



**Vancouver Police Department
Planning & Research Section**

**Patrol Resource Allocation Review
Phase 3 Report**

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1 Background

The Vancouver Police Department's (VPD) Planning and Research Section (P&R) initiated a detailed study to determine whether the current patrol shift deployment meets the demands of each district, at various times throughout the day. Further, the study was intended to examine the effectiveness and efficiency of patrol operations to determine whether patrol was meeting its goals and objectives in its current state.

In November 2002, a report presenting the results of the first stage of the study was completed. Ryan Prox and Isabelle Groc from the Planning and Research Section were the authors of the *Resource Allocation Review – Phase 1 Report*. Two variables were then examined: 1) the number of calls for service by day of the week and time of the day; and 2) the time spent on calls for service (defined as unit-minutes). These two variables were used to examine the distribution of patrol workload throughout the Districts. The analysis was based on a custom Computer Aided Dispatch (CAD) data extraction for the year 2000.

While the Phase 1 analysis showed call distribution patterns, as well as unit-hours spent on calls by time of the day, it did not include data on the actual number of units deployed by hour and by day. In order to fully understand the current patrol resource allocation model and to make recommendations in this area, the Planning and Research Section initiated a second phase for the project. To this end, the P&R Section collected attendance data with respect to patrol deployment, which was entered into an Access database to integrate the information with workload-related data and aid in the final analysis.

A custom data extraction program was created to identify the actual patrol unit-hours deployed by day and by hour in each of the four policing districts. This statistical model was necessary to perform calculations, such as: patrol utilization based on available unit-hours, number of calls for service, and time spent on calls for service. The program calculated what percent of available patrol time was consumed by calls for service and what the peak times were by hour and day. The analysis of this data produced several recommendations and a proposed patrol deployment model that addressed key areas of inefficiency. This was the first detailed analysis of the VPD patrol deployment model and with it several shortcomings were identified in the report. For example, the report did not contain historical data needed to conduct time series analysis and to identify yearly trends and patterns. As well, overtime data was not included as part of the analysis, thereby overlooking a key element of patrol deployment. While workload was examined in detail, police response times to emergency calls were not evaluated as part of the overall patrol model. The combination of these issues had a detrimental effect on the acceptance of the final report.

In response, a third phase analysis of patrol was developed that took into account these issues, with the intent of providing an analysis of both past and present patrol deployment that is as comprehensive as possible.

2 Objective

This document, the *Patrol Resource Allocation Review: Phase 3 Report*, is an evolution of the two previous Vancouver Police Department reports on patrol deployment and efficiency, with the added benefit of both retrospection and improved data analysis techniques. As detailed in the Background Section, Phase 3 contains six years of data spanning January 1st 2000 to December 31st 2005 inclusive. This provides a point of departure from where the previous reports left off, while analyzing deployment in terms of changes and modifications that have occurred in the last six years. It also provides the unique opportunity to review recommendations put forward in the previous reports to ascertain whether the findings are still accurate today.

The methodology used in this report was compared to the best practices of organizations that are considered leaders in policing to determine whether any additional techniques or modifications to the process should be incorporated into the analysis. A review of best practices literature determined that the methodology used in the Patrol Allocation Review was sound, and in some cases superior to those used by other review and audits of police patrol deployments.

There are two main areas of police patrol that this report will address. First, the report will examine whether there are sufficient resources to respond to calls for service. Included in this is the number of resources necessary in order to meet certain thresholds of effectiveness. Second, changes to the existing system of deployment that maximize the efficient use of resources are examined. While each topic requires a review of different components of patrol, the two are interrelated. An organization that is efficiently deployed will make the best use of the finite resources it has at its disposal. This involves reviewing shift scheduling and deployment to eliminate times of inefficiency and ensuring deployment corresponds with the predicted call-load according to the time of day and day of the week. These factors have a profound impact on when and how many officers should be deployed to respond to emergency calls.

The Phase 3 report also incorporates a detailed analysis of district overtime usage, examining the extent, types and frequency of overtime. This level of detail makes it possible to also analyse overtime usage by day of week and time of day, as well as identify distinct differences that exist between the patrol districts of the city. Callouts to maintain staffing minimums and extended tours of duty (otherwise known as holding back officers at the end of a shift to deal with arrests and unanticipated emergencies) are the two main types of overtime used in patrol. The main thrust of the analysis delves into these types of overtime usage in detail.

Further, police response times to emergency calls were analyzed according to priority, day of the week, time of day and district variations. This was deemed important to analyze, as a lack of resources, poor shift scheduling and a deficient business process, both by the police agency or E-Comm itself, can have a profound affect on the time it

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takes police officers to arrive at emergency calls. Structured interviews were conducted at E-Comm, the emergency call centre that dispatches 911 calls to police officers, with the intent of examining the entire response process from the time a 911 call is received to the time when police arrive on the scene. The same process was repeated with VPD patrol personnel to explore similar issues. Rather than looking at the process in a compartmentalized manner, a more global and holistic approach was preferred. The results of this analysis provide keen insight into areas of inefficiency, resource deficiencies and possibly ways to improve the process.

The final analysis and findings were used to accomplish two objectives. First, to identify existing inefficiencies and impediments to the most effective use of current patrol resources. This included a review of the current deployment model and the workload that patrol manages on a regular basis. Second, to make recommendations on how to correct any efficiency shortcomings through a modified shift deployment model and other innovative techniques used to maximize efficiency. Several options are presented in the recommendations section with cost implications and efficiency gains detailed for each.

3 Methodology and Assumptions

3.1 Data Collection Framework

3.1.1 Introduction

The following provides an outline as to how data was extracted and synthesized in preparation for the data analysis that was conducted for the Patrol Deployment Study Phase 3. A total of six years of data was compiled for this project.

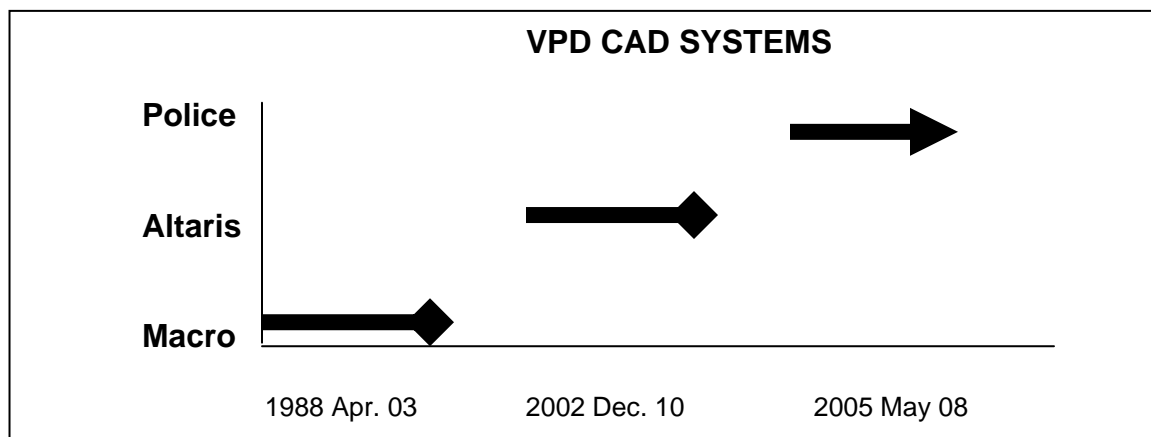
The following limitations were taken into account when the data sets were created:

- historical changes to CAD
- VPD process changes
- hardware and software.

3.1.2 Historical Changes to CAD

In the last ten years the VPD has utilized three different CAD systems. Each system brought with it a new vendor as well as the introduction of unique features and functions pertaining specifically to that system. Some of these specific features include additional data fields and different methods for data collection and storage. These different CAD systems are listed below.

Diagram 1.0 – VPD CAD SYSTEMS



3.1.3 VPD Process Changes

The adoption of the three different systems created a need for changes in operational practice. Some of these changes were driven by internal operational decisions and others by the requirements of external agencies (i.e. Justice System, PRIME Corp.). An example of an internal change that impacted operational practice is the transition of the

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Call Centre from the VPD to E-Comm, while an example of an external change implemented by E-Comm is the change in priority of the call type “*Motor Vehicle Accident with Injury (MVI)*” from a priority one to a priority two call for service.

3.1.4 Hardware and Software

All data on calls for service is generated and stored at E-Comm. Since August 2006 the VPD has received ongoing data extracts from E-Comm that provide access to the core component data as selected by the VPD.

Mini databases were created from the E-Comm extract data to facilitate analysis of all the data from the three different CAD systems. The database application used to build the databases was MS Access 97. A series of linked queries were used to access the “raw” data from the SQL Server; this resulted in the creation of data tables. The final aggregate tables were presented in an MS Excel format.

Database limitations such as blank data fields, unidentifiable data fields and disk volume errors were encountered in the course of creating the data tables.

3.2 Databases

3.2.1 Vancouver Police Department SQL Server

The SQL Server comprises of three CAD data sets:

- Police (PC) CAD
- Altaris CAD
- Macro CAD

3.2.2 Police CAD (May 08th, 2005 – December 31st 2005 (Present))

This data set is comprised of twenty data tables, with over 600, 000 transaction records. For the purpose of this study, three tables were used and two tables were created with additional information. The five tables are:

- | | |
|----------------------------------|--------------|
| 1. dc_data | - CAD System |
| 2. cc_data | - CAD System |
| 3. unit_mileage | - CAD System |
| 4. Translation_Code_Table_PC_CAD | - Created |
| 5. tbl_shift | - Created |

3.2.3 Altaris CAD (December, 10th, 2002 – May 8th, 2005)

This data set is comprised of seven data tables with over 700,000 transaction records spanning over three years including part of 2005. The following five tables were used:

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1. mis_rpt_evh_stl - *CAD System*
2. mis_rpt_evh - *CAD System*
3. uhist_primary - *CAD System*
4. Translation_Code_Table_PC_CAD - *Created*
5. tbl_shift - *Created*

3.2.4 Macro CAD (April 03rd, 1988 – December, 10th, 2002)

The data set tables for the Macro CAD are very similar to Altaris CAD; the same processes and analysis were applied to Macro CAD as to Altaris. The following four tables were used:

1. chist_primary - *CAD System*
2. uhist_primary - *CAD System*
3. Translation_Code_Table_Macro_CAD - *Created*
4. tbl_shift - *Created*

3.3 Calculations

Three main data calculations were performed.

1. Response Times - total time it takes a patrol unit to response to a call for service (“at_scene” – “time-received”).
2. Consumed Minutes - total minutes in a time period when a patrol unit is dispatched (“cleared_time” – “time_dispatched”)
3. Available Minutes - total minutes a patrol unit is available for work (“time_logoff” – “time_logon”)

3.4 General Assumptions

The documented processes for the building and translation of the tables are based on the PC CAD database tables. There was no need to replicate the same information for all three CAD systems. They all shared the same data extraction process and queries.

For maximum efficiency and accuracy between databases the technique of “*Aliasing*” was used. Aliasing is used to specify a custom name for a source table or query when the same table or query is used more than once. This facilitated using the same queries for all three CAD databases with minimal adjustments.

The following patrol units were extracted from the three CAD systems’:

- Uniform Patrol Units (i.e. VA1A11)
- Plainclothes Patrol Units (i.e. VA1D21)
- Patrol Beat (Foot) Units (i.e. VA1B77)
- Beach Patrol Units (i.e. VA4H11)

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- Bicycle Squad (i.e. VA4C44)
- CITU/SOCO (VA5S20)
- Telephone Response Team (TRT) (VA5B52)

With the joining of multiple data tables duplicate records do occur, and they must be filtered out. Using MS Access to filter out the records, a nine step elimination process, available in the Help Index under “Automatically delete duplicate records from a table”, was used.

Where District identifiers are not present within the record, the District can be identified by the district identifier within the Unit call sign (i.e. unit_id - VA2G18, first numeric value indicates the district. This numeric value was appended to the record entry. In some cases a unit in District 02 VA2xx will assist in District 03, the time will be credited to District 02 not District 03.

3.5 Response Time Assumptions

Records included:

- All records where the “time_received” or “at_scene_time” was not null

Records excluded:

- All records where the Unit call sign was a Wagon (VAxxx62) or NCO (VAxxx51)
- On View calls – “how_received” = ‘s/v’
- Priority 1 (P1) calls less than 1 minute or greater than 2 hours in duration
- Priority 2 (P2) calls less than 1 minute or greater than 12 hours in duration
- Priority 3 (P3) calls less than 1 minute or greater than 24 hours in duration
- Priority 4 (P4) calls less than 1 minute or greater than 24 hours in duration

3.6 Consumed Minutes Assumptions

Records included:

- All records where the “time_dispatched” or “clear_time” was not null

Records excluded:

- All records where the “clear_time” – “time_dispatched” is greater than 11 hours.
- Any dispatch record that shows a unit particular unit dispatched more than once to the same call
- Any record where the Unit dispatched is an NCO (VAxxx51)

3.7 Available Minutes Assumptions

For records where the logoff times were not available, the following assumptions were made:

- That all units log on immediately when on shift and log off thirty minutes before the end the shift. i.e. (BRAVO SHIFT 0700 hrs – 1800 hrs. Adjusted Time 0700 hrs – 1730 hrs)

Records excluded:

- All records where the “clear_time” – “time_dispatched” is greater than 11 hours.
- Any dispatch record that shows a particular unit dispatched more than once to the same call
- Any record where the Unit dispatched is an NCO (VAxxx51)

3.8 Queries

3.8.1 Response Time

Response time was calculated by finding the difference between the **at scene time** and **time received**. The results were then converted to minutes i.e. (24*60).

Response Time = (24*60*([at_scene_time]-[time_received]))

- 24 hours a per day
- 60 minutes in a hour

This function calculates the number of minutes.

Hour of the Day = Hour ([time_received]) (hour)

Day of the Week = Day ([time_received]) (day of the week)

Week Day = Weekday ([time_received]) (week day)

response_time	hour_day	day_wec	week_day
1.0333333339077	18	1	Sunday

complaint_rin	date_added	priority	district	how_received	time_received	dispatch_time	at_scene_time	clear_time	unit_id
VA05000285558	2005/11/27	1	02	9	2005/11/27 6:48:37 PM	2005/11/27 6:49:39 PM	2005/11/27 6:49:39 PM	005/11/28 12:43:31 AM	VA2D12

3.8.2 Consumed Minutes

Consumed minutes were calculated by finding the difference between the **clear time** and **dispatch time**. This time difference is stored in a field named **Service Time**

In-service or (time the call was cleared)

Clear_time

Dispatched Time - time the call was dispatched

Service_Time = ([inservice_time]-[dispatch_time])

inservice_time	time_dispatched	service_time
2005/05/09 12:04:22 PM	2005/05/09 10:15:53 AM	0.07538564815094

Results

date_inc_entry	occ_num	district	priority	unit_id	time_dispatched	time_cleared	service_time
2005/05/08 7:27:44 AM	120002	02	3	VA2B11	2005/05/08 8:49:45 AM	2005/05/08 9:23:23 AM	0.02335648147709

3.9 Available Minutes

Available minutes were calculated by finding the difference between the **CDate ([time_logoff])**-**CDate ([time_logon])**.

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The time difference was stored in a field named **total time deployed**.

time_logon

time_logoff (Adjusted logoff time)

$$\text{total_time_deployed} = ([\text{time_logoff}] - [\text{time_logon}])$$

time_logon	time_logoff	total_time_deployed
2005/12/16 4:59:09 AM	2005/12/16 3:30:00 PM	0.438087962960708

Results

unit_stamp	jurisd	shift	shift	unit_id	vehicle_nu	officer_nc	officer_no2	unit	uhist_date	time_logon	time_logoff	translation
VA2G14	08/13/20	VA	G	Delta	VA2G14	VAD8035	VA2162	VA1999	IS	2005/08/13 5:08/13 5:15:29 PM	08/14 3:30:30 AM	BEAT ENFORCEMENT TEAM

3.10 Utilization Rate

The calculation for the Utilization Rate, which is the percentage of available time consumed by calls for service, was computed using an MS Excel spreadsheet. Formula: Utilization Rate = (consumed minutes/available minutes).

Sample MS Excel – Utilization Rate

	A	B	C	D	E	F	G	H	I
1	Year	2000							
2									
3	HOUR OF DAY	DISTRICT 1							
4		Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Total
5	0000 to 0059	0.529	0.537	0.524	0.485	0.475	0.563	0.528	0.521
6	0100 to 0159	0.566	0.509	0.533	0.509	0.482	0.521	0.582	0.535
7	0200 to 0259	0.593	0.487	0.553	0.579	0.539	0.548	0.617	0.567

Sample Formula

=SUM('M:\P&R\PROJECTS\PR2005\078\PHASE II\Patrol Deployment Study\Ryan Prox\Ryan's Minutes Consumed 2000-2005.xls]2000'!C\$6:C\$8)/'M:\P&R\PROJECTS\PR2005\078\PHASE II\Patrol Deployment Study\Ryan Prox\Ryan's Minutes Available 2000-2005.xls]2000'!B5

3.11 Units Considered

In order to accurately reflect patrol workload, certain unit types were excluded from the study. Specifically, some units that organizationally belonged to the Patrol Division were not counted as “deployable” units, as they either fulfilled very specialized functions, took very few calls, or were limited to a very small geographic area. In short, they are not patrol units and are typically not dispatched to 911 calls for service. As a result, the following units were excluded:

- Patrol team supervisors
- Mounted Squad
- Waterfront Unit (District 2 “Team 11”)
- Marine Squad
- Youth Squad
- Community Policing Officers
- School Liaison Officers

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- Car 86 and Car 87

Only the following units were included in the study:

- District 1 Bike Team (“Team 11 Bicycle Patrol”)
- Uniform Patrol Units (i.e. VA1A11)
- Plainclothes Patrol Units (i.e. VA1D21)
- Patrol Beat (Foot) Units (i.e. VA1B77)
- Beach Patrol Units (i.e. VA4H11)
- Bicycle Squad (i.e. VA2E11)
- CITU/SOCO (VA5S20)
- Telephone Response Team (TRT) (VA5B52)

The same rules were applied to the CAD workload data collected in Phase 2, which allows consistent comparisons to be made between the workload data – number of consumed unit-hours by calls, and the deployment data, i.e., number of available unit-hours.

3.12 Shifts

Because CAD data only records the time when a officer is logged on to the system and taking calls the recording of data took into account any modified shift scheduling in place throughout the districts. The patrol division has a system comprised of 11 patrol teams in each district, eight of which work four shift rotations for 24-hour coverage. Some districts have modified start times for Friday and Saturday afternoon shifts. The specific shift configuration used by each district will be examined within the overview and analysis section for each district. Generally speaking, the shift rotations follow the outline below:

- Early Day shift (0500-1600) – **Alpha**
- Day shift (0700-1800) – **Bravo**
- Afternoon shift (1400-0100 Monday to Thursday) or (1600-0300 Friday to Saturday) – **Charlie**
- Late Afternoon shift (1600-0300 Monday to Thursday) or (1700-0400 Friday to Saturday) – **Delta**
- Nights (1900-0600) – **Echo**

It’s important to note that the adjusted weekend start times are not universally applied throughout the districts. Each district has adopted combinations of the above scheduling, or has not adjusted start times at all for Friday or Saturday, depending on the call-load pattern for the district.

4 Data Usage and Interpretation

4.1 Data Application and Analysis Process

With respect to consumed unit-minutes, the database considered the fact that several units might attend a call, in addition to the dispatched primary unit. Given that one or more units can attend a call, and that units arrive and leave the scene at different times, the program allocated the time spent by each unit on a given call to the 24-hour time-blocks that make up a day. Recognizing that calls have different durations, each call was broken into the time consumed by hour of the day and on the appropriate day of the week. For example, a call that began at 11:45 p.m. on Saturday and concluded at 12:30 a.m. Sunday was broken into the 15 minutes consumed in the 11 p.m. to 12-midnight block on Saturday, and 30 minutes in the midnight to 1 a.m. block on Sunday.

Only those calls that were actually attended by patrol officers, as opposed to calls where a police officer was not dispatched, were captured. As a result, based on disposition information, a number of incidents were excluded. In all, 17 disposition types disqualified CAD calls from the data collection. These dispositions included cancelled calls, general broadcast calls, and reports to follow from com-centre that indicated no police unit was dispatched.

The available unit minute tables and the consumed unit minute tables were then used to calculate an additional table that shows, by hour and day, what percent of the available time is consumed by calls for service ("unit utilization" table). This table was used to determine how well the current use of time matches that desired by management. Specifically, using target percent time allocations (i.e., ratio of time consumed by calls for service), the matrices were then used to assess how time is currently being used and how close current usage matches the target allocation percentages. It was then ascertained whether more or less officers were needed to reach the target percent time allocations. Each district was individually evaluated to determine the number of officers required to meet target rates.

An additional matrix was produced incorporating the total consumed unit-minutes by factored available unit-minutes expressed as a ratio. The average time consumed by calls for service was calculated for each day of the week. Unit utilization by hour and day was then graphically charted to assist in the analysis.

The number of units available to take calls was compared to the total number of calls for service on an hourly basis, according to each day of the week. This relationship was charted for analysis purposes to determine weekly and hourly trends and to assess whether there were times and days that were under or over resourced for the call demand.

Similarly, a city-wide comparison matrix was produced, which incorporated the average unit utilization for each one hour block within a twenty-four hour period for each district.

The results of this matrix were graphically charted to aid in district comparisons and identify call-load patterns.

The statistical package SPSS version 15.0 (SPSS Inc.) was also used to assist in the data analysis and to help identify relationships and patterns within the various data-sets. Specifically, regression analysis features of the statistical software and binomial staffing analysis based on mathematical probabilities was utilized for the analysis section of the report.

4.2 Assumptions

Even though officers work 11-hour shifts, they don't actually spend their entire shift attending calls. Available unit-hours are usually adjusted to account for the various tasks occurring during a shift that render a unit unavailable to attend calls. These tasks include meetings, squad briefings, meal breaks, vehicle servicing and other various administrative functions. Previous studies used percentages ranging between 20%¹ and 25%². For this study, the 13.6% factor was used, which means that nine hours and thirty minutes out of an 11-hour shift were available for deployment. In practical terms, this accounts for the one hour, plus two 15 minute coffee breaks, that are mandated by the collective agreement.

To facilitate analysis, an extraction table was built to illustrate the staffing data with no built-in assumptions (i.e. 100% of patrol time is available to take calls), as well as tables that include the 13.6% assumption. Administrative tasks were considered to be accounted for by the CAD data, given the fact that the CAD system accurately records only those times when officers are logged into the system and able to respond to emergency calls. Officers can still be deployed to a call, even when on a meal break if the situation warrants it. While the system does not record a unit as taking calls when on a meal break, as a dispatcher will try to use the other available units if possible, it still records the officers as available. In essence, a dispatcher will try to accommodate meal breaks as best as possible, but at times of high volumes of calls, meal breaks are sometimes overlooked or interrupted. Therefore the 13.6% unavailability factor is a conservative estimate.

4.3 Data Definitions

The following terms and definitions are used throughout the report:

- **Consumed patrol unit-minutes** are defined as the total number of minutes in the period from when the unit is dispatched to a call until the unit is cleared and available

¹ Holland, Melissa. *Update of Workload Data for 1995*. Planning, Research and Audit Section, August 1999.

² Fleming, Zach and Cst. D. Kim Rossmo. *Optimizing Patrol Resources: Vancouver's 4/11 Team Model*. 1995.

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to take another call. This is a precise method of measuring call load in terms of patrol resources devoted to responding to calls within each hour block.

- **Available patrol unit-minutes** are defined as the total number of minutes that a patrol officer is available for work. This is a key indicator of patrol resources available to respond to calls within each hour interval.
- **Unit utilization** refers to the percent of the available time consumed by calls for service (calculated as: consumed patrol unit-minutes/available patrol unit-minutes).
- **Unavailability factor** accounts for the Collective Agreement – *Schedule G No.4 – Rest and Meal Breaks* – that accounts for one 60 minute meal break and two 15 minute rest breaks during an 11 hour shift that render a unit unavailable to attend calls. A 13.6% unavailability factor was applied to the data, and the data was also run with no factor applied (i.e. assuming that patrol officers are devoting 100% of their time attending calls for service).

4.4 Consumed Patrol Unit-Minutes Special Consideration

As was the case in Phase 2, when examining calls attended, consumed patrol unit-minutes are impacted by the availability of police resources. Priority three calls are the most likely to be impacted by the number of police officers available to attend calls and address the call load. These two variables directly impact the total time available for units to attend calls. In other words, consumed unit-minutes are dependent on whether supply (officers) can keep pace with demand (call for service).

Given a situation of scarce resources available to attend calls, the Patrol Division often finds itself vetting calls and limiting the time spent on calls in order to meet demands. Therefore, limited resources only permit patrol to spend a finite number of minutes attending calls before a district vetting process is implemented and lesser priority calls are not responded to. This is where a patrol sergeant calls complainants and cancels calls or places calls in a holding queue for the next day. This sometimes causes citizens to wait over 24 hours until a police officer attends their lower priority call. This has the effect of capping the total number of consumed patrol unit-minutes according to the number of units available and the level of the resource burden. Simply, a heavily taxed patrol district can only consume so many unit-minutes per hour given the maximum number of unit-minutes that can be consumed. In practice, patrol officers who are constantly attending queued calls would only have the ability to attend as many calls as time permits. Calls unattended remain in the queue until they are cancelled or dealt with through other means. Team sergeants regularly monitor the call load during a shift and will call back a complainant to inform them there are no police units available to be dispatched and that they will be contacted the next day.

Considering the internal vetting process, in circumstances where demand exceeds the resources available, the consumed patrol unit-minutes may not accurately reflect the actual unit-utilization, which at times would be represented as over 100%.

The use of consumed unit minutes for part of the analysis is considered a superior measure of workload, especially when compared to simple reporting of dispatched calls for service. While many police audits and efficiency studies have been based on dispatched calls for service, the use of consumed unit minutes is a better overall indicator of actual patrol workload. Unlike aggregate calls for service data, consumed unit minutes take into account the total time spent on a call. Additional units, such as cover units, containment units, and additional resources required for major incidents, are all captured in consumed unit minute data.

As well, the difference in call types are accounted for using consumed unit minutes, as it records the total officer time spent on a call. For example, a *break and enter* call typically requires additional investigative follow up that is recorded by the CAD system and used to calculate consumed unit minutes. Conversely, a simple fight call can usually be resolved quite quickly, which is also reflected in the data. Variations in call types distributed by district and at different times of the day are then reflected by the total amount of time it takes officers to deal with each call recorded. The total number of dispatched calls in a give hour would only provide a partial picture of actual workload performed. As well, district variations and changes in call types by time of day are not accounted for with calls for service data. For these reasons, consumed unit minutes and the subsequent unit utilization ratios that are partially based on this data, are considered a valid indicator for evaluating police deployment, efficiency and patrol effectiveness.

5 Research Findings

5.1 Overview

One of the goals of most police agencies is to ensure efficient Operations that meet the goals and priorities of the organization while staying on track and within the annual agency budget. This is best accomplished through proper planning and review of two significant issues. The first issue delves into the way resource allocation is managed within a police agency, by examining ways to maximize efficiency through scheduling and deployment. The second looks at enhancing effectiveness, which can be accomplished through the use of internal processes that reduce administrative burdens, addressing morale issues and providing staff with adequate equipment and training to perform their job.

When discussing benchmark information from other police agencies, it is important to remember that this information is only relevant when used to compare against the current performance and practices of your own organization. This information is then used to develop mechanisms and strategies to facilitate progressive change within the organization, such as greater efficiency and improved policies and procedures. Factors that distinguish a police department as a leader in policing and one where best practices are used to advance the goals and objectives of the organization change from agency to agency. However, in terms of evaluating a Department's Patrol Division, the standard is

far more evident. Patrol units that simply respond to calls, in a relentless pursuit of trying to catch up with the incoming calls for service, will never be in a position to solve the underlying issues that are driving these calls. “Pro-active policing”, or “problem solving policing” requires a deployment model that provides officers the ability to develop strategies and plans that will encourage officers to take responsibility for issues. To obtain accountability in Patrol, it must flow from management as part of the overall goals and objectives of the organization. In order to empower officers to act as problem solvers, they must be given the opportunity to get to know their local community, its individual needs and issues, and to develop an awareness of the broader context in which they operate. This is not accomplished by responding to calls while working a patrol shift each day. Adequate time, support from supervisors and individual ability come into play. Other less tangible issues, such as two-officer units versus one, impact effectiveness and the ownership officers feel over a particular problem. While scheduling and deployment factor into these considerations, they are not answers unto themselves to community crime problems.

5.2 Beat Assignment

Other recent developments in policing include the assignment of beat responsibility as a way to enhance the effectiveness of patrol officers. The main premise behind beat responsibility is that an officer should attempt to develop a geographic identification within the patrol beat that they are assigned to. A beat or sector refers to a relatively small geographic area, usually four to six blocks, where patrol officers are assigned to work on a consistent basis. This facilitates patrol officers becoming familiar with community needs, unique crime patterns, trouble spots and policing issues within their beat. Further, any crime reduction or proactive policing initiatives are expected to be lead by the officer responsible for that beat. Most calls located within a particular geographic area are fielded by the responsible beat officer. Proactive and focused police attention on problem areas is a method for increasing the effectiveness of patrol units and has been regarded as a best practice by literature on the subject.³ This allows police to target recurring crimes, repeat offenders, and problem premises, resulting in a more effective method for reducing crime.

5.3 Roving Metro Patrols

Roving Patrols, otherwise known as units established for cross-district dispatching, are a cost effective way to maximize available resources while not creating a large number of new shifts and teams to staff them. Roving patrols work as a city-wide resource that is available for dispatch to areas of the city that are experiencing the greatest demand for service. In circumstances where the call-load is evenly distributed, the roving team can also be distributed evenly to the city’s four districts. This is a fluid resource that adjusts to

3 Broom Cheryle. (2004). Performance Audit of the King County Sheriff’s Office. Seattle, WA: Metropolitan King County.

call-load variations in a very uncomplicated manner. For example, on any given day District 3 may be experiencing a series of bank robberies that has the potential to tie up police resources within the district for a considerable amount of time, rendering them unavailable for further emergency calls for service. This can create call stacking and a serious disruption in service for adjacent districts if police units are called from neighbouring districts to help lessen the resource crisis. In this situation a roving team could be deployed to District 3 on a temporary basis to assist with taking calls, while the remaining units finish attending the bank robbery calls. Neighbouring districts would be left unaffected and a resource crisis could be averted. This is a very efficient use of resources, as it only requires the creation of two additional teams that can have a similar effect on call utilization issues as the creation of four new teams (one team per district and four districts).

5.4 Scheduling

A detailed analysis of efficiency looks at ways that scheduling can improve patrol efficiency. Modification of an existing deployment model, or the complete redesign of the way officers are scheduled, depends on whether the analysis indicates a very low level of efficiency or whether only minor modifications are necessary to optimize the current system. Another factor to consider is the level of efficiency desired. No deployment model can achieve perfect efficiency, as there are always tradeoffs between gains in one area and losses in others. Less tangible issues such as quality of life, which can have a detrimental effect on morale, must also be weighed when any proposed changes are considered. Efficiency gains must also be weighed against costs associated with certain proposed deployment models.

Typically, an eight hour shift creates the best options for scheduling resources to meet demands for service. However, in a large department this can create an undesirable consequence of a prohibitively large infrastructure requiring a large number of managers, support services and equipment. As well, it creates a substantial number of shifts to cover a 24 hour period; far more than is cost effective compared to efficiency gains that are acquired. Conversely, twelve hour shifts provide less flexibility for managers to schedule shifts to maximize efficiency and match resources to service demands. Yet, twelve hour shifts require the least amount of infrastructure to support, making it cost effective and easier to manage. Therefore, a compromise between the two extremes is the most desirable option, taking advantage of the best each has to offer. Another important factor to consider when developing a deployment model is the total police resources available.

Independent of considerations for the total number of officers available to respond to calls, scheduling must account for the workload variation and take the steps to equalize these fluctuations by adjusting deployment. One of the main goals of scheduling is to even out workload across the hours of the day and days of the week, and to establish a deployment model that assigns officers to work at times of greatest demand. A further

difficulty is designing a shift schedule that doesn't artificially create times of peak inefficiency during shift changes.

The elimination of gaps between the end and start of shifts is a complex endeavour. Several competing issues must be addressed for everything to function smoothly. For example, multiple shifts should only provide coverage during times of high demand for service. At times of lower call demand, a reduced number of resources should be scheduled. While at first glance appearing reasonable, it is the transition between the two that can be problematic. Even during times of low demand, an improperly scheduled shift transition can create chaos for the oncoming shift. Inadequate overlap can create a substantial spike in the utilization ratio, where the oncoming shift can spend a considerable amount of time playing catch-up with stacked calls. This artificially created inefficiency can be resolved by creating an overlap at the time when the shifts start and end. However, when operating with a set number of shifts, the change of one shift's start time to an hour earlier can have an escalating effect, by eliminating an overlap that may already exist at the shifts end time. The only viable solution is to create additional shifts to fill the inefficiency gaps or to accept that a certain degree of inefficiency is acceptable. Either option has a consequence in terms of increased cost for additional teams or reduced service levels.

The process of staggering shifts start and end times to reduce inefficiency spikes is also problematic unto itself. A one hour overlap between the ending of one shift and the start of another is not the most desirable option either; the rationale being that officers are more productive during the middle of their shift than at the start or end. Another strategy to address this issue includes staggering shifts at half hour intervals to provide a greater spread in overlap. While shift staggering issues can rarely be eliminated entirely, steps can be taken to mitigate the disruption, but with a compromise for any solution adopted.

5.5 Evaluation Objectives

An efficient use of resources will not ensure there are sufficient officers available to deal with emergency calls. Efficiency can only go so far to improving service delivery. Complimentary to maximizing efficiency is an assessment of the effectiveness of existing resources to respond to calls for service, factoring in response times, and the balance between the ability to respond to emergency calls and the demand created by emergency calls. Within the realm of police resource effectiveness, these variables are measured as *available unit minutes* and *consumed unit minutes*, respectively. The ratio of the two variables is called *unit utilization* and is represented as a percentage. This ratio is a good indicator of how busy patrol officers are at a given time and day and whether there is sufficient time available to engage in proactive policing activities. The methodology section provides a detailed explanation of the terms and the calculations involved in generating these figures. Most police agencies strive for a utilization ratio that ranges from 40% to 50% at the extreme high end. For example, the Shreveport (LA) police resource study indicated that the standard for most organizations, taking into account the actual time available to respond to calls was 50%.

While issues such as crime rate and crime types are not directly evaluated by this type of review, it is generally accepted that these issues will be indirectly incorporated into the data when calculating the total *consumed minutes*. In brief, *consumed minutes* are calculated as the total time it takes for each unit to respond, resolve and clear each call within an hour block of time. This data is expressed as the total consumed minutes per hour of the day and day of the week. Therefore, the total consumed minutes will reflect the type of calls responded to within a given hour. This type of calculation is more accurate than a simple total of the calls for emergency services because it accounts for calls that require more than one police unit to respond. Consumed minutes is an aggregate of every minute consumed by every police unit that responds to calls within a given hour of the day. This is a concise figure that accounts for every minute that patrol units spend dealing with emergency 911 calls. As there are only a finite number of available minutes to address emergency calls for service, the utilization ratio is a good indicator of how busy patrol units are at different times of the day and days of the week. As well, it provides a good indication of how effectively patrol is carrying out its duties and meeting its objectives. Certain performance thresholds in the unit utilization, as established by the Department, will indicate when staffing levels should be increased, reduced or left unchanged.

When examining deployment, scheduling and effectiveness, invariably the question arises as to the best way to make use of existing resources before considering additional resources in the equation. Herein lies one of the most difficult issues with reviews of efficiency and effectiveness. There are basically two ways to address inefficiency that exist in scheduling. First, you can redesign the existing deployment model to fix inefficiencies. Second, you can add additional shifts and staff more teams to correct inefficiencies. Both options have benefits and disadvantages. The scheduling section looks at these issues in detail, but for discussion purposes it is important to bear in mind the costs associated with creating more shifts and additional teams, such as supervision, administrative support, equipment, vehicles and scheduling difficulties. One of the understated goals of deployment modelling is to create the best level of efficiency using the least resources possible, which is referred to as a cost benefit analysis in business terminology.

Within the VPD context, certain realities must be considered when developing a more efficient model. The aim of the analysis was to determine the efficiency of the existing model and explore how minor adjustments could potentially improve overall performance. To reach these goals, a detailed analysis of each district for a twenty-hour period, spanning seven days a week, and using six years of data. Certain inefficiencies were observed in each district with distinct and consistent patterns. The analysis section of this report contains a very detailed breakdown of each district's identified periods of inefficiency. In general terms, each district had, on average, three periods of inefficiency. These periods were either times of high demand for resources that were poorly compensated for by shift scheduling, or conversely, times of low demand for resources that were poorly compensated for by shift scheduling.

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Generally, the VPD patrol deployment model is a progressive model that compensates for most periods of high volume of calls with an escalating increase in resources. The only caveat being, there is no mechanism built into the current system to address the gradual built-up of demand for services that takes place from Monday to Saturday. That issue aside, the current system makes reasonable use of existing resources. The Department has five distinct shifts for each district that are staffed by two teams each; with a total of 40 teams for the entire Patrol Division. For an organization the size of the VPD, with an authorized strength of 1,214 sworn officers, 40 teams is considered quite high. Most other agencies the size of the VPD have on average, 20 to 30 teams. Of course, the higher the number of teams, and the greater number of shifts the better management is equipped to schedule resources to mirror demands for service more accurately. But as mentioned, having a large number of shifts does not guarantee the best efficiency, as there are negative costs associated with an overly high number of teams needed to staff these shifts. The existing shift model is generally accepted to be the most efficient model possible, given the realities that it operates under.

Reviewing the VPD's situation, there are two options available to deal with the current inefficiency issues, while still operating within the existing resources. The first option is to split existing shifts to create extra shifts that can address those times and days of greatest inefficiency. *Option "D"* provides a model that can be phased in over the course of several years while additional resources are added to the deployment model, yet gaining immediate efficiency that can be carried throughout the process. However, the downside to splitting existing shifts is that it may create new inefficiencies at other times of the day. *Option "D"* creates up to three more shifts per district, requiring an additional six teams for each district for a total of 24 new teams. An additional 24 more teams, whether reduced in size or not, is problematic. These new teams would require one line supervisor each (24 new Sergeants) and administrative support to maintain these new teams. The cost for additional vehicles for these staff would also weigh against the net gains in efficiency. As well, by splitting shifts to create new shifts, there are practicality issues with only deploying a five to six person team. When vacation leave, sick time and training is incorporated into the analysis there is a very real possibility that only a three person team may be deployed on a regular basis. In reality, a three person team, which equates to one, one person unit and one, two person unit fielded per shift, has no practical benefit for the time they are deployed. If anything, this creates more issues than solutions for fielding emergency calls. It then requires a large number of teams to be deployed simultaneously to address emergency 911 calls. In the final analysis, there is very little distinction to the current model, except it creates a heavy administrative burden and has high costs associated with maintaining it.

The other alternative is to accept a certain level of inefficiency with the presumption that future staffing will be deployed to address this issue in the most cost effective manner possible. For example, the preferred recommendation for addressing both efficiency and patrol effectiveness does so with the creation of only a minimum number of shifts. This option reduces associated infrastructure costs, limits the number of new supervisors and does not create an unwieldy deployment model that is difficult to maintain and staff. Given the negative realities of splitting shifts, the possibility of introducing new

inefficiencies and the limited gains from creating up to 24 new teams using existing resources, it may be more cost effective and wise to accept a limited degree of inefficiency until such time as a fully staffed new team can be created.

5.6 Methods for Analysis

The analysis of staffing needs can be grouped into a number of approaches that attempt to provide the best estimate of the number of officers necessary to respond to emergency calls for service. Queuing analysis is typically used to determine the number of officers needed to ensure a high probability that an officer will be available to respond to an emergency 911 call. There are several commercially available programs that conduct queuing analysis and several private companies that will conduct patrol audits that will provide an organization with a set figure on what its deployment profile should look like. Most of these options are quite costly and only provide a one-time analysis of deployment. Another shortcoming of these systems is that a limited number of variables are examined to make recommendations that may result in sweeping changes.

In response, the VPD Planning and Research Section chose to develop an in-house expertise on patrol deployment analysis using many of the concepts and methodologies used by past audits, but with the added benefit of incorporating additional elements that are missing from many of these approaches. For example, a well know process called MPP (Managing Patrol Performance) assists in establishing staffing requirements based on response time targets, call volume, and the policy expectations and benchmark set by management for the amount of time available to engage in proactive policing, otherwise known as unallocated patrol time. However, MPP does not account for the total time spent on calls, which is especially important when more than one unit responds to a call, effectively doubling the resource commitment. Further, MPP does not fully account for the total time available to take calls within a given hour, based on the number of officers, breaks, shift overlap, and a multitude of other factors.

5.7 Patrol Resource Analysis Issues

Any examination of VPD's Patrol deployment model must take into account the established operational performance goals set for the Operations Division. The operational goals and standards are important when reviewing organizational performance, as it helps to gauge whether current practices meet the expectations set by management. Patrol utilization and the effectiveness of patrol districts has a direct bearing when analyzing whether the organization is meeting its patrol objectives⁴.

It is anticipated the best practices research conducted as part of this report will help establish and implement set guidelines and standards for patrol that will help shape future

⁴ Broom Cheryle. (2004). Performance Audit of the King County Sheriff's Office. Seattle, WA: Metropolitan King County.

deployment reviews. Clearly defined objectives help ensure that resource deployments are consistent with these goals and objectives.

5.8 Consumed Minutes

Consumed minutes provide the best indicator of actual hours worked by patrol officers over a six year period. Over the course of six years the total city consumed minutes has been in transition, depending on how the data is interpreted.

City-wide, from 2000 to 2005, a 7.2% drop in consumed minutes was recorded, with District 2 recording the largest reduction of 28% for the same period. However, this figure is somewhat misleading, as the City-wide Enforcement Team (CET) was created in the spring of 2003, whereby 56 beat officers were deployed in a ten block radius of the Downtown Eastside (DTES). This had a profound impact on patrol resources in District 2, as the influx of officers to the area assumed the majority of calls and problem drivers in the area. While the DTES only composes a small geographic portion of District 2, it accounts for the majority of calls for that district. A review of calls for service for the DTES for a five year period prior to CET's inception, indicates a range of between 40% and 55% of the calls within District 2 were located within the DTES. Similarly, for the period between 2000 and 2005, the total consumed officer minutes were calculated for both District 2 and the DTES. This comparison revealed a range of between 52% to 58% of the District's total officer consumed minutes were within the DTES. Given the fact that the majority of calls for service and consumed office time for District 2 is focused in the DTES, it stands to reason that eliminating this area of responsibility from District 2 would have a significant impact on resource and workload levels. Therefore, the 28% reduction in consumed officer time for the district can be attributed to the creation of the CET.

When consumed minutes are re-examined and CET, now called BET (Beat Enforcement Team), data is added to the District 2 calculation, there is a 0.4% increase recorded for 2000 to 2005. For the same period the population of District 2 increased slightly by 1.7%. The addition of the CET/BET data to the analysis also impacts the city-wide total consumed minutes. The addition of CET/BET data alters the total consumed minutes for the city with a marginal increase of 1.6%. This is a significant difference than the 7.2% drop recorded with the CET/BET data removed. Clearly, the size and complexity of District 2 workload has an impact on both the district itself and city-wide analysis. For this reason, the analysis will present both CET/BET data when its inclusion or exclusion impacts the results.

Consumed Minutes by District and City-wide Total

	District 1	District 2	District 3	District 4	City-wide
2000	2,329,221	3,372,083	2,814,838	2,479,887	10,996,029
2001	2,537,700	3,275,824	3,020,435	2,562,828	11,396,787
2002	2,409,315	3,099,586	2,847,764	2,259,754	10,616,419
2003	2,480,150	2,798,128	2,753,936	2,418,421	10,450,635
2004	2,659,288	2,553,117	2,917,958	2,613,298	10,743,660
2005	2,539,691	2,424,143	2,743,295	2,500,998	10,208,126
Total	14,955,363	17,522,880	17,098,227	14,835,186	64,411,656
2007 Predicted	2,723,452	2,001,184	2,792,011	2,581,130	10,097,777
Consumed Minutes 00 to 05	2,492,560.56	2,920,479.97	2,849,704.50	2,472,530.96	10,735,275.99
% Change 00 to 05	9.0%	-28.1%	-2.5%	0.9%	-7.2%
Forecast % Change 05 to 07	7.2%	-17.4%	1.8%	3.2%	-1.1%

Note: Excluding CET / BET Data

Continuing at the district level, District 1 experienced the greatest increase in workload in relation to the other districts. District 1 encompasses the downtown business core, and has seen its population increase by approximately 9,600 from 2000 to 2005⁵. With a population increase of 12.9% from 2000 to 2005, it is not surprising that consumed officer minutes have also increased in the District for the same period by 9%. Conversely, District 3 saw a 2.5% drop in consumed minutes and District 4 had a marginal increase of 0.9% from 2000 to 2005. Interestingly, both District 3 and 4 experienced a 2% and 2.5% population increase respectively for the same period.

5.9 Available Minutes

Available unit minutes provide the best indicator of the actual officer deployment level at any given hour or day of the week. This is important for further calculations and comparison with consumed unit minutes, but it also provides insight into Department deployment practices within patrol. When examined in relation to authorized strength changes, it provides some understanding of whether patrol is being used as effectively as possible and whether there is a deviation from the Operations Division goals and objectives.

The authorized strength in patrol has not increased in any sizable manner in the past six years, with two exceptions. District 1 changed from 98 patrol officers to 131 on October 4th 2005. This addition was in direct response to uncurbed street disorder issues in the downtown core and the escalating downtown population which created a significant need for additional officers, more than any other area of the city.

⁵ BC Stats Population Estimates for BC Metropolitan Centres, 2006.

As well, the City-wide Enforcement Team (CET) was created to police the Downtown Eastside (DTES) in April 2003, resulting in an additional 56 patrol officers being added to that initiative. In 2006, CET evolved into the Beat Enforcement Team (BET) and by default, the 56 officers augmented the District 2 authorized strength. In fact, the majority of officers within CET/BET originated from District 2, augmented by officers drawn from throughout the Department. However, an important distinction must be made with CET/BET, as these officers are used exclusively for enforcement and proactive initiatives in the Downtown Eastside, and do not take calls elsewhere in the district. Further, CET/BET is a beat enforcement team, meaning they are mainly foot patrol based, and therefore are not typically used to respond to 911 emergency calls. That does not mean CET/BET officers do not take calls in the DTES, but rather that is not the focus of their deployment. The CET/BET is premised on a proactive enforcement strategy and the ability to address on-view incidents, meaning taking immediate action as situations unfold in plain view of the beat officers. It also involves officers taking proactive measures to address repeat and systemic issues in their area of responsibility.

In total, from 2000 to 2005 there has only been an increase of 33 officers to patrol. If 2006 is included, then the realignment of staffing within District 2 and the addition of 18 officers is incorporated under the authorized strength for District 2. As is apparent, the inclusion of CET/BET in the analysis of total available minutes for District 2 is a complex undertaking. Since CET/BET has been in existence in April 2003, there has a reduction in the total available officer minutes for the area not including the DTES. This has tended to skew the District 2 data, requiring special attention when examining the analysis results.

Patrol Authorized Strength 2005

	District 1	District 2	District 3	District 4	Total
Current Patrol Team Staffing	131	136	119	103	489

There are two major issues to consider when reviewing these results. First, the primary role of CET/BET is not to respond to 911 calls for service, which is the main focus of this review when exploring patrol scheduling and efficiency. Second, when CET/BET available minutes are added to the district totals it creates a very different picture of available resources. While CET/BET does not focus on responding to 911 calls in District 2, by default of patrolling the DTES area they assume responsibility for many calls that normally would fall to the District 2 teams. In conclusion, when comparing available unit minutes it is not unreasonable to include both CET/BET within the total available minutes for the district. Consumed unit minutes are a completely different issue and will be dealt with in that section.

City-wide, the percentage of available minutes has increased marginally from 2000 to 2005 by 0.4%. This figure includes CET/BET staffing for District 2, which has an upward driving affect on the overall city available minutes. When CET/BET data is excluded from the analysis there is a significantly different result of a 10.3% reduction in available unit minutes. A district analysis provides further insight into patrol deployment practices. In

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District 1, there was a net reduction in total available minutes of 4.2% from 2000 to 2005. In contrast, District 2 saw a net gain of 15.5% available minutes from 2000 to 2005 when CET/ BET data is included in the analysis. However, for the reasons stipulated above, when the CET/BET data is removed from the calculations there is a drop in available unit minutes for District 2 by 22.4%. This stands to reason given the majority of staff originated from District 2, causing a reduction in the total available minutes for the district. District 3 mirrored District 1 closely, with a 2.3% reduction in available minutes from 2000 to 2005. For the same period, District 4 witnessed the greatest decrease in available minutes, with an 8.9% decrease recorded.

Available Minutes by District and City-wide Total

	District 1	District 2	District 3	District 4	City-wide
2000	4,814,835	5,892,017	5,018,285	5,074,320	20,799,456
2001	4,875,026	5,855,666	5,125,018	5,074,140	20,929,851
2002	4,645,632	5,393,413	4,764,732	4,299,356	19,103,133
2003	4,340,923	5,130,425	4,865,334	4,432,502	18,769,185
2004	4,595,536	4,972,037	4,926,902	4,729,123	19,223,599
2005	4,611,428	4,575,109	4,843,957	4,622,809	18,653,304

Total	27,883,381	31,818,667	29,544,228	28,232,250	117,478,527
2007 Predicted	4,485,674	4,212,344	4,732,020	4,382,262	18,320,113

Available Minutes 00 to 05	4,647,230.24	5,303,111.22	4,924,038.00	4,705,374.98	19,579,754.43
% Change 00 to 05	-4.2%	-22.4%	-3.5%	-8.9%	-10.3%
Forecast % Change 05 to 07	-2.7%	-7.9%	-2.3%	-5.2%	-1.8%

Note: Excluding CET / BET Data

If current trends continue, it is predicted that District 1 will experience a further 2.7% decrease in available minute from 2005 to 2007. District 2 depending on whether CET/BET data is included, will experience either a 22.3% increase or a 22.4% decrease. District 3 is predicted to have a further 2.3% decrease in available minutes from 2005 to 2007 and District 4 will likely see a 5.2% decrease for the same period.

The authorized strength data indicates that there has been either an increase in staff to the districts, such as District 1 or staffing has remained constant. Therefore the reduction in available unit minutes can not be attributed to a decrease in the number of officers available to work. Alternative causes must be examined. A likely possibility is that while the officers still show on the official authorized strength for the various districts, they have been deployed to other duties. Likely explanations for this include patrol based surveillance teams that are comprised of patrol officers, but whose task is primarily conducting surveillance on property offenders. In essence, these officers show on the authorized strength of a team, but their duties have been altered to meet some other

need. Other possible explanations include special initiatives throughout the various districts. It is not uncommon for a District Commander or Inspector to create special initiatives whereby patrol officers are assigned to deal with an issue. While these initiatives are frequently based on problem solving techniques and proactive policing, the negative affect they have on patrol deployment cannot be ignored. If on the other hand, patrol had additional resources and a utilization ratio that allowed for unallocated time to engage in preventive and intelligence lead initiatives, then the redirected use of the above resources would be a welcome addition to any patrol environment. However, given the realities of a consistently high utilization ratio and unallocated time that is far below the threshold to support proactive policing, the best use of these resources would be to maintain a strictly 911 based response to calls for service. Any proactive initiatives should be reviewed with the intent of maximizing officer availability to take 911 calls.

5.10 Response Times

5.10.1 Overview

The VPD experiences a significant time lag between when a call is received at the 911 Call Centre (E-Comm) and the time it takes for the call to be dispatched to a unit. This has an adverse affect on the total response time, as this figure is calculated from the time a 911 call is received to the time it takes for a police unit to arrive on the scene. The elements of this calculation include the total of queuing delay, unit travel time and arrival time on scene. On average, looking at city-wide data, queuing delay accounts for 30% of the total response time, with travel time accounting for the remaining 70%. In terms of total minutes, this equates to a little less than eight minutes of travel time and a little over three minutes of time spent in a queue for priority one calls. City-wide response time data for 2005 indicates an average of eleven minute and forty seconds (11 min, 40 sec) response time for priority one calls. Priority one calls are the most serious 911 emergency calls that require immediate police attention.

For priority two calls, the second tier of emergency calls requiring police response, the ratio is almost the exact reverse. Approximately 30% of the total response time is consumed travelling to a call and the remaining 70% is spent waiting in a queue at E-Comm. In terms of actual time, this translates into approximately 13.5 minutes of travel time and 31 minutes waiting in a queue, for a total 45 minute response time for city-wide data.

Extensive interviews were conducted at E-Comm to determine the nature of the excessive time that calls wait in a queue before being dispatched to a unit, and to ascertain whether there were systemic inefficiencies related to the call centre that were adversely affecting police response times. Structured interviews were conducted with a sampling of staff members throughout the call centre, ranging from actual call-takers and dispatchers to staff supervisors and senior managers. As well, a thorough review was conducted of their current business model, staffing practices and workflow in handling incoming calls.

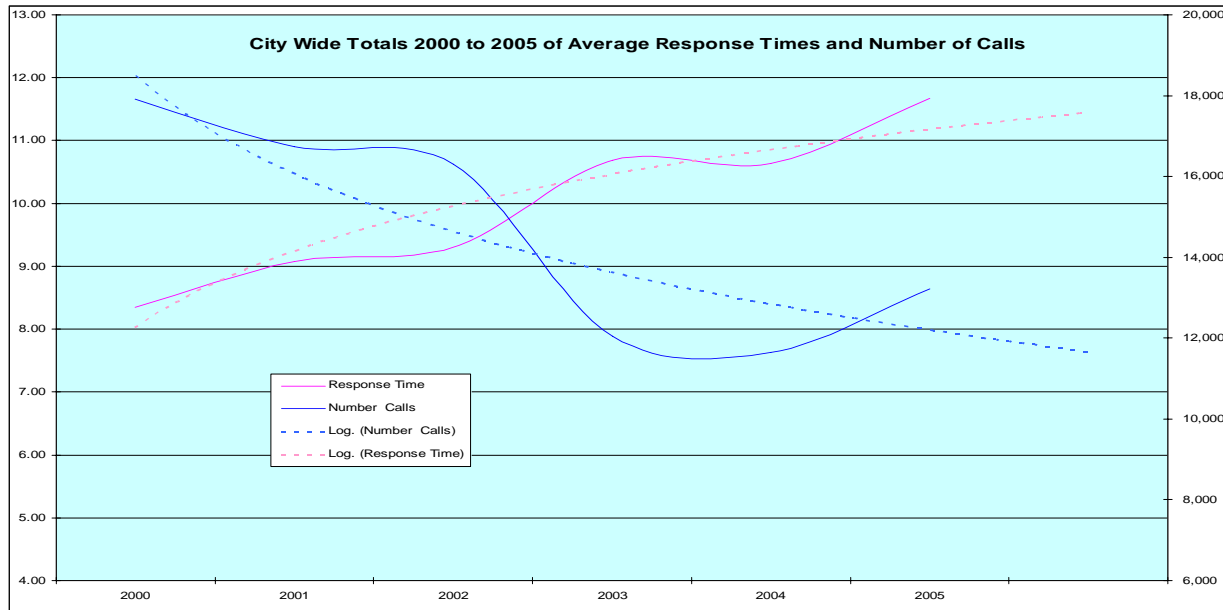
The results of this examination determined that the nature of the lengthy call queuing times was a result of low number of police units available to take the incoming calls. Due to police units being unavailable to respond to emergency calls, incoming calls were subsequently stacked or put on hold until a unit could be made available. As is quite evident, this process is less than ideal, as extreme emergency calls are simply not responded to immediately, due to lack of police resources. This situation must be kept in mind when reviewing unit utilization ratios. Unit utilization ratios, taken in isolation, do not tell the whole story of police resource issues. Generally speaking, whenever high utilization ratios are observed there is a very good chance that call stacking is also taking place. Simply, whenever police units are proceeding from call to call, typically a utilization ratio above 55%, then call stacking is also occurring because there are only a finite number of units available to take incoming calls. Furthermore, when a substantial number of units are occupied with existing calls it stands to reason that there are fewer units available to field new calls for service.

5.10.2 City-wide

Looking at priority 1 city-wide response times by each day of the week, they are lowest on Sundays with a sharp build-up to Tuesday. From Tuesday, there is a gradual increase to Friday, where it peaks and then drops sharply on Saturday. On a yearly basis, 2005 had the highest response times, both by day of week and for time of day. From 2000 onward, every successive year saw marginal increases in priority 1 response times, starting at a low of 8.3 minutes and escalating to 11.7 minutes in 2005. If the current city-wide trend continues unabated, by 2007 it will take 13.1 minutes on average to respond to priority 1 calls.

In detail, it took the longest to respond to priority 1 calls between 0800 H and 1800 H, but dropped sharply before and after these times. Peak response times were observed at 1500 H. Looking at City-wide totals for 2005, the range between the highest and lowest response times was 6.2 minutes. The slowest average response time was 15.5 minutes at 1500 H and the quickest average response time was 9.14 minutes at 0400 H.

The relationship between response times and number of calls from 2000 to 2005 indicates that as responses times increase every year, the number of calls decreases for the same period. This inverse relationship is contradictory to what would be expected under the circumstances. A more expected relationship would be for response times to decrease in relation to a drop in the number of calls for service. The rationale is that a reduction in the number of calls for service would result in an increased availability of officers to respond more quickly to calls. Given indications from the data, it can not be said that such a relationship exists and other factors are likely driving response times higher. Other explanations include that there are fewer officers available to take calls than in the past. A reduction in the total available minutes per hour reflects this possibility. As well, the total time spent on calls has increased, reflected in the consumed unit minutes data, thereby further reducing the number of officers available at any give time to respond to calls in an expedited manner.



5.10.3 District Comparison

When examining Districts 1 through 4, the change in priority 1 response times from 2000 to 2005 increased by 29.5%, 40%, 43% and 44% respectively. This resulted in it taking on average 9.3 minutes in District 1, 11 minutes in District 2, 13.2 minutes in District 3, and 13.2 minutes in District 4 to respond to priority 1 calls. Priority 1 calls are the most serious emergency 911 calls that the police department responds to. This includes calls such as armed robbery, sexual assault in progress, shots being fired and other life threatening emergencies requiring immediate police attention. If unchecked and no steps are taken to alter this trend it is predicted that by 2007, all things being equal, it will take 11.3 minutes for District 1, 12.2 minutes for District 2, 14.4 minutes for District 3 and 14.2 minutes for District 4 to respond to these types of calls. This will reflect an increase in response times of 21.3%, 10.2%, 9.2% and 7.8% for District 1 through 4 respectively from 2005 to 2007.

District averages do not always tell the full story of response times, as it tends to have a mediating affect over extremes, even when those extremes are experienced on a consistent basis, albeit for a shorter period of time, such as two to three hours. To provide a more complete picture of actual response times experienced by the general public at various times of the day and in each district, a comparison between highs and lows is provided. When examining 2005 high and low response times by district for priority 1 calls, District 1 took the longest to respond to calls at 1500 H with an average 13.4 minute response. Conversely, at 0200 H it only took 6.3 minutes to respond to calls. District 2 followed a similar pattern with a high 13.8 minute response at 1400 H compared to a 8.4 minute response at 0200 H. District 3 experienced significantly higher average response

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times, with an average high of 18.3 minutes at 1300 H and a low of 9.4 at 0500 H. District 4 took the longest to respond to priority 1 calls at 1400 H, with an average 19 minutes and the quickest response took place at 0400 H at 8.1 minutes.

Response Times by District and City-wide Total

	District 1	District 2	District 3	District 4	City-wide
2000	7.22	7.91	9.21	9.18	8.38
2001	8.03	8.63	10.18	9.82	9.17
2002	8.40	8.76	10.18	10.43	9.44
2003	9.89	10.58	11.72	11.52	10.93
2004	10.26	9.71	11.65	11.24	10.72
2005	9.35	11.08	13.21	13.21	11.71
2007	11.34	12.21	14.43	14.23	13.1
Average Response Time 00 to 05	8.86	9.45	11.03	10.90	10.06
% Change 00 to 05	29.5%	40.0%	43.4%	43.9%	39.8%
Forecast % Change 05 to 07	21.3%	10.2%	9.2%	7.8%	11.8%

5.11 Overtime

5.11.1 Overtime Overview

Overtime is used in patrol for several purposes. First, it is used for hold-back (extended tour) whereby a patrol team is held back at the end of its shift due to an unusually high workload or series of emergencies that necessitate additional resources to maintain minimum service levels. Second, overtime can be used to maintain minimum staffing levels (callout), which are important not only to ensure appropriate to response to calls for service, but for the safety of those officers working and the preservation of sufficient backup officers. Callout and extended tour are the main reasons overtime is used in patrol.

5.11.2 Background

As part of the ongoing Operational Review, the Vancouver Police Department developed an Overtime Database in June of 2005 to identify and quantify the primary drivers of overtime use in the organization. In order to achieve these goals, the Overtime Database was designed to capture detailed information about each overtime claim. Prior to the inception of this database, the VPD relied on SAP software for information regarding

overtime usage. Unfortunately, the SAP product was not designed to capture basic information regarding overtime usage, such as the type of overtime being used, the reason why the overtime was required, or the times when the overtime occurred. As a result, only limited information regarding overtime can be obtained for dates prior to June 2005.

As part of the Patrol Resource Allocation Review, a year's worth of data from the Overtime Database was extracted to examine the efficiency with which the VPD currently deploys its patrol officers. Ideally, the overtime data used by patrol officers in the most recent calendar year would have been compiled. Unfortunately, this could not be accomplished. While the Overtime Database has been established for over a year, this period actually straddles two calendar years (the years of 2005 and 2006). As a result, it was only possible to extract annual overtime data for patrol officers for the period from June 1st, 2005 to May 31st, 2006.

5.11.3 Overtime Methodology

The Overtime Database is robust in that it records both the number of hours earned by the individual, as well as the time period during which the overtime occurred. Thus, either the actual number of hours worked or the number of hours earned by the officer can be obtained. As a result, hourly figures represent the number of actual hours worked by the individual (e.g. if an officer worked a callout that lasted eleven hours, this will be recorded as eleven hours, not the 22 hours that the officer receives in compensation for this overtime tour).

The Overtime Database records information on all overtime worked by employees of the VPD, both sworn and civilian. As a result, the first step in this compilation involved isolating operational overtime worked by sworn patrol officers. In order to achieve this goal, the data was sorted by division. Only overtime which occurred in the Operations Division was considered. Because only data for frontline patrol sergeants and constables was desired, it was necessary to remove overtime claims submitted by managers and overtime worked by support units in the Operations Division, such as the district surveillance teams and the units in the Patrol Support Section. Next, data that was worked by patrol officers but was billed to other sections of the VPD or other police agencies was removed from the data; this was achieved by examining each cost center and/or determining if the overtime had been funded by another agency.

While it was clear that the above items should be removed from the overtime data that was collected, overtime used to fund the Liquor Squads (which are commonly referred to as Lima callouts) was also excluded from the main data-set used for patrol analysis. Arguably, this overtime should not be included because it is not used to deploy patrol officers in a traditional sense (the primary focus of this overtime is not 911 response, but the creation of order and the preservation of peace in the entertainment district). However, it can be argued that these squads provide additional resources which are required to meet the excess demand for police services in District One (if these squads

were not deployed this work would fall to the on duty District One patrol teams). Because there was no clear answer, it was decided that two separate data sets should be compiled for the subsequent analysis, one set with the Liquor Squad callouts included and the other with this overtime removed; in effect, creating two data sets.

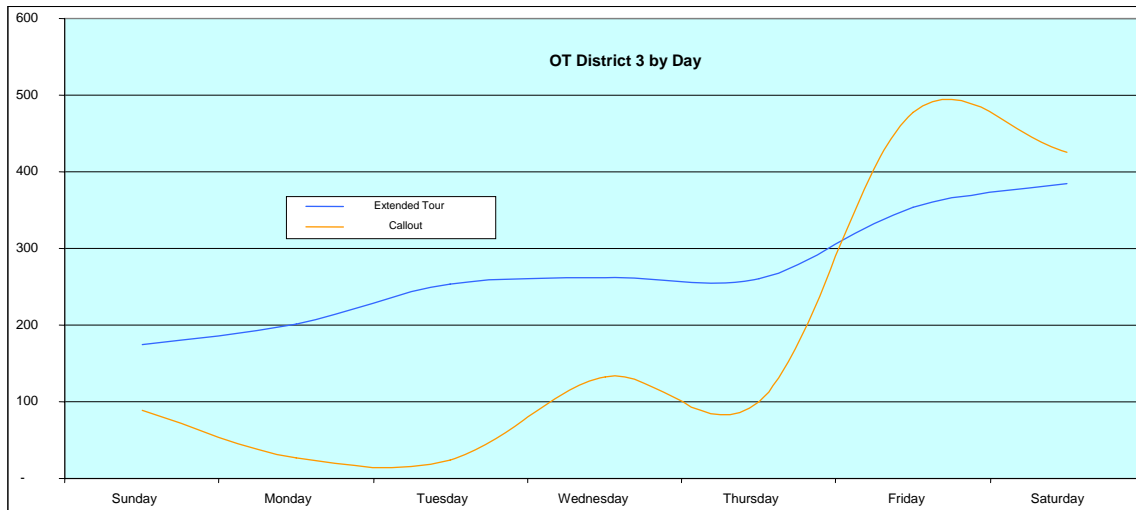
Once the entries for patrol officers were isolated, the data was then sorted by district, day of the week, and type of overtime. This process allowed for the computation of aggregate levels of overtime usage for each district according to the day of the week. The breakdown of overtime usage by day of the week was simplistic when compared to the time series analysis that was performed.

It was also necessary for cross comparison analysis with utilization data that the overtime data illustrate the times when demand for overtime began. The data also needed to account for the number of officers working at any given time. This was accomplished by first breaking the day into 15 minute intervals. Next, an automated program of binary data switches was incorporated to record the period over which the overtime occurred. As a result, the computer would turn on all the data switches for the intervals that covered the period over which the overtime occurred, while leaving all the other data switches for the rest of the day turned off (a switch that was turned on was recorded as a one, while a switch that was turned off was represented by a zero). This analysis allowed for the preparation of graphs that depict the timing, length, type, and frequency of overtime usage.

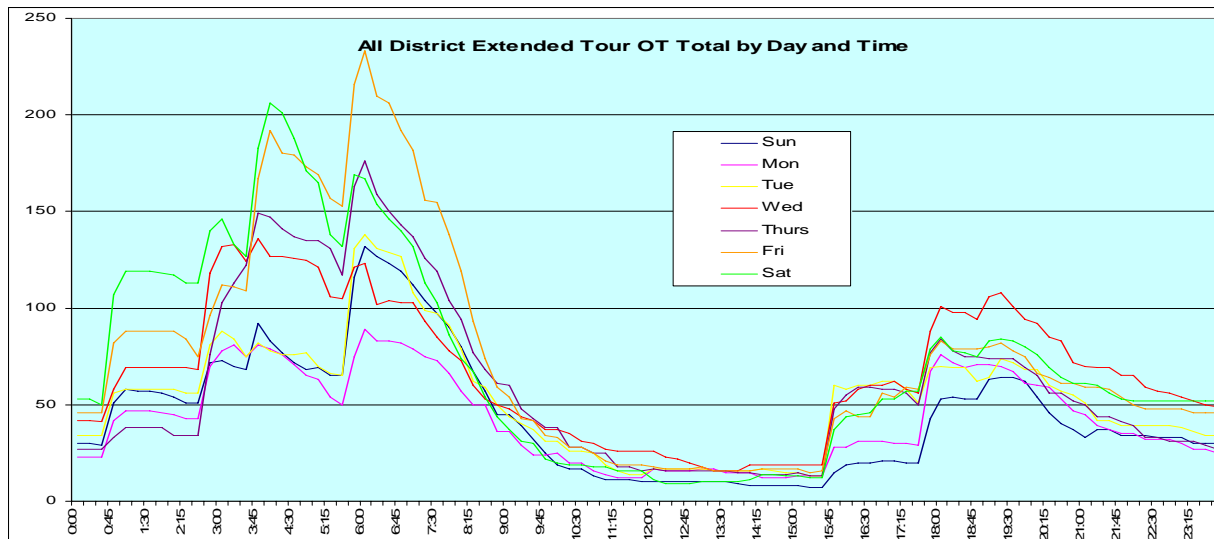
The analysis that was performed allowed for a comprehensive examination of the data contained in the VPD Overtime Database. Rather than simply examining overtime start times or total expenditures billed to a given cost centre, this methodology permitted a detailed analysis regarding the frequency of overtime, the specific time over which it occurred, and the underlying reason why this work was required.

5.11.4 Overtime Usage Findings

When examining overtime usage in patrol it is evident that its use is limited for most days of the week with the exception of Thursday, Friday and Saturday where it is more prevalent. Callouts (to maintain minimum staffing) are used most extensively on Thursday to Saturday, compared to extended tours which are more gradual and a stepped increase throughout the week from Sunday to Saturday. Further, extended tour overtime was used 67% more than callouts to maintain minimums. This use of extended tour overtime is consistently higher than callouts by 2/3 for each district, regardless of day or time in question. As well, each district follows a similar and consistent pattern, but with District 3 experiencing the greatest increase near the end of the week compared to the other districts. Interestingly, callout overtime used to maintain minimum staffing was not used as extensively as first thought and extended tour overtime was used far more than anticipated, indicating a possible issue with shift deployment at the times of high overtime usage.



In terms of hour of the day and day of the week where extended tour overtime was used more extensively, Friday early morning between the hours of **0345 and 0430** and between **0600 and 0645**. A similar practice is repeated on Thursday and Saturday at the same times, but with slightly lower usage.



When examining district discrepancies, District 1 is unique, in that Thursday evening for the same times listed above record the highest use of overtime, followed closely by Friday and Saturday. For District 3, Saturday is disproportionately higher than any other day of the week for the same times listed above, followed by Friday and Thursday. District 2 and 4 are consistent for Friday and Saturday morning, at the same times listed above, as being the highest use of overtime.

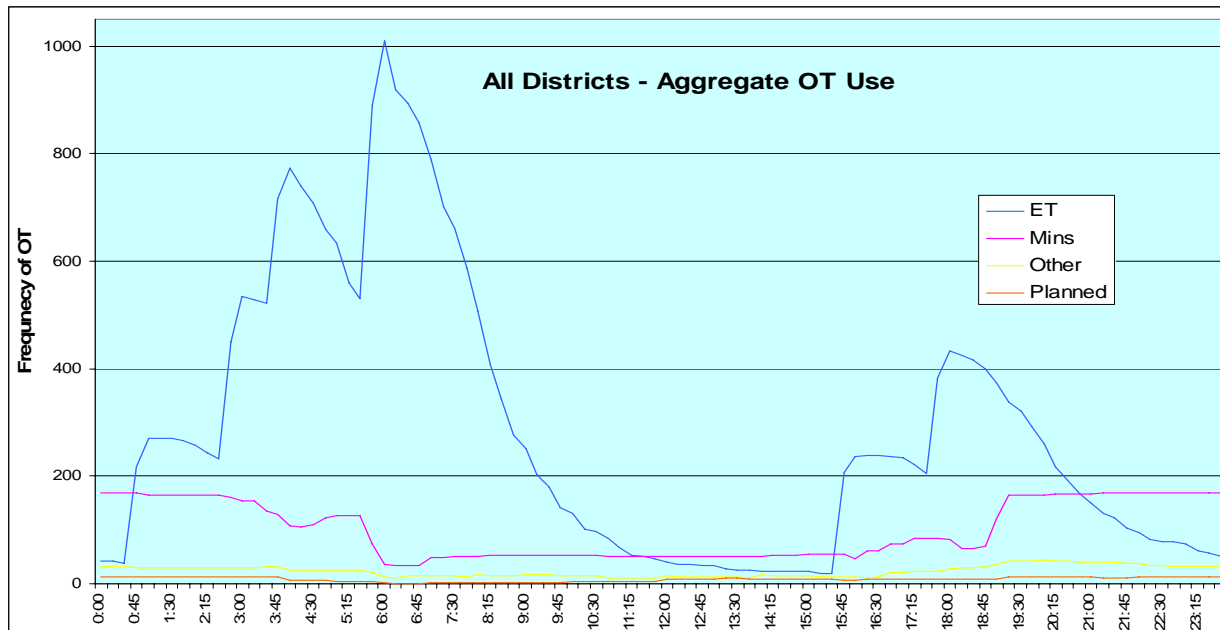
Given these findings, there is some evidence to support an argument that extended tour overtime is being used to compensate for inadequate weekend resources and a poor shift

scheduling at times when arrests are occurring as shifts are endings during times of peak utilization.

As detailed in the utilization analysis section, weekend (Thursday to Sunday morning) has long been problematic for patrol, regardless of district. The times between **0300 H and 0430 H** and between **0600 H to 0630 H** consistently have high peak utilization, indicating inefficiency with the current deployment model. This is a mirror overlap of the extended tour overtime peak usage as well. Interestingly, both times of high inefficiency and highest use of overtime are one in the same. It appears that extended tour overtime is being used as an ad hoc way to compensate for shift resource issues. Albeit, not the most cost-effective manner to correct deployment model shortcomings, the regular and extensive use of extended callouts can have a mediating effect on times of peak inefficiency without adding an entirely new shift to compensate.

This is an important distinction to make, as the use of extended tour overtime is limited to individual officers that are engaged in a serious call and cannot be released or officers that have a suspect in custody that requires documentation that can not wait until another shift. One of the main reasons for the concentration of extended tour overtime at the two times listed above, as opposed to other times of the day, is that in the early morning there are fewer shifts available to handover serious calls to. Typically, during the afternoon, a dispatcher will assign calls that have a substantial investigative component to oncoming shifts rather than to a unit that is about to go off shift. This reduces the need to use extended tour overtime, as the fresh unit has the entire shift to wrap up the call. However, this situation does not exist during the early morning between 0300 H and 0500 H, as there is only a Delta shift (Delta ends 0400 H) and then only an Echo shift available to field calls (Echo ends at 0600 H). The next shift doesn't start until 0500 H. This limits the ability to transfer serious calls that occur between 0300 H and 0430 H to an oncoming team that will have 11 hours to deal with the situation. The two available teams are left to deal with the situation, regardless if it happens very close to the end of their shift.

The alternative is to create a transition shift to bridge the gap between the end of Echo and the start of Alpha shift. However, certain realities must be considered. Throughout the city the call load is very low between 0400 H and 0700 H, with 0630 H having the lowest call-load in any given 24 hour period, regardless of day of the week. Therefore, the cost implications of creating an entire team to exclusively address these early morning times of peak utilization is far greater than the overtime generated by individual officers on a need basis. An entire shift devoted to fixing the overtime issue would be a very poor use of resources given the extremely low call load at this time. While some modifications can be made to help address the use of extended tour overtime in the early morning, the complete elimination of all overtime can not be accomplished in a cost effective manner. A detailed examination of proposed shift modifications that will help address some of these issues is contained in the recommendations section.



6 Patrol Workload Detailed Analysis

6.1 Project Outline

While Phase 2 identified call distribution patterns and the unit-hours spent on calls by time of day, Phase 3 represents a follow-up analysis that more accurately depicts resource allocation. The addition of data spanning six years from 2000 to 2006 includes available unit-minutes, consumed unit-minutes and utilization figures. This provides crucial information as to how active patrol officers are at various times and days of the week, as well as compared to other districts within the city.

By benchmarking unit utilization (time consumed / available minutes) with an unavailability factor of 13.6% to account for unavailability during meal breaks, the current shift deployment model can be compared to the demand for service and changes that have occurred over the six years. Through this analysis, a better appreciation of the nature of the call load and police resource availability can be made. Ultimately, this report will assess whether the current deployment model accurately mirrors demands for service and, if not, which time blocks, days and districts would benefit from modified scheduling.

The intent of this section of the report is to review the deployment of patrol officers and determine whether the current shift model accommodates the changing needs of the Districts. The results of the analysis will then be used to assess the current shift deployment model and which peak call-load times have the greatest need for resource

modification. In some cases this may involve a modified shift model, such as the creation of additional shifts to more closely match resources to demands for service.

A unit utilization ratio of 70% or higher was used as a benchmark to indicate a workload that has reached a level where it has a limiting effect on the ability for police to respond to additional demands for service or respond in a proactive manner. Police that are deployed in a reactive model, going from call to call, cannot be expected to produce or respond to calls beyond their means. The 70% cut-off was used, as this equates to 10 minutes or less of unallocated time within each hour block.

The calculation is based on 9.5 hours available to take calls using the unavailability factor of 13.6% after meal breaks have been deducted from each 11 hour shift. Further, the 10 minutes that is unallocated within each hour block may be further broken down into small time-block segments, such as five minutes or less, which is virtually unusable in terms of proactive policing. In reality, 10 minutes or less within an hour time-block would allow for little more than finishing up report entry and preparing for the next call. At this heightened level of call load, officers are simply responding to dispatched calls that are queued in a priority sequence.

In practical terms, officers who spend 70% of their time responding to calls for service are considered extremely high within the policing community. For example, the International City/County Management Association has stated:

Generally when a department operates at optimum efficiency, patrol officers will spend approximately 30 to 35 percent of their time committed to calls for service. Spending 45 to 50 percent of patrol time on calls leads to call stacking, citizen dissatisfaction, neglect of crime prevention, and officer stress. This also means that there may not be enough time to conduct proper investigations.^{6,7}

While adverse affects have been noted in police departments whose patrol officers spend over 45% of their time responding to calls, at levels above 70% the degradation of service is so severe that patrol officers are stretched beyond their ability to effectively respond to emergency calls. Under these conditions, emergency calls become backlogged and are transferred to a queue for the next available unit. Any form of proactive policing is virtually non-existent, including core functions such as traffic enforcement. Special notations are made throughout the report identifying those days and times when unit utilization surpassed the 70% mark. When reviewing the findings outlined in the subsequent section, consider the implications each percentage value represents in terms of time spent responding to calls and what effect that has on the ability to provide an emergency service to the public.

⁶ VPD. *Administrative Report to Vancouver City Council*. Planning Research & Audit Section. March 2003.

⁷ International City/County Management Association (ICMA). 1997. *Comparative Performance Measurement: FY 1995 Data Report*. Washington DC: ICMA.

6.2 District 1

6.2.1 Overview

District 1 has been noted as the district that has experienced the greatest growth and transition within the past 10 years compared to any other area of the city. For example, District 1 has seen a population increase of 52% from 1993 to 2001^{8,9}. Furthermore, from 2000 to 2006 the population continued to grow, recording an increase of 12.9% or 9,667 people. This population increase becomes significantly more pronounced when contributing factors such as an estimated 125,000 commuters enter the district during the day, according to GVRD estimates for 2001.

Similarly, licensed premises seating capacity has increased by 20% from 1998 to 2001 within the downtown core¹⁰. The impact on police resources has been most significant within the Granville Mall area, where late night bar crowds and intoxicated persons have created social disorder problems for police (e.g. assaults, disturbances, noise, intoxicated persons). These changes and other contributing factors resulted in the VPD transferring an additional 33 officers to the district. This benefited the District by increasing patrol team strength to approximately 13 officers versus a previous team strength of approximately 9 officers, depending on individual teams. However, while these officers were added to the authorized strength on October 4th 2005, their actual deployable strength did not come into effect until late 2006, after a lengthy recruiting and training process. As a result, given that this report was produced in mid 2006, it was impossible to weigh their impact on the district's available minutes and utilization ratio. However, given that the additional resources were simply added to the existing deployment structure, it is safe to assume that the same pattern in utilization was maintained, although at a reduced level.

Extrapolating from 2000 to 2005 data should not be problematic in terms of assessing inefficiency peaks and issues with deployment. Regardless of the additional officers added to District 1, the same times and days that create scheduling issues will continue in 2006, independent of the 33 officers added to the existing shift model. However, it would stand to reason that levels of inefficiency will be considerably lower with the added resources. Following this reasoning, the 2000 to 2005 data was still analyzed with the intent to assess shift deployment issues that could be improved upon and possibly modified to provide a better use of resources. This is premised on the analysis still carrying through to the current District 1 staffing composition and informing possible deployment changes.

The number of available patrol units within District 1 comprises of 23% of the total patrol units within the city. With slightly less than one quarter of the Operations Division's patrol units, District 1 attends 21% of the total calls for service within the city. Similarly, the

⁸ Prox, Ryan. *Patrol Shift Analysis District 1*. Planning, Research and Audit Section, February 2002.

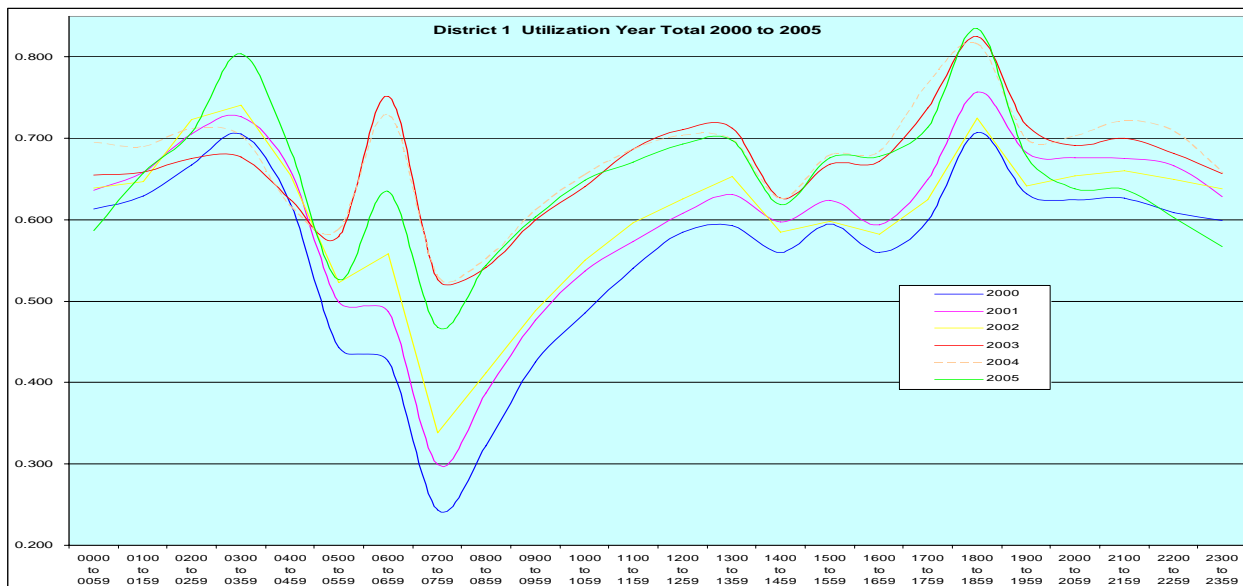
⁹ BC Provincial Government. *Total Municipal Population 1991-2002*. BC Stats

¹⁰ Meeres, Grant. *Patrol District 1, An Analysis on Demographic and Workload Changes – Addressing the Policing Issues*. District 1 Patrol, September 2003.

number of patrol minutes consumed by District 1 was 25% of the city total.

District 1 unit utilization, which is the percentage of time consumed relative to available time, fluctuates significantly by day of the week and the hour of the day. As well, there are slight variations from year to year, that will be examined separately when there is a deviation from the established trend. Using 2000 data, starting at 7:00 am, unit utilization progressively builds for every day of the week from the 15% to 25% range until reaching a plateau at noon that slightly drops off until 2:00 pm. In contrast, the same trend is followed by 2005 data, with the exception that the utilization rate has increased by an average of 13.8%. For example, 7:00 am Tuesday, which is the lowest point of utilization for every time and day of the week, the utilization 16.3% compared to the same time and day in 2005, which is 45.7%. Another example is Wednesday evening at 6:00 pm in 2000, which recorded a utilization ratio of 74.4% in 2000 compared to the same day and time in 2005 which increased to a utilization ratio of 84.8%.

For every year studied, after 5:00 pm, unit utilization increases sharply for each day of the week until reaching a peak at 6:00pm. For 2005, Saturday had the highest utilization with an average high of 89.4%. At this level of unit utilization only 6 minutes are unaccounted for within the hour block. The remaining days were within the 73% to 90% range of utilization, which is a remarkable increase within a very compressed time. Continuing to look at 2005 data, after 6:00 pm, unit utilization once again dropped sharply to the 50% to 56% range with a slight increased noted between 8:00 pm and 9:00 pm and then continuing to drop again. Interestingly, Friday and Saturday unit utilization increased slightly above the norm to midnight, from the years 2000 to 2002. From 2003 onward, every day followed the same pattern outlined above, which was a gradual decrease until a 3:00 am spike.



Saturday and Sunday early morning utilization did not spike until 4:00 am, likely attributed to a modified weekend shift extended to 4:00 am. Wednesday, Thursday and Friday

early morning experienced a substantial spike (up to 85% in 2005) occurring at 3:00 am. After 3:00 am, mid-week utilization, which includes Thursday and Friday mornings, drops significantly to a 40% to 51% range in 2005, while Saturday and Sunday morning remain elevated in the 67% to 68% range. In 2000, for the same time and day, utilization ranged from 52% to 53%.

For the six years studied, utilization spiked everyday of the week at 6:00 am, with the highest levels displayed for Saturday and Sunday in the 82% to 76% range in 2005, versus midweek, which was significantly lower in the 50% to 68% (2005) range. Friday morning was the midweek day with the closest level to weekend rates, at 68% in 2005, with the second highest day being Tuesday at 61%. Again looking at 2005, between 6:00 am and 7:00 am, unit utilization dropped to the lowest levels in a 24 hour period, with midweek at 40% to 50% and Saturday and Sunday levels at 55% to 48% respectively.

District 1 reaches its weekend early morning peak of consumed minutes between 0200 H and 0300 H. This is a significant change from the past, where the same District hit its weekend early morning peak between 0100 H. and 0200 H. This is probably a reflection of later bar closings that have extended the time when drinking related calls impact the District.

Interestingly, District 1 peak consumed minutes was higher in 2000 and 2001 compared to 2004 and 2005. However, the overall level of consumed minutes stayed relatively higher for 2004 and 2005 compared to the past. In other words, the volume of consumed minutes was consistently higher on average than in the past, but extremes were higher in the past compared to more recent years. This indicates more recent police intervention tactics have had a preventative effect on calls for service and consumed minutes. While the volume of calls has not abated, the extreme peaks has been mediated through a strong enforcement presence on weekends. While not exactly equal to mid-week consumed minutes for the evening, there is a closer mirroring for 2005 than the extremes observed in 2000.

6.2.2 Analysis

As to be expected, unit utilization was greatest during weekends, with early mornings recording the highest elevated rates that deviated from midweek levels. On closer examination, the primary factor for the elevated unit utilization during these weekend times was an elevated call load that resulted in a substantial increase in consumed patrol unit-minutes. Despite the fact that available unit-minutes were also higher on weekend evenings and early mornings, this was not adequate to cope with the spike in consumed unit-minutes. In other words, while District 1 did attempt to compensate for the increase in consumed unit-minutes during weekend evenings and early mornings by increasing available units through modified shifts, deployment was still below the level required to prevent extreme spikes in unit utilization levels.

The spikes at 3:00 am and 4:00 am were also compounded by the fact that available

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units decreased at these two crucial times because of shifts ending despite the elevated call load. The substantial call-load volume during weekend bar hours, coupled with shift changes that do not align well with the current call load pattern, results in several spikes in unit utilization.

Early morning midweek unit utilization also followed a similar pattern, albeit at a less magnified level. As was the case on the weekend, midweek experienced a spike in unit utilization at 3:00 am. While not as significant as the weekend, it clearly demonstrates that similar issues are at play during the early morning. As was the case with the weekend, consumed unit minutes was quite elevated at 3:00 am in District 1, but resource levels drop off sharply as a result of shifts concluding. Following a comparable trend to the weekend but one hour earlier, midweek unit utilization climbs significantly at 3:00 am. This was a result of an elevated call load consuming available unit-minutes, but also a consequence of a late afternoon shift ending at 3:00 am on Monday to Thursday, compared to ending at 4:00 am on Saturday and Sunday. In essence, the weekend unit utilization spike is offset by one hour due to a modification in shift scheduling.

As mentioned previously, each day recorded a significant rise in unit utilization at 6:00 pm. While the call load gradually increased from 6:00 am onward for every day of the week, the sharp increase in unit utilization was a direct result of resource scheduling. At 6:00 pm, day shift ended (Bravo shift) and there was an hour lag before the next significant shift became available, namely the 7:00 pm Echo shift. This resulted in a yo-yo effect in the unit utilization, as remaining shifts scrambled to deal with the number of calls until the next shift became available. Unit utilization then dropped sharply once more units were available, but only temporarily.

Call load (consumed minutes) continued to build and place increasing demand on available shifts until 9:00 pm when it hit a plateau and then continued to slowly drop off until 6:00 am the next morning. Friday and Saturday evening and the following early morning were the exception to this midweek trend, as the call load decreased slight until 2:00 am, then increased slightly before continuing on a downward trend to 6:00 am. This pattern was most prevalent in 2005.

In terms of adequately resourced days, Monday and Tuesday appear to have the best ratio of unit-minutes to call load compared to other days of the week. This translates into the greatest number of available units at most hours of the day. However, calls for service are consistently low on Tuesday and Wednesday, which together impact the low unit utilization percentage for these two days.

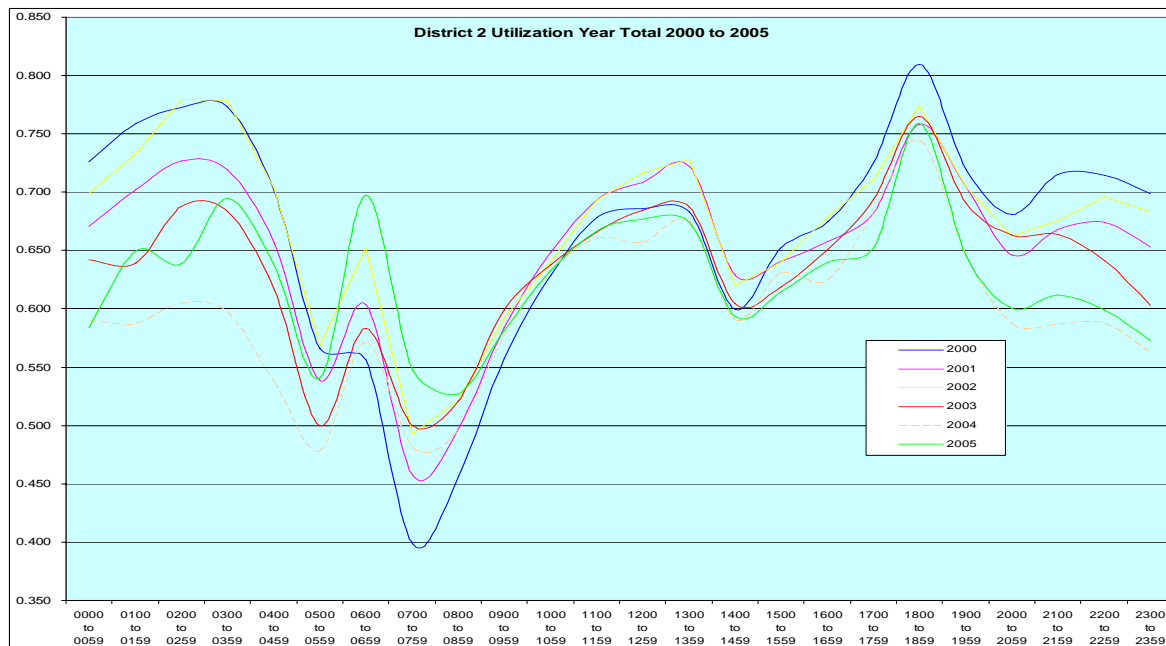
6.3 District 2

6.3.1 Overview

District 2 has traditionally been viewed as a district with an intense workload. This is partially attributable to the inclusion of the Downtown Eastside (DTES), which is a

significant consumer of district. Despite the fact that it only comprises 3% of the city population, the DTES is responsible for nearly 18% of all calls for service compared to the remainder of the City of Vancouver (COV)¹¹. The majority of Vancouver's homicides and overdose deaths occur within District 2, and it is generally regarded as one of the more dangerous areas of the city. In April 2003, the DTES experienced a patrol based initiative to restore order and assist a community in crisis. The City-wide Enforcement Team (CET) and eventually the Beat Enforcement Team (BET) was premised on a highly visible police presence aimed at restoring order to one of the most impoverished and drug filled areas of the city. District 2 also includes the areas east of Clark Drive to Boundary Road, which encompass several gentrified neighbourhoods, as well as middle income and lower income areas with diverse policing needs and unique service requirements.

Using 2005 data as an illustration, District 2's unit utilization ratio corresponds to extremes that range from 44% to 80% depending, on day and time. Using 7:00 am as a point of departure, as this time consistently has the lowest values, utilization increased incrementally every hour until reaching a high at 1:00 pm. The 1:00 pm peak ranged from 62% to 74% (2005). This increase is evident for every day of the week, but Saturday and Sunday represent markedly higher ratios than the midweek increases. From 1:00 pm to 2:00 pm, unit utilization drops significantly to the 56% to 63% range. Everyday experiences a significant upward spike at 6:00 pm. After 6:00 pm, unit utilization drops for each day at 7:00 pm and then gradually climbs to 9:00 pm. After 9:00 pm, Friday continues to climb and the remaining days gradually decrease until midnight.



From midnight onward, unit utilization increased rapidly reaching a peak at 1:00 am. Midweek levels are within the 60% to 63% range, and weekends 77% to 68% range. Utilization levels dropped at 2:00 am for 2005 and the remaining years are split between

¹¹ Based on 2002 Prime BC figures prior to the inception of the City-Wide Enforcement Team initiative.

decreasing at either 1:00 am or 2:00 am. In 2005, levels sharply increased again at 3:00 am, reaching 74% to 60% utilization before dropping to the 46% to 64% range at 5:00 am. Weekend unit utilization closely mirrored midweek trends, with the exception of the 3:00 am peak occurring one hour later. After dropping at 2:00 am, weekend levels rose sharply at 4:00 am. From 4:00 am onward, weekend levels dropped until 5:00 am. From 5:00 am, unit utilization increased rapidly to 6:00 am for each day, including weekends, and then dropped again at 7:00 am. Throughout these fluctuations, Friday and Sunday morning utilization levels were appreciably higher than during midweek days.

6.3.2 Analysis

District 2 has five significant increases in unit utilization that are examined in detail. The first section will deal with late morning and early evening periods of fluctuation, and the second section will deal with late evening and early morning shift variances.

Call load (consumed minutes), gradually increased throughout the day, starting from a low at 6:00 am and generally building to a high at 9:00 pm. Consumed minutes increased more aggressively from 7:00 am to 11:00 am, then generally levelled until 2:00 pm, at which time it escalated more abruptly until 4:00 pm. From 4:00 pm to 6:00 pm, call load remained relatively level before increasing again from 6:00 pm to 8:00 pm. After 8:00 pm the call load plateaued before dropping slightly until midnight. Weekends presented some variations in the call load trend by increasing more rapidly in the evening, and continuing to increase after 8:00 pm, but generally followed the same pattern of build up.

In contrast, available unit-minutes, which are dependent on the number of units available, followed a more abrupt pattern of increases and reductions throughout the same time period. Considering the extreme fluctuations in unit utilization, it appears that the deployment model fails to keep pace with the gradual increase in calls for service. Calls for service and the associated consumed unit-minutes are predictable over time. Therefore the most efficient use of patrol resources would mirror call load with the appropriate units required to field calls.

Notably, the number of available units increased significantly at 7:00 am as Bravo (day shift) started. From 7:00 am to 9:00 am the available unit-minutes kept pace with consumed unit-minutes. However, as the call load continued to climb and the number of units remains constant, unit utilization levels peaked at well over 73% (2005) at 1:00 pm. As was mentioned previously, a high unit utilization ratio is indicative of overworked patrol officers that are unable to engage in proactive policing.

At 2:00 pm, Charlie shift started, which increased the available unit-minutes in a significant step that reduced the unit utilization ratio to a more manageable level, within the 56% to 63% range in 2005. However, the compensating effect of Charlie shift is negated by the 5:00 pm reduction in available unit-minutes on Friday and Saturday and the 6:00 pm ending of Bravo shift, which isn't replaced until 7:00 pm by Echo shift. The ending of Bravo shift created a jump to the 74% to 78% range for one hour in 2005.

The following section will focus on the late evening and early morning variations in unit utilization, as well as influencing factors. At 1:00 am, available unit-minutes drop off significantly as a result of Charlie shift ending. This results in a significant spike in unit utilization, as the remaining units are left to manage a call load that is significantly elevated compared to day shift. Weekends were the most appreciably impacted, as Saturday unit utilization, on average, reached 77% (2005).

The situation is further compounded at 3:00 am when Delta shift ends. This substantially reduces the number of units available to field calls, resulting in a unit utilization that is in the 60% to 75% range (2005), depending on the day of the week. In 2005, weekends are impacted by the adjustment of Delta shift, which ends at 4:00 am. The modified Friday, Saturday shift repositions the weekend unit utilization spike to 4:00 am. Regardless of the one-hour variation between times when unit utilization surges, it is quite evident that resources are considerably over extended, both on weekdays and on weekends.

At 5:00 am Alpha shift starts, creating a temporary reduction in unit utilization; however, at 6:00 am, Echo shift ends creating another surge. While not as pronounced as earlier utilization increases, due to a decrease in call load, the surge still represents an inefficiency that requires other patrol teams that are only just starting, to attempt to compensate for the spike.

While an overlap of shift end times would help alleviate the drastic surges in unit utilization at 1:00 am, 3:00 am, 4:00 am (weekends) and 6:00 am, the elevated call load and rapid reduction in available units would still result in a high unit utilization ratio. A comprehensive strategy needs to incorporate an increase in available resources for the late evening/early morning call load, an extending of the shifts to provide longer coverage at peak times, and an overlapping of the shifts to reduce unnecessary utilization surges. This topic will be discussed in detail within the Deployment Model Recommendations section.

6.4 District 3

6.4.1 Overview

District 3 encompasses one of the more ethnically diverse and stratified areas of the city. While the majority of the district is primarily single-family residential housing, the highly concentrated businesses along Kingsway and Main Street represent a unique challenge to policing. The distinct neighbourhoods and sub-communities that are characterized throughout the policing area compound this challenge. Further, the SkyTrain transportation corridor that cuts through this district also impacts policing issues and the distribution of crime. For example, areas that were previously less accessible, except by vehicle, are now easily targeted by criminals that make use of the transit system to both aid in their movement and avoid apprehension.

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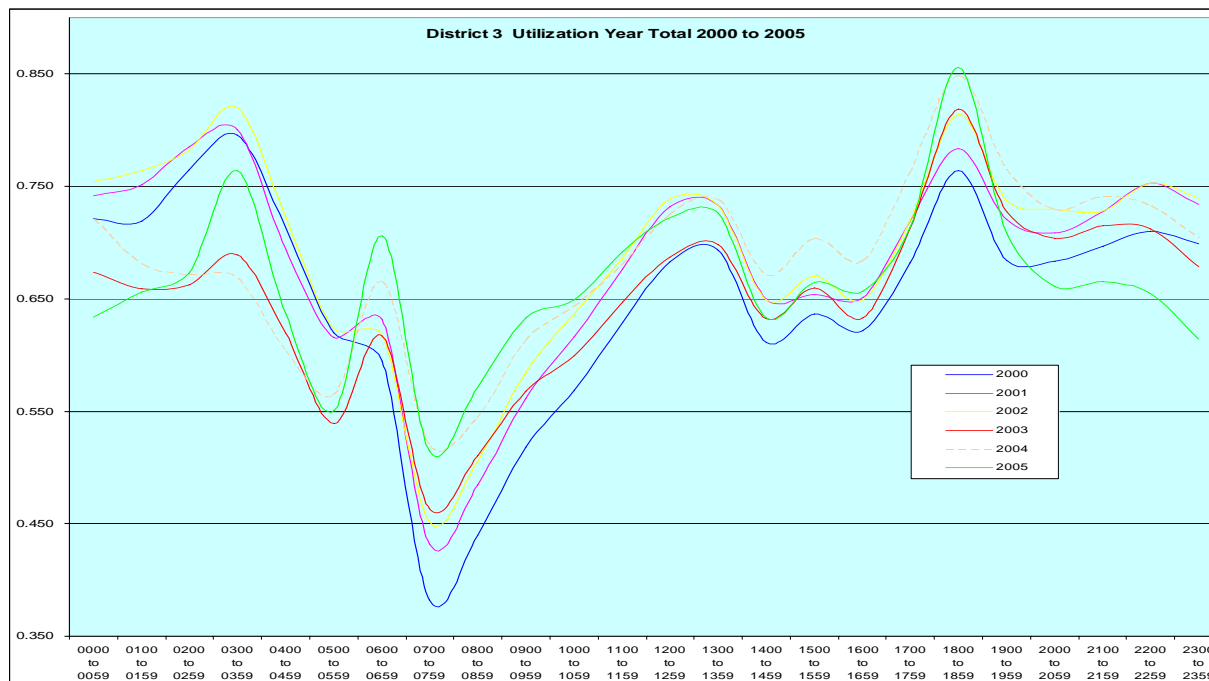
Geographically, District 3 is considerably larger than Districts 1 and 2, which has an impact on response times. Resources available to take calls in District 3 comprise 28% of all patrol units, which closely mirrors the consumed patrol unit-minutes (27% of the total consumed unit-minutes).

Changes impacting the current deployment model also include an increase in licensed establishments and licensed seating capacity within the district. This has influenced the late night call load and created similar trends to those seen in Districts 1 and 2, which in the past were primarily where drinking establishments were located.

District 3 experienced a similar pattern of unit utilization to that of District 2, albeit at an elevated level. The ebb and flow of the unit utilization closely mirrored District 2, with weekend peak utilization matching and at times surpassing those seen in District 1.

Specifically, District 3 unit utilization was quite low at 7:00 am, with a range of 43% to 64% in 2005. From 7:00 am to 1:00 pm, the unit utilization ratio increased progressively, until reaching a high point at 65% to 76% (2005), depending on the day of the week. Saturday and Sunday were the two days with the highest utilization ratio at 1:00 pm in the afternoon. Between 1:00 pm and 2:00 pm, utilization plummeted, before increasing slightly at 3:00 pm and then dropping slightly at 4:00 pm. More importantly, unit utilization increased from the range of 70% to 75% at 5:00 pm to 89% to 89% at 6:00 pm in 2005. Immediately after 6:00 pm, unit utilization dropped sharply at 7:00 pm to levels similar to those seen at 5:00 pm before increasing again at 9:00 pm. From 9:00 pm to midnight, unit utilization drops slightly plateau, with only minor fluctuations noted.

From midnight to 7:00 am unit utilization data demonstrated wide variances. Starting at midnight, unit utilization increased gradually to 1:00 am, with weekends peaking at 72% and 73% for Saturday and Sunday respectively. In fact, weekend levels remain elevated above those recorded for midweek for the entire early morning timeframe.



From 1:00 am to 3:00 am, the most significant utilization ratio increases were recorded compared to any other time block. Weekend levels peaked at 96% and 85% for Saturday and Sunday, respectively in 2005. While midweek levels also increased substantially, with highs in the 70% to 75% level for Thursday and Friday morning. From 3:00 am to 5:00 am, unit utilization recorded its most significant drop. For example, on Saturday, utilization changed from 96% to 73% in only two hours (2005).

Similar trends were observed for the other days of the week, with Monday and Tuesday recording the lowest utilization ratio compared to the other days. From 5:00 am to 6:00 am there is a substantial spike in utilization, with Saturday and Sunday reaching highs in the ranging from 91% to 86% respectively. Surprisingly, Friday does not follow the same trend, but rather more closely mirrors midweek levels in the 65% range.

From 6:00 am to 7:00 am utilization levels drop to all-time lows, with Monday, Tuesday and Wednesday grouped closely at the 45% level (2005). Saturday and Sunday were more elevated, in the 60% range (2005). Friday morning was between these two sets at 51% (2005).

6.4.2 Analysis

From 2000 to 2005, District 3 resource deployment was an exception to the other districts in that it did not have a modified weekend Charlie or Delta shift. Throughout this period, District 3, both midweek and weekend shift patterns, were exactly the same. This practice was despite substantial variations in call-load, especially on Friday and Saturday evenings, as well as Saturday and Sunday early mornings. The following analysis will

identify the times and days that are influenced by resource availability and calls for service fluctuations.

Unit utilization levels were at their lowest point at 7:00 am for every day of the week. While calls load was lowest at 6:00 am, the start of Bravo shift at 7:00 am resulted in an elevated but steady overall unit usage, despite a notable increase in the call-load. From 7:00 am to 1:00 pm, the unit utilization ratio increased substantially, a direct product of the rise in consumed unit-minutes. In other words, the total number of minutes spent attending calls increased throughout the late morning until reaching a peak at 1:00 pm in the 65% to 76% range (2005).

At 2:00 pm, Charlie shift started, which caused a drop in the unit utilization ratio despite a continued increase in the call-load. The extra patrol resources temporarily reduced the utilization ratio to approximately 62%, but the level of consumed unit-minutes continued to rise, creating a slight upsurge at 3:00 pm before levelling off again at 4:00 pm when Delta shift started, providing much needed units to cope with the mounting calls for service. This levelling continued until 6:00 pm when unit utilization increased rapidly. For example, Wednesday and Monday recorded ratios of 85% and 88% respectively (2005). The ending of Bravo shift created a temporary gap in resources until 7:00 pm when Echo shift became available to take calls. Consequently, unit utilization dropped again at 7:00 pm, although still maintaining a higher level than at 5:00 pm, as a result of a continued increase in the call load.

From 8:00 pm to 9:00 pm, unit utilization increased slightly while patrol resources remained stable. From 10:00 pm to midnight, there was a gradual decrease recorded in the utilization ratio.

From midnight to 1:00 am, unit utilization climbed for every day of the week with the exception of Saturday and Sunday, that were notably higher with levels at 72% and 73% compared to 60% and 66% for Monday and Friday. While in the early morning, call load decreased for every day, the ending of Charlie shift at 1:00 am was substantial enough to create a resource dependant spike.

At 3:00 am, Delta shift ended creating a sizeable increase in unit utilization. In fact, utilization levels were at their highest level at 3:00 am, with Saturday and Sunday leading at 96% and 85% respectively. However, Wednesday, Thursday and Friday were still quite high, recording utilization ratios of 75%, 69% and 77% respectively. As is evident from the data, Echo shift was left to respond to the bulk of the calls for service within the district until 5:00 am. From 3:00 am to 5:00 am consumed unit-minutes continued to drop, which impacted the unit utilization ratio causing it to fall. The rapid drop after the 3:00 am spike was further fuelled by the additional resources of Alpha shift, which came available at 5:00 am. However, the low utilization ratio was soon reversed by a spike at 6:00 am when Echo shift ended. The one hour that Alpha shift was left without other resources created a spike such that Saturday and Sunday morning levels were in the 91% to 86% range. The remaining days were considerably lower at the 65% level. From 6:00 am to 7:00 am unit utilization dropped to its lowest level, as Bravo shift started,

resulting in a substantial influx of available patrol units when the call load was still quite low and only starting to build.

6.5 District 4

6.5.1 Overview

District 4 is the largest of the patrol districts. Land use in this district is primarily residential, with mixed business use scattered throughout the district, but predominantly located in the north along Broadway, Granville, Cambie, 4th Avenue, in Kitsilano and on Granville Island. The residential areas are in well-established neighbourhoods that are, generally speaking, stable and homogeneous compared to the other districts. As was the case in District 3, nightclubs and bars are not the primary destination point within this district, however, there has been a slight increase over the years that have altered the late evening and early morning call load.

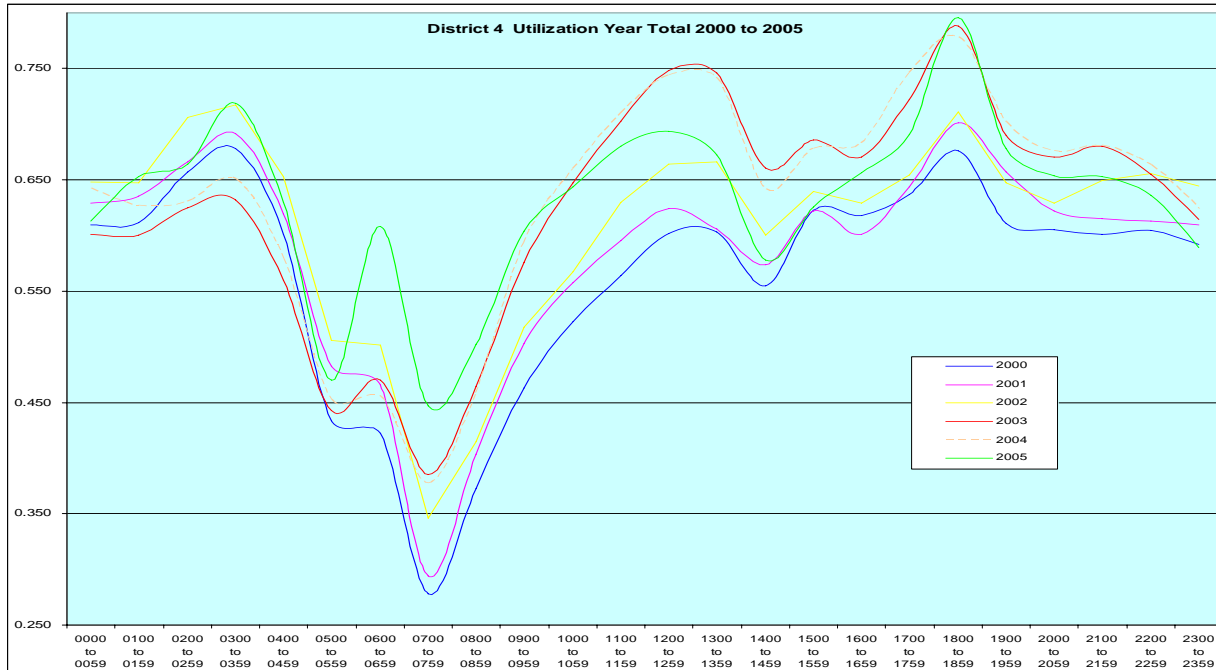
Similar to District 3, District 4 response times are adversely impacted by the large geographic size of the policing area. The business corridors to the north consume a disproportionate amount of police resources, with Vancouver General Hospital (VGH) requiring special police attention. The higher density housing and business areas to the north also experience more disorder and crime control related calls requiring a greater police presence. In contrast, the residential areas to the south predominantly record property crime offences, but at a far lower rate than the rest of the city. As well, the light industrial use concentrated along the Fraser River primarily experience property related crime.

In terms of current resource deployment, District 4 has 25% of the total available units allocated within the city. The number of calls for service is also reflected in 25% of the city total. Similarly, the consumed patrol unit-minutes is 25% as well.

Unit utilization fluctuated throughout the twenty-four hour period for each day of the week, with weekend levels consistently recording higher values than midweek. Beginning at 7:00 am, District 4 unit utilization was at its lowest point for the twenty-four hour period. Midweek levels were in the 44% range and weekend levels were slightly elevated in the 47% range (2005). From 7:00 am, unit utilization increased until reaching a high at noon. At noon the utilization ratio was approximately 71% for Saturday and Sunday, and midweek was within a range of 64% to 70% (2005).

From noon to 2:00 pm, utilization decreased sharply, to the 54% to 60% range for both weekdays and weekends (2005). From 2:00 pm, utilization increased until reaching a peak at 6:00 pm. However, at 3:00 pm utilization spiked slightly, with Friday reacting in a more pronounced manner. Neither of these spikes were at levels close to the 6:00 pm peak, which for Friday was 89% and for Thursday 81% in 2005. Immediately after 6:00 pm, utilization levels dropped sharply at 7:00 pm and then increased again at 9:00 pm

before slowly decreasing to midnight. Looking back to 2000 data, Friday and Saturday evening deviated from the other years by increasing from 9:00 pm to midnight, with Friday evening reaching a utilization ratio of 71% at 11:00 pm.



From midnight to early morning, unit utilization continued sporadic shifts between extremes, with weekend levels reaching highs in the 84% range. For midweek, utilization increased from midnight to 1:00 am reaching levels that ranged from 59% (Tuesday) to 68% (Friday). In comparison, Saturday and Sunday noted increases that were substantially more pronounced at 75% and 73% respectively.

From 1:00 am to 3:00 am midweek levels spiked to a range of 65% (Tuesday) to 84% (Friday) in 2005. For the same time, weekend levels increased sharply. Midweek levels then dropped drastically to 5:00 am to a range of 42% to 40% for Monday to Thursday and 48% for Friday (2005). Weekend levels also reacted similarly, by decreasing to 61% range. From 5:00 am to 6:00 am, weekday utilization levels increased to a range of 50% to 66% (2005). In the same pattern, weekend levels also increased, but to a higher point at 67% to 77% (2005). From 6:00 am to 7:00 am, utilization dropped again, but in this instance to the lowest point in the twenty-four hour period at an average of 45%.

6.5.2 Analysis

From 7:00 am, unit utilization climbed sharply to 8:00 am. This increase was a result of a substantial rise in the number of calls and a static number of units available after day shift (Bravo) started at 7:00 am. From 7:00 am, the number of available unit-minutes remains constant until 1:00 pm. In other words, no other shifts began until 2:00 pm, despite the

fact that call load builds throughout the day. This resulted in an increased unit utilization that eventually peaked at 1:00 pm. The utilization ratio dropped significantly at 2:00 pm, as a direct result of Charlie shift starting and a relative levelling in the call load. The extra resources assisted with the elevated afternoon call-load.

From 2:00 pm to 4:00 pm, call-load continued to climb, while available unit-minutes remained constant. At 4:00 pm, early day shift (Alpha) ended and Monday to Thursday Delta shift started. This had little effect on unit utilization, bearing in mind the call-load is stable for this part of the day. In contrast, for the same time, Friday and Saturday recorded a spike in unit utilization. This spike was a direct result of the one-hour interval between Alpha shift ending and the 5:00 pm start time for Delta shift on Friday and Saturday. The Friday and Saturday delay in the Delta shift start-time also created a drop in unit utilization at 5:00 pm, as extra police resources became available to deal with the previous hour's spike in call load.

At 6:00 pm, Bravo shifted ended, which adversely impacted unit utilization, creating an increase that was recorded for each day of the week. Friday was most significantly impacted with a utilization ratio reaching 89%. For one hour, available unit-minutes remained low until Echo shift started at 7:00 pm, generating a pool of police resources that increased the unit-minutes available to deal with calls. The availability of Echo shift also mitigated the impact of the call-load spike at 7:00 pm resulting in a net decrease in unit utilization for this time. However, the call-load (consumed unit-minutes) continued to increase from 7:00 pm to 9:00 pm resulting in an eventual jump in utilization. From 9:00 pm to midnight, utilization remained stable with a slight decrease noted.

From midnight to 1:00 am, unit utilization spiked sharply. Weekend utilization was the most severely impacted, with Saturday hitting a high of 75% and Sunday at 73%. At 1:00 am Charlie shift ended, resulting in a resource generated utilization spike. This substantial increase in utilization occurred despite a slight drop in consumed unit-minutes. However, weekend levels were already at an excessive level for this time of the morning and any slight decrease had little effect on overall unit utilization. Similarly, midweek days were impacted by the ending of Charlie shift at 1:00 am, but not to the same extent as weekends. The utilization spike was not as pronounced considering the reduced call-load during midweek early mornings.

From 1:00 am to 3:00 am, available unit-minutes remained constant compared to consumed unit-minutes that decreased substantially within the 2 hours. From 1:00 am to 3:00 am, this trend reversed, as Delta shift ended at 3:00 am. The ending of this shift resulted in a substantial reduction in the total available minutes. Consequently, unit utilization surged to new highs. For example, Monday and Friday utilization levels were at 65% and 84% respectively, which is the second highest level either day attained within the twenty-four hour period (2005). Weekend utilization reacted slightly differently, pushing the utilization spike to 4:00 am on Saturday and Sunday morning. From 1:00 am to 4:00 am, utilization increased significantly, such that Saturday went to 81% (2005) at 4:00 am. This was due to an adjusted end time for weekend Delta shift.

5:00 am recorded a substantial decline in utilization, both weekend and midweek alike. The predominant cause was a rapid decrease in call-load paired with the start of the early morning Alpha shift at 5:00 am.

From 5:00 am to 6:00 am, both midweek and weekend utilization spiked upwards when night shift (Echo) ended, but dropped again at 7:00 am when Bravo shift started. While the range between unit utilization was not as pronounced as that recorded during early morning, it nonetheless represented a period of fluctuation and resource inefficiency with Saturday hitting a high of 77% utilization at 6:00 am.

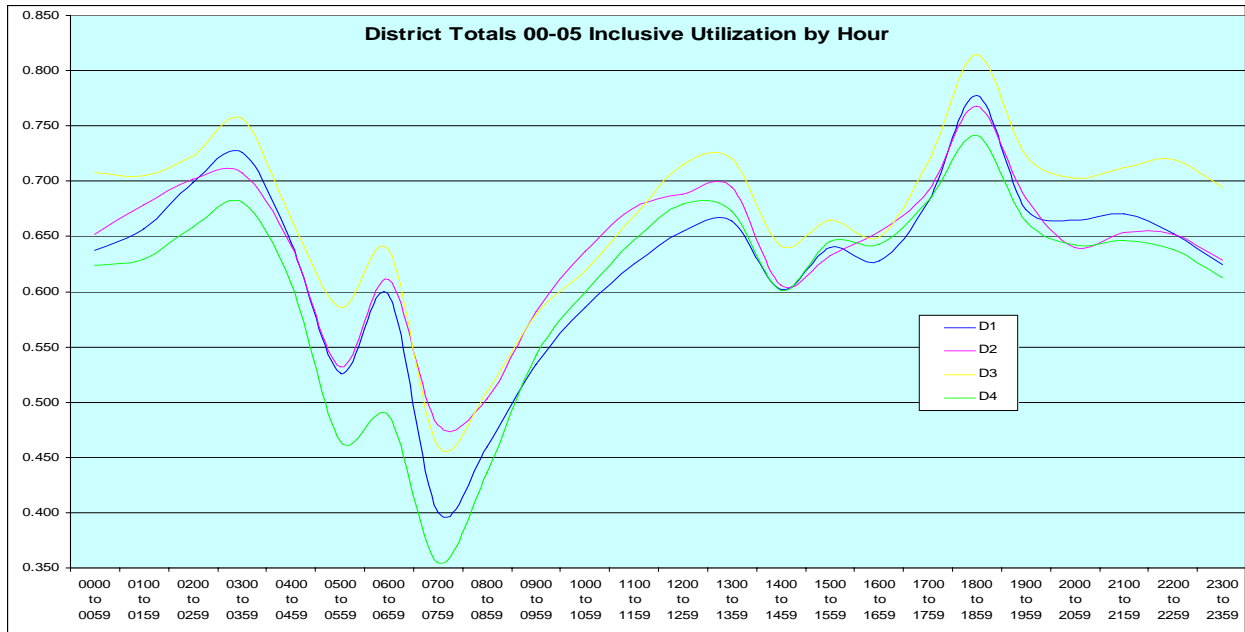
6.6 City Comparison

6.6.1 Overview

When examining 2005 district utilization rates, in rank order, District 3 had the highest average unit utilization at 67%, followed by District 1 at 65%, District 2 at 62% and District 4 at 64%.

Still using 2005 data, when weekends (Saturday and Sunday early mornings) were examined independently of the other days of the week, District 3 consistently had a higher utilization ratio than any other district. For example, at 1:00 am and 4:00 am, the average weekend utilization ratio was 73% and 70% respectively. Similarly Monday to Thursday data also recorded District 3 peaking higher than the other districts between 1:00 am and 3:00 am and at 6:00 am.

The fact that District 3 did not adjust its Charlie and Delta shifts from 2000 to 2005 is quite apparent when the utilization percentages are compared across districts. While more pronounced on weekends, the 3:00 am spike in unit utilization for District 3 is considerably higher than even District 2. This abnormally high level in unit utilization, compared to the other districts, is caused by Delta shift ending when the call load is still quite high for only one shift to deal with. The deployment of a single shift, namely Echo, is inadequate to deal with the call load at 3:00 am. The lack of available resources creates utilization levels that are consistently in the high 80% range during peak times (2005).



In contrast, District 1 had several times when utilization was elevated, especially on weekends, but the extent of the increase was still well below levels seen during District 3 high points. District 1 utilization patterns were extensively detailed within the analysis section; however, it is important to note that despite fluctuations, the levels recorded were substantially higher than the other districts. District 1 utilization was second highest for 2005, compared to the other districts from midnight to 6:00 am. After 6:00 am, utilization dropped significantly, save from 6:00 pm to 7:00 pm where it was the second highest and only slightly below District 3 at a high of 89%.

7 Resource Distribution by District

7.1 Overview

This study included a complete and detailed data set of consumed unit-minutes, total calls for service and available unit-minutes ordered by district. This data allowed for an analysis of the distribution of resources throughout the patrol districts and provided a means to determine the relative efficiency of each district's deployment. This analysis also provided an opportunity to evaluate which districts would benefit from additional resources or a redistribution of existing patrol staff.

Compared to the other districts, District 1 had the second highest percentage of total available minutes with 25% of the patrol total in 2005. In 2005, this roughly equated to 89 officers available to respond to calls for service. In other words, District 1 officers comprised 22% of the total officers available in patrol.

Despite having the lowest authorized strength of the four districts, District 1 maintained a percentage of available unit-minutes of 25% compared to the other districts. The

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percentage of consumed unit-minutes was also 25% of the city total, which equates to a 65% utilization ratio for the entire district in 2005.

Resource Distribution by District

	District 1	District 2	District 3	District 4	Total
Consumed Patrol Unit Minutes	2,539,691	2,424,143	2,743,295	2,500,998	10,208,126
Percent of Total Consumed Minutes	25%	24%	27%	25%	100%
Available Unit Minutes	7,286,057	6,954,166	7,847,211	7,165,353	29,252,787
Percent of Total Available Minutes	25%	24%	27%	24%	100%
Number of Calls	32,749	49,606	35,117	38,981	156,453
Percent of Total Calls	21%	32%	22%	25%	100%

District 2 has the second smallest complements compared to the other districts, with 98 officers available to respond to calls. This translates into 24% of the total patrol strength. In terms of available unit-minutes, District 2 had 24% of the city total. Consumed patrol unit-minutes for District 2 was also 24% of the city total (2005).

District 2 had an average unit utilization level of 62% in 2005. Interestingly, the number of calls for service ratio was higher than any other district, with 32% of the total calls responded to by the VPD. This indicates that the calls were of the type that required less time to complete and conduct investigative follow-up.

District 3 available unit-minutes was the highest in the city at 27%. This matched consumed unit minutes which was also 27% for the district in 2005. District unit utilization was on average 67% in 2005, which was the highest in the city.

While District 4 has the largest geographic area to police in the city, the resources allocated to this district are the second lowest after District 2. In 2005, District 4 had 103 officers, 25% of the total patrol strength in the city. In terms of calls for service, District 4 had the second highest level after District 2, with 25% of the city total. Despite having a relatively high number of calls for service, consumed unit-minutes were lower than would be expected at 25% of the city total. In a reversal of the phenomenon seen in District 3, the matching of consumed unit-minutes with calls for service indicate many of the calls were dealt with much more quickly, and were of the type that did not require as much investigative follow-up. This could be explained by more minor and nuisance type calls.

On average, District 4 had the second lowest utilization rate compared to the other patrol districts at 64% in 2005. This indicates District 4 available unit-minutes were the second closest paired to the consumed unit-minutes relative to the other districts. However, as will be examined in the recommendation section, this does not indicate that the resources

allocated were sufficient to deal with the call-load and maintain an acceptable level of service.

8 Deployment Model Recommendations

8.1 Overview

The following section will provide six proposed deployment models that are premised on improving efficiency and reducing instances of peak utilization that are known to create periods of instability and an unusually high workload. The first set of shift deployment models were developed with the goal of reaching a 50% utilization ratio across each district. The second set of shift deployment models closely mirrors the first set in structure, but with a change in the projected utilization ratio used to calculate the resources necessary to implement the model. In the second set, a utilization ratio of 40% was used to calculate staffing strength and unit composition.

Each recommended shift model advances a range of efficiencies that varies in degree and outcome. Each has its own strengths and shortcomings, depending on the measurements being used to evaluated against. With this in mind, there are no perfect solutions to any staffing situation. Each solution is wrought with positive gains mixed with some degree of consequences. For these reasons, an array of options is provided to ensure any decisions are premised on reaching a balanced and realistic approach to patrol deployment. Any decision on the best course of action should then be weighed against the intended goals and objectives of the organization, cost effectiveness, the degree of efficiency to be obtained, and the proposed service levels to the public. The shift model of choice will then depend on the level of importance placed on each influencing variable.

From an efficiency perspective, the oscillation in unit utilization, or the fluctuating level in which patrol units are engaged in taking calls, creates numerous issues for patrol officers. Under these circumstances, officers are constantly shifting from periods that are extremely demanding to periods of relative normality in a very short time. Ultimately, the impact of an escalating workload is degraded service, significantly increased response times for emergency incidents and an increased risk to police due to unfilled shifts. The use of excessive overtime is not an efficient strategy and, in the long-term, the costs are greater than the solution.

Ultimately, these circumstances create stress and reduce the quality of life for officers, as well as negatively impacting the level of policing within the community. Not only is this an inefficient use of police resources, but also the scheduling system artificially creates unnecessary periods of stress and fatigue.

8.2 Analysis

Generally, call-load is quite predictable over time, with only occasional variations due to special events, holidays and seasonal changes. Given this scenario, it is possible to match resources to call-load with a reasonable degree of certainty. Therefore, more efficient models, such as the options presented below, incorporate a best fit between the pairing of police officers to the call load and a gradual layering of available officers as the call load changes.

As previously stated, the optimum level for patrol utilization, based on the industry workload standard is in the 40% to 50% range. As is evident from the preceding analysis, the Patrol Division currently operates at a level considerably higher than that. In some instances, unit utilization reaches levels that are consistently over 70%. Under these circumstances, patrol units are simply responding to emergency 911 calls in priority sequence while lesser priority calls are stacked waiting for available resources. In some situations, calls are simply not responded to due to a lack of available units. Team supervisors are then left to contact the complainants to inform them no unit will be attending their call. The limitations on officer availability also has serious implications, as there have been situations where there are not enough available officers to respond to emergency calls. Part of the problem rests with the Department operating with too few officers to ensure there is a contingent of units unassigned to calls and available for emergencies.

The solution to the fluctuations and lack of resources, due to peak utilization, is the addition of more shifts staggered over time to coincide with the gradual increase and decrease of the call load. The best way to accomplish this depends not only on the level of service sought, but on the intended effectiveness of the deployed resources. Basically, two things must happen concurrently. First, additional resources must be added to address the elevated utilization ratio that is negatively impacting the police department's ability to adequately respond to calls for service. Second, modifications need to be made to the existing shift deployment model to make better use of existing resources in a more efficient manner. Simply doing one or the other independently will not have the desired effect of improving the ability of patrol to respond to calls for service.

For example, adopting only one option of redesigning the shift model to maximize efficiency, will result in some efficiency gains throughout the patrol squads, but it will be insufficient to address the issue of a consistently high utilization ratio. While some inefficiency peaks may be reduced with such an approach, the fact remains that the utilization ratio for each district is consistently above 60% the majority of the time (85%). No degree of efficiency gains will compensate for a continually elevated utilization ratio that only drops below a 60% utilization ratio 15% of the time. The best that efficiency gains could hope to accomplish would be to even out times of extremely high and low utilization, where available officers do not match the call-load as efficiently as possible. However, for the majority of the remaining times, where efficiency is already optimized, the only method to reduce utilization is through the addition of more resources. This results in an increase in the number of available minutes to better match consumed

minutes, thereby reducing the utilization ratio to a more manageable level. It is also important to keep in mind that the existing patrol deployment model is a relatively efficient model. Generally speaking, it gradually increases the number of officers on shifts as the call load increases throughout the day. When discussing inefficiencies in patrol, there are approximately three significant times throughout a 24 hour period when the utilization ratio indicates a period of ill-matched resources to call-load. However, with relatively minor adjustments and fine-tuning, and a limited impact on the existing infrastructure, these issues can be resolved satisfactorily. Still, these efficiency gains do little to address the overall systemic issues of an elevated utilization ratio, indicative of an under-resourced patrol division.

8.3 Recommendation Methodology

A computational matrix was developed to ascertain unit utilization ratios as resources are adjusted to target levels. Specifically, using staffing data (available minutes) and workload data (consumed minutes) to calculate the percentage of available time consumed by calls for service, equally weighted by time and day, an adapted version of the unit utilization matrix was produced. The matrix was designed to allow for the modification of available unit-minutes by adjusting the percentage of resources allocated to each district.

Available unit-minutes were manipulated by adjusting the percentage of resources assigned to each time block and to each day of the week. By adjusting the available unit-minutes in a systematic manner, the target utilization ratio could be attained. For example, in order to attain an average unit utilization ratio for each district, at each time and day of the week within a 24 hour period, incorporating a full seven day period at a 50% level, each district available unit-minutes was increased by the percentage necessary to meet this target. This percentage increase was then translated from the target available unit-minutes into the number of officers required to reach this level of utilization. Once this figure was calculated it was then a matter of determining how many officers were required to distribute equally to each team within the districts and to adjust the figure to compensate for the deployment of one and two officer units and specific nuisances of a proposed shift model. The Department policy of a 60/40 ratio between one to two officer units was used.

For each district, a figure was obtained that captured the true number of officers that respond to calls for service as a normal function of their position. Each district's authorized strength was then calculated using the same exclusions that were used in the "*Units Considered*" section of this report. In particular, the following units and individuals were not included as deployable patrol officers that respond to 911 emergency service calls: Patrol team supervisors, Mounted Squad, Waterfront Unit, Marine Squad, Youth Squad, Community Policing Officers, School Liaison Officers, and Car 86 and Car 87. As well, District 1 surveillance team was excluded, as was CET/BET; as their primary function is proactive policing activities, versus exclusively responding to 911 emergency calls. Given these exclusions, the adjusted figure more accurately reflects the number of officers within the Patrol Division that are tasked with responding to dispatched calls. This

figure may differ slightly from the official authorized strength figures for each district.

8.4 Resource Requirements

The following section details the exact number of officers necessary for each district, in order to meet a target efficiency of a 50% utilization ratio. Subsequent to this section will be a detailed examination of the number of officers needed to meet a 40% utilization ratio, using the same methodology and benchmarks. While from a policing perspective a 40% utilization ratio is preferred, budget constraints, electoral satisfaction, service levels and organizational objectives must be considered as part of the decision making process. For these reasons, both options are presented so that management, the Police Board and elected officials can weigh the implications of each option, and make an informed decision as to the best possible approach.

8.4.1 Proposed 50% Utilization

Overall, in order for the VPD Patrol to reach an acceptable level of efficiency, where the delivery of emergency services are no longer an issue and proactive work and more thorough investigations can occur, an additional 82 constables are required within the three districts. The addition of 82 constables will provide sufficient resources to meet a benchmark that an average of 50% of officer time will be consumed responding to calls for service. This standard will be equally applied to every district and will adjust staffing so as to provide a consistent level of policing, regardless of location within the city.

The figures listed below do not include supervisory positions, which would vary according to the modified shift model adopted by the Department. Typically, each additional team requires one supervisory sergeant. In situations where new positions are integrated into existing teams, an additional sergeant is only required when the span of control exceeds 14 constables. In situations of split teams, where the team composition is particularly low, such as below six constables, it is possible to share sergeants amongst two split teams. Each proposed shift model will provide details regarding supervisory span of control and the required sergeant positions.

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Adjusted Patrol Authorized Strength⁸

	District 1 ⁶⁷	District 2 ⁵	District 3	District 4	Total
Current Patrol Team Staffing	89	98	119	103	409
Authorized Strength % Adjustment ¹	27%	22%	30%	24%	
Evaluated Resource Total ²	113	120	155	128	515
District Increase	24.0	21.6	35.7	24.7	106
Factored Team Increase ³	-33	0	0	1	
Adjusted District Increase⁴	0	22	36	24	82
Percentage Proactive Time	50%	50%	50%	50%	
Percentage Allocated Time	50%	50%	50%	50%	
New Patrol Team Staffing	122	120	155	127	524

Note:

1. Based on obtaining unit utilization percentage range below 50% weighted by day and time for each district
2. Figure based on the calculation (Patrol Team x Percent Adjustment).
3. An adjusted figure that takes into account an even distribution of officers for each patrol team within the district. All districts have ten teams that respond to calls for service. Furthermore, the staff increase for each team is adjusted to compensate for one and two officer units in order to impact unit utilization to the level stated.
4. The actual number of officers required per district in order to effect change in the unit utilization ratio to the level stated.
5. Based on District 2 authorized strength, but excluding CET/BET staffing. See analysis section for complete explanation of FTE figures.
6. Excludes recent addition of 33 officers to District 1 that only became deployable in late 2005 through mid 2006.
7. On October 4th 2005 the VPD increased the number of officers in District 1 by 33. This resulted in patrol teams increasing from a norm of 9 to a new norm of 13 person teams. The authorized strength for PCs in District 1 is now at 122 officers.
8. These numbers do not include Sergeants (supervisors)

Looking only those patrol teams that exclusively respond to calls for service, the current aggregate total is 409 constables distributed between the four districts. By adopting the recommended staff increase to attain optimal efficiency, the total number of constables responding to calls for emergency service would increase to 524.

Specifically, in order for District 1 to obtain target efficiency, whereby patrol officers spend 50% or less of their time responding to calls for service, the district will need to increase the number of 911 responder units by 27%. Therefore, District 1 will need to bolster its strength from its complement of 89 constables to a minimum of 113 constables.

However, the District 1 recommended staffing increase is not included in the current patrol submission. The reason for this exclusion is due to a previous staffing request in 2005 that resulted in an additional 33 officers being assigned to this district by 2006.

While the additional officers were added to the authorized strength in mid 2005, the recruit and training process is quite lengthy and it takes approximately 9 months of Academy and Field Training before a new recruit is considered a deployable resource.

For these reasons, and the fact that the current study examined the period from 2000 to 2005 inclusive, the new positions were not incorporated into the evaluation. As well, the 33 new constable positions that were added to District 1 exceed the current district evaluation by nine positions. It should be recognized that the current workload and utilization for District 1 has been underestimated due to the liquor squads (Lima units) and the Firearms Interdiction Team (FIT). These units were deployed on weekends to deal with the street disorder in the Entertainment District, and the gang and gun violence that has become commonplace in District 1. In fact, more than nine officers were deployed to Lima and FIT to deal with the unique problems that have developed over time in District 1. By deploying these extra squads in District 1 it took a significant workload away from the regular patrol units that would have had to deal with these issues otherwise. The full impact of these 33 constables has not been evaluated, given they only became fully operational in the summer of 2006. A follow up evaluation in mid-2007 will need to be conducted to examine the net benefit from these positions over a one year period.

The projected staff requirements for District 1 are then included in this report for comparison purposes only, as the 2005 staffing allocation to VPD has already addressed this need. Further, the proposed shift modifications require an equal allocation of resources amongst the four districts, which is relevant to follow-up discussions and explanatory sections below. Therefore, it is necessary to look at the resources required across every district to fully evaluate the various shift models put forward below.

As previously stated, District 2 had the lowest utilization ratio in the Patrol Division. In order to meet target efficiency, this district will require the lowest contingent of constables compared to the other districts. Currently, there are 98 constables that respond to calls for service. The district requires an additional 22 constables to reduce the percentage of time consumed by responding to immediate calls for service to 50%.

District 3 requires the largest increase in patrol team staffing after in order to meet minimum target efficiencies. At present, the district has 119 constables distributed amongst ten teams that respond to dispatched calls. The proposed efficiency level for District 3 requires patrol strength to increase by 30% to reach a unit utilization ratio of 50%. This would require 36 constables distributed amongst the teams. With four additional constables allocated per team, the total deployable strength will increase to 155 constables, bearing in mind that this figure only refers to those officers that respond to calls as a regular function of their position.

**50% Utilization Ratio
 Adjusted Resource Distribution by District¹**

	District 1	District 2	District 3	District 4	Total
Consumed Patrol Unit Minutes	2,539,691	2,424,143	2,743,295	2,500,998	10,208,126
Percent of Total Consumed Minutes	25%	24%	27%	25%	100%
Available Unit Minutes	5,856,514	5,581,633	6,297,145	5,732,283	23,467,575
Percent of Total Available Minutes	25%	24%	27%	24%	100%
Number of Calls	32,749	49,606	35,117	38,981	156,453
Percent of Total Calls	21%	32%	22%	25%	100%

Unit Utilization

50% 50% 50% 50%

1. The 50% utilization factor considered a 13.6% unavailability factor as part of the available unit minutes to address Collective Agreement meal breaks.

District 4 requires the second lowest number of additional officers in order to meet the objective of 50% of officer time spent responding to service calls. Given the current deployable strength of 103 constables, District 4 requires an additional 24% to meet this goal. In real terms, this translates into 25 additional officers allocated amongst the ten teams. The total number of district patrol officers would then increase from 103 to 128.

8.4.2 Proposed 40% Utilization

Following from the 50% utilization section, the total officers required within the Patrol Division to meet a 40% utilization ratio is 611. This is based on an existing city-wide authorized strength of 409 and an additional 202 officers distributed throughout the four districts. As was the situation with the 50% utilization analysis, District 1 staffing is modified to incorporate the 33 officers the district received as part of the 2005 staffing request. Therefore, any projected staffing increases for District 1 factor in the existing 33 new officers.

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Adjusted Patrol Authorized Strength⁸

	District 1 ^{6,7}	District 2 ⁵	District 3	District 4	Total
Current Patrol Team Staffing	89	98	119	103	409
Authorized Strength % Adjustment ¹	58%	52%	62%	55%	
Evaluated Resource Total ²	141	149	193	160	642
District Increase	52	51	74	57	233
Factored Team Increase ³	-19	-1	0	1	
Adjusted District Increase⁴	20	50	74	58	202
Percentage Proactive Time	60%	60%	60%	60%	
Percentage Allocated Time	40%	40%	40%	40%	
New Patrol Team Staffing	109	148	193	161	611

Note:

1. Based on obtaining unit utilization percentage range below 40% weighted by time and day for each district
2. Figure based on the calculation (Patrol Team x Percent Adjustment).
3. An adjusted figure that takes into account an even distribution of officers for each patrol team within the district. All districts have ten teams that respond to calls for service. Furthermore, the staff increase for each team is adjusted to compensate for one and two officer units in order to impact unit utilization to the level stated.
4. The actual number of officers required per district in order to effect change in the unit utilization ratio to the level stated.
5. Based on District 2 authorized strength, but excluding CET/BET staffing. See analysis section for complete explanation of FTE figures.
6. Excludes recent addition of 31 officers to District 1 that only became deployable in late 2005 through mid 2006.
7. On October 4th 2005 the VPD increased the number of officers in District 1 by 33. This resulted in patrol teams increasing from a norm of 9 to a new norm of 13 person teams. The authorized strength for PCs in District 1 is now at 122 officers.
8. These numbers do not include Sergeants (supervisors)

Specifically, District 1 requires 20 additional officers over the 33 it has already received, to achieved a 40% utilization. This would result in a total district authorized strength of 141 officers compared to the current 122 officers, including the 33 recently deployed and the elimination of the district surveillance team. The recommended elimination of the district surveillance team provides an additional 9 officers to be added to the authorized strength as well. This redeployment is explained in detail in the proposed shift models outlined below. However, it is fair to say that the elimination of the district surveillance team is a proactive measure aimed at eliminating internal inefficiencies and maximizing the number of deployable officers in patrol.

District 2 requires the second lowest number of officers compared to the other districts to reach an optimal utilization ratio. Based on a current staffing of 98 officers, District 2 staffing would need to increase by 51 additional officers to reach a 40% utilization. The district authorized strength would then move to 148 total officers.

District 3 currently has an authorized strength of 119 constables. At 40% utilization this would increase by 74 officers to a total of 193 constables, the largest district increase in patrol. District 4 follows closely behind with the second largest increase in patrol. An additional 57 officers need to be added to its existing strength of 103, for a total of 161 officers.

8.5 Proposed Shift Models

8.5.1 Overview

To address systemic inefficiencies with the current shift deployment model three proposed models have been designed that will correct this problem with varying degrees of improvement and efficiency gains. When examining these proposed changes it is important to note that no one deployment model can create a perfectly efficient system. While one model may create a statistically ideal and efficient deployment in terms of patrol utilization, it may also introduce new issues that impact efficiency and cost effectiveness. Patrol efficiency goes beyond maximizing the amount of officer time available to respond to emergency calls and includes striking a balance between response times, effective policing strategies and resource management considerations. Therefore, a more holistic approach is necessary that weighs the merits of deployment efficiency, quality of life for police officers, infrastructure support, span of control for supervisors, and changes in demands for emergency services.

The first deployment model that is examined (*Option A*) offers the best balance between the above noted considerations. As well, it offers the greatest efficiency gains with the lowest number of officers needed to support the model and with only marginal increases in infrastructure support. Other important factors relate to change management and implementation within the patrol. Those models that can integrate easily with the existing system and cause the least disruption in services, will ultimately make the transition more seamless. While not directly related to efficiency, these issues are still important concerns when making changes in any organization.

8.5.2 Proposed Shift Model Option “A”

Deployment Model Option “A” introduces two additional shifts in order to maximize efficiency over a 24 hour period and to adjust for service demands over a seven day period. These are the two major issues with the current deployment structure, in that it fails to adequately compensate for hourly fluctuations within a twenty-four hour period or adjust for a gradual increase in demands for service that starts building on Monday and eventually peaks on Sunday early morning (late Saturday night). Therefore, any efficiency changes will at a minimum, need to correct these shortcomings.

Other inefficiencies that are introduced by the current deployment model concentrate around shift start and end times that do not adequately overlap at times of high demand for service. This has a magnifying effect, in that a one hour period of ill matched shift

new modified Charlie shift will be kept to a minimum. Four teams of approximately nine to 12 constables, depending on the district, will be required for a Department-wide rollout.

In addition to the creation of a new fixed shift for each district, there is an added requirement for resources to address demands for service throughout the entire week and to compensate for ill matched shift changes primarily seen in the afternoon and evening. While Monday typically has approximately a 10% drop in demand for service, there are still peak times of inefficiency created by the current shift model. To compensate for these peaks in resource utilization, a second 'fixed shift' is required. As a result of the net gains in efficiency from the modified Charlie shift, a reduced number of officers are required for the second fixed shift. Therefore, a new shift deployed as a city-wide resource will meet the remaining service demands and compensate for shift overlap. The new shift, a 'fixed' modified Charlie, will work a four 'on' and four 'off' rotation requiring a total of two squads to staff. Each team will work an 11 hour shift with a staff of 14 constables each.

This city-wide resource, otherwise known as a 'roving patrol' team or 'Metro team', will provide the flexibility to deploy officers throughout the city wherever the demand is greatest and will account for daily fluctuations. As well, the team can be split and sent to any district to help reduce stacked calls or other unanticipated developments. The new modified Delta shift will have a fixed start and end time of 3:00 pm to 2:00 am (everyday). The combination of the new modified fixed Delta and Metro fixed Delta shift will address the inefficiencies seen in the current deployment model, while requiring the fewest officers to accomplish the greatest gains. A total of six new squads will be required to staff this model, with four teams for the new modified fixed Charlie shift and two for the modified fixed Delta roving shift.

Other benefits of this model include the ability to phase in components over a gradual time frame. For example, the Metro roving teams can be created with only 28 patrol officers and two supervisors. This option will still have a marked impact on patrol efficiency, with no modifications required of the existing shift deployment model. This strategy could be implemented until such time as the fixed Delta resources are available for district-wide augmentation.

The officer staffing for this model, whether at a 50% or a 40% utilization, is detailed in the tables that follow. Each district's specific needs are taken into account with this staffing estimate, including internal staffing redeployments that advance internal efficiency and help address patrol resource issues in the most cost effective manner. As well, supervisory positions are added to the staffing table according to the needs of each option. While supervisory positions were not included as part of the calculation, the general rule is that each team requires one sergeant and any team over 14 constables requires additional supervision due to the larger span of control. These general rules were applied in the allocation of supervisory positions in each model.

8.6 Internal Efficiency Issues with Patrol

In addition to the creation of a fixed 4/3 Delta shift and a Metro roving team under Option “A”, several internal efficiency modifications are also required to field as many patrol officers as possible. For example, current practices include every district maintaining its own district surveillance team. The staffing for these surveillance teams are skimmed from teams 3 through 10 in each district, creating a seven constable and one sergeant special project / surveillance team.

This is problematic for several reasons. First, the authorized strength for each district does not accurately reflect the true staffing deployment within each district. With the exception of District 1, which has its surveillance team counted as part of its actual authorized strength, namely team 11, the remaining districts simply loan the officers from each team. Second, by loaning up to seven constables and 1 sergeant from each district to an ad hoc surveillance team, on an indefinite basis, and in some cases several years, the remaining officers are left to compensate for the reduced staffing levels. This creates further problems for maintaining minimum staffing on busy weekends and for the individual officers themselves, who find it difficult to book leave with a understaffed team. Additionally, by reducing each team’s strength by one person, there are less officers available to take calls in each district, thereby leading to a higher utilization ratio and call stacking. While the reduction of one person per team is not a significant driver in elevating the utilization ratio, at times when the call load is already elevated, any reduction in available minutes will likely compound the problem.

To address the necessary and important work that these units fulfil, it is recommended that two patrol based surveillance teams be created using resources drawn from each of the four districts. The various shift model options outlined below provide a template for the best use of these officers in addressing the current resource inefficiency while still maintaining a surveillance capability spread between the North and South districts. The solution of creating two properly equipped and staffed surveillance teams will free up approximately 10 constables for redeployment back into squads that actively respond to calls for service. As well, the creation of the two new surveillance teams effectively stops the current practice of loaning out officers to special projects without adequate adjustments in the district resources to compensate. In practical terms, a newly created Patrol North Surveillance Team will be shared between District 1 and 2, and a new Patrol South Surveillance Team will be shared between District 3 and 4. The Patrol North Surveillance Team is a progressive step towards eliminating individual district surveillance teams and amalgamating resources between two consolidated surveillance teams.

It is recommended that the District 1 Team 11 Surveillance Team, District 2 Rapid Action Team (RAT), the District 3 Street Crime Enforcement Unit (SCEU), and District 4 Property Crime Reduction Unit (PCRU) be disbanded and the officers currently staffing these adjunct units return to regular patrol duties. Some of these officers will be used to create a Patrol North Surveillance Team and a Patrol South Surveillance Team. It is further recommended that the Deputy Chief of the Operations Division establish a policy directive

that prevents future adjunct specialty squads from being created within patrol and that the practice of loaning officers out of patrol without receiving a replacement cease immediately. As is evident, both these current practices add to the issues patrol is facing and negatively affects the ability of patrol to manage its high call load. In contrast, measures such as the above should be endorsed to maximize the number of officers that are deployed and able to respond to emergency calls for service.

8.7 Shift Model Implementation Option “A”

To adequately staff patrol to meet the projected utilization ratio of 50%, an additional 82 officers are required. In addition, several modifications to the current deployment model must take place to facilitate this transition. At a 50% utilization ratio, the creation of the District 1 4/3 fixed Delta team requires a redistribution of existing district resources to accomplish the creation of a new team. This is based on the fact that 33 new constables were added to District 1 in 2005 and no other new resources will be transferred to this district. Any further additions to the authorized strength will be distributed to Districts 2 through 4 according to the implementation plan outlined below.

The current District 1 team composition of 13 constables will need to be dropped to 12 constables, with the 8 constables coming from teams 3 to 10 and the remaining 3 coming from the redeployed District 1 Team 11 surveillance team. In detail, the 9 constables from the District 1 surveillance team are divided between the creation of an 11 constable fixed 4/3 Delta team and a newly created Patrol North Surveillance Team. Three constables from team 11 are to be used for the 4/3 Delta team and the remaining 6 constables form part of the district contribution to the amalgamated Patrol North Surveillance Team.

District 2 is projected to receive 22 additional constables to reach a 50% utilization in this district. As well, the disbandment of the RAT will provide an additional seven constables for redeployment. Six of those officers from District 2, plus three constables and a sergeant from Team 11 in District 1 will form the new Patrol North Surveillance Team. The remaining staff are distributed amongst the new fixed 4/3 Delta shift (9), the Metro roving team contribution (7) and the district patrol teams (6).

District 3 is predicted to receive an additional 36 new constables. The creation of the amalgamated district Patrol South Surveillance Team sees five officers contributed to that undertaking, with the remaining three (2 constables and 1 sergeant) redistributed back to the district. From the 36 new constables, 12 form the new fixed 4/3 Delta and 13 go to the Metro roving team and 11 are distributed amongst the 10 teams.

For District 4, four officers from the PCRU help form the Patrol South Surveillance Team, and three are redeployed back into patrol. From the 24 new constables, 9 create the 4/3 fixed Delta shift, 8 contribute to the Metro roving team and 7 augment the existing patrol teams.

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The distribution of resources and breakdown of staffing for both a 50% and 40% utilization is detailed in the following tables:

50% Utilization Staffing Projections

Option A

	Team	Redeployed to Patrol	Combined Tm	Delta (4/3)	Roving	Total	New FTE
	Increase	Officers	Increase	4 Teams	2 Teams	6 Teams	Increase
District 1 ¹	-8	3	0	11 (8 + 3)		11	
District 2	6	4	10	9	7	16	22
District 3	11	3	14	12	13	25	36
District 4	7	3	10	9	8	17	24
Team Supervisor North		4		4	2	6	4
Surveillance South		9 ([D1] 6 + [D2] 3)					
Surveillance South		9 ([D3] 5 + [D4] 4)					
PC Only Total				41	28	69	82
Total	24	35	34	45	30	75	86

Note: 2% efficiency gain over Option B
 1. District 1 - Team 3 to 10 reduces in size from 13 to 12 constables.

40% Utilization Staffing Projections

Option A

	Team	Redeployed	Combined Tm	Delta (4/3)	Roving	Total	New FTE
	Increase	Officers	Increase	4 Teams	2 Teams	6 Teams	Increase
District 1	3	3	6	11	6	17	20
District 2	34	4	38	9	7	16	50
District 3	54	3	57	12	8	20	74
District 4	42	3	45	9	7	16	58
Team Supervisor North		4		4	2	6	4
Surveillance South		9 ([D1] 6 + [D2] 3)					
Surveillance South		9 ([D3] 5 + [D4] 4)					
PC Only Total				52	28	69	202
Total	133	35	146	56	30	75	206

Note: 2% efficiency gain over Option B

8.7.1 Proposed Shift Model Option “B”

Deployment Model Option “B” is very similar to the first model proposed with a few minor alterations. In lieu of the fixed modified Delta shift that is four days on and three days off, the alternative model has the fixed modified Delta shift work a four ‘on’ and four ‘off’ rotation. This four day rotation more closely emulates current shift cycles, in that each team would work an 11 hour shift starting at 6:00 am and ending 5:00 am. Because this shift does not mirror a seven day cycle, and it advances one day forward every eight day

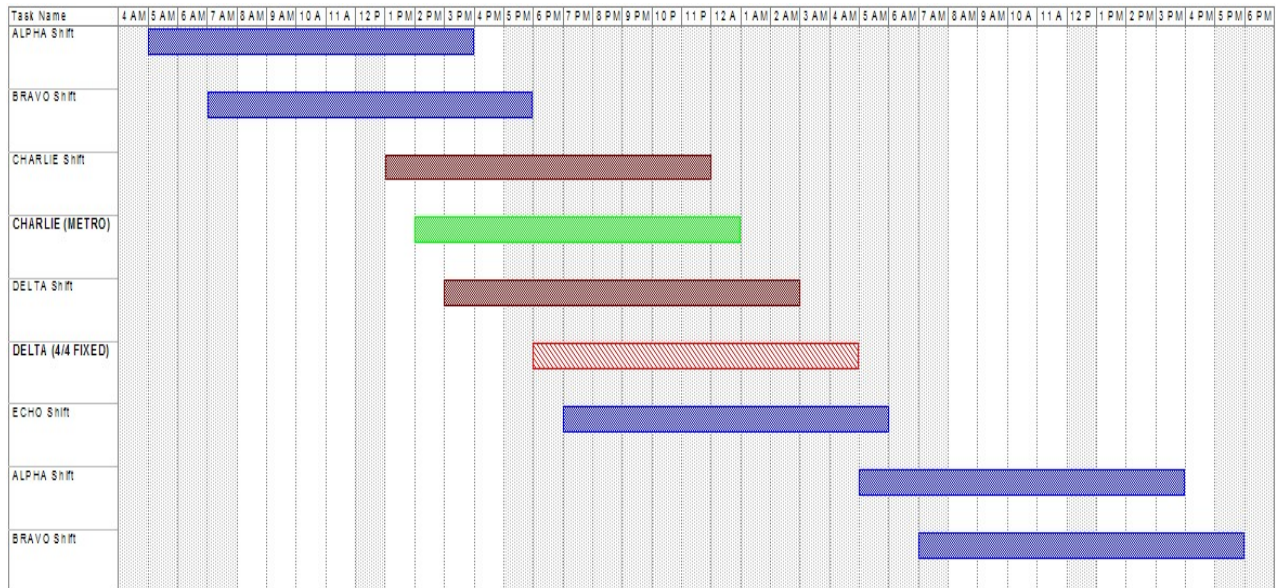
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cycle, there is a need to staff the shift throughout the entire rotation. Otherwise known as an 'odd' and 'even' shift, the modified fixed Delta shift will require between nine and 12 constables, depending on the district, for each of these teams. While not matching the weekly call-load increase as efficiently as the first model, this model does provide additional resources throughout the week that could be used for proactive policing initiatives. Proactive policing is an important component to any patrol deployment because it functions to reduce the call load by addressing problems in a more concerted and focused manner. The alternative is to constantly respond to the same issues every week rather than directing solutions at the problem. By deploying strategies to solve problems in a consistent manner, a net reduction in the issues that generate call load can be achieved.

The positive attributes of the fixed Delta shift is the ability to alter start and end times to accomplish a greater degree of efficiency. While not possible with Option "A" because of the 4/3 Delta only working four days, the 4/4 Delta shift permits the modification of shifts that start before it and end after it. Because the fixed Delta shift maintains the same level of coverage throughout the week, altering the other shifts will not create further issues. However, if the same strategy was attempted with *Option "A"* it would create times of greater inefficiency on the remaining three days when there is no 4/3 Delta coverage. For this reason, Charlie and Delta shift are only modified under this Option.

Specifically, Charlie shift alters its start time to 1:00 pm and an end time of midnight. Further, Delta shift switches to a start time of 3:00 pm and an end time of 3:00 am. With the shift modifications in place, there are a greater concentration of resources during times of highest demand, while still maintaining an adequate coverage and matching of resources throughout the remaining 24 hour period.

PROPOSED SHIFT DEPLOYMENT MODEL ALL DISTRICTS "OPTION B"



Just as the *Deployment Model Option "A"* detailed, there is a need for resources to address demands for service throughout the entire week and to compensate for ill matched shift changes primarily seen in the afternoon and evening. The new Metro fixed afternoon shift will compensate for lack of shift overlap. As in the previous model, the new Metro shift will work a four 'on' and four 'off' rotation, requiring a total of two squads to staff.

The flexibility of a 'roving patrol' team is that it can be sent throughout the city wherever the demand is greatest. The combination of the new modified Delta and the new Metro shift will address the inefficiencies seen in the current deployment model. However, this model requires more officers in order to reach efficiencies that are equal to those expected in *Deployment Model Option "A"*. A total of ten new squads are required to staff this model, with eight required for the modified fixed Delta and two for the fixed Metro roving shift. For that reason alone this model is a secondary recommendation.

The officer staffing for this model, whether at a 50% or a 40% utilization, is detailed in the below table. Each district's specific needs are taken into account with this staffing estimate, including internal staffing redeployments that advance internal efficiency and help address patrol resource issues in the most cost effective manner.

8.8 Shift Model Implementation Option "B"

Following a similar process as Option "A" for a 50% utilization ratio, Option "B" requires two (2) constables to be drawn from teams 3 to 10 in District 1, in order to staff the shift model without additional resources beyond the already 33 allocated to the district in 2005. By reducing the number of constables in each of the eight teams, 16 staff are now available for reallocation. However, Option "B" involves the creation of two fixed Delta shifts per district (odd and even shift), unlike Option "A" which only required one new shift per district with the 4/3 model. District 1 requires a 22 constable fixed 4/4 Delta team to effect change in the district and address shift inefficiencies. With that in mind, an additional six more constables are required for District 1. The elimination of the District 1 Team 11 surveillance team provides the necessary 6 constables to create a fully staffed fixed 4/4 Delta shift. The remaining 3 constables and 1 sergeant from the 9 person team are attached to the shared Patrol North Surveillance Team.

District 2 contributes the remaining 6 officers to staff the Patrol North Surveillance Team, for a total of 9 officers and 1 sergeant. One officer and one sergeant return to the district in a capacity to respond to calls for service. From the 22 (adjusted to 23 for even staffing) new positions allocated to the district, 7 are slated for the Metro roving team and 16 are allocated to the 4/4 fixed Delta team.

District 3 allocates 5 officers from the eliminated SCEU to the Patrol South Surveillance Team and the remaining 3 officers are reintegrated back into patrol. From the District's allocated 36 new officers, 12 help form the Metro unit roving and 24 create the 4/4 fixed Delta shift.

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District 4 has 4 officers transfer to the Patrol South Surveillance Team and the remaining 3 (2 PCs and 1 Sgt) return to the Districts patrol strength. District 4 is predicted to receive 24 new officers, of which 7 will contribute to the Metro roving team and 17 will create the fixed 4/4 Delta shift.

The following tables outline in detail the distribution of staff for the Option “B” shift model, both with a 50% utilization and a 40% utilization.

50% Utilization Staffing Projections

Option B

	Team Adjustment	Redeployed Officers	Combined Tm Increase	Delta (Fixed) 8 Teams	Roving 2 Teams	Total 10 Teams	New FTE Increase
District 1 ¹	-16	6	0	22 (16 + 6)		22	
District 2		1	1	16	7	23	23
District 3		3	3	24	12	36	36
District 4		3	3	17	7	24	24
Team Supervisor		4		8	2	10	8
North Surveillance		9 ([D1] 3 + [D2] 6)					
South Surveillance		9 ([D3] 5 + [D4] 4)					
PC Only Total		31		78	26	104	83
Total	-16	35	7	86	28	114	90

Note:

1. District 1 - Team 3 to 10 reduces in size from 13 to 11 constables.

40% Utilization Staffing Projections

Option B

	Team Adjustment	Redeployed Officers	Combined Tm Increase	Delta (Fixed) 8 Teams	Roving 2 Teams	Total 10 Teams	New FTE Increase
District 1	0	4	4	22 (20 + 2)	6	28	20
District 2	25	1	26	18	7	25	50
District 3	46	3	49	20	8	28	74
District 4	33	3	36	18	7	25	58
Team Supervisor		4		8	2	10	8
North Surveillance		9 ([D1] 3 + [D2] 6)					
South Surveillance		9 ([D3] 5 + [D4] 4)					
PC Only Total		29		78	28	106	202
Total	104	33	115	86	30	116	210

Note:

1. From the 20 officers deployed to District 1,

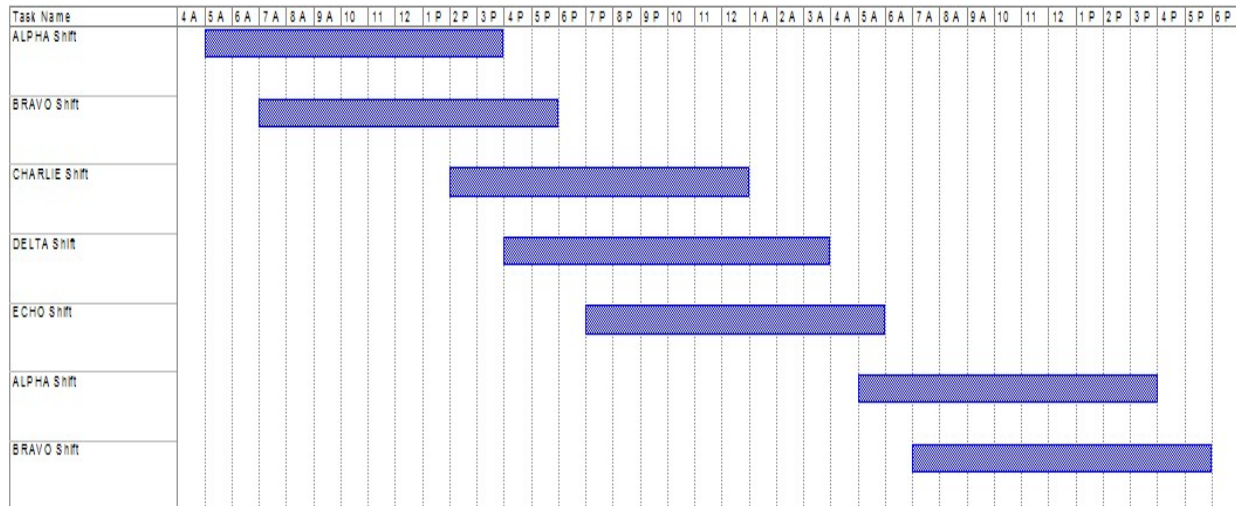
8.8.1 Proposed Shift Model Option “C”

A third option involves maintaining the existing deployment model with no changes, but

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redistributing the estimated 82 new patrol constables to Districts 2 to District 4. Under this proposed model, District 1 would not receive any new patrol constables as the new constables would only be distributed amongst the remaining three districts. The distribution of constables would be in relation to district size, call-load and the utilization ratio. Specifically, District 2 would receive 22, District 3 would receive 36, and District 4 would receive 24 patrol constables. As well, patrol efficiencies discussed in detail in the preceding sections would also be incorporated into the redistribution. In other words, District 2 would regain much of its authorized strength by the elimination of the district surveillance team and the creation of a shared Patrol North Surveillance Team. The same would apply to Districts 3 and 4, and the creation of the Patrol South Surveillance Team. Further, the elimination of the current practice of using Charlie and Delta teams for special projects would apply to this model, thereby maximizing the utilization of existing resources. The existing Delta shift would continue to extend from 4:00 pm to 4:00 am (12 hours) throughout the districts and minimum staffing levels would be properly adjusted to match call-load.

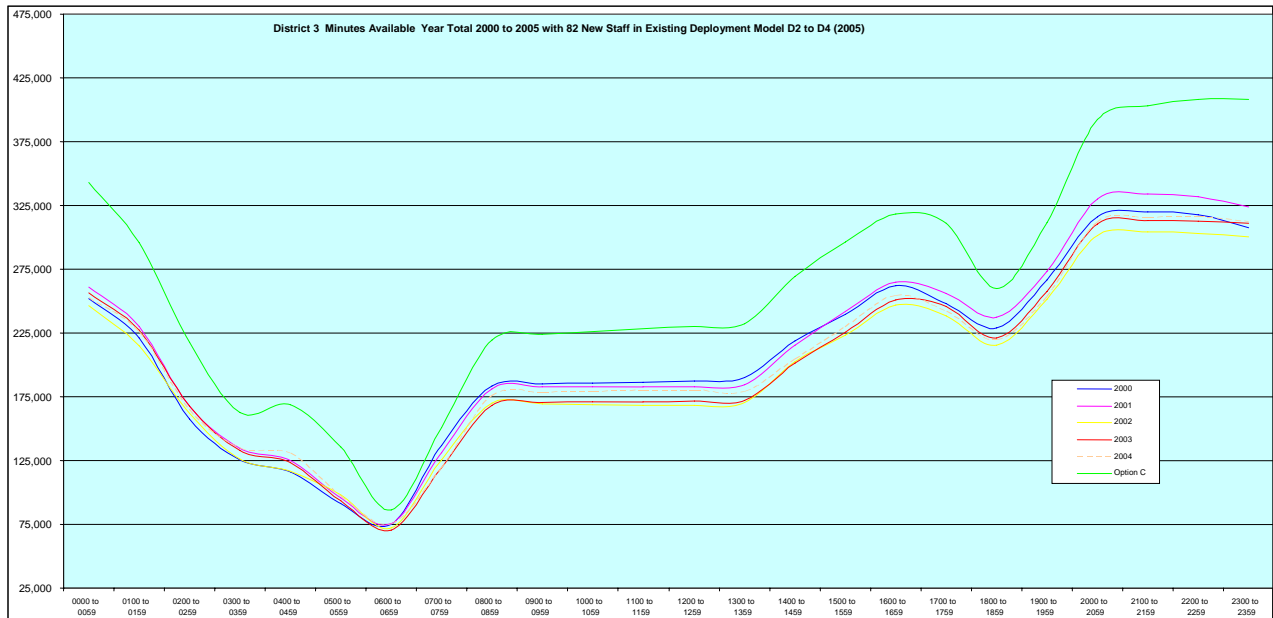
CURRENT SHIFT DEPLOYMENT MODEL ALL DISTRICTS 2006/02/06 TO CURRENT



By adhering to the above criteria, and the addition of 82 new constables to patrol, an average utilization of 50% is still obtained with this model. However, this figure does not fully account for district efficiencies and maximizing the use of resources. As detailed throughout this report, one of the major shortcomings of the existing patrol deployment model are periods of both high and low utilization. This is typically a result of poor deployment scheduling that fails to adequately pair resources to call-load. The subsequent peaks and lows indicate periods of extreme activity or inactivity. In either case, there is an abundance of resources disproportionate to the demand, or an inadequate allocation of resources to meet demand. Regardless, each type of variability are indicators of periods of inefficiency. Other areas of concern rest in the fluctuation between the two extremes that create further problems for officers and exemplify a shift deployment model that artificially generates heightened periods of stress and anxiety.

An examination of these factors provides some insight into the situation. This is done

using a predictive model, based on the redistribution of resources according to the proposed deployment option, covering a 24 hour period of deployment. To start, additional constables distributed throughout the districts have a positive affect on the available minutes compared to previous years. For example, the chart below illustrates a gain in resources available to take calls in District 3 compared to previous years without the additional constables or internal efficiency gains. Clearly, the additional officers deployed in the existing model demonstrate an improvement over past years.

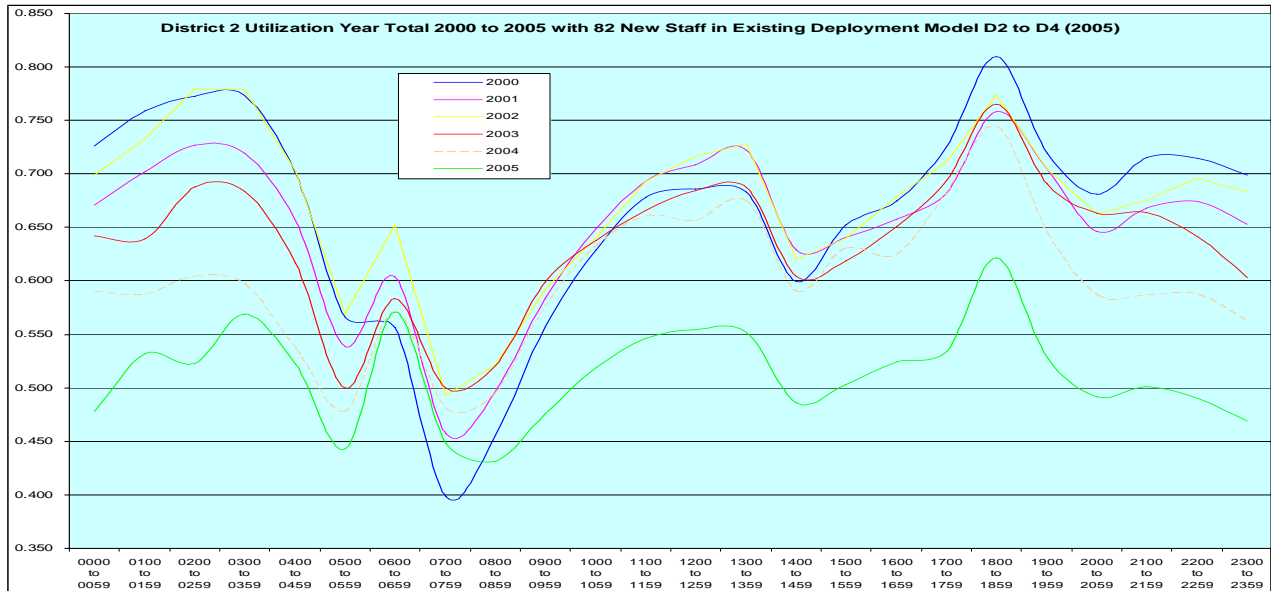


While the additional officers illustrate a net gain in the total available minutes over a 24 hour period, this does not provide a complete representation of the situation. A district by district examination of the predicted utilization ratio will help explain some of the issues related to this option.

While District 2 has an *average* utilization ratio of 50%, there are 14 times through the 24 hour period where the ratio peaks over 50% and there are nine (9) times throughout the same time frame where utilization drops below 50%. Looking specifically at the extremes, utilization reaches a high of 62% and a low of 43%, each illustrating periods of substantial inefficiency.

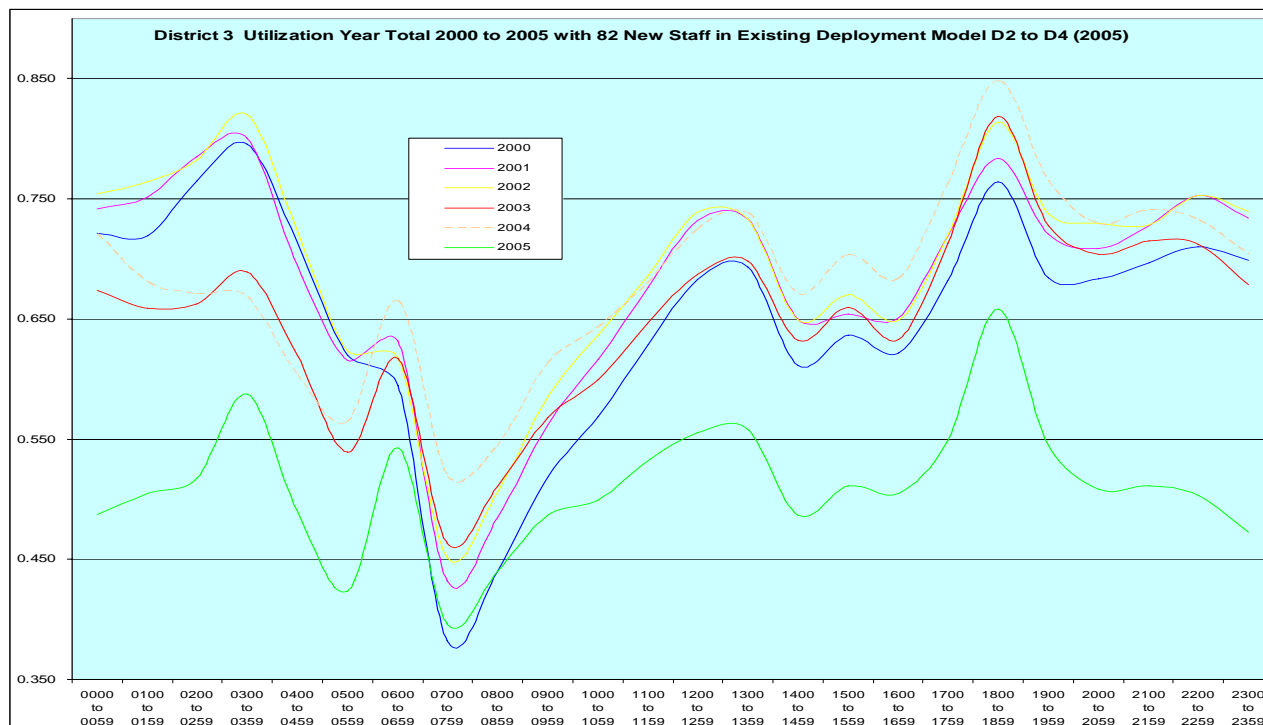
A special notation on measurements of central tendency may help explain this effect. When measuring central tendency such as the mean (average), the purpose is to summarize in a single value the typical size or central location of a set of values. The most familiar measure of central tendency is of course the mean. However, some data-sets have a skewed distribution, when the values are much larger or smaller than the typical values found in the data set. Because it is affected by all the values of the variable, the mean can lose its representative quality in badly skewed data sets. When this occurs it is important to account for dispersion or variability in the data-set. By measuring the spread in a data-set it is then possible to compare distributions with the same mean

(average) and different dispersions. The simplest way to measure dispersion is by providing the range, which are the highest and lowest values recorded, as indicated above, District 2 has a range of 43% to 62%. An efficient deployment model is premised on reducing skew around the mean and maintaining a concentration around the central tendency. It is for this reason that additional shifts were created in the proposed models detailed in Options “A” and “B”.



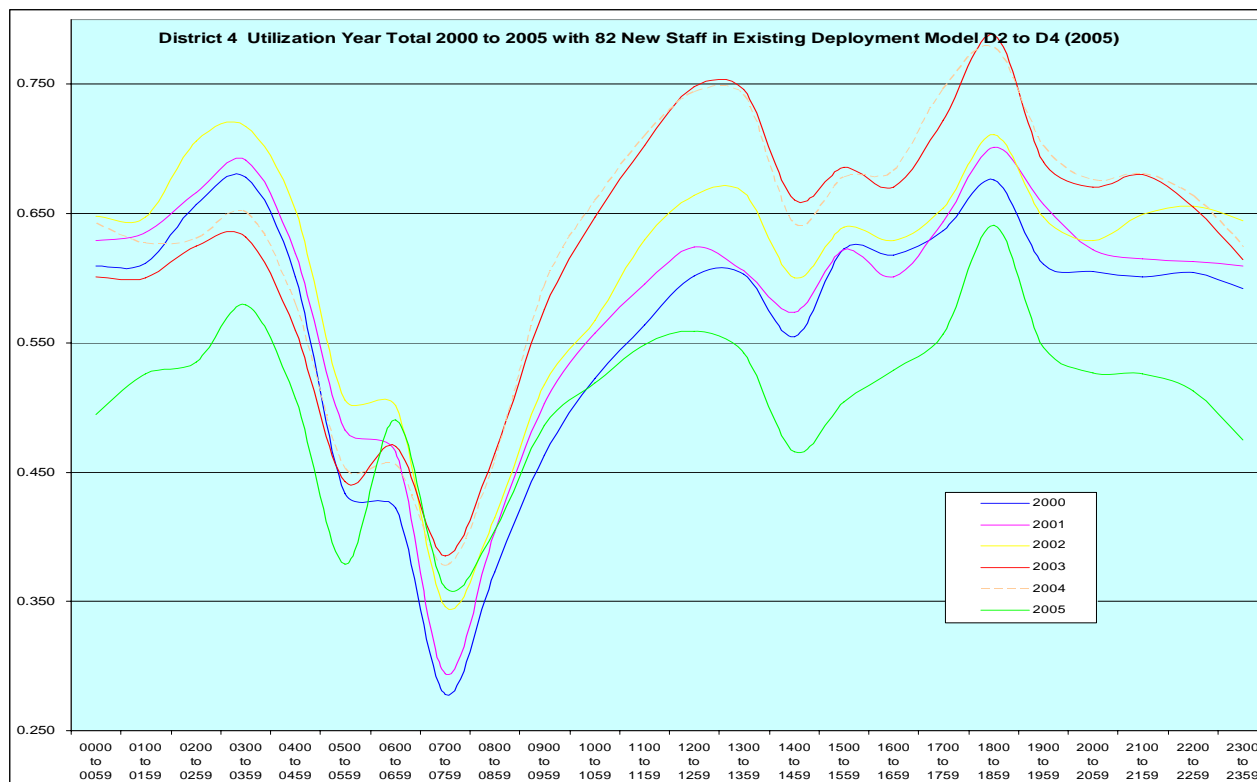
As was the case with the existing shift deployment model, there are still periods of peak inefficiency in District 2 that are not addressed by simply adding more constables to a poorly structured deployment model. Similar to the previous six years, 6:00 pm is problematic, as it reached peak utilization well above 60%. As well, between the times of 1:00 am and 4:00 am, the current shift deployment model fails to account for an elevated call-load and reduced resources; this combination results in an elevated utilization ratio.

District 3 experienced much of the same issues as District 2, in terms of periods of peak inefficiency, but with the added factor of greater fluctuations and extremes. For example, in terms of range, the uppermost utilization ratio was 66% and the lowest was 40%, indicating periods of significant inefficiency and dispersion. In other words, 66% and 40% measure how far away the peak and low utilization ratio are from the average of 50%. This is further reflected in the spread in the data, where nine times in a twenty-four hour period the utilization ratio was above 52% and four times it was below 48%. One of the goals of a shift deployment model is to reduce this amount of spread or scatter and to implement corrective measures that result in the values more tightly clustered about their mean.



As was the case with District 2, the additional constables in District 3 did little to address periods of systemic inefficiency seen over the past six years, but it did significantly reduce baseline utilization to within the 50% limit. Previous years illustrate how the utilization ratio was consistently above the 50% threshold, in fact rarely dropping below it. After the deployment of 36 additional constables within the district, it was only during periods of peak utilization, which was quite frequently observed in the chart above, that the ratio crossed the 50% mark. A more efficient deployment model, such as those outlined in Option “A” or “B”, would address times of peak inefficiency and correct the highs and lows observed with this model.

District 4 witnessed three distinct times where there were substantial peaks in utilization spread throughout the day. Mirroring much of the patterns seen in other districts, this indicates a shift model that generates deficiency in deployment; District 4 reached its highest point at 6:00 pm. Between the times of 6:00 pm and 7:00 pm was problematic for every district. This was due to Bravo shift ending at 5:00 pm and the next shift, Echo, not starting until 7:00 pm. The ending of Bravo occurs during a time of high demand for service, reflected in the elevated call-load. Yet this is the exact time when a crucial shift ends, generating a peak inefficiency. This one hour period of operating with a reduced number of officers creates a series of issues that takes hours to recover from. Whenever utilization peaks over 60% it can take the oncoming shift hours to adequately deal with the backlog of calls that have been placed in a priority queue. Therefore, even with the additional 24 constables added to the deployment model, the range for District 4 was 36% to 64%.



At 8:00 pm the utilization rate has still not completely recovered, hovering at 53%. However, this is still an improvement over 2004 when at the same time the utilization levelled at 67% after a sharp drop from a high of 78%.

Other factors to consider with this model are a phased in approach that can be accomplished with relative ease. While it is unlikely that 82 officers will be deployed simultaneously to correct the existing deployment deficiency, a phased approach could see up to 30 patrol constables allocated to the districts. Following a similar deployment pattern as the 82 officers detailed above, 30 officers would see an improvement in the average utilization ratio ranging from the current 2005 city-wide ratio of 66% to a low of 57%. The exact utilization rate would be dependent on the number of constables deployed per district and the implementation time frame. A cautionary note concerning the expected utilization ratio is required. While under optimal conditions 30 constables could be deployed relatively quickly and reach an average utilization rate of 57%, the same high and low issues that plagued the deployment of 82 would still hold true. A reduction in the baseline utilization ratio would be a welcome improvement over the current elevated rate; however, regardless if 30 or 82 officers are deployed, the current model fails to address even basic issues of inefficiency and the lack of shift overlap during times of peak call-load.

8.8.2 Proposed Shift Model Option “D”

The final deployment model offers the greatest potential for overall efficiency gains, but

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with several unintended consequences. The introduction of three new shifts in this model creates a need for a substantial increase in infrastructure support and supervisory control. Therefore, not only will the creation of three new shifts require the greatest number of officers to staff these positions, it will create a need for additional sergeant and inspector positions as well. Further, administrative support will need to be increased to accommodate these new teams and additional equipment support, such as vehicles, laptop computers and office space. When examining this model, these considerations should be weighed against the benefits of improved efficiency, as the overall cost for service support and additional officers may outweigh the gains in efficiency.

However, the adoption of three additional shifts will help reduce peak utilization and more efficiently distribute resources according to calls for service. There are three significant problems with the current shift model that create circumstances where resources are not deployed in a very efficient manner. First, gaps in service occur at critically busy times of the day. This is created by the erratic transition from one shift to another without the benefit of sufficient overlap or staggering. Second, during peak workloads, one shift will end and the replacement shift doesn't start for another hour. In this situation, the one-hour lag leaves the remaining shift scrambling to adjust to the lack of officers required for the call load.

While call volume has increased over the years, the times that are busiest have remained constant in each district depending on the day of the week. However, the current shift model does not field adequate shifts at the times that are busiest and pair resources to call load effectively.

The proposed shift model addresses these shortcomings and more effectively allocates resources to meet demand. This is accomplished through realigning the current shifts to more accurately mirror patrol utilization trends and by the addition of three new shifts, Split Bravo, Split Charlie and Split Echo shift. The creation of three new shifts allows for a more gradual augmentation of resources and provides greater flexibility to distribute shifts more efficiently based on resource utilization on an hourly basis.

Further, the proposed shift model maintains uniformity with the prior model, as much as practicable, to limit disruption and social impact on police officers. However, the ultimate goal was to eliminate periods of inefficiency, which by adopting the proposed system will virtually remove periods of extreme workload and provide an environment where officers can respond to calls for service in a uniform manner. By eliminating periods of severe fluctuation in workload, there will be an anticipated reduction in call stacking and an improvement in response times for emergency incidents. The projected gains in efficiency are in the 7% to 10% range, depending on the district and extent of the spikes during peak times. In districts where unit utilization reaches levels close to 100%, improvements to the shift model will result in more substantial gains in efficiency.

The current shift pattern of five distinct shifts should be replaced with a more efficient eight-shift model. The addition of three more shifts would allow for the overlap and staggering of teams that would still maintain the required 24-hour coverage, but it would

also reduce the extreme fluctuations in available unit-minutes based on call load demand.

There are too few officers in Patrol. Until this situation improves, an interim solution could incorporate the splitting of existing patrol teams to provide coverage for the three new shifts. In practical terms, this would require teams working these shifts to split, in order to provide overlap coverage. Upon rotation to the next shift, the teams would merge again and work as a consolidated team for the other shifts that do not require staggering.

Under the proposed schedule, team sergeants would be required to supervise both of the split shifts administratively. However, at those times when one of the split teams is working outside of the sergeant's normal duty hours, other on-duty sergeants would be required to assist in patrol supervision. Ultimately, the goal of the modified shift deployment would be to create fully staffed teams, rather than split teams. Additional sergeants will eventually be required to supervise the newly created teams once staffing is at a level where splitting shifts was no longer required and stand-alone teams were formed.

While the splitting of the teams and the addition of the three extra shifts will address the extreme fluctuation in unit utilization, the overall issue of operating levels well above the recommended 35% rate will only be resolved through the addition of more officers. Recommendations will be made, specific to each district, outlining the resources required in order to reduce unit utilization levels using the evaluative approach outlined below.

Considering current fiscal constraints, a shortage of police officers due to retirement attrition and logistics alone, a more realistic target for utilization is 50%. This figure is still obtainable given the realities of police budgets and furthermore, it still falls within the upper limits of acceptable allocated time. At this level, patrol could still operate efficiently, as only 50% of officer time would be committed to responding to calls for service. This would still allow the minimum time recommended in order for police to be able to engage in proactive initiatives and provide a level of service that promotes crime prevention, public satisfaction and a timely response to calls.

The adoption of three additional shifts will help reduce peak utilization and more efficiently distribute resources according to calls for service. There are three significant problems with the current shift model that create circumstances where resources are not deployed in a very efficient manner. First, gaps in service occur at critically busy times of the day. This is created by the erratic transition from one shift to another without the benefit of sufficient overlap or staggering. Second, during peak workloads, such as 6:00 pm, one shift will end and the replacement shift doesn't start for another hour. In this situation, the one-hour lag leaves the remaining shift scrambling to adjust to the lack of officers required for the call load. Third, the pattern that the call-load follows has been stable and consistent for the past five years or more.

While the volume has increased over the years, the times that are busiest have remained constant in each district depending on the day of the week. However, the current shift model does not field adequate shifts at the times that are busiest and pair resources to call load effectively. For example, 6:00 pm is consistently one of the more demanding

a new shift model, it is still obtainable using resourceful shift re-engineering. Until additional resources can be added to reduce the inordinate percentage of time spent attending calls for service, the current system can still be redesigned to function more efficiently.

Operating under the assumption that no additional resources can be added in the immediate future, the option still exists to redistribute current patrol officers according to the proposed shift model. Under the proposed model, Alpha and Delta shift would remain unchanged; however, the addition of Split Bravo, Split Charlie and Split Echo would alter the composition of Bravo, Charlie and Echo shift. Specifically, Bravo, Charlie and Echo shift would be split in half, with half the police officers moving to the newly created Split Bravo, Split Charlie and Split Echo shifts. Therefore, Bravo and Split Bravo shifts, while staffed by a single patrol team, will in fact be distributed between two distinct shifts with independent start and end times. Likewise, officers originally slated for only Charlie shift would now be split and distributed between two shifts and fill both Charlie and Split Charlie. The same process is then repeated for Echo and split Echo shift as well.

The splitting of Bravo, Charlie and Echo shift into six shifts would result in each shift being deployed with only half the regular complement of officers. In effect, each of these shifts would only be operating at half strength. The half shift deployment provides flexibility in arranging teams to match call load, but it also creates some organizational issues. Where in the past, it was only possible to arrange shift overlap of two, three or four fully staffed shifts, under the proposed system shift overlap can now incorporate shifts staffed by only half a team. For example, a shift with half the regular staff complement can now be arranged so as to provide extra overlap when less than a fully staffed team is required to meet call-load. Therefore, shift deployments of 1, 1½, 2, 2½, 3, 3½ and 4 can be used where needed. In practice, a fully staffed Alpha shift could be scheduled with a half team such as Bravo shift, resulting in 1½ teams deployed when both overlap. In some circumstances this model provides more efficient options.

This system could operate temporarily until additional officers are permanently allocated to the teams operating at half strength. Ultimately the goal would be to create independently staffed shifts with the addition of extra teams, rather than relying on team splitting to gain efficiency.

Vancouver Police Department
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Proposed shift schedule:

Shift	Current Shift Model	Proposed Shift Model
Alpha	0500-1600	0500-1600
Bravo	0700-1800	0700-1800 (½ team)
Bravo Split	-----	1100-2200 (½ team)
Charlie	1400-0100	1200-2300 (½ team)
Charlie Split	-----	1800-0500 (½ team)
Delta	1600-0300	1600-0300
Echo	1900-0600	1900-0600
Echo Split	-----	2000-0700 (½ team)¹²

As is evident from the preceding analysis, each district has very distinct characteristics and issues that impact the times and days that require more or less resources according to demand. However, call-load patterns follow a fairly consistent format for mid-week and weekend time-blocks, with only minor variations within a definable range. With the exception of differences in volume that change from district to district, the model for addressing shift distribution should not need to change by district. Therefore, the requirements of the districts can be accommodated through a universal shift model that addresses both midweek and weekend shift allocation and incorporates sufficient buffering to manage district variations.

**50% Utilization Staffing Projections
Option D**

	Split Shift B 8 Teams	Split Shift C 8 Teams	Split Shift E 8 Teams	Total 24 Teams	New FTE Increase	Redeployed Officers
District 1 ¹	11	11	11	33		3
District 2	8	8	6	22	22	4
District 3	13	14	11	38	38	3
District 4	8	8	6	22	22	3
North Surveillance						9 ([D1] 6 + [D2] 3)
South Surveillance						9 ([D3] 5 + [D4] 4)
Total	40	41	34	115	82	31

Note:

1. District 1 - Team 3 to 10 reduces in size from 13 to 9 constables. Team 1 and 2 reduce to 8 constables

¹² Staffed using over time call-out. No permanent officers allocated given that only two shifts a week are required.

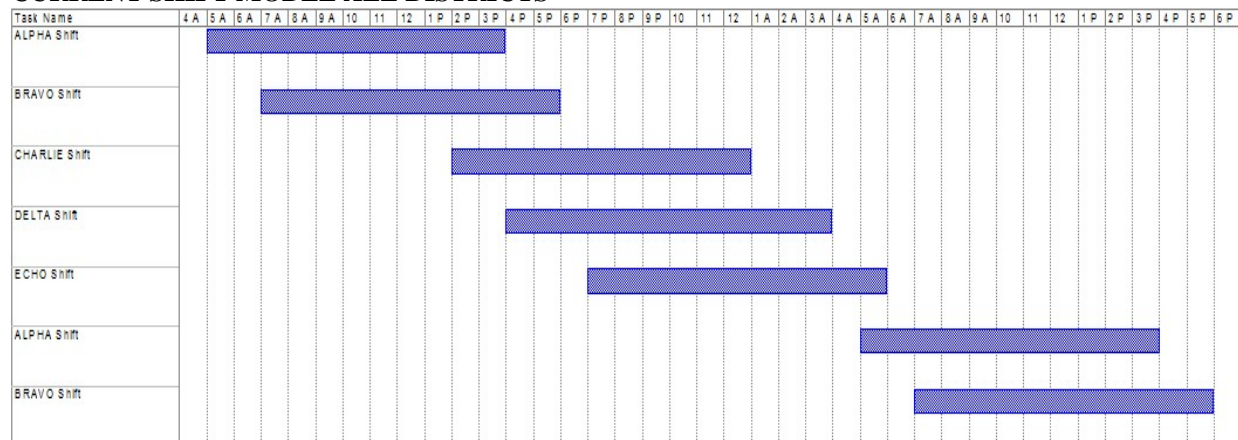
40% Utilization Staffing Projections
Option D

	Split Shift B 8 Teams	Split Shift C 8 Teams	Split Shift E 8 Teams	Total 24 Teams	Redeployed Officers
District 1	6	8	6	20	3
District 2	17	17	16	50	4
District 3	25	25	24	74	3
District 4	19	20	19	58	3
North Surveillance					9 ([D1] 6 + [D2] 3)
South Surveillance					9 ([D3] 5 + [D4] 4)
Total	67	70	65	202	31

8.8.3 Option “D” District Deployment

Midweek, the current district shift model allocates an inadequate level of resources from 12:00 am to 1:00 pm, with both Alpha and Bravo shift deployed at this time. This issue is evident in all the districts. The gradual build-up throughout the morning culminates with an elevated unit utilization that requires additional resources from 12:00 am onward. The proposed shift model provides an additional split shift (Split Bravo) at noon, bringing the total number of shifts available to 2 ½. Throughout the afternoon, 2 ½ shifts are consistently available to respond to calls, as the end and start of shifts are arranged in a manner so as to provide sufficient overlap and maintain consistent resource allocation through the afternoon.

CURRENT SHIFT MODEL ALL DISTRICTS



At 7:00 pm, which corresponds to the next measurable increase in call-load, the available shifts again increases to 3 ½ to match demand. From 7:00 pm to 10:00 pm the available shifts remain at 3 ½ until gradually decreasing to 3 shifts at 10:00 pm and then 2 ½ shifts from 11:00 pm to 3:00 am. This shift adjustment closely corresponds to the change in call-load, which is substantially elevated between 7:00 pm and 10:00 pm and then gradually reduces throughout the morning.

The proposed shift model maintains the same shift structure for weekends as it does for the mid-week. The Split Echo shift mirrors the existing Echo shift but provides much needed overlap during times of early morning inefficiency. The additional shift is designed to provide the necessary number of officers to deal with the elevated call-load and to reduce the severe increases in unit utilization levels during these times.

For example, the identified spikes in unit utilization at 1:00 am and 4:00 am are eliminated by the gradual reduction in resources. Unlike the current system, which has two shifts available at 1:00 am and only one shift available after 4:00 am, the proposed model has 2 ½ shifts available until 3:00 am and 1 ½ shifts available until 5:00 am.

From 5:00 am to 6:00 am the continued practice of overlap between Echo and Alpha shift is maintained. From 6:00 am to 7:00 am, the period with the lowest call-load, the proposed model has only one shift scheduled (Alpha). This setup is consistent with the current shift model arrangement and does not adversely affect unit utilization.

The current practice of attempting to compensate for an inefficient shift model will no longer be required. Ultimately, these adjustments may have provided temporary assistance during the early mornings, but the afternoon unit utilization levels were adversely affected, creating ancillary problems. The proposed model accommodates variances between districts and provides for the adjustment of Echo shift staffing to compensate for variances between district bar issues and alcohol problems. It is clear District 1 and 2 require more early morning resources due to the concentration of bars and nightclubs, and District 3 and District 4 now experience similar issues in the early morning that warrant staffing of a Split Echo shift as well. Further, bar issues are no longer confined to weekends only, as every district experience weekend like issues through everyday of the week, although at a reduced level midweek.

9 CONCLUSION

The ongoing costs associated with overtime and holding back teams at the end of their shift in order to deal in an ad hoc manner with unit utilization levels are creating more issues than they resolve. Under the current system both the financial and human costs are substantial and must be considered when weighing the option of maintaining the status quo or facing the challenge of adopting innovative strategies and solutions. The oscillation in unit utilization, or the fluctuating level in which patrol units are engaged in taking calls, creates numerous issues for patrol officers. Officers are constantly faced with extremely demanding work and must remain in a state of heightened response for prolonged periods of time. Not only is this an inefficient use of police resources, but also the scheduling system artificially creates unnecessary periods of stress and fatigue.

Shifts are left to deal with an extremely busy call load with limited resources. In some instances, shifts are temporarily left to deal with a period of frenzied response until

another shift becomes available to render assistance. A more efficient model, such as one of the proposed patrol deployments, incorporates a more gradual decrease in police officers paired to the call load and a more gradual phasing in of officers as the call load builds. The current shift pattern of five distinct shifts could be replaced with a more efficient model. Each recommended model addresses shift inefficiency in a slightly different way, but ultimately results in a more efficient deployment model than the current process provides.

The matching of resources to call load under one of the proposed systems will result in a very efficient model that has the potential to increase productivity, as well as maximize the performance of patrol teams. While there are other shift models available that also improve efficiency and match resources to demand, the gains between highly efficient models are relatively inconsequential.

In terms of systemic problems with elevated levels of unit utilization, a threshold should be set at which unit utilization should not exceed a certain level in order to maintain an acceptable level of policing service. The current situation, where unit utilization levels frequently exceeding 70%, is not in accordance with best practices and a more appropriate target would be in the 50% range. This would allow patrol officers the available time to engage in proactive policing in support of the VPD's strategic objectives, specifically "improving community safety".

While the initial conclusion could be drawn that adopting the proposed shift model will resolve workload issues and periods of over utilization, this is not entirely accurate. While the reduction of extreme peaks and fluctuations will certainly make utilization levels more consistent, the fact remains that Patrol is substantially under staffed given their workload. When staff are continually taxed beyond their ability to meet call load demand, service to the public suffers. The only tangible solution is to increase the authorized strength in order to meet the target utilization rate of 40% to 50%. Without these additional officers, Patrol will continue to operate at elevated utilization levels and be severely limited in its ability to engage in any form of proactive policing.

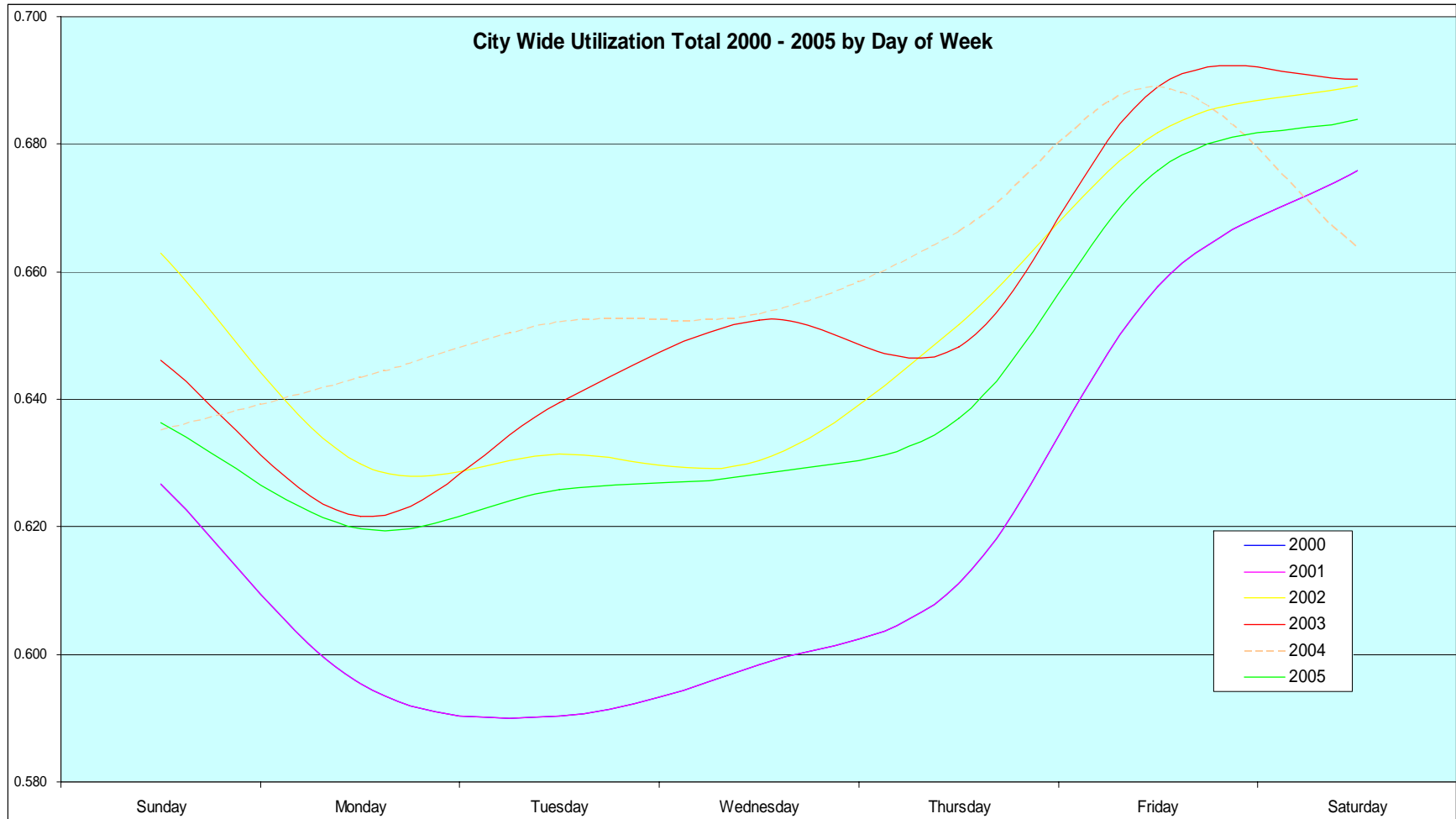
10 RECOMMENDATIONS

I recommend:

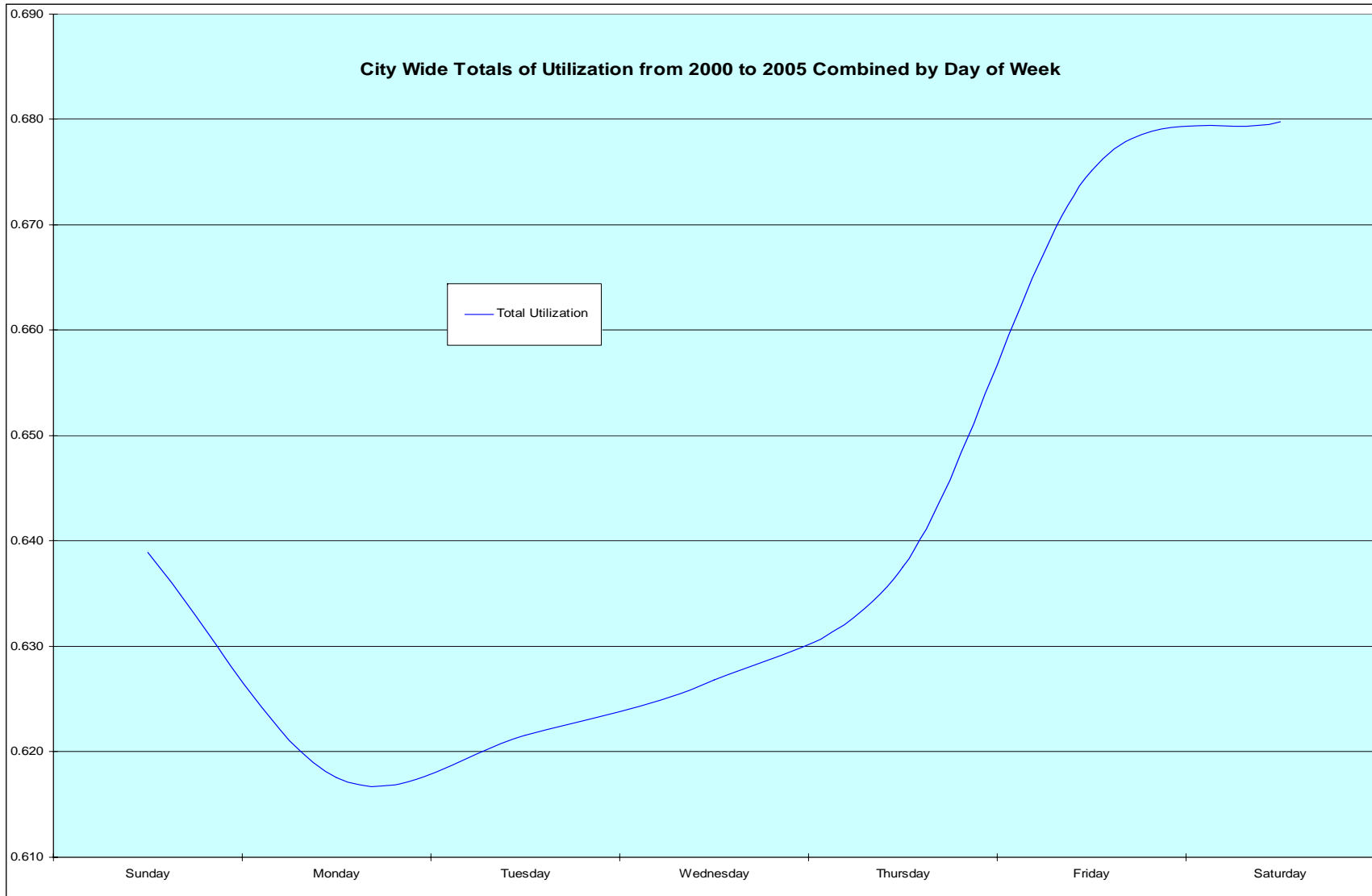
1. THAT, the VPD adopt one of the proposed patrol deployment models on a trial basis in District 1 for a 12-month duration.
2. THAT, on successful completion of a trial deployment, the VPD adopt, on a city-wide basis, the proposed patrol deployment model.
3. THAT, the Planning and Research Section incorporates the results of this analysis into the pending report to the Police Board and Vancouver Council in support of a request for a substantial increase in authorized strength.
4. THAT, future increases in authorized strength be allocated to the four districts based on their utilization rates as these rates could change in the future.
5. THAT, regular evaluations are conducted of patrol efficiency, unit-utilization and the shift deployment model to ensure current practices are in keeping with call load pattern changes within the districts.
6. THAT, the District 1 Team 11 Surveillance Team, District 2 Rapid Action Team (RAT), the District 3 Street Crime Enforcement Unit (SCEU), and District 4 Property Crime Reduction Unit (PCRU) be disbanded and the officers currently staffing these adjunct units return to regular patrol duties.
7. THAT, the Deputy Chief of the Operations Division establish a policy directive that prevents future adjunct specialty squads from being created within patrol without a business case, and that the practice of loaning officers out of patrol for specialty projects cease immediately.
8. THAT, a new Patrol North Surveillance Team and a new Patrol South Surveillance Team be created using existing resources.

11 APPENDIX

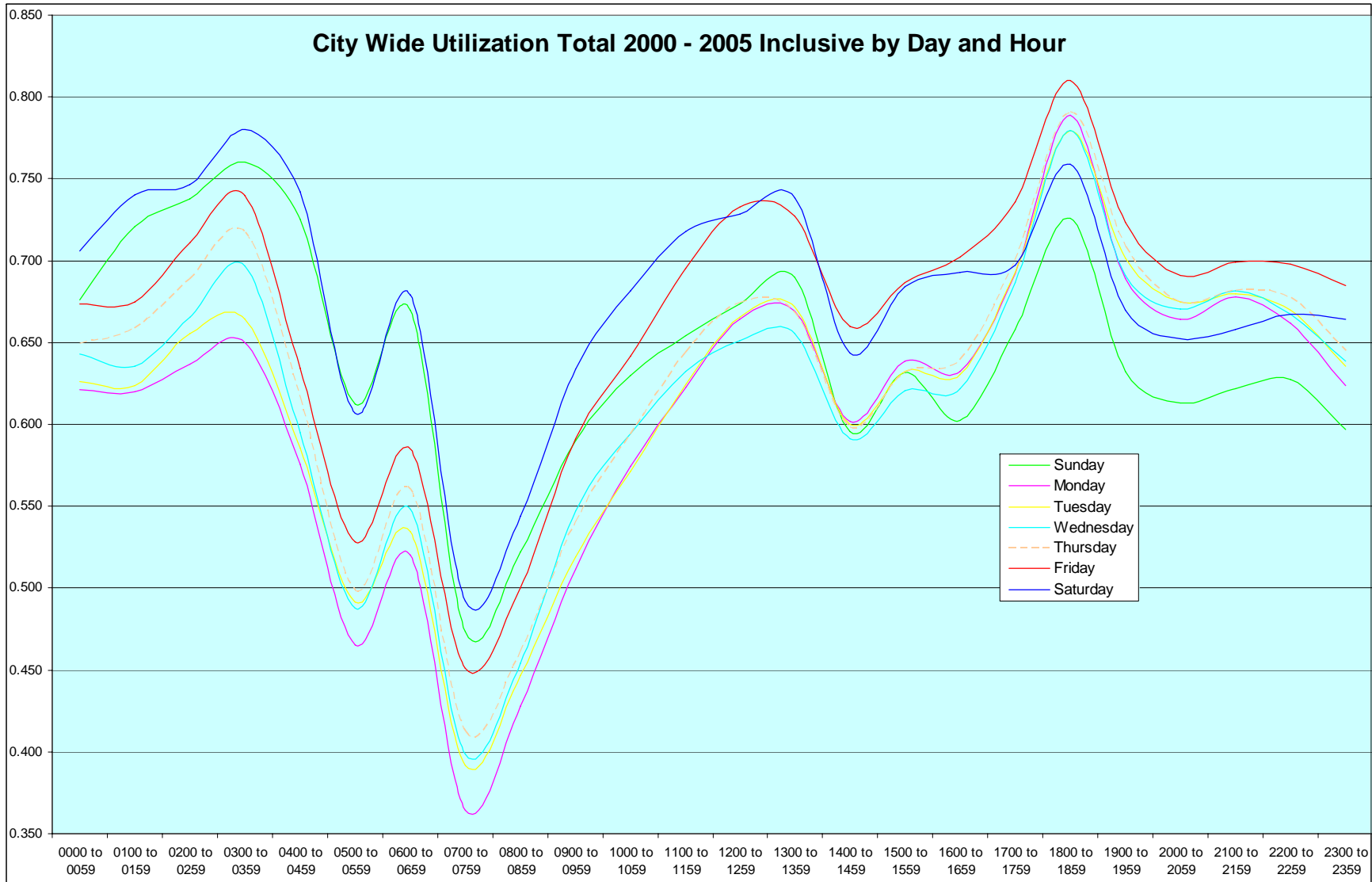
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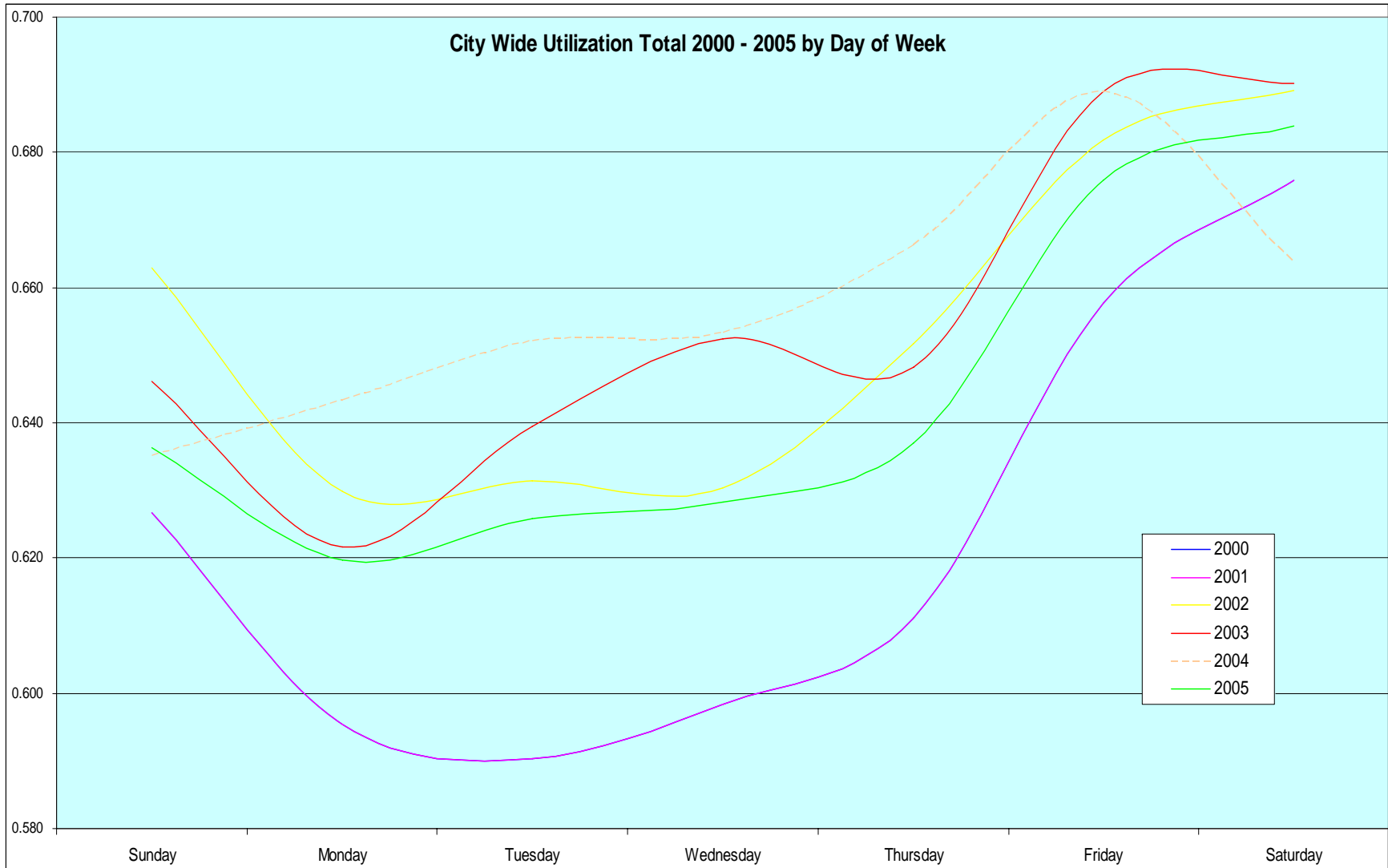
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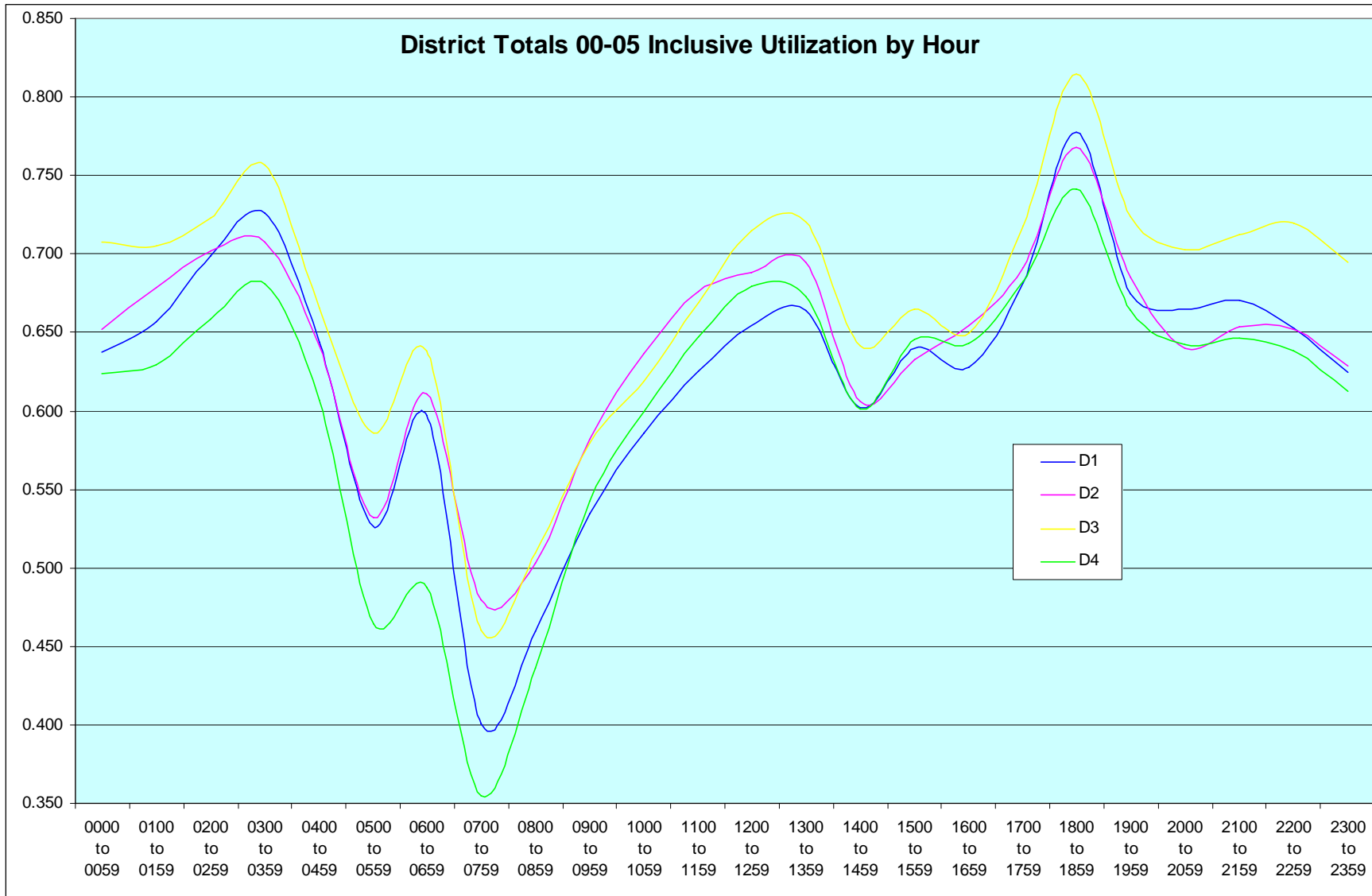
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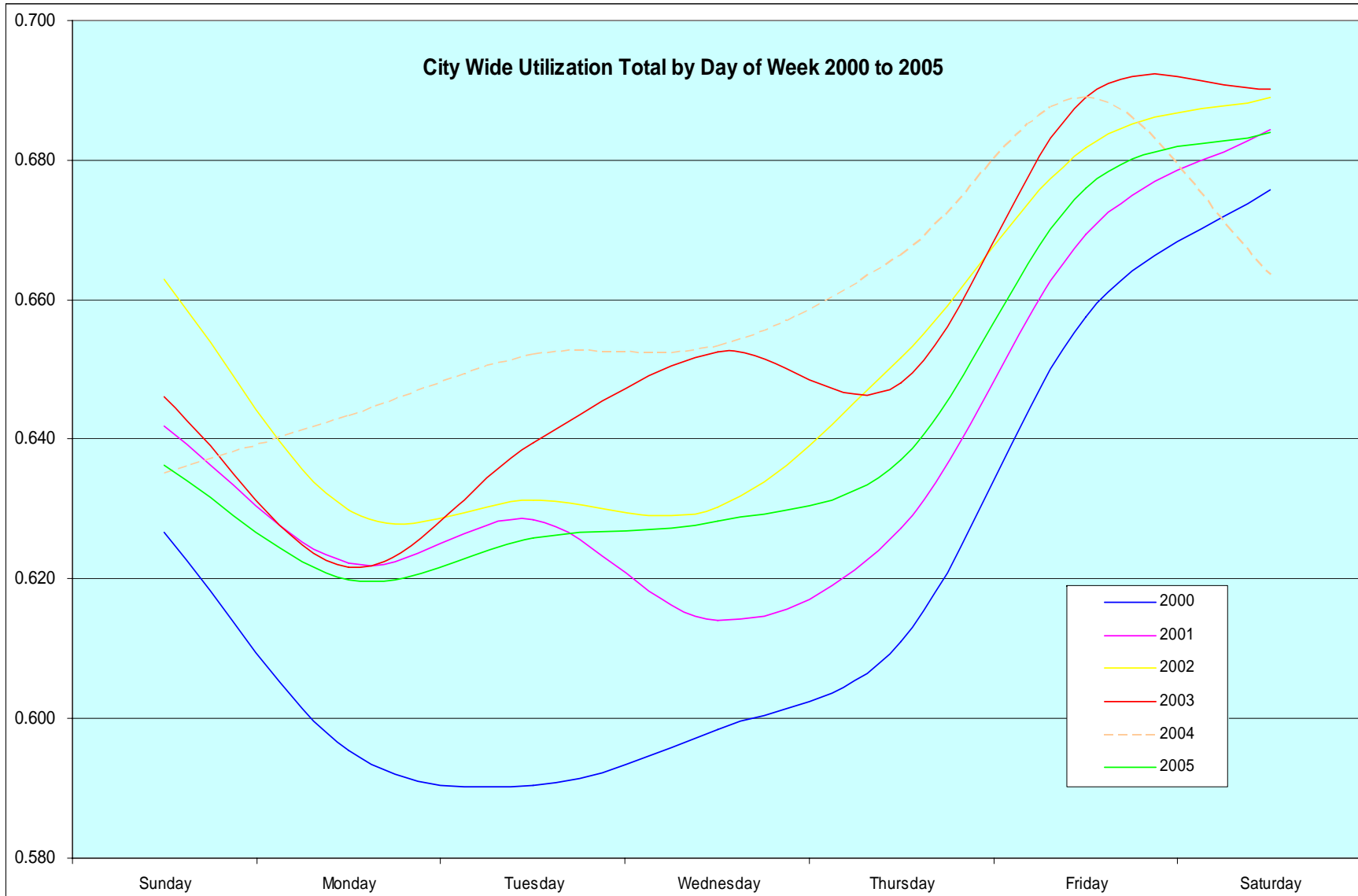
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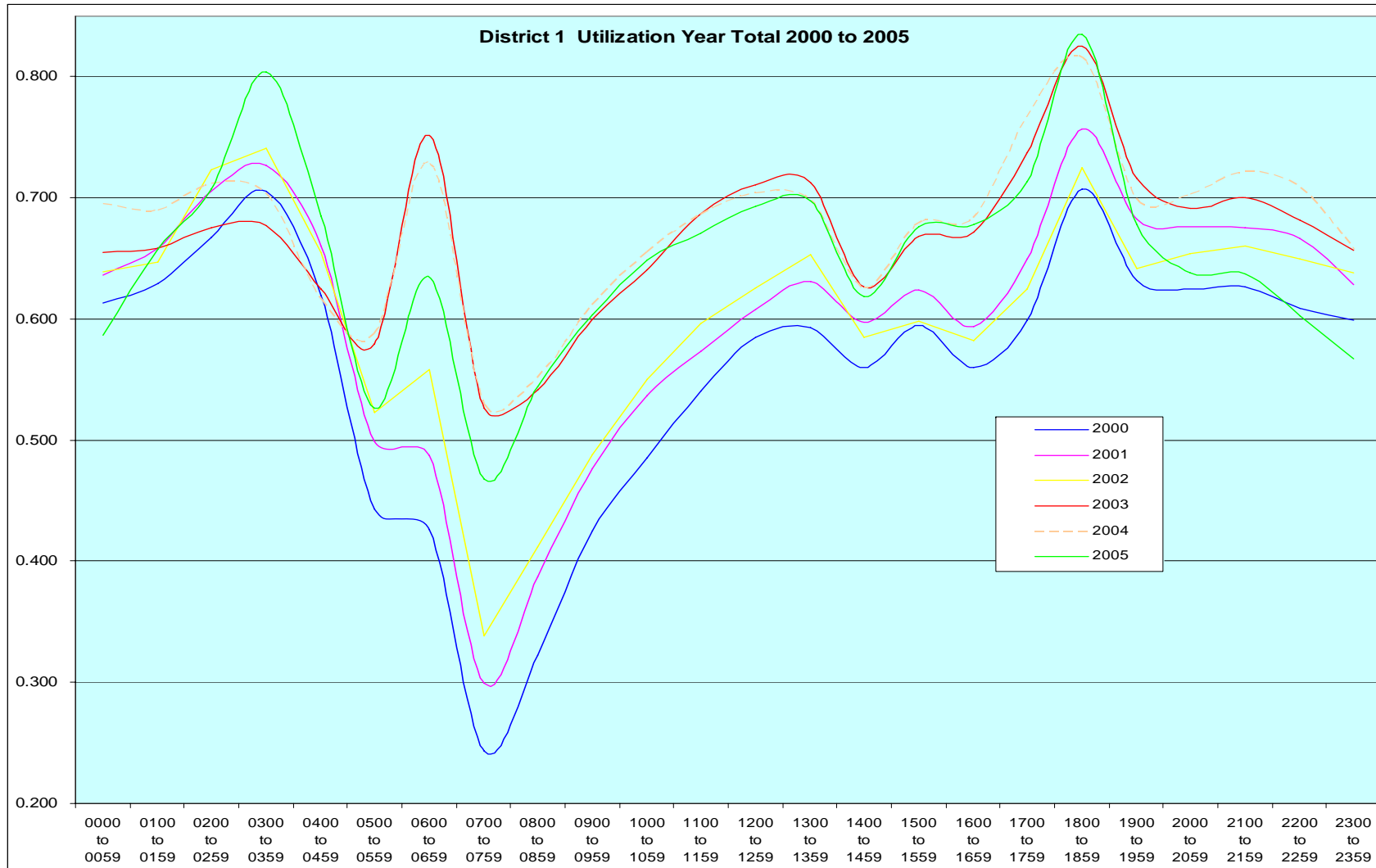
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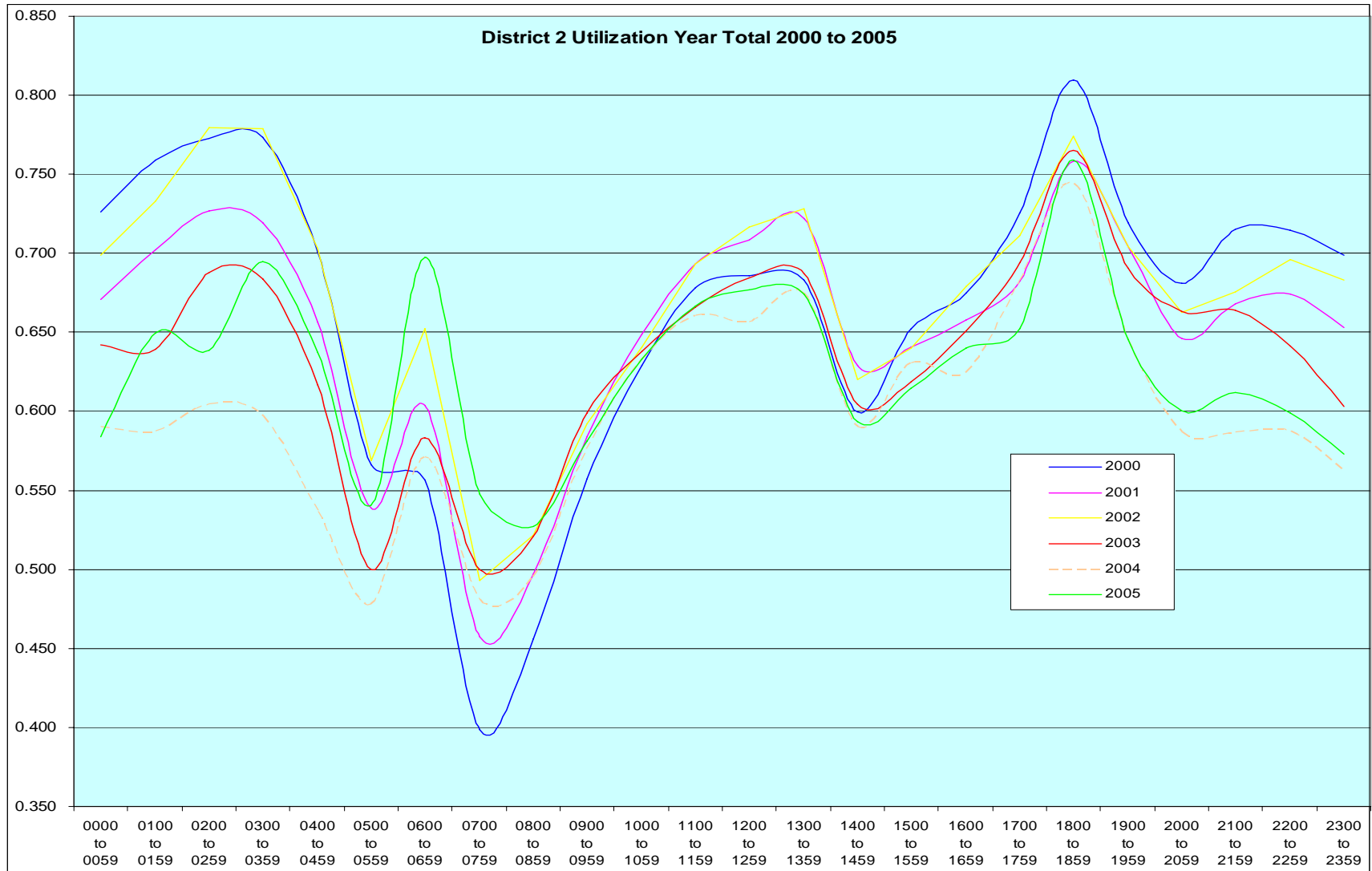
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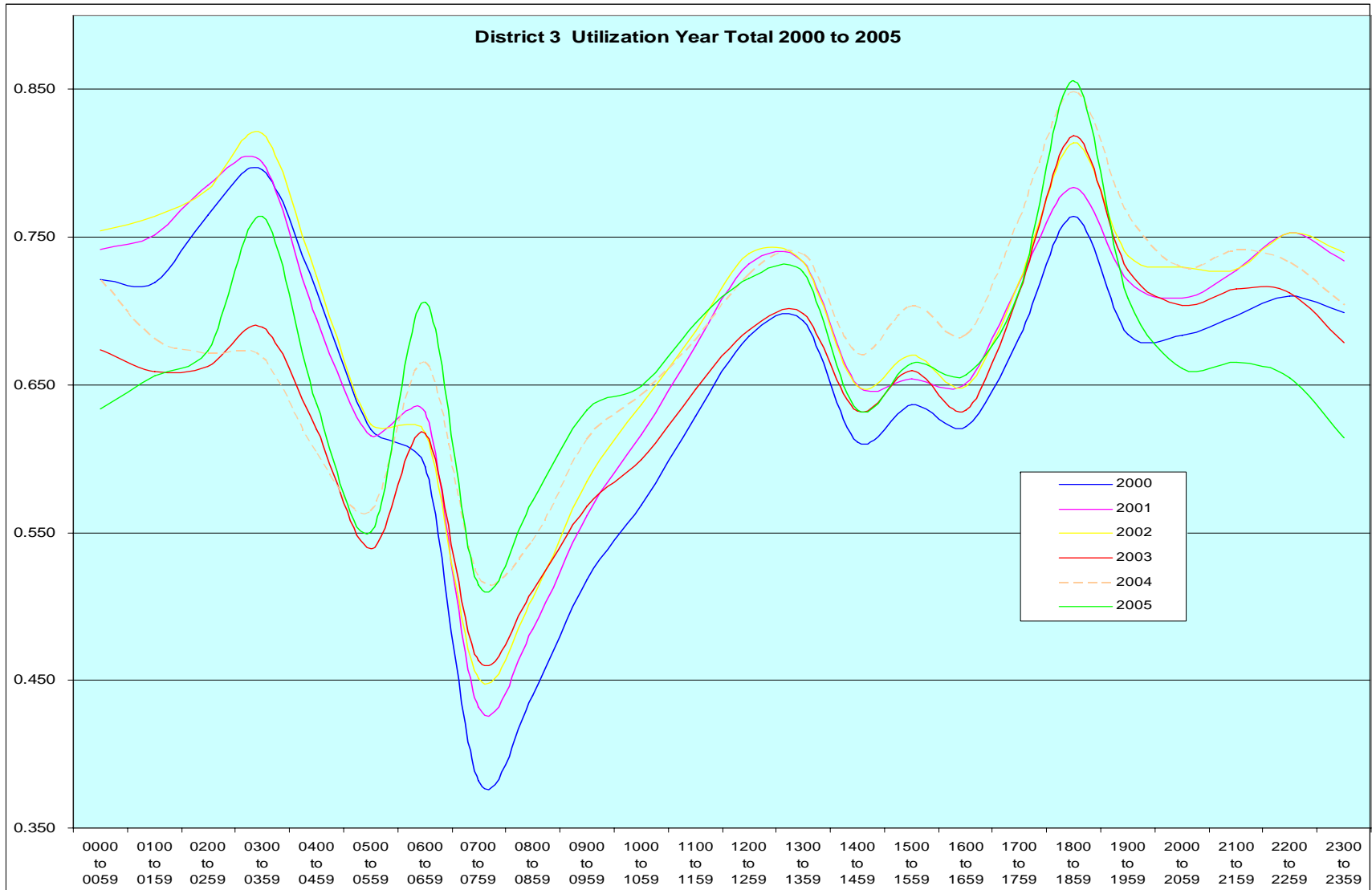
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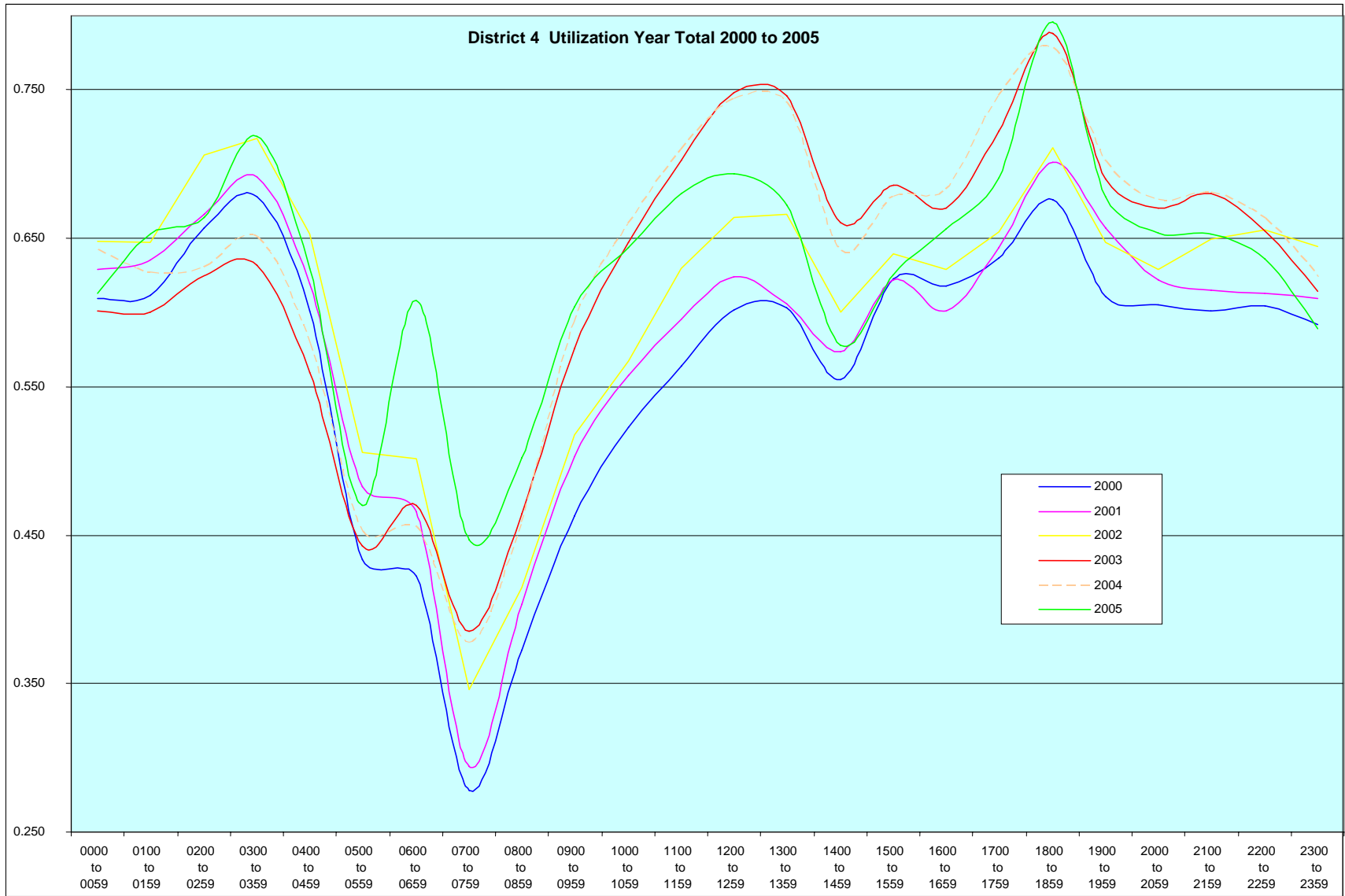
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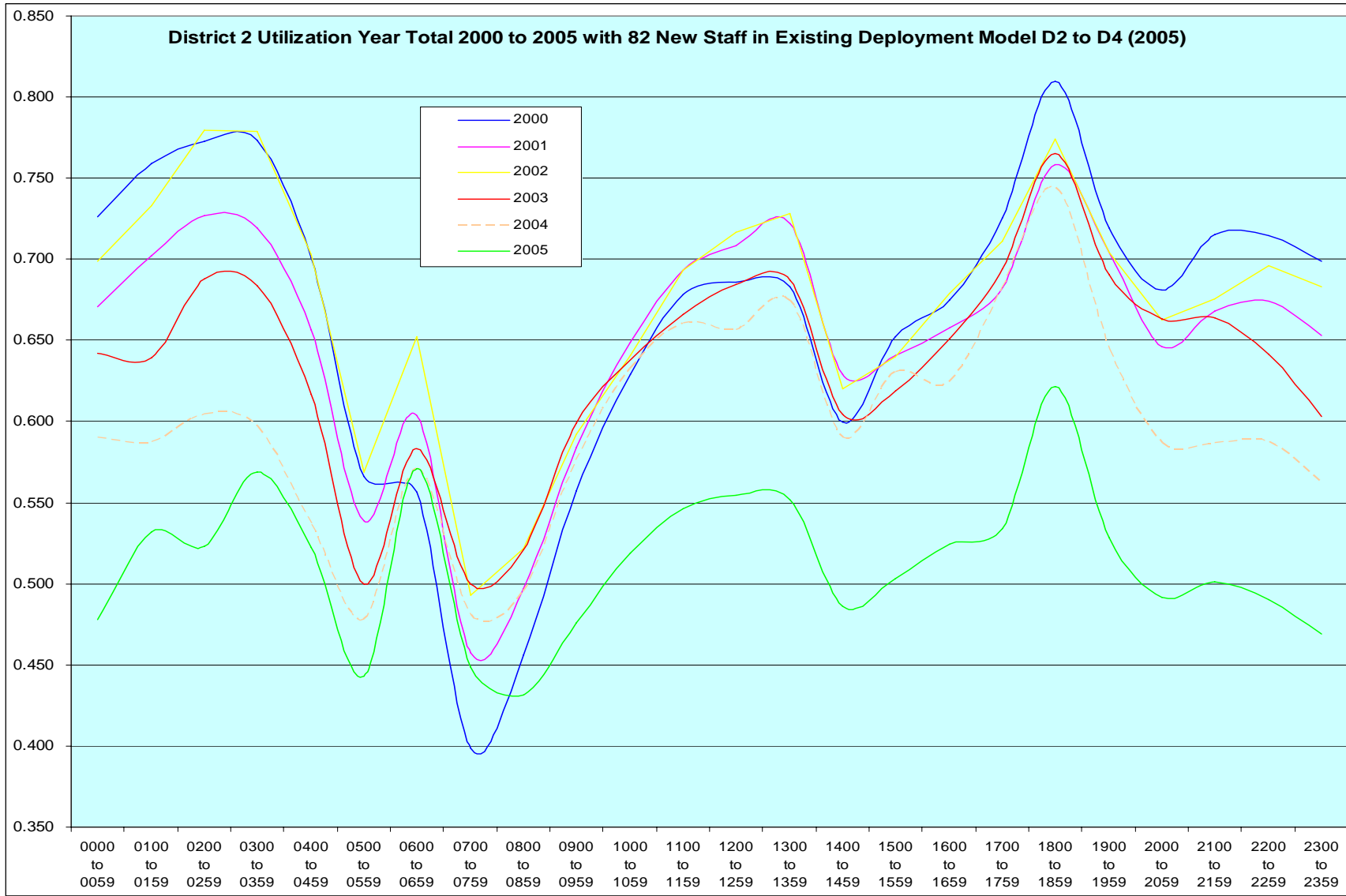
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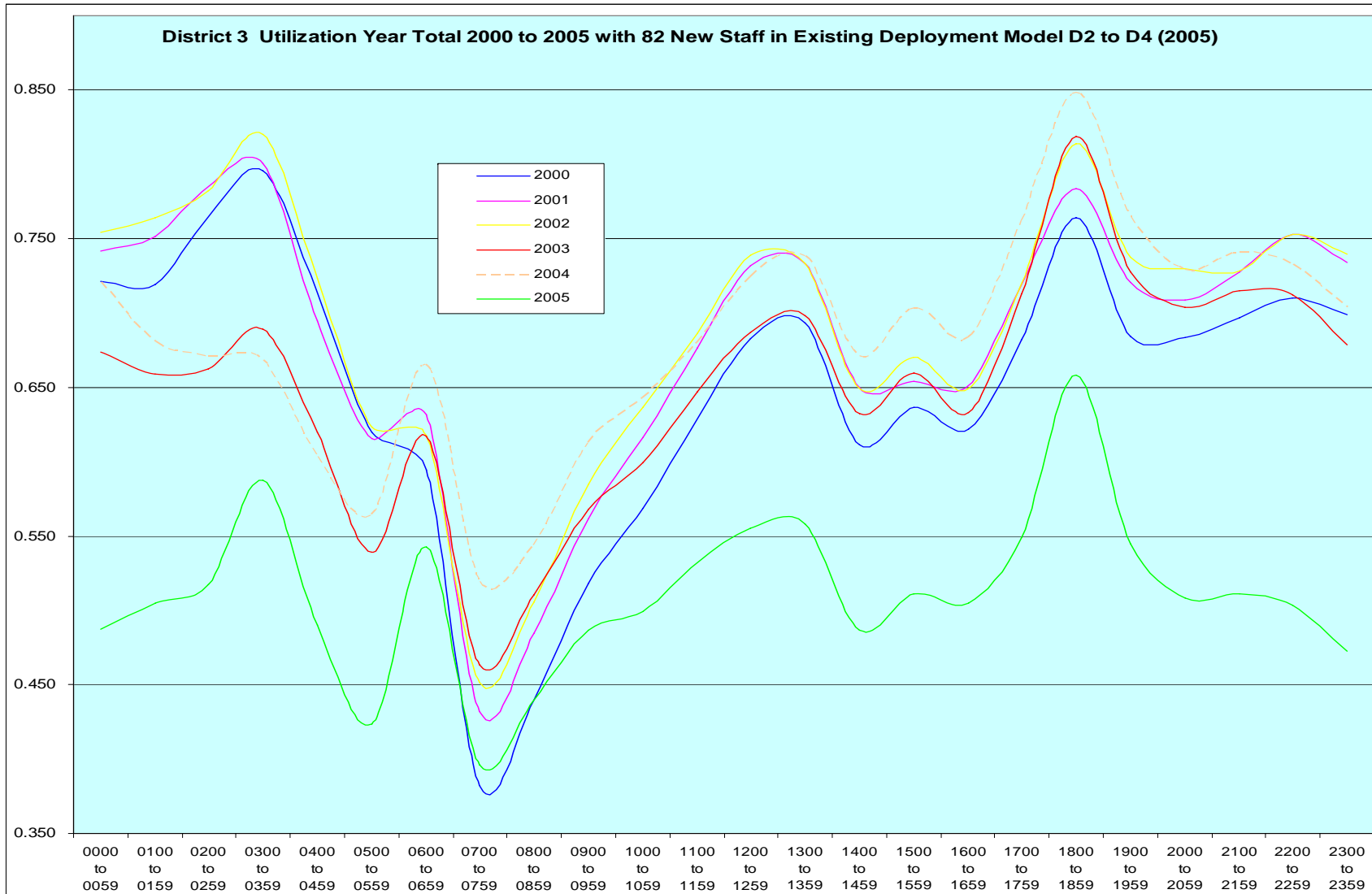
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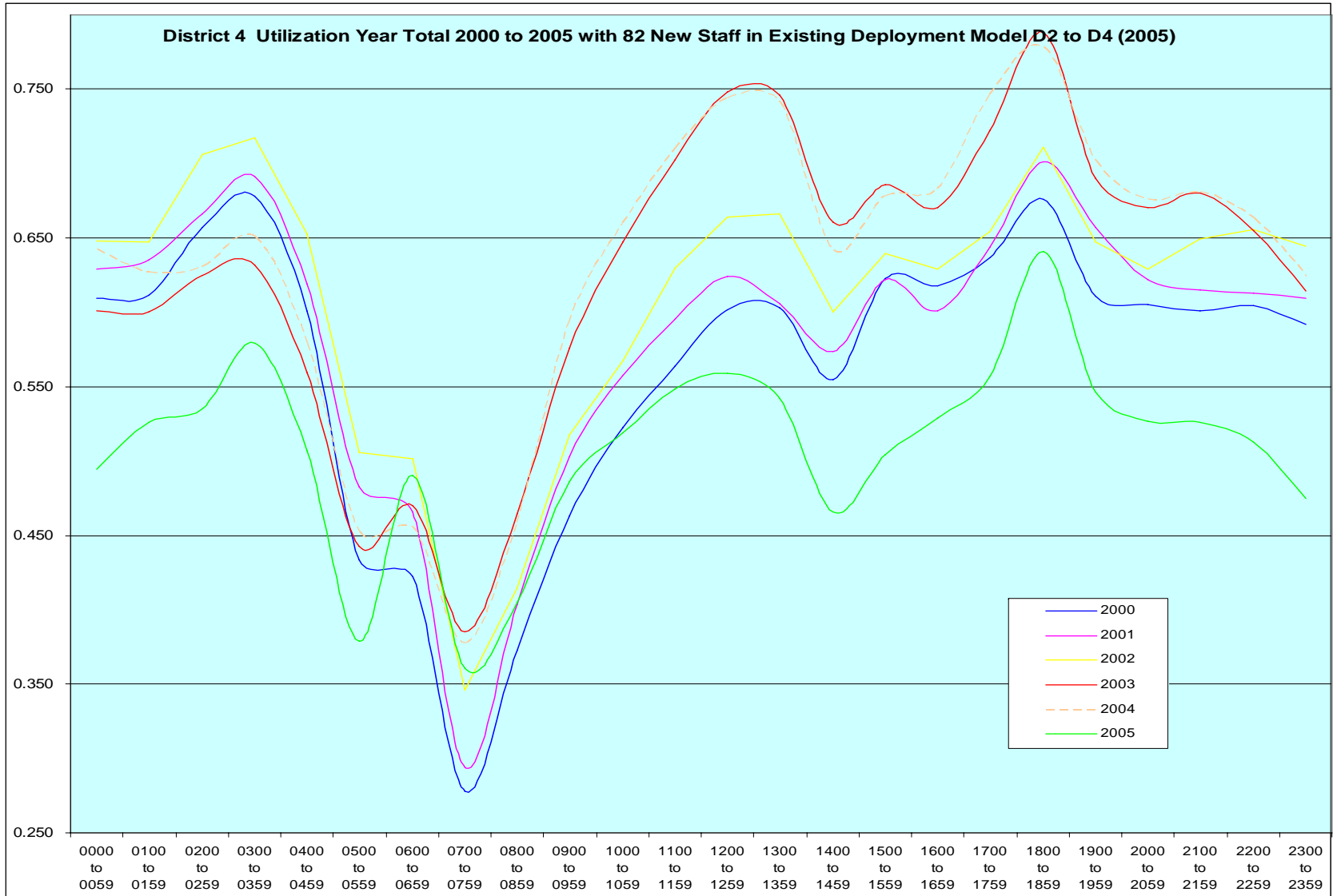
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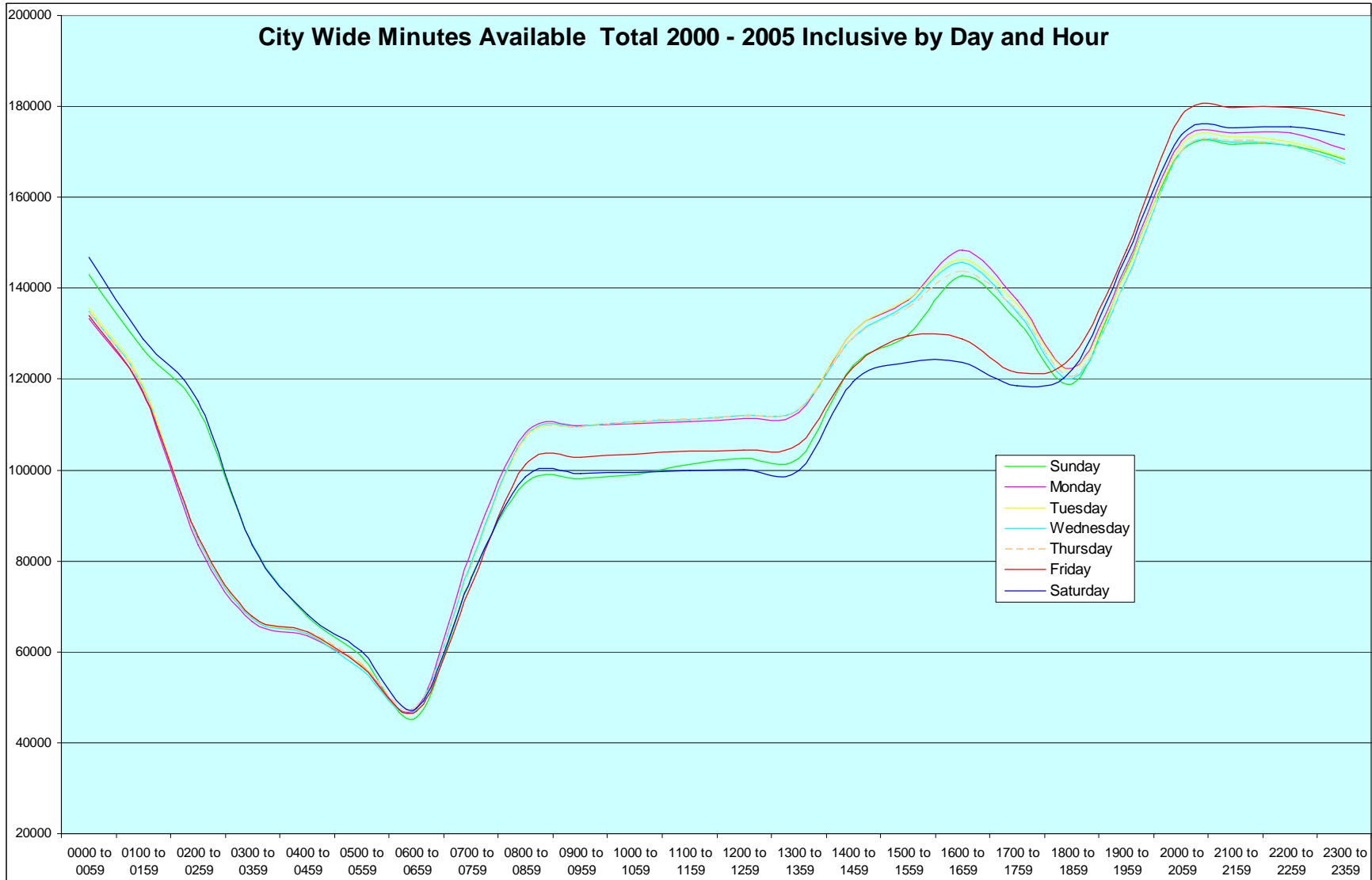
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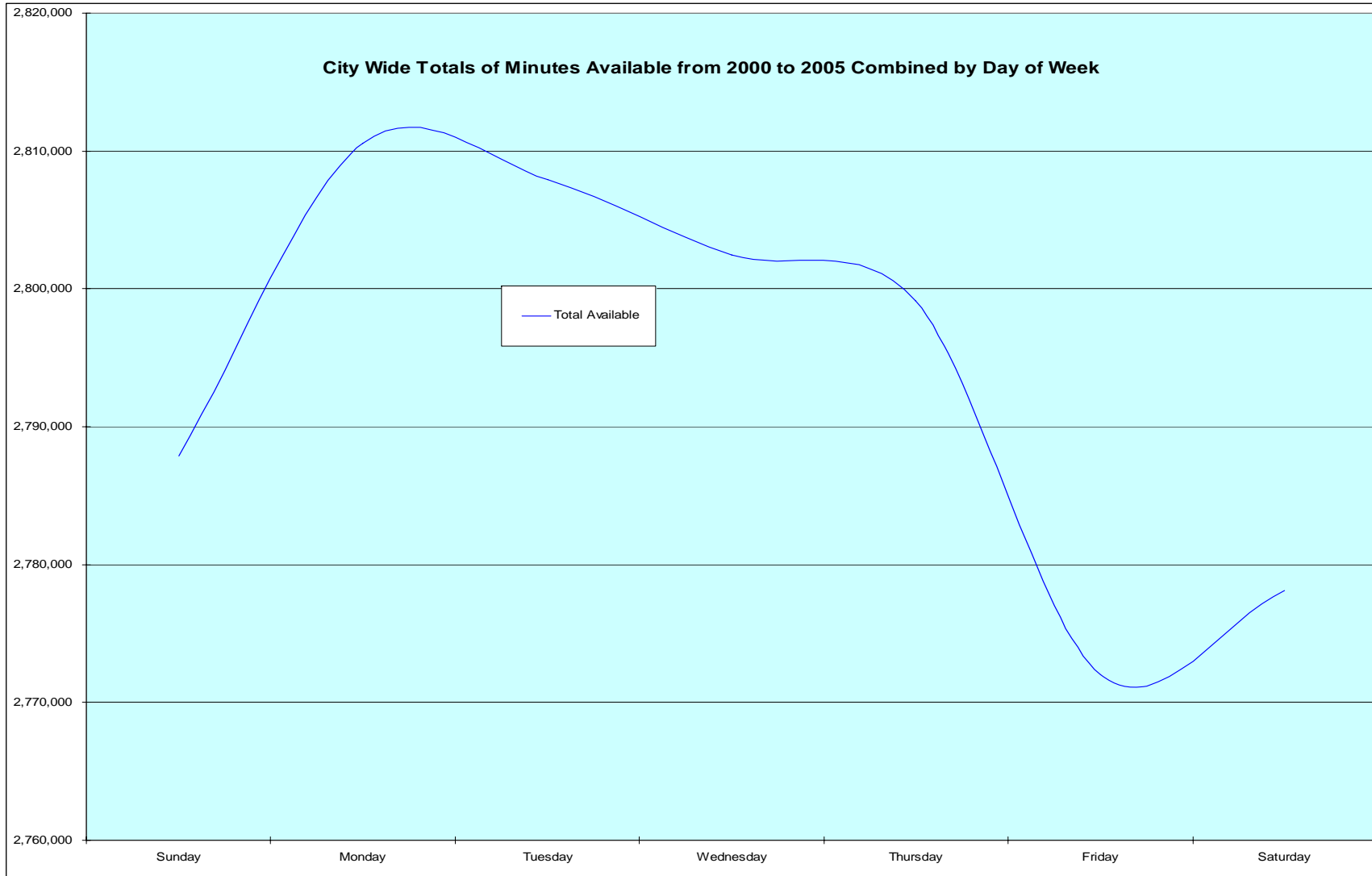
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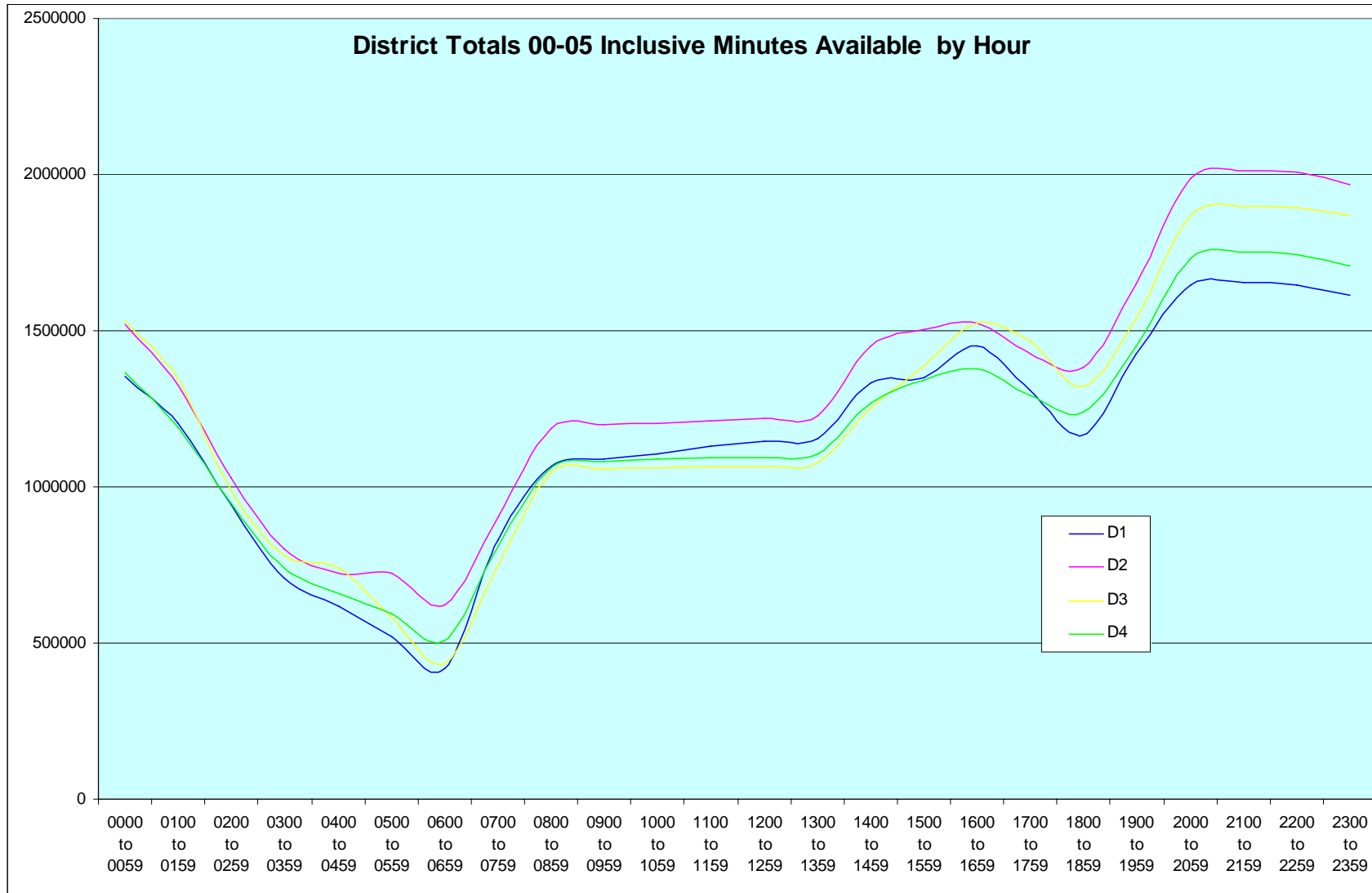
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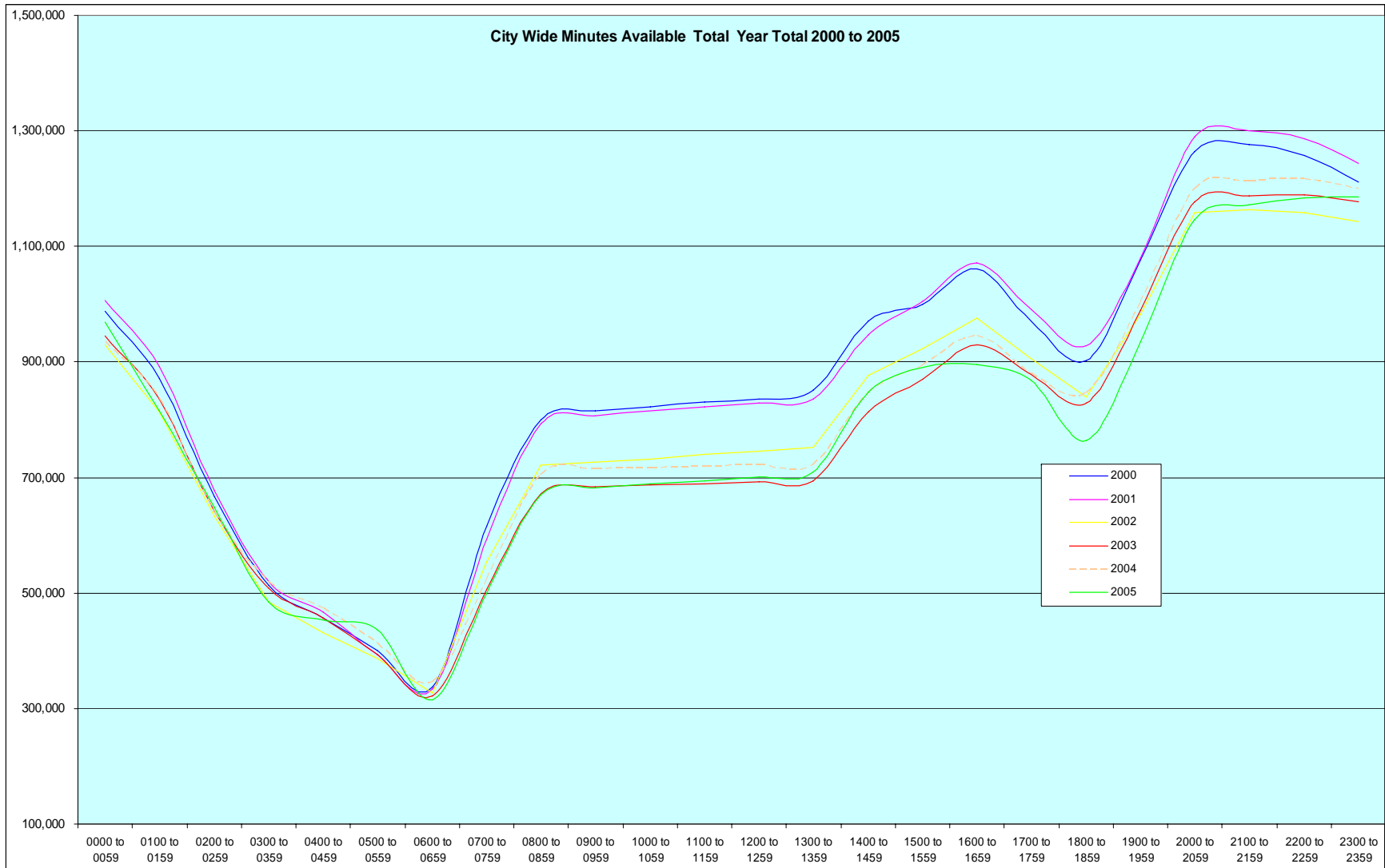
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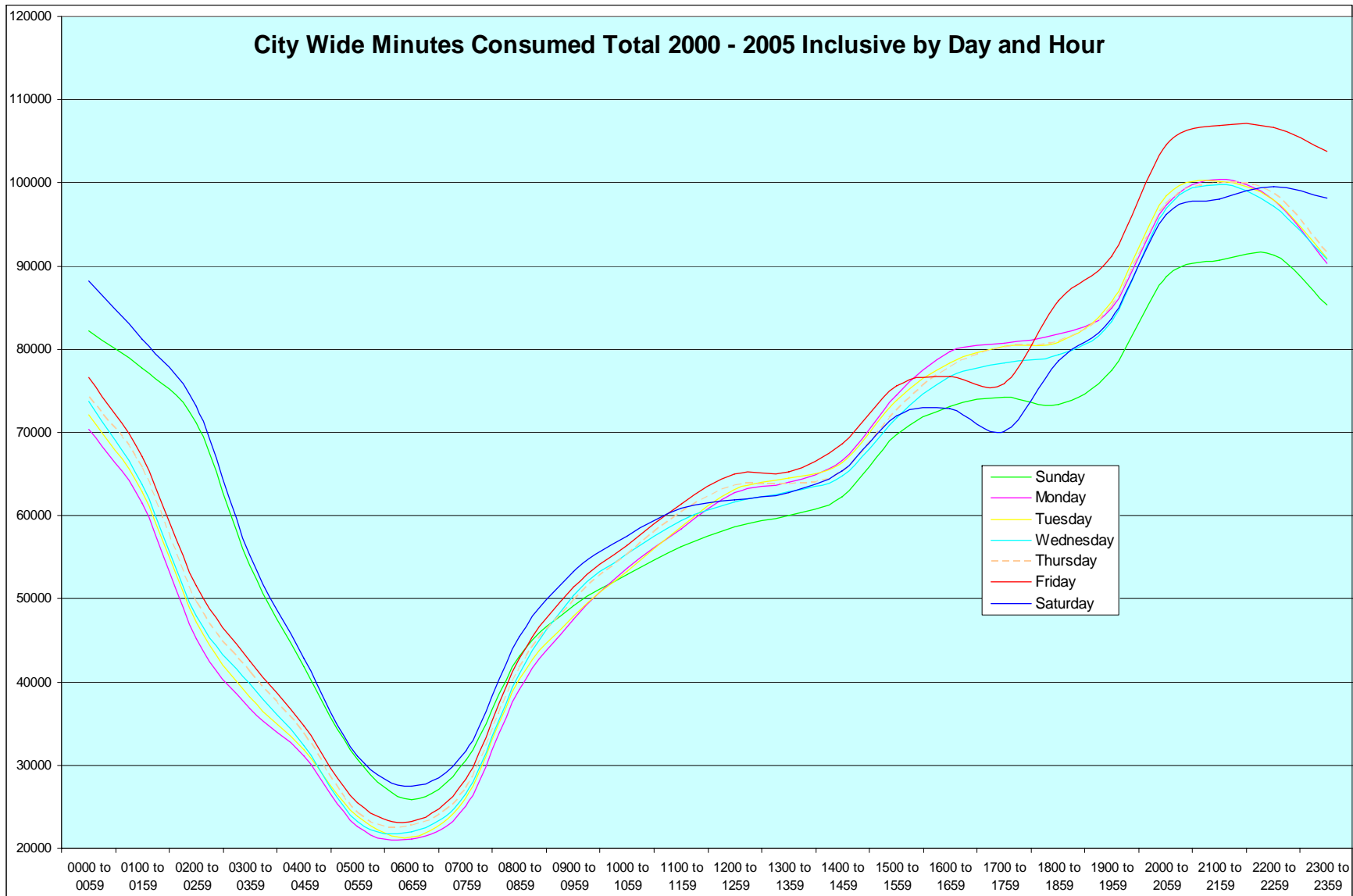
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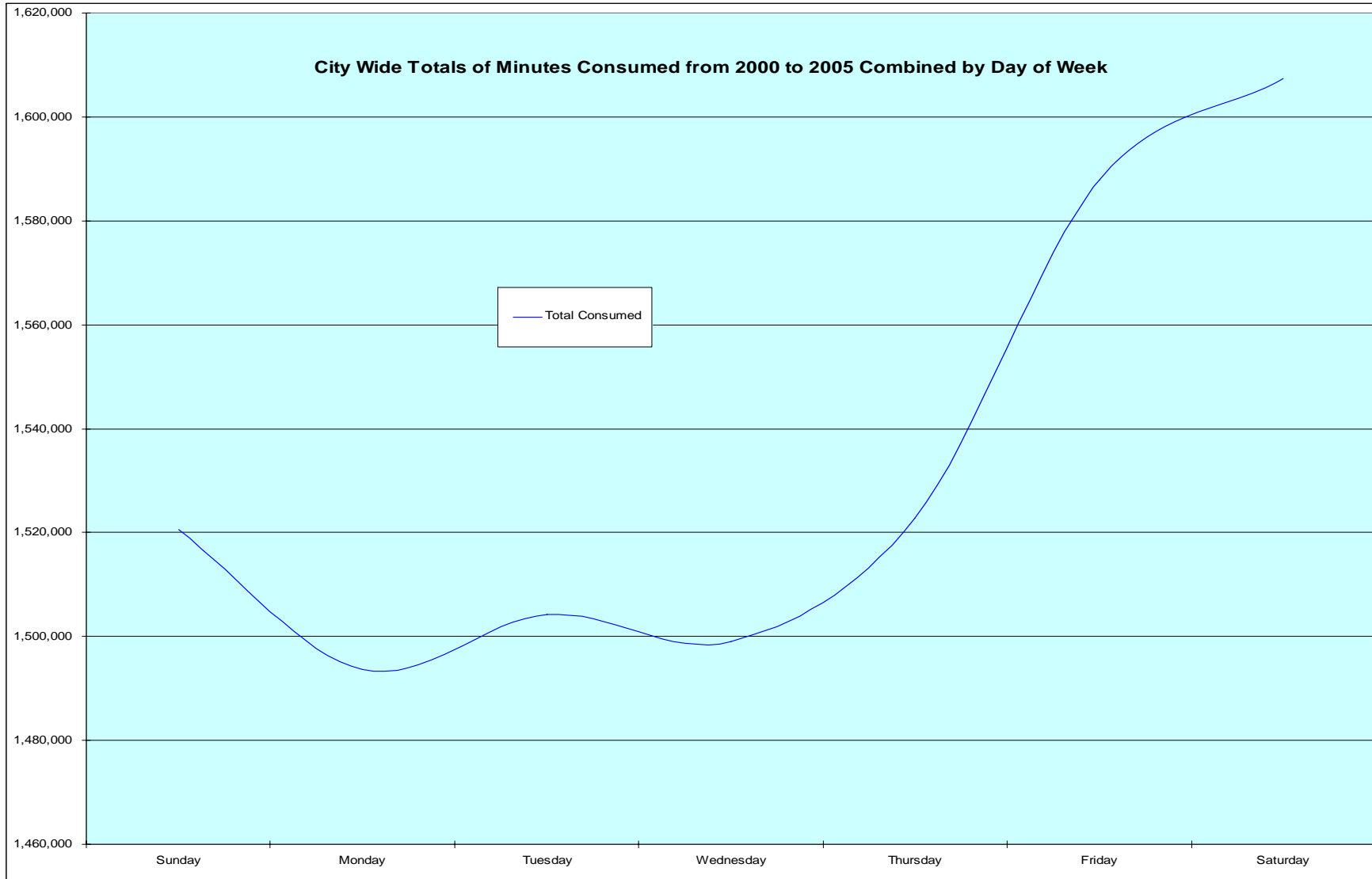
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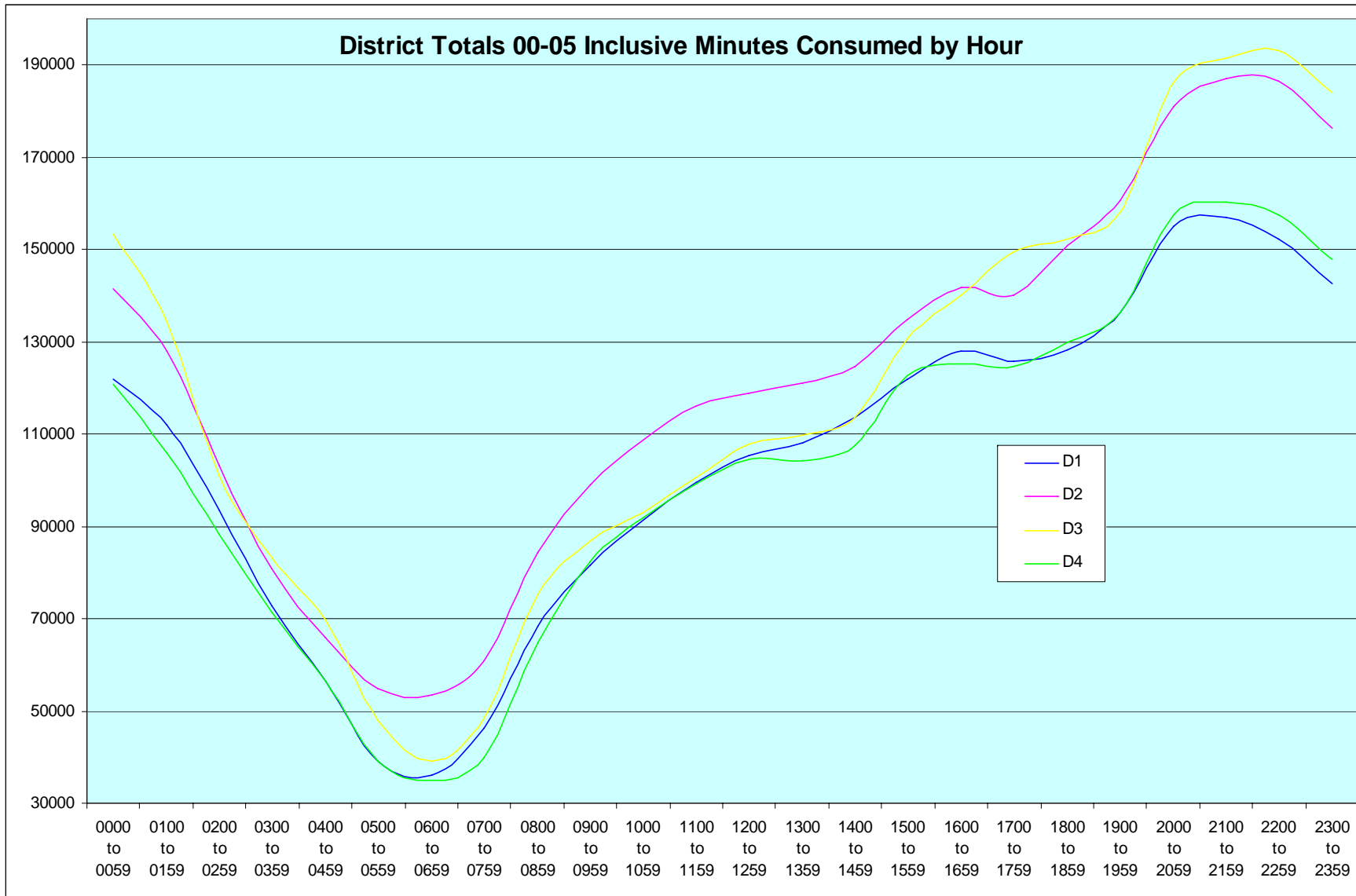
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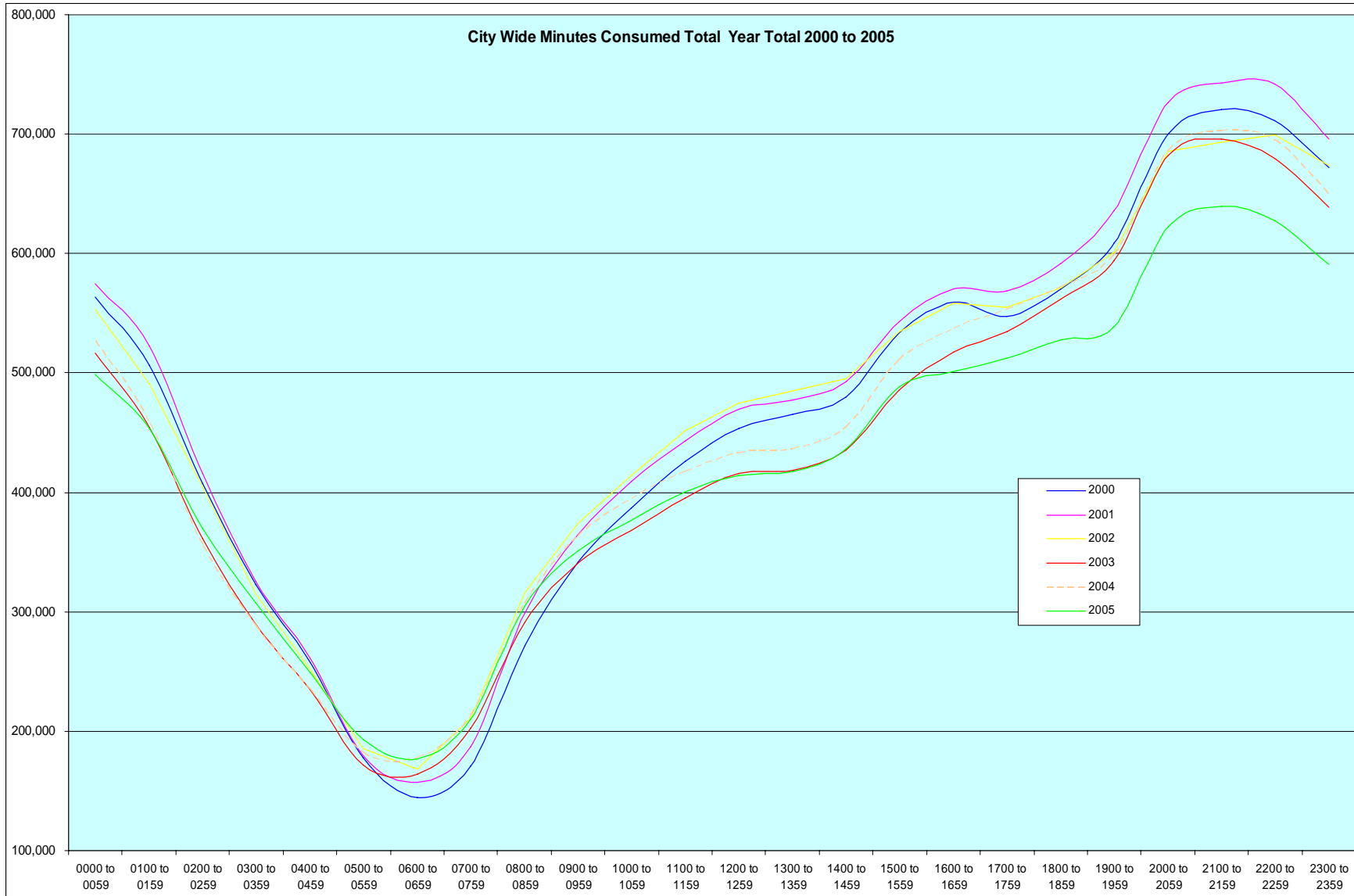
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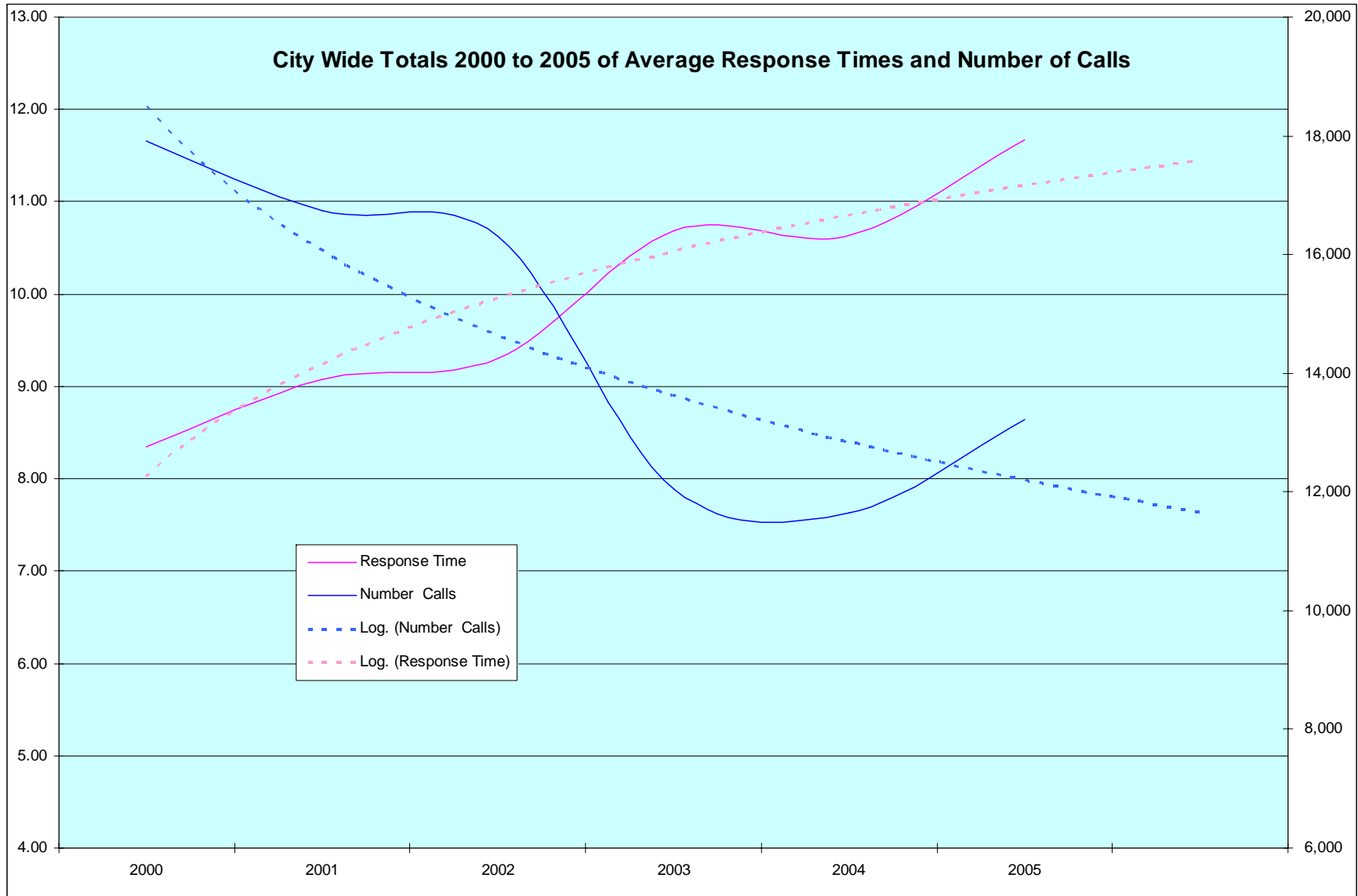
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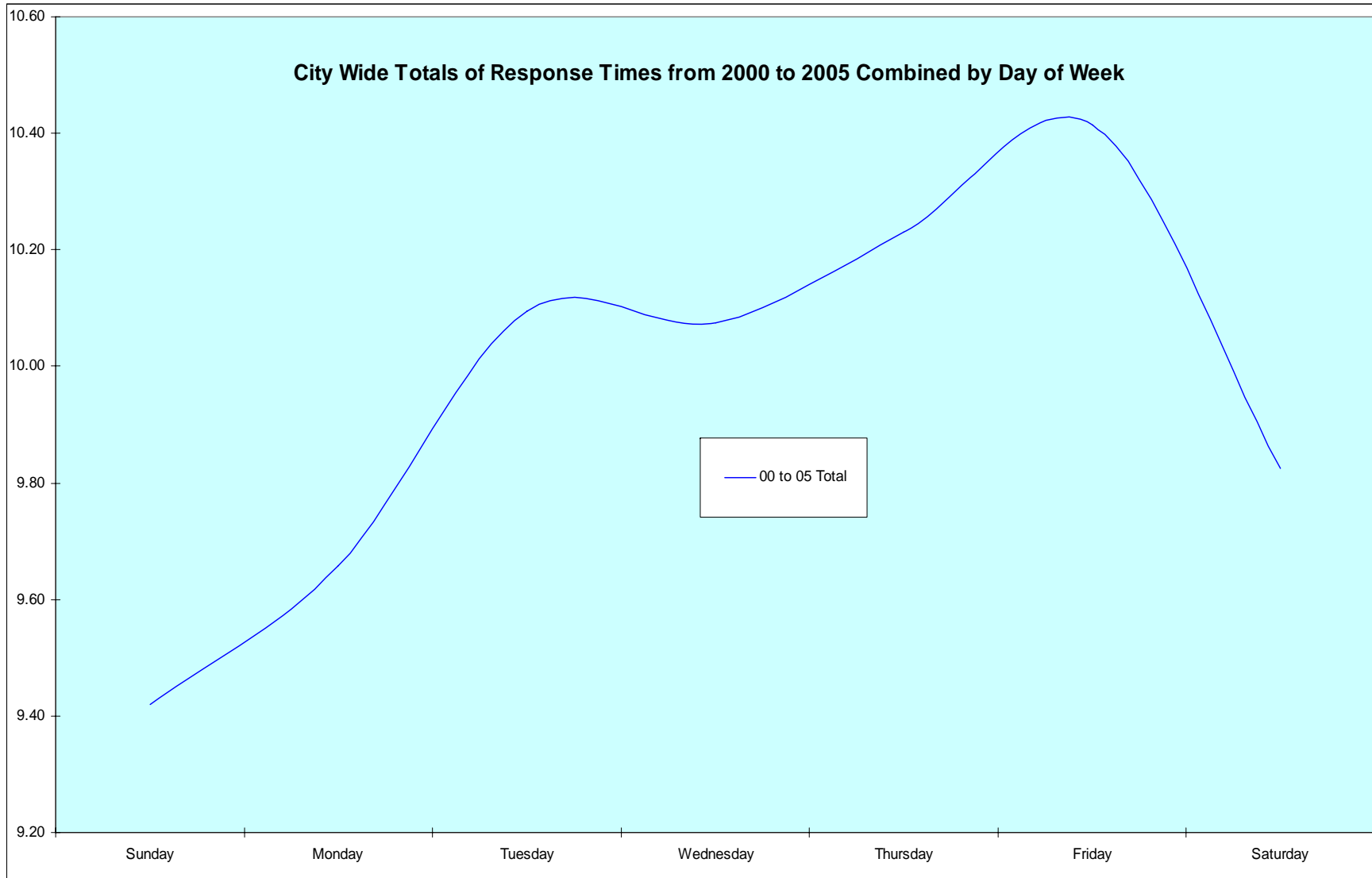
Appendix C-4



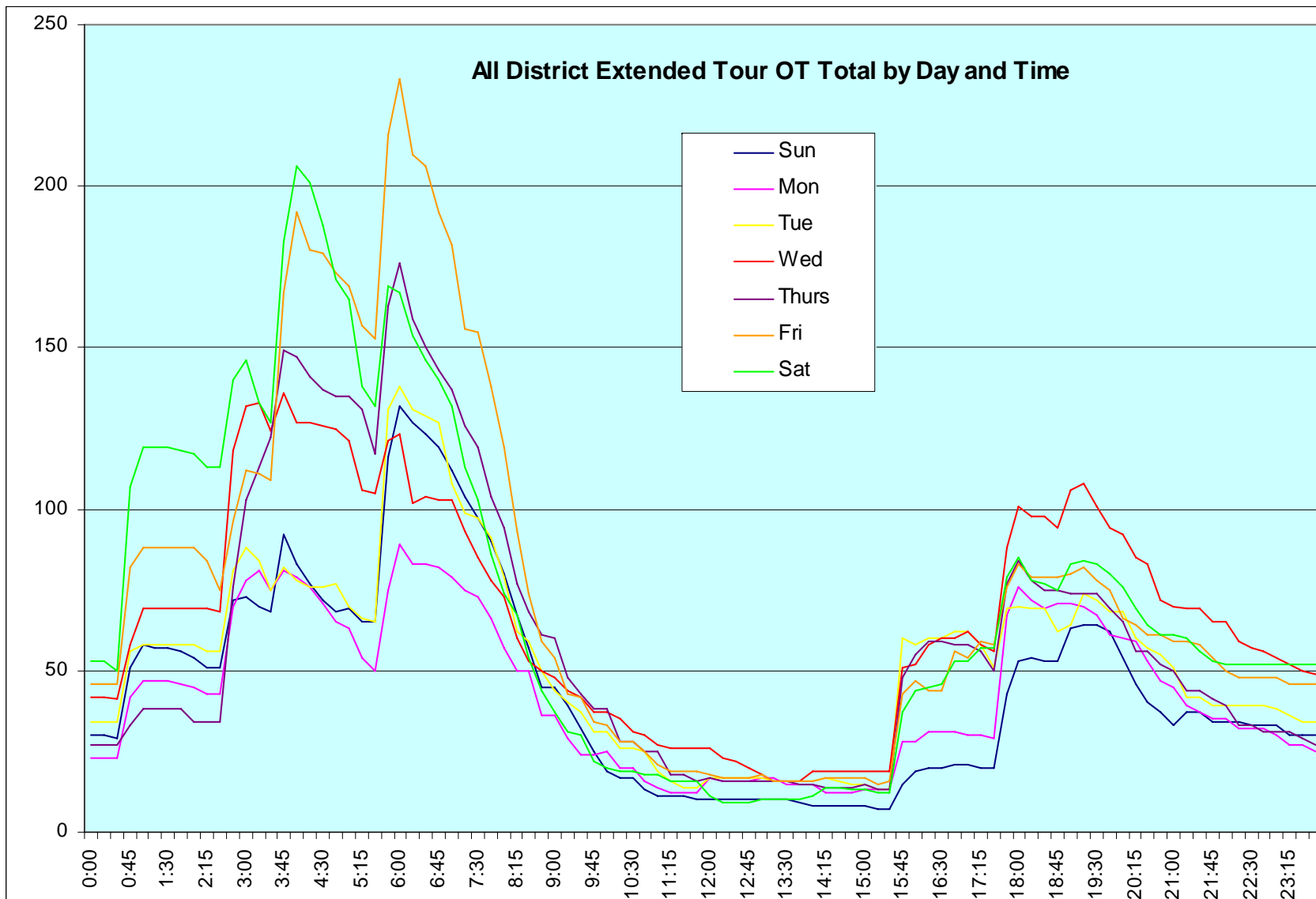
Appendix D-1



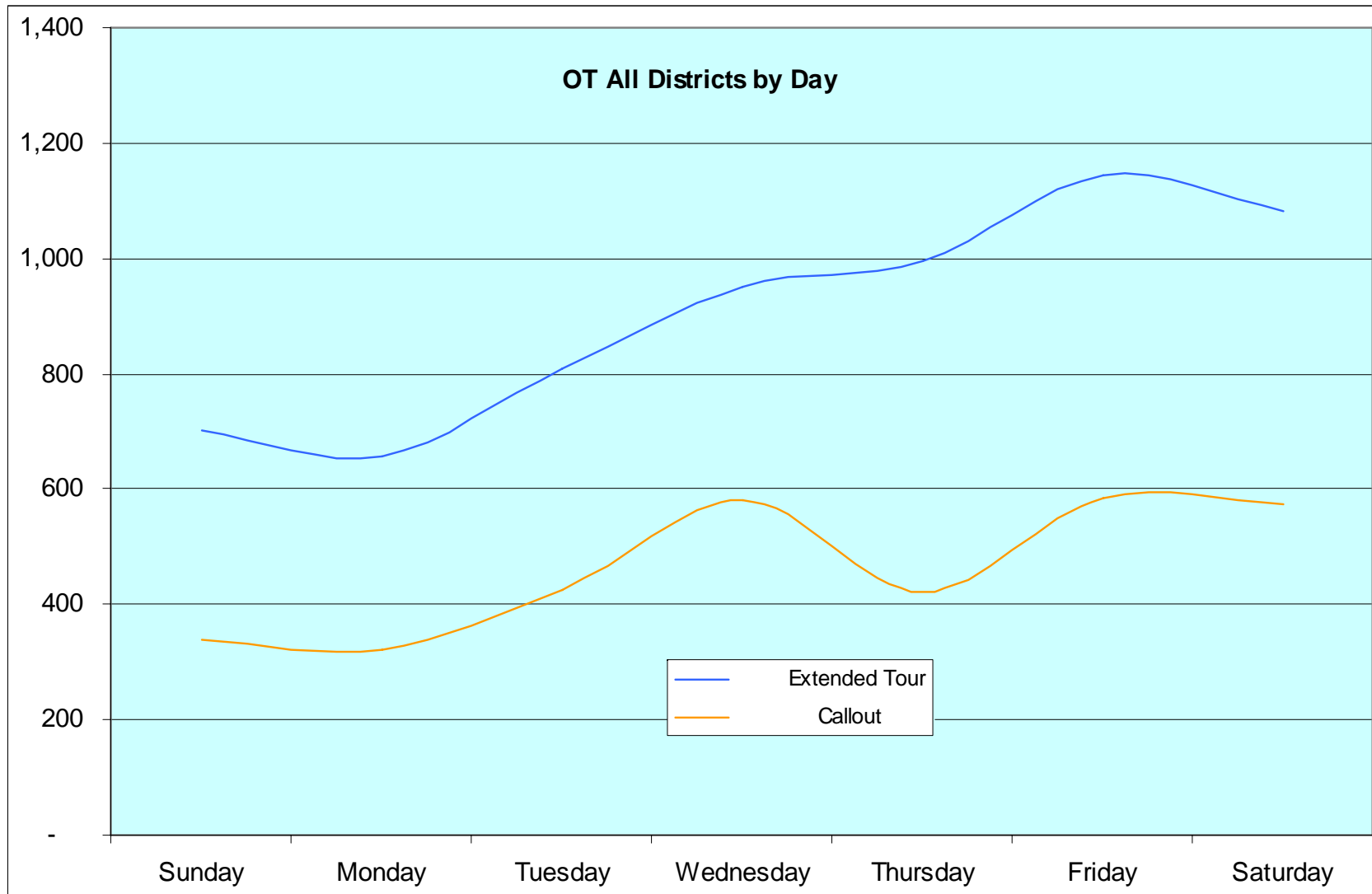
Appendix D-2



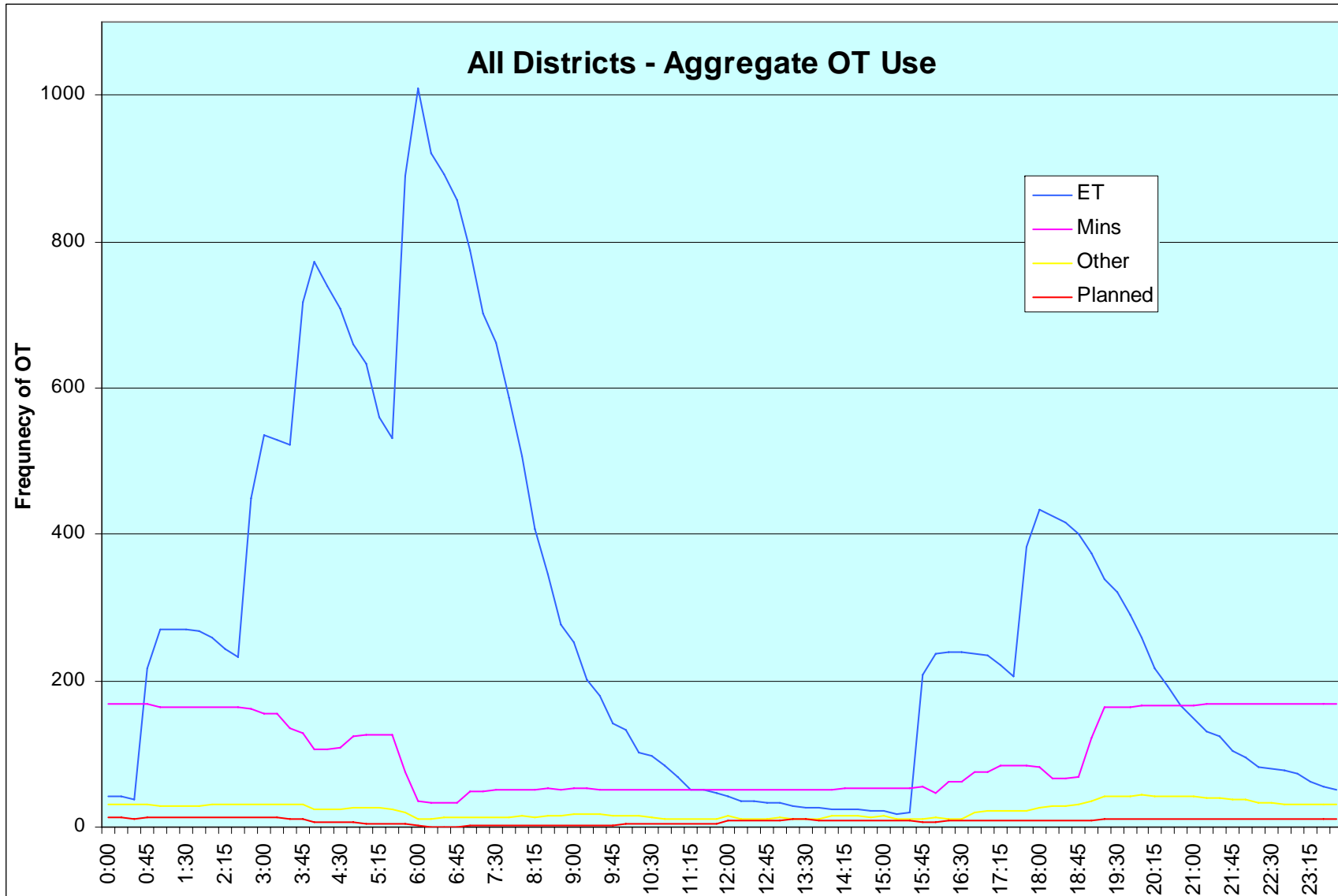
Appendix E-1



Appendix E-2



Appendix E-3



Vancouver Police Department
Planning & Research Section

Appendix F-1

50% Utilization Ratio

Adjusted Resource Distribution by District

	District 1	District 2	District 3	District 4	Total
Consumed Patrol Unit Minutes	2,539,691	2,424,143	2,743,295	2,500,998	10,208,126
Percent of Total Consumed Minutes	25%	24%	27%	25%	100%
Available Unit Minutes	5,856,514	5,581,633	6,297,145	5,732,283	23,467,575
Percent of Total Available Minutes	25%	24%	27%	24%	100%
Number of Calls	32,749	49,606	35,117	38,981	156,453
Percent of Total Calls	21%	32%	22%	25%	100%
Unit Utilization	50%	50%	50%	50%	

Adjusted Patrol Authorized Strength

	District 1 ⁶⁷	District 2 ⁵	District 3	District 4	Total
Current Patrol Team Staffing	89	98	119	103	409
Authorized Strength % Adjustment ¹	27%	22%	30%	24%	
Evaluated Resource Total ²	113	120	155	128	515
District Increase	24.0	21.6	35.7	24.7	106
Factored Team Increase ³	-33	0	0	1	
Adjusted District Increase⁴	0	22	36	24	82
Percentage Proactive Time	50%	50%	50%	50%	
Percentage Allocated Time	50%	50%	50%	50%	
New Patrol Team Staffing	89	120	155	127	491

Note:

1. Based on obtaining unit utilization percentage range below 50% weighted by day and time for each district
2. Figure based on the calculation (Patrol Team x Percent Adjustment).
3. An adjusted figure that takes into account an even distribution of officers for each patrol team within the district. Most districts have either ten or eleven teams that respond to calls for service. Furthermore, the staff increase for each team is adjusted to compensate for one and two officer units in order to impact unit utilization to the level stated.
4. The actual number of officers required per district in order to effect change in the unit utilization ratio to the level stated.
5. Based on District 2 authorized strength, but excluding CET/BET staffing. See analysis section for complete explanation of FTE figures.
6. Excludes recent addition of 33 officers to District 1 that only became deployable in late 2006.
7. On October 4th 2005 the VPD increased the number of officers in District 1 by 33. This resulted in patrol teams increasing from a norm of 9 to a new norm of 13 person teams. The authorized strength for PCs in District 1 is now at 131 officers.

Vancouver Police Department
Planning & Research Section

Appendix F-2

50% Utilization Staffing Projections

Option A

	Team Increase	Redeployed Officers	Combined Tm Increase	Delta (4/3) 4 Teams	Roving 2 Teams	Total 6 Teams	New FTE Increase
District 1 ¹	-8	3	0	11 (8 + 3)		11	
District 2	6	4	10	9	7	16	22
District 3	11	3	14	12	13	25	36
District 4	7	3	10	9	8	17	24
Team Supervisor		4		4	2	6	4
North Surveillance		9 ([D1] 6 + [D2] 3)					
South Surveillance		9 ([D3] 5 + [D4] 4)					
PC Only Total				41	28	69	82
Total	24	35	34	45	30	75	86

Note: 2% efficiency gain over Option B

1. District 1 - Team 3 to 10 reduces in size from 13 to 12 constables.

Option B

	Team Adjustment	Redeployed Officers	Combined Tm Increase	Delta (Fixed) 8 Teams	Roving 2 Teams	Total 10 Teams	New FTE Increase
District 1 ¹	-16	6	0	22 (16 + 6)		22	
District 2		1	1	16	7	23	23
District 3		3	3	24	12	36	36
District 4		3	3	17	7	24	24
Team Supervisor		4		8	2	10	8
North Surveillance		9 ([D1] 3 + [D2] 6)					
South Surveillance		9 ([D3] 5 + [D4] 4)					
PC Only Total		31		78	26	104	83
Total	-16	35	7	86	28	114	90

Note:

1. District 1 - Team 3 to 10 reduces in size from 13 to 11 constables.

Appendix F-3

50% Utilization Staffing Projections

Option D

	Split Shift B 8 Teams	Split Shift C 8 Teams	Split Shift E 8 Teams	Total 24 Teams	New FTE Increase	Redeployed Officers
District 1 ¹	11	11	11	33		3
District 2	8	8	6	22	22	4
District 3	13	14	11	38	38	3
District 4	8	8	6	22	22	3
North Surveillance						9 ([D1] 6 + [D2] 3)
South Surveillance						9 ([D3] 5 + [D4] 4)
Total	40	41	34	115	82	31

Note:

1. District 1 - Team 3 to 10 reduces in size from 13 to 9 constables. Team 1 and 2 reduce to 8 constables

Vancouver Police Department
Planning & Research Section

Appendix F-3

40% Utilization Ratio

Adjusted Resource Distribution by District

	District 1	District 2	District 3	District 4	Total
Consumed Patrol Unit Minutes	2,539,691	2,424,143	2,743,295	2,500,998	10,208,126
Percent of Total Consumed Minutes	25%	24%	27%	25%	100%
Available Unit Minutes	7,286,057	6,954,166	7,847,211	7,165,353	29,252,787
Percent of Total Available Minutes	25%	24%	27%	24%	100%
Number of Calls	32,749	49,606	35,117	38,981	156,453
Percent of Total Calls	21%	32%	22%	25%	100%
Unit Utilization	40%	40%	40%	40%	

Adjusted Patrol Authorized Strength

	District 1 ⁶⁷	District 2 ⁵	District 3	District 4	Total
Current Patrol Team Staffing	89	98	119	103	409
Authorized Strength % Adjustment ¹	58%	52%	62%	55%	
Evaluated Resource Total ²	141	149	193	160	642
District Increase	52	51	74	57	233
Factored Team Increase ³	-19	-1	0	1	
Adjusted District Increase⁴	20	50	74	58	202
Percentage Proactive Time	60%	60%	60%	60%	
Percentage Allocated Time	40%	40%	40%	40%	
New Patrol Team Staffing	109	148	193	161	611

Note:

1. Based on obtaining unit utilization percentage range below 40% weighted by time and day for each district
2. Figure based on the calculation (Patrol Team x Percent Adjustment).
3. An adjusted figure that takes into account an even distribution of officers for each patrol team within the district. Most districts have either ten or eleven teams that respond to calls for service. Furthermore, the staff increase for each team is adjusted to compensate for one and two officer units in order to impact unit utilization to the level stated.
4. The actual number of officers required per district in order to effect change in the unit utilization ratio to the level stated.
5. Based on District 2 authorized strength, but excluding CET/BET staffing. See analysis section for complete explanation of FTE figures.
6. Excludes recent addition of 31 officers to District 1 that only became deployable in late 2006.
7. On October 4th 2005 the Department increased the number of officers in District 1 by 33. This resulted in patrol teams increasing from a norm of 9 to a new norm of 13 person teams. The authorized strength for District 1 is now at 131 officers.

Vancouver Police Department
Planning & Research Section

Appendix F-4 40% Utilization Staffing Projections

Option A

	Team Increase	Redeployed Officers	Combined Tm Increase	Delta (4/3) 4 Teams	Roving 2 Teams	Total 6 Teams	New FTE Increase
District 1	3	3	6	11	6	17	20
District 2	34	4	38	9	7	16	50
District 3	54	3	57	12	8	20	74
District 4	42	3	45	9	7	16	58
Team Supervisor		4		4	2	6	4
North Surveillance		9 ([D1] 6 + [D2] 3)					
South Surveillance		9 ([D3] 5 + [D4] 4)					
PC Only Total				52	28	69	202
Total	133	35	146	56	30	75	206

Note: 2% efficiency gain over Option B

Option B

	Team Adjustment	Redeployed Officers	Combined Tm Increase	Delta (Fixed) 8 Teams	Roving 2 Teams	Total 10 Teams	New FTE Increase
District 1	0	4	4	22 (20 + 2)	6	28	20
District 2	25	1	26	18	7	25	50
District 3	46	3	49	20	8	28	74
District 4	33	3	36	18	7	25	58
Team Supervisor		4		8	2	10	8
North Surveillance		9 ([D1] 3 + [D2] 6)					
South Surveillance		9 ([D3] 5 + [D4] 4)					
PC Only Total		29		78	28	106	202
Total	104	33	115	86	30	116	210

Note:

1. From the 20 officers deployed to District 1,

Vancouver Police Department
Planning & Research Section

Appendix F-5 40% Utilization Staffing Projections

Option D

	Split Shift B 8 Teams	Split Shift C 8 Teams	Split Shift E 8 Teams	Total 24 Teams	Redeployed Officers
District 1	6	8	6	20	3
District 2	17	17	16	50	4
District 3	25	25	24	74	3
District 4	19	20	19	58	3
North Surveillance					9 ([D1] 6 + [D2] 3)
South Surveillance					9 ([D3] 5 + [D4] 4)
Total	67	70	65	202	31

Vancouver Police Department
Planning & Research Section

Appendix G-1

Unit Utilization by District and City-wide Total

	District 1	District 2	District 3	District 4	City-wide
2000	0.569	0.673	0.660	0.575	0.6220
2001	0.612	0.658	0.693	0.594	0.6406
2002	0.610	0.676	0.703	0.618	0.6877
2003	0.672	0.642	0.666	0.642	0.6551
2004	0.681	0.604	0.697	0.650	0.6575
2005	0.648	0.623	0.666	0.636	0.6575
2007 Predicted	0.726	0.609	0.688	0.683	0.679
Average Utilization 00 to 05	63%	65%	68%	62%	65%
% Change 00 to 05	13.8%	-7.4%	1.0%	10.7%	5.7%
Forecast % Change 05 to 07	12.0%	-2.3%	3.3%	7.3%	3.3%

Vancouver Police Department
Planning & Research Section

Appendix H-1

Available Minutes by District and City-wide Total

	District 1	District 2	District 3	District 4	City-wide
2000	4,814,835	5,892,017	5,018,285	5,074,320	20,799,456
2001	4,875,026	5,855,666	5,125,018	5,074,140	20,929,851
2002	4,645,632	5,393,413	4,764,732	4,299,356	19,103,133
2003	4,340,923	5,130,425	4,865,334	4,432,502	18,769,185
2004	4,595,536	4,972,037	4,926,902	4,729,123	19,223,599
2005	4,611,428	4,575,109	4,843,957	4,622,809	18,653,304
Total	27,883,381	31,818,667	29,544,228	28,232,250	117,478,527
2007 Predicted	4,485,674	4,212,344	4,732,020	4,382,262	18,320,113
Available Minutes 00 to 05	4,647,230.24	5,303,111.22	4,924,038.00	4,705,374.98	19,579,754.43
% Change 00 to 05	-4.2%	-22.4%	-3.5%	-8.9%	-10.3%
Forecast % Change 05 to 07	-2.7%	-7.9%	-2.3%	-5.2%	-1.8%

Note: Excluding CET / BET Data

Consumed Minutes by District and City-wide Total

	District 1	District 2	District 3	District 4	City-wide
2000	2,329,221	3,372,083	2,814,838	2,479,887	10,996,029
2001	2,537,700	3,275,824	3,020,435	2,562,828	11,396,787
2002	2,409,315	3,099,586	2,847,764	2,259,754	10,616,419
2003	2,480,150	2,798,128	2,753,936	2,418,421	10,450,635
2004	2,659,288	2,553,117	2,917,958	2,613,298	10,743,660
2005	2,539,691	2,424,143	2,743,295	2,500,998	10,208,126
Total	14,955,363	17,522,880	17,098,227	14,835,186	64,411,656
2007 Predicted	2,723,452	2,001,184	2,792,011	2,581,130	10,097,777
Consumed Minutes 00 to 05	2,492,560.56	2,920,479.97	2,849,704.50	2,472,530.96	10,735,275.99
% Change 00 to 05	9.0%	-28.1%	-2.5%	0.9%	-7.2%
Forecast % Change 05 to 07	7.2%	-17.4%	1.8%	3.2%	-1.1%

Note: Excluding CET / BET Data

Vancouver Police Department
Planning & Research Section

Appendix H-2

Available Minutes by District and City-wide Total

	District 1	District 2	District 3	District 4	City-wide
2000	4,814,835	5,892,017	5,018,285	5,074,320	20,799,456
2001	4,875,026	5,855,666	5,125,018	5,074,140	20,929,851
2002	4,645,632	5,393,413	4,764,732	4,299,356	19,103,133
2003	4,340,923	7,521,836	4,865,334	4,432,502	21,160,597
2004	4,595,536	7,784,721	4,926,902	4,729,123	22,036,283
2005	4,611,428	6,804,946	4,843,957	4,622,809	20,883,140
Total	27,883,381	39,252,600	29,544,228	28,232,250	124,912,459
2007 Predicted	4,485,674	8,322,546	4,732,020	4,382,262	21,922,502
Available Minutes 00 to 05	4,647,230.24	6,542,099.97	4,924,038.00	4,705,374.98	20,818,743.19
% Change 00 to 05	-4.2%	15.5%	-3.5%	-8.9%	0.4%
Forecast % Change 05 to 07	-2.7%	22.3%	-2.3%	-5.2%	5.0%

Note: CET / BET Data Included 2003 to 2005

Consumed Minutes by District and City-wide Total

	District 1	District 2	District 3	District 4	City-wide
2000	2,329,221	3,372,083	2,814,838	2,479,887	10,996,029
2001	2,537,700	3,275,824	3,020,435	2,562,828	11,396,787
2002	2,409,315	3,099,586	2,847,764	2,259,754	10,616,419
2003	2,480,150	3,352,552	2,753,936	2,418,421	11,005,058
2004	2,659,288	3,512,781	2,917,958	2,613,298	11,703,324
2005	2,539,691	3,385,224	2,743,295	2,500,998	11,169,207
Total	14,955,363	19,998,049	17,098,227	14,835,186	66,886,825
2007 Predicted	2,723,452	3,484,782	2,792,011	2,581,130	11,581,375
Consumed Minutes 00 to 05	2,492,560.56	3,333,008.09	2,849,704.50	2,472,530.96	11,147,804.11
% Change 00 to 05	9.0%	0.4%	-2.5%	0.9%	1.6%
Forecast % Change 05 to 07	7.2%	2.9%	1.8%	3.2%	3.7%

Note: CET / BET Data Included 2003 to 2005

Appendix I-1

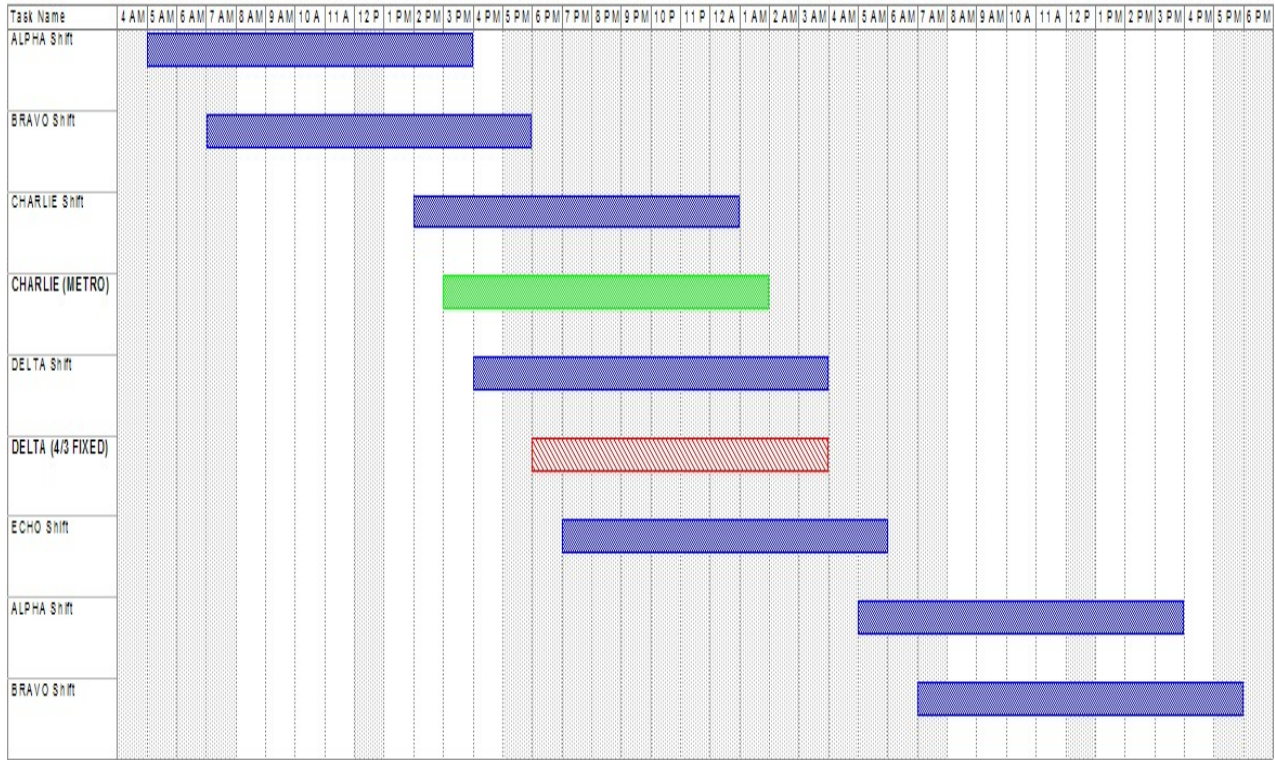
Response Times by District and City-wide Total

	District 1	District 2	District 3	District 4	City-wide
2000	7.22	7.91	9.21	9.18	8.38
2001	8.03	8.63	10.18	9.82	9.17
2002	8.40	8.76	10.18	10.43	9.44
2003	9.89	10.58	11.72	11.52	10.93
2004	10.26	9.71	11.65	11.24	10.72
2005	9.35	11.08	13.21	13.21	11.71
2007	11.34	12.21	14.43	14.23	13.1
Average Response Time 00 to 05	8.86	9.45	11.03	10.90	10.06
% Change 00 to 05	29.5%	40.0%	43.4%	43.9%	39.8%
Forecast % Change 05 to 07	21.3%	10.2%	9.2%	7.8%	11.8%

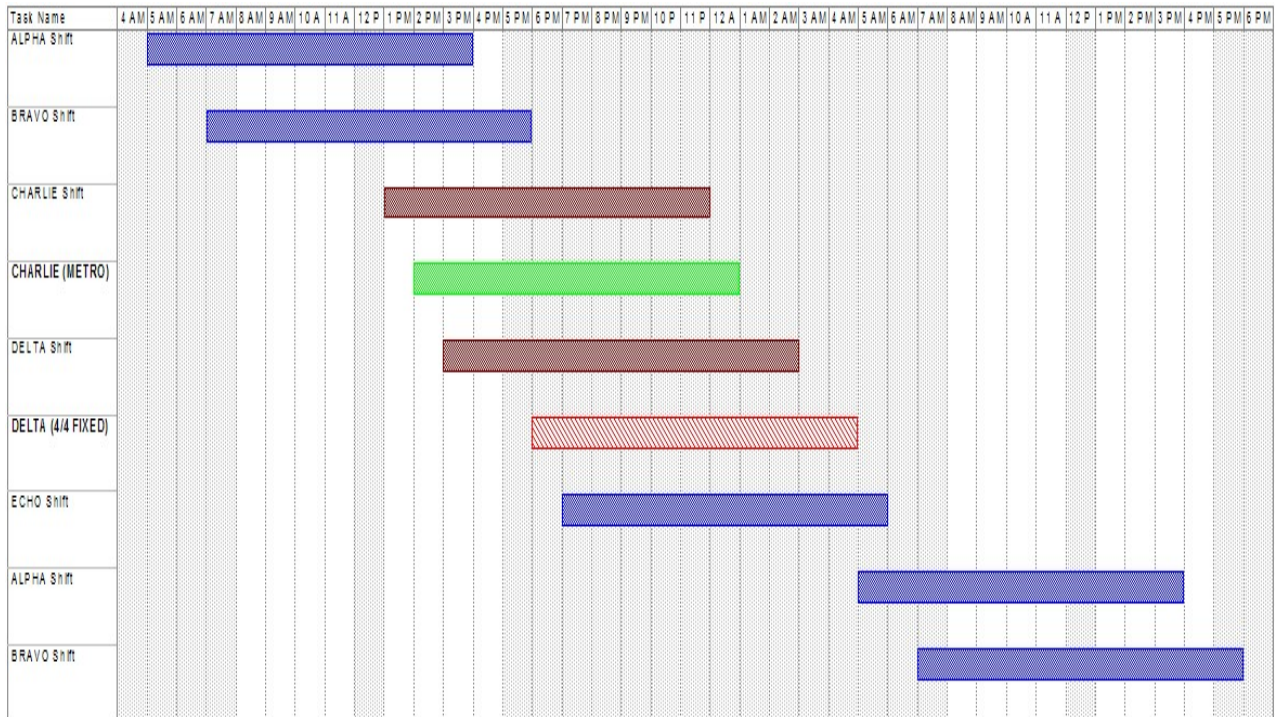
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APPENDIX K-1

PROPOSED SHIFT DEPLOYMENT MODEL ALL DISTRICTS "OPTION A"

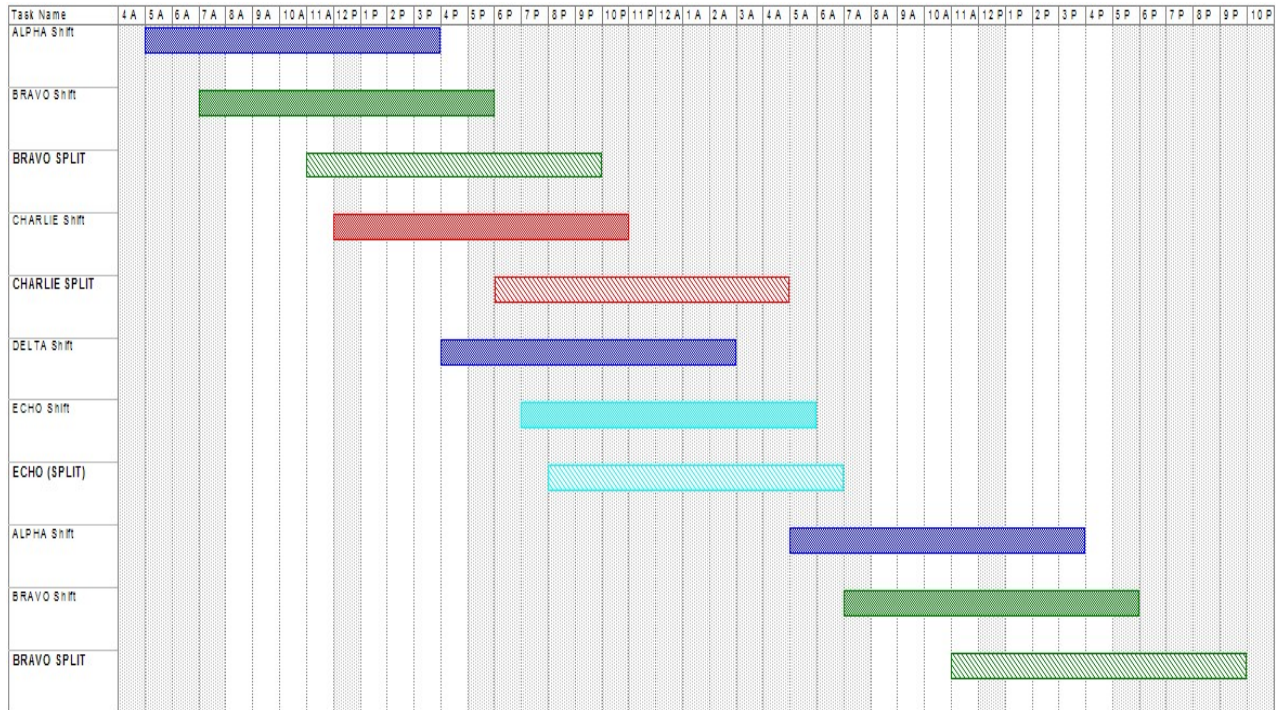


PROPOSED SHIFT DEPLOYMENT MODEL ALL DISTRICTS "OPTION B"



APPENDIX K-2

PROPOSED SHIFT DEPLOYMENT MODEL ALL DISTRICTS “OPTION D”



Works Cited

Berkshire Advisors Inc. (2004). *Dallas Police Department Management and Efficiency Study*. Austin, Texas: Author.

Prox, Ryan. (2004). *Patrol Resource Allocation Review: Phase II Report*. Vancouver Police Department: Planning Research & Audit.

Northwestern University Centre for Public Safety. (2004). *Assessment of the Scottsdale Police Department’s Allocation, Deployment and Scheduling Process*. Evanston, Illinois: University of Northwestern Press.

Bellmio, Peter. (2004). *Shreveport Police Department: Patrol Staffing Assessment*. Annapolis, Maryland: Author.

Sullivan, G., Bellmio P., Hubler G., Somers, S., Adkins, B., (2001). *Performance Audit of the Pierce County Sheriff’s Department*. Carlsbad, CA: Police Management Advisors.

Broom Cheryle. (2004). *Performance Audit of the King County Sheriff’s Office*. Seattle, WA: Metropolitan King County.