

Assigning Pastors to Parishes: A Method to Reduce Travel Expenses and Enhance Ministerial Service

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Abstract

Volunteer pastors in a particular religious organization in Canada are required to make regular monthly visits to parishes. During such visits, pastors train parish leaders, greet worshippers, provide religious instruction, and speak at church services. Previously, each year's month-by-month visit schedule was manually constructed. We report on a quantitative methodology for pastor-parish assignments that makes better use of the organization's financial resources. Through the adoption of this approach, the church has stabilized (and in some cases, reduced) its annual travel reimbursement costs while providing enhanced opportunities for pastors to minister to worshippers.

Introduction

R-I-N-G.....

“Hello, this is Pastor Alan.”

“Hi, Pastor Alan. Pastor Kim here. We're refining next year's speaking schedule and we'd like you to visit the Melfort parish in July.”

“Umm... not sure that will work out. You've already assigned me to visit Melfort in April, and I'd prefer to spread out my visits to the different parishes as much as possible. How about sending Pastor Stan to Melfort in July?”

“No can do. Pastor Stan has already booked off the month of July because of a family holiday.”

“Didn't realize that, Pastor Kim. OK, here's a suggestion – just flip-flop the assignments for Pastor Larry and me. Send him to Melfort and I'll go wherever you had originally planned to send Pastor Larry.”

“That's a reasonable idea, Pastor Alan. But Pastor Larry lives a fair distance from Melfort. I'm getting a signal from our church leaders that they would prefer we put together a schedule that is as cost-effective as possible. There has to be some way of creating a schedule that meets all of our needs, isn't there?”

“I sure hope so, Pastor Kim. This is getting to be a real headache.”

Religious leaders are appointed to help other people fortify faith, overcome emotional and spiritual distress, and approach challenges with cheerful dispositions. In short, they assist parishioners in becoming converted to a better way of life. Ecclesiastical leaders do this by effectual, nurturing ministerial service. They reach out to those lonely or in need of comfort. They remember the names of parishioners and become better acquainted with them. They love them without judging them, and endeavor to establish sincere friendships with them.

Besides the sacred call to ministerial service, a religious leader may be required to manage programs, administer policies, and oversee organizations. Administrative work could involve, among other activities, delegating pastors to visit particular parishes and safeguarding the organization's financial reserves. As described in the initial dialogue, a religious leader may face considerable challenges in creating pastoral schedules and travel assignments that make optimal use of scarce financial resources. The desire for travel cost frugality necessitates assigning pastors to visit parishes in close proximity to the pastor's home location. On the other hand, pastors may wish to travel to remote parishes in order to establish mutually satisfying connections with those individuals.

The purpose of this paper is to apply a quantitative methodology – known as an integer optimization model - to make cost-effective assignments in a nonprofit context. Specifically, we assign monthly visits of religious pastors to parishes. The overall theoretical framework adopted in this paper involves the provision of enhanced pastoral care, while simultaneously stabilizing the ecclesiastical society's financial management.

In a variety of fields, decision-makers use quantitative methodologies to optimize resource allocation. Such applications include assigning law students to employment fair interview slots (Bartholdi III and McCroan 1990) and flight training time blocks to aeronautical students (Bazargan-Lari 2004).

The religious organization explored in this paper involves a church in Saskatchewan, Canada with ten respective parishes. Figure 1 shows a map of the organization's area with the parish locations circled (the city of Saskatoon near the bottom of the map includes four parishes). As points of reference, Kindersley (near the bottom left corner of Figure 1) is about two hours driving time from Saskatoon. Flin Flon (towards the upper right corner of Figure 1) is roughly four hours by vehicle from Prince Albert (near the center of the map). The requirement for parishes – especially smaller units such as Flin Flon, Meadow Lake and Kindersley – to have regular visits combined with the fact that the bulk of pastors resides in Saskatoon suggests that travel costs are non-trivial financial expenditures.

===== insert Figure 1 about here =====

The eleven pastors in this church are required to make periodic visits to units in order to meet with parish members, provide religious instruction, speak at church services, and train parish leaders. These pastors are un-paid volunteers who maintain regular careers during the rest of the week. For example, the current roster of pastors includes, among others, a Political Science professor, chiropractor, health systems analyst, and computer retail store manager. The only compensation received for their parish visits is a reimbursement of round-trip travel costs. Table 1 lists the first names of each pastor and indicates those who reside outside of Saskatoon. The notion of stewardship parishes will be discussed later in this paper.

===== insert Table 1 about here =====

In the past, a well-meaning church volunteer (one of the pastors) had manually created each year's speaking schedule. Regrettably, such an approach was fraught with complexities for the scheduler and frustration by all parties involved. For example, it was not unusual for a speaking assignment to include a specific pastor visiting the same parish multiple times within a year, a situation that did not provide the variety of speaking engagements pastors desired for themselves. By assigning an individual pastor to visit the same location multiple times, parishioners were also deprived of the diversity offered by the unique ministerial perspectives of individual pastors. Visits by a multiplicity of religious leaders enhance ministerial service and solidify pastoral care.

Moreover, the scheduler frequently devoted several hours and numerous iterations to creating a schedule. Despite his best efforts, no one ever seemed completely satisfied with the final product.

This frustration – combined with some tough economic times experienced in late 2008 – fueled the desire to seek a better solution to the assignment problem. Annual travel reimbursement costs were approaching nearly \$14,000, and this nonprofit organization wanted to be as frugal as possible in the allocation of its resources. It received a fixed annual budget from central church authorities. Consequently, any budget funds not devoted to travel expenditures could be allocated to the rest of the organization's religious and charitable work. On the whole, there was a sense that the church could improve the manner in which it assigned pastors to visit parishes, and that such improvement would lead to better financial management of its resources and enhanced ministerial service. Through a personal contact with one of the pastors, we were approached about using a quantitative methodology to explore this assignment problem.

We will present the development of our analytical approach by separately considering the model's three components (decision variables, objective function, constraints). This will be followed by a description of the model results. We will then discuss the theological rationale of our work. We will complete the paper with some concluding remarks and suggestions for readers to consider in their particular ministerial contexts.

Quantitative Methodology

As indicated earlier, we will develop a quantitative method known as an integer optimization model to make cost-effective monthly visit assignments of religious pastors to parishes. Such a methodology is commonly applied in a variety of management and economics settings in which organizations desire to make efficient use of scarce resources. Essentially, we formulate different analytical variables and equations within a computer spreadsheet to represent the annual scheduling of pastors to parishes. We then use a computer software package that considers our different variables and equations, then ultimately determines an annual speaking schedule that provides the lowest total travel costs.

Decision Variables

In order to begin applying this methodology, we require a concept known as a decision variable. These variables are used by our analytical model to identify the assignment of a specific pastor to a particular parish in a given month. Our decision variables are a mathematical quantity with the following format:

$$\begin{aligned} X_{ijk} &= 1 \text{ if pastor } i \text{ visits parish } j \text{ in month } k \\ X_{ijk} &= 0 \text{ otherwise} \end{aligned}$$

For example, if our analytical model seeks to assign Pastor Alan to visit the Melfort parish in October, then the value of that decision variable will be equal to one for that specific combination of pastor-parish-month assignment.

Objective Function

Our decision variables are important, but we need a way of calculating the total annual travel costs for any particular schedule. Recall that the goal of our quantitative methodology is to use an approach that can determine the specific assignment schedule with the lowest annual costs. The calculation of annual costs is accomplished through a feature termed an objective function. For each possible pastor-parish assignment, we identify the travel distances associated with sending the particular pastor to a specific parish. For example, sending pastor Kim (who resides in Saskatoon) to the North Battleford parish requires a round-trip travel distance of 276 kilometres. Since pastors are reimbursed at a rate of \$0.42 per kilometre, such an assignment would involve a travel cost of \$115.92. The computer software would consider all those decision variables that were equal to one and multiply those pastor-parish-month visit combinations by the associated round-trip travel costs. This, then, would result in the religious organization's overall annual travel cost.

Constraints

The final feature of our quantitative methodology involves aspects called constraints. These are restrictions that limit the potential pastor-parish assignments that we can make in our schedules. Without incorporating such constraints, the model may produce some rather infeasible and awkward assignments (for example, sending a pastor to the same parish two months in a row, or requesting a pastor make a visit during a month in which he has requested a holiday break).

One constraint we require is that pastors can make at most one visit each month. This avoids the problem of pastors – especially those in remote communities – spending inordinate amounts of time with their visit responsibilities. Recall that these pastors are non-paid volunteers who, although willing to sacrifice time in their church service, do maintain other careers during the rest of the month. The computer model limits the assignment of pastors in each month by ensuring that the sum the decision variables for a specific pastor in a given month can be no more than one.

We require minimum and maximum numbers of annual visits per pastor. If we failed to include this in our model, then an approach that sought to reduce travel costs would allocate hardly any visits at all to pastors in remote locations. We incorporate minimum and maximum annual visit totals to provide equity in pastor assignments, so that each pastor will receive a roughly comparable visit list each year. After some discussion, church officials felt that an appropriate minimum number of annual visits per pastor was five, while the highest number of annual visits would be seven. To include this in our model, we had the computer software add up the number of visits for each pastor and ensure that the resulting total was between five and seven.

Different parishes have distinctive needs. Smaller parishes (for example, Melfort and North Battleford) require a higher number of visits owing to their specific need for parish leader training and member support. Church officials in this religious organization felt that these two parishes required ten annual visits (one visit per month in ten months of the year). On the other hand, some parishes (for example, Kindersley and Flin Flon) required six annual visits (one visit every other month). Larger parishes in Saskatoon (for example, Saskatoon 1st or Saskatoon 2nd) only required four annual visits (one visit per quarter). We reflected the diverse needs of each particular parish by using our computer software to add up the total number of annual visits assigned for each parish, and then ensuring that this total equaled the specific needs of each parish.

Since pastors have regular careers besides their church responsibilities, there may be specific months of the year in which they are unable to complete parish visits. This could occur due to the desire for a family holiday or because of particularly demanding months in their employment. As an example, one pastor manages an agricultural greenhouse that becomes especially hectic during the spring months of May and June. This pastor, therefore, has requested a break from visit assignments during these months. In our computer model, we considered the specific months in which given pastors indicated visit unavailability and forced the decision variables for these combinations to be equal to zero. Using this approach, our quantitative methodology would never assign a pastor to visit a parish during a month in which he has called for a break from his volunteer duties.

As indicated in Table 1, nearly all of the pastors have specific parishes over which they have particular stewardships. For example, pastor Alan is responsible for the North Battleford parish while pastor Gerry has specific duties with the Prince Albert parish. (Due to other obligations associated with his church service, pastor Kim was not assigned a particular parish). These stewardships were instituted to maintain a connection between the given pastors and parishes. In the event that the parish required more detailed ministerial training or instruction on religious topics, the assigned pastor would be responsible for such activities. Church officials stipulated that pastors visit their stewardship congregations once per year; consequently, our computer model included a restriction that the decision variables for such pastor-parish combinations when summed over all months would be equal to one.

The final constraint in our model was included to obviate the dilemma of assigning a given pastor to the same parish multiple times in year. We note that this predicament had appeared in some of the previous years' manually-determined schedules. To provide variety in visits, church officials desired that no pastor make more than one visit to a specific parish during the year. Therefore, we set up a constraint to assure that each pastor can visit a particular parish at most once annually.

Theological Rationale

It is vital to place our paper within a proper setting of faith and practice. Unquestionably, it is true that the primary work of religious leaders involves ministerial service. Such leaders have a sacred responsibility to spiritually care about each person, rather than simply managing the mundane administrative nature of an organization. Leaders are shepherds and servants, not bosses and bureaucrats. Their work is truly measured by the saving of souls rather than the saving of dollars.

The quantitative methodology adopted in this paper, although crucial in helping an organization to stabilize its deployment of financial resources, does permit an enhancement to ministerial service and strengthening of faith in members. For example, pastors traveling shorter distances means that they can devote more of their time to ministerial efforts. They are less burdened with administrative tasks, thus freeing their time to meet with members and encourage them in their religious devotional practices.

Trimming travel reimbursement costs was a non-trivial matter for this religious organization. Since it received a fixed annual budget, funds not allocated to pastor travel expenditures could be distributed to other religious and charitable opportunities.

This particular methodology allows the various congregations to see a variety of traveling pastors throughout the year. Consequently, members can receive faith-fortifying instruction from several different individuals, as opposed to having a single pastor solely dedicated to a particular parish.

The approach developed in this paper permits a healthier experience for pastors. Recall that these individuals are non-paid volunteers who, although willing to sacrifice time in their church service, do maintain other careers during the rest of the month. Incurring less mileage means that pastors are spending less time in a car, thereby providing them with more opportunities to attend to other aspects of their lives.

Moreover, the computer methodology provides less anxiety and frustration for the one pastor who previously created each year's visit schedule. He frequently devoted several hours and numerous drafts to creating a workable schedule. By having schedules that can be created at "the push of a button", he is not required to spend inordinate amounts of time in fruitless futility.

Results

We formulated and solved our integer programming optimization model using *Premium Solver* on an IBM desktop computer with an Intel Pentium D processor. This particular package works within a spreadsheet environment. We set up specific spreadsheet cells to represent the decision variables, objective function and constraints, then requested the software to identify the least-cost solution. Even though our model included over 1,000 decision variables (recall that the decision variables represent particular pastor-parish-month combinations), the software determined the preferred set of monthly assignments in just a few seconds. The computer model would seek to find the "best" combination of pastor-parish-month assignments (the "decision variables") to set equal to one. In this particular case, "best" meant the lowest overall travel costs subject to not violating any of our constraints.

The solution our model proposed for the 2009 travel schedule reduced costs from those experienced with the manual schedules. For example, in 2007 this religious organization incurred a travel reimbursement cost of \$13,016. In 2008, the costs climbed to \$13,886. The use of our model reduced the 2009 costs to \$8,989, a reduction of 35.3% in reimbursed expenses. On the whole, the religious organization was quite pleased with these results and adopted the proposed assignment schedule in 2009. In subsequent years, it used this quantitative methodology to make annual pastor-parish assignment schedules.

A graphical illustration of the annual costs is offered in Figure 2. It should be noted that the yearly costs from 2010-2014 are not directly comparable to those experienced in the 2007-2009 period. Religious leaders were very pleased with the 2009 schedule since it dramatically cut travel expenditures. However, in the next few years, they felt that the organization could increase its number of monthly visits to particular parishes in order to enhance ministerial service, fortify faith, and strengthen religious practice. The quantitative methodology used by the computer software allowed them to superbly accomplish those objectives. Although they augmented the number of overall visits during the 2010-2014 period, the total annual travel costs became rather stabilized. Increased numbers of visits did not lead to skyrocketed travel costs. In other words, the religious organization was able to better meet the spiritual, religious needs of its members (through increased number of monthly visits) while maintaining a consistent travel reimbursement budget. This capability would have been entirely impossible under the previous manual approach. The reader may detect some annual cost variation in the 2010-2014 period. This could be traced to different sets of pastors in particular years. These ministers typically serve for periods of one to four years, so it would not be uncommon for a particular year to feature higher travel costs if several pastors resided in remote communities (e.g. Kindersley or Flin Flon in Figure 1).

==== insert Figure 2 about here ====

As an example of monthly visit schedules, we use Table 2 to illustrate 2009 assignments for two pastors (recall that Hans resides in Saskatoon, while Steve L. does not). Shaded cells denote stewardship visits. Blank cells represents months in which no visit is required by the particular pastor. We note that Hans incurs seven visits in this schedule while Steve L. receives six assignments.

===== insert Table 2 about here =====

Conclusions and Suggestions

Our paper has described the development of a quantitative model to determine the least-cost annual assignment of pastors to parishes. Using a spreadsheet optimizer, we were able to model the particular restrictions desired by the organization and produce a solution that stabilized costs while enhancing ministerial service opportunities. The religious leaders have continued to be impressed with the quantitative methodology's flexibility, ease of use, capability, and proficiency.

A factor that further supports ongoing adoption of our computer model approach is that the religious organization can efficiently determine schedules during a calendar year. Given that pastors hold regular careers outside of their ministerial service, it is not uncommon for a pastor to relocate outside of the church area during a calendar year. This necessitates identifying a new pastor to take the relocated pastor's place. Should this happen, one could "lock in" those visits that have already transpired and "re-run" the model to determine the best set of assignments for the remainder of the year. This provides the religious organization with the opportunity to continue to be as cost-effective as possible, even if new pastors are appointed during a year.

Besides the overall savings in travel reimbursement costs, our model produces schedules in a relatively quick fashion. It has eliminated the hassle and trouble experienced by the scheduler in manually crafting each year's set of assignments. No longer are the parties frustrated by the schedule, and there is a greater sense of equity and fairness in the final product. Rather than relying on the subjective whims of the (well-intentioned) church volunteer's manual approach, we have created an objective method that quantitatively identifies the least-cost set of monthly visits. The approach also provides the organization with an opportunity to enhance ministerial service through greater numbers of monthly pastoral visits.

We would anticipate that our approach may be of interest to other religious organizations facing similar management and resource allocation issues. Indeed, the software used in this methodology is readily available on most computer desktops. Procuring the appropriate tools to deploy this methodology does not require excessive expenditures.

Notwithstanding the adoption of our quantitative approach, we made some important observations as we engaged the organization in developing the computer model. These form some practices and lessons of which religious societies ought to be aware should they attempt to apply similar methodology in their respective environments. We came to appreciate that equity in pastoral visits is exceptionally important. To wit, we initially included a value of three for the minimum number of annual visits for each pastor. However, this produced schedules in which those pastors residing outside of Saskatoon received the bare minimum number of visits. Since four of the congregations are located in Saskatoon, and since the quantitative model seeks to identify the set of visits with the lowest overall travel reimbursement cost, it would offer more visits to Saskatoon

pastors. Assigning a Saskatoon pastor to visit a Saskatoon parish incurs zero travel expense. Pastors living in the periphery of the religious organization's area would encounter substantial costs in traveling to their assigned parishes. Consequently, any cost-minimizing solution would attempt to limit the number of visits for these pastors. When we displayed the results from this initial attempt (using a value of three for the minimum possible visits), the non-Saskatoon pastors felt somewhat slighted. After some discussion between the various parties, we decided to augment this total to five. It resulted in a more equitable set of overall assignments.

Another lesson involved the benefit of showing the religious leaders the impact of different scenarios. In the parlance of optimization modeling, this is known as "what-if analysis" since it demonstrates what would occur if particular model features were modified. For example, we could reveal the expenditure impact if specific parishes required a greater number of annual visits. We could also show resulting scheduling changes if particular pastors provided more constrained availabilities. Ultimately, this analysis offered the religious authorities insight into the scheduling process and helped them to recognize the value of a quantitative methodology.

References

J.J. Bartholdi III and K.L. McCroan, Scheduling interviews for a job fair, *Operations Research*, 38 (1990), 951-960.

M. Bazargan-Lari, Flexible versus fixed timetabling: A case study, *Journal of the Operational Research Society*, 55 (2004), 123-131.

Figure 1
Map of Parish Locations



Table 1
List of Pastors and Stewardship Parishes

Pastor (** = resides outside of Saskatoon)	Stewardship Parish
Alan	North Battleford
Alex	Saskatoon 4 th
Armes	Saskatoon 2 nd
Gerry **	Prince Albert
Hans	Saskatoon 3 rd
Kim	None
Larry **	Flin Flon
Rick	Melfort
Stan	Saskatoon 1 st
Steve L**	Meadow Lake
Steve W	Kindersley

Figure 2

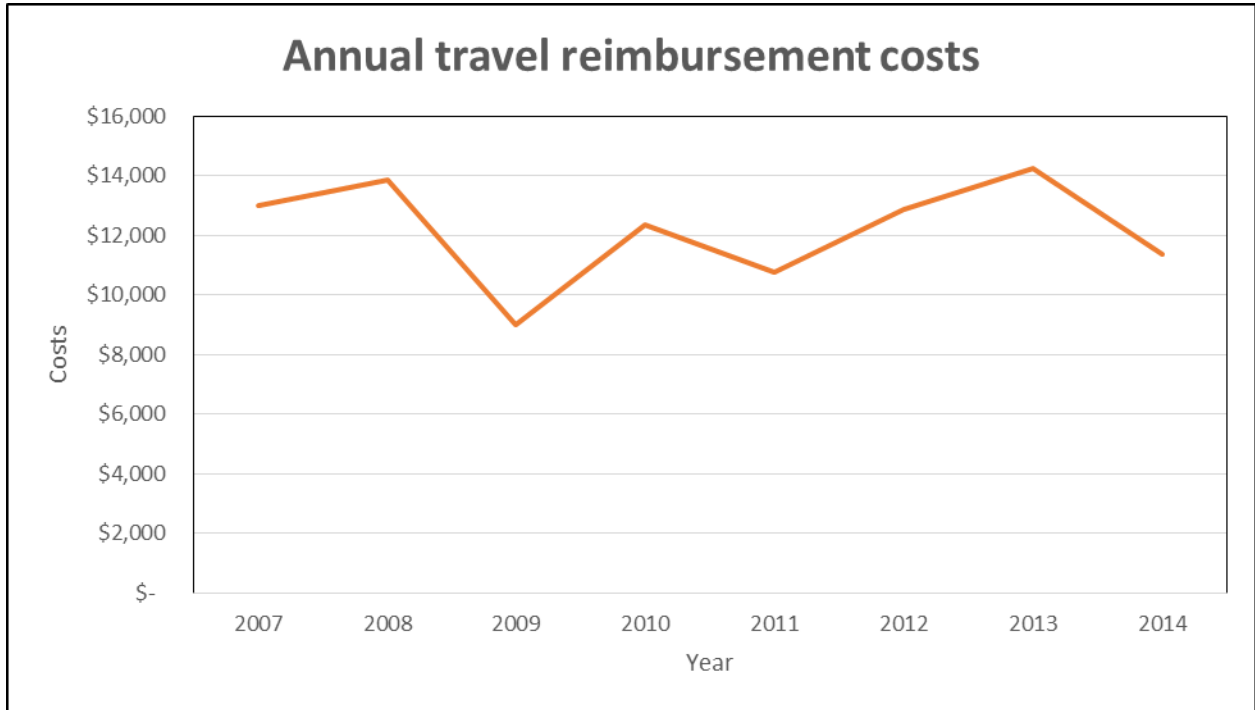


Table 2
Example of Monthly Visit Schedules

Month	Pastor	
	Hans	Steve L
January	Saskatoon 3 rd	Prince Albert
February		
March	Kindersley	Flin Flon
April	Prince Albert	
May	Melfort	Saskatoon 4 th
June		Meadow Lake
July		Battlefords
August	Meadow Lake	
September		
October		
November	Saskatoon 4 th	Saskatoon 1 st
December	Battlefords	