions required or eliminated, desired staffing and service levels from the past to that proposed, and any requirements imposed by a collective bargaining agreement. It is highly recommended that computer software specifically designed for personnel staffing be utilized to improve the accuracy of any evaluation.

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Appendix A

Four-platoon Shift Schedule with Assigned Debit Days

Sun	Mon	Tue	Wed	Thu	Fri	Sat
C a6	D b6	C a7	D b7	A c1	B d1	A c2
B d2	C a1	D b1	C a2	D b2	A c3	B d3
A c4	B d4	C a3	D b3	C a4	D b4	A c5
B d5	A c6	B d6	C a5	D b5	C a6	D b6
A c7	B d7	A c1	B d1	C a7	D b7	C a1
D b1	A c2	B d2	A c3	B d3	C a2	D b2
C a3	D b3	A c4	B d4	A c5	B d5	C a4
D b4	C a5	D b5	A c6	B d6	A c7	B d7

Legend

A	Regularly scheduled work day; A-shift, B-shift, etc.
a1 - a7	Assigned debit day positions for A-shift, B-shift, etc.

Appendix B

Questionnaire to Redmond Medic One Paramedics

From: Bill Newbold
Sent: Monday, June 25, 2012 12:46 PM
To: !_Fire Medics
Subject: Research on Shift Schedules
Attachments: Shift Schedule Questionnaire.p

Paramedics,

As part of my research for the National Fire Academy I'm looking at various shift schedules and configurations. Please take a moment and complete the attached Questionnaire (11 questions). You can return a completed hardcopy to me or provide your responses electronically in some manner. Feel free to include your name if you wish or return it anonymously.

Thanks in advance for your time on this – it should take less than 15 minutes. I would appreciate your response no later than July 13th.

Thanks again,

- Bill

Bill Newbold
Deputy Chief of EMS
Redmond Medic One
Redmond Fire Department
425-556-2203

Paramedic Shift Schedule Questionnaire

1. How satisfied are you with working a 48-hour shift when considering the following?

   a. Work schedule:

Low				High
1	2	3	4	5

   b. Personal schedule away from work:

Low				High
1	2	3	4	5

   c. Level of fatigue while at work:

Low				High
1	2	3	4	5

   Comments:

_____

_____

_____

2. Overall, with all things considered, which shift would you rather work?

   24-hour 48-hour

3. What is your level of interest in returning to our previous work schedule of

   ON off **ON** off **ON** off off off off?

Low				High
1	2	3	4	5

4. Our current 48/96 and the previous “modified Detroit” were three-platoon configurations. What is your level of interest in moving to a four-platoon configuration?

Low				High
1	2	3	4	5

Describe why:

_____

_____

_____

5. There are various schedules with the four-platoon system. What is your level of interest in each of these?

a. **ON** **ON** off off off off off off

Low				High
1	2	3	4	5

b. **ON** off **ON** off off off off off

Low				High
1	2	3	4	5

c. **ON** off off **ON** off off off off

Low				High
1	2	3	4	5

6. List what you believe are the benefits and drawbacks of the four-platoon configuration:

Benefits	Drawbacks
_____	_____
_____	_____
_____	_____
_____	_____

7. How willing are you to try a pilot program of the four-platoon for a year or more?

Low				High
1	2	3	4	5

8. In addition to 24-hour schedules, other shift schedules that are used in the fire and EMS services include 12-hour shifts or 10/14-hour shifts. Examples are:

   4 12-hour shifts/ 3 days off; or 2 12-hour shifts/ 2 days off
   4 10-hour shifts/ 4 days off
   3 10-hour shifts/ 2 days off, 3 14-hour shifts/ 4 days off

   What is your level of interest in working shifts that are less than 24-hour?

Low				High
1	2	3	4	5

9. Overall, with all things considered, which shift would you rather work?

   12/12 or 10/14 24-hour 48-hour

10. What are the benefits you see in the 12/12 or 10/14 type of shift vs. a 24-hour shift?

_____

_____

_____

11. Please provide any additional comments you have relative to work schedules:

_____

_____

_____

_____

_____

Appendix C

Questionnaire Results

Paramedic Shift Schedule Questionnaire

Results/comments from respondents are shown in italics
22 of 30 questionnaires returned (73%)

1. How satisfied are you with working a 48-hour shift when considering the following?

d. Work schedule:

Low					High
1	2	3	4		5
3	*1*	*5*	*2*	*1*	*10*

e. Personal schedule away from work:

Low				High
1	2	3	4	5
1	*2*	*1*	*5*	*13*

f. Level of fatigue while at work:

Low						High
1		2	3		4	5
2	*1*	*3*	*3*	*1*	*6*	*6*

Comments: *Listed below are comments received from respondents; like comments were grouped together and indicated with number of personnel making similar comment.*

- *Busy shifts become long*
- *Fatigue level is much less on 48 hr shift (x3)*
- *48-hour shift is too long – boredom, not fatigue*
- *4 days off is great for the family*
- *48 hr shift prevents me from seeing kids/family for three mornings straight*
- *48 hr shift is too long for children and family (x2)*
- *Reduced commute – less fatigue*
- *Much better than previous modified Detroit schedule – less fatigue (x3)*
- *Best schedule ever*

2. Overall, with all things considered, which shift would you rather work?

24-hour	48-hour
8	*14*

3. What is your level of interest in returning to our previous work schedule of

   ON off **ON** off **ON** off off off off?

Low				High
1	2	3	4	5
21	*0*	*0*	*1*	*0*

4. Our current 48/96 and the previous "modified Detroit" were three-platoon configurations. What is your level of interest in moving to a four-platoon configuration?

Low				High
1	2	3	4	5
2	*3*	*5*	*5*	*6*

   Describe why: *Listed below are comments received from respondents; like comments were grouped together and indicated with number of personnel making similar comment.*

   - *Less ability to get more than 2 weeks off for vacation due to debit vs. Kelly days*
   - *Will have more time to recuperate after work cycle – more consecutive time off (x4)*
   - *Better lifestyle due to personnel time off (x2)*
   - *Not excited about debit days and them being scheduled (x5)*
   - *Only if we can pick our debit days*
   - *Show me how four-platoon saves money*
   - *Only if we stick with 48-hour shift (x3)*
   - *Need more information to evaluate*
   - *Desire 24-hour shift for my family*
   - *Improved potential for promotion*
   - *Better safety for crews and citizens*
   - *Do not desire to work different shift than our consortium members*
   - *Better staffing model – cost savings for the organization*

5. There are various schedules with the four-platoon system. What is your level of interest in each of these?

   d. **ON** **ON** off off off off off off

Low					High
1	2	3	4		5
4	*1*	*3*	*3*	*1*	*9*

   e. **ON** off **ON** off off off off off

Low				High
1	2	3	4	5
6	*4*	*1*	*8*	*3*

   f. **ON** off off **ON** off off off off

Low				High
1	2	3	4	5
7	*4*	*4*	*3*	*4*

6. List what you believe are the benefits and drawbacks of the four-platoon configuration:
   Listed below are comments received from respondents; like comments were grouped together and indicated with number of personnel making similar comment

   Benefits

   - *More consecutive time off; ability to recuperate (x10)*
   - *No more Kelly Comp Time issues for admin*
   - *Greater job opportunities; promotions (x4)*
   - *More consistent training*
   - *Less burnout at work (x3)*
   - *Cost savings for organization*
   - *Decreased sick leave usage*
   - *Improved safety (x2)*

   Drawbacks

   - *Increased costs to department*
   - *Less ability to schedule time off (x9)*
   - *Debit days (x 12)*
   - *No drawbacks*
   - *Different schedule than neighboring agencies (x2)*
   - *Increased commute (x2)*
   - *Will be away from work longer – be more out of touch*

7. How willing are you to try a pilot program of the four-platoon for a year or more?

Low				High
1	2	3	4	5
3	*4*	*2*	*3*	*9*

8. In addition to 24-hour schedules, other shift schedules that are used in the fire and EMS services include 12-hour shifts or 10/14-hour shifts. Examples are:

   4 12-hour shifts/ 3 days off; or 2 12-hour shifts/ 2 days off
   4 10-hour shifts/ 4 days off
   3 10-hour shifts/ 2 days off, 3 14-hour shifts/ 4 days off

   What is your level of interest in working shifts that are less than 24-hour?

Low				High
1	2	3	4	5
21	*0*	*0*	*1*	*0*

9. Overall, with all things considered, which shift would you rather work?

12/12 or 10/14	24-hour	48-hour
1	*6*	*14*

10. What are the benefits you see in the 12/12 or 10/14 type of shift vs. a 24-hour shift?
    Listed below are comments received from respondents; like comments were grouped together and indicated with number of personnel making similar comment.

- *None (x16)*
- *Negative – It will create more overtime costs*
- *Negative – It will increase fatigue (x3)*
- *Positive – Opportunity to be at home part of every day*
- *Negative – Will worsen commute – increased travel time (x4)*
- *Negative – Requires more personnel*
- *Negative – creates childcare issues (x2)*
- *Negative – complicates training*
- *Negative – sleep cycle confusion*
- *Positive – better sleep cycles*

11. Please provide any additional comments you have relative to work schedules:
    Listed below are comments received from respondents; like comments were grouped together and indicated with number of personnel making similar comment.

    - *Let's try it (x3)*
    - *We need to remain flexible in regards to any changes*
    - *48-hour shift is best for personal time and family time (x3)*
    - *Leave our schedule as it is – better working relationship with consortium members*
    - *Hope survey is true request for dialogue and not a stamp applied to decision already made*
    - *Do not expect to work different shift from rest of local (suppression personnel)*
    - *In favor of the 24-hour shift (x3)*
    - *Do not assign debit days – need ability for employee to schedule*
    - *four-platoon creates safer environment for employees and citizens (no 48hr shift)*
    - *Reduces costs of overtime and costs associated with minimum and over-staffing*
    - *Better quality of life*
    - *Be careful of your cure*