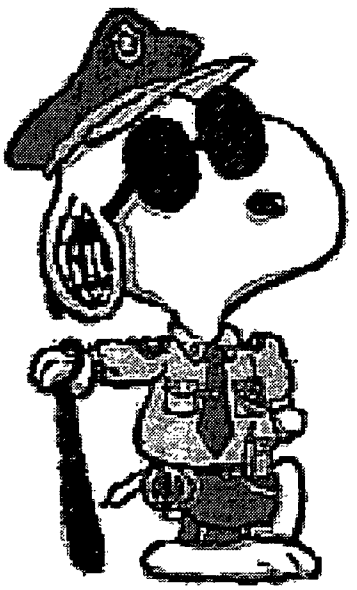
Incident-Based Crime Analysis Manual

Utilizing Local-Level Incident Reports for Solving Crimes

December 1999



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Introduction

Crime analysis is a key step in the sequence of activities aimed at conceiving, implementing, and evaluating measures to prevent crime. This manual is concerned with the application of crime analysis to one specific area of police work: the analysis of high volume crime at a local level. The focus of this report reflects the fact that this type of analysis is a major priority for most police departments and that there is an increasing demand for the application of crime analysis techniques that utilize data available from departmental incident reports. A new generation of crime data based on individual offenses and arrests, rather than summary statistics, has emerged and will provide a rich source of information for law enforcement policy analysts.

Modern crime analysis techniques have become decidedly more useful and accessible to non-statistically trained analysts. These updated techniques have moved towards understanding crime from the standpoint of the perpetrator's psychological and behavioral patterns. These scientific methods constitute a means of providing systematic analytical techniques directed at providing timely information relative to crime patterns and trends. This information can then be used to assist operational personnel in planning the deployment of resources for preventing and suppressing criminal activities, increasing criminal apprehensions, and clearing unsolved and ongoing cases.

Purpose and Scope

Using a single fictional scenario over time, this report will provide both beginning and veteran crime analysts with the necessary guidance to conduct all stages of the crime analysis process, from initial community problem identification to final response assessment and evaluation, using basic incident reports and data elements.

Organization

This manual is divided into five sections.

1. The initial examination of aggregate statistics for pattern identification.
2. Statistical time, date, and location prediction from incident-level crime data.
3. Various reporting techniques that can be used in law enforcement responses.
4. Statistical methods for performing evaluations of the law enforcement responses.
5. A comprehensive crime analysis bibliography and appendix with forms that can be duplicated.

Acknowledgements

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Chapter One – Beginning the Crime Analysis Process

In general, crime analysis is the process of using a systematic methodology to produce statistics and reports. The individual who takes on these tasks, the crime analyst, is a professional, often sworn, employee of a law enforcement department who uses computer technology to analyze, organize, and present various types of data in order to address relevant crime-related questions and assist in problem-solving. A crime analyst can make use of many different sources of data for these analyses, including aggregate counts, incident reports, accident reports, and other law enforcement information. In many situations, the crime analyst has experience with statistics and computer software and is an expert in data collection, data manipulation, statistics, and research methods. One way of thinking of the crime analyst is as a police researcher who assists other law enforcement personnel in doing their jobs.

This manual will help alleviate the common misconception within law enforcement agencies that crime analysts are merely data entry clerks, computer technicians, or the people who can make "pretty" charts. It seeks to broaden the methods of accessing and analyzing information using computerized automation such as spreadsheet software. The quality of a crime analysis unit is intrinsically tied to the level of confidence the department has in the analyst. This manual is intended to transform the novice crime analyst with a general background in research and statistics into an expert capable of performing advanced analyses under difficult circumstances. On the next page, we will join the world of law enforcement from a crime analyst's point of view already in progress. Read on and welcome to the world of crime analysis.

On a sunny summer morning in early June, Officer William Dover left his house and, as always, proceeded to work in his car. Since joining the department back in January, Dover has held the unique position of crime analyst within the Beaufort Police Department's research division. This fairly unwelcome task, as he saw it, was based on a number of factors. First, he had just graduated college in December and was freshly trained in statistics and research methods. Second, he had actually turned on a computer before, so that qualified him as the department's computer expert. And finally, he was the newest hire to the force, so he received the coveted "tough-luck" award by being placed in a position that the chief had promised both the media and the community would take effect in January of the new year.

As Dover turned into the parking lot, he reflected on the unusual peace that had settled over the small Illinois village of 15,000. So far, the extent of his statistical excursions into crime analysis had been very simple monthly counts of the number of index crimes occurring. Nothing really exciting.

It's interesting though, all those college courses apparently qualified me to be the crime analyst and as of today, I haven't had to use statistic one to help solve a crime. What I've been doing so far a monkey could do, Dover thought as he walked into the building.

Officer Dover didn't know, however, that all that would quickly change.

"Hey Dover, Chief Meer is looking for you," the desk sergeant called out as Dover walked by.

Dover's first thought, *uh-oh.* Dover's first response: "Is the chief in his office?"

"Yep, and he is not looking too happy," came the reply with a chuckle.

Dover put his bag down, grabbed his clip-on from the coat rack, checked to see if today's breakfast had disappeared from his teeth, grabbed his pen and paper and headed for the chief's office. Maybe today would be the first day he'd be doing some "real" crime analysis. Perhaps he'd be given the task of converting collected information from incident reports into crime prevention and offender apprehension strategies. This was, after all, the purpose of the crime analyst position, and Dover relished the chance to support his department with analyses that might lead to strategic planning, manpower deployment, or investigative assistance.

"Chief, you wanted to see me?" Dover asked as he stood in the doorway.

"Yeah, have a seat Dover, something has come up and I think we will actually need you to do some *crime analysis*," the chief said rather sarcastically. It was well known that the chief did not have a high regard for book learning and instead preferred to put men on the street, not behind a desk. However, with more and more competing departments putting crime analysts on the payroll, Chief Meer figured that a token paper pusher was probably not a bad idea. He had hoped to be able to get by without actually using him for anything, but it looked like that hope was to end today.

"What's up chief?" Dover inquired as he sat down.

"Well, it appears that a large number of cars in Beaufort are disappearing at a rather rapid rate. We have never had a crime spree in this town and we will not have a crime spree while I'm working here. I want you to find out if these cars are being stolen, running away, whatever; just do it fast, before the media turn it into something enormous. That's all I need, packs of rabid reporters broadcasting that no one's car is safe anymore and we might as well move to another city," the chief exclaimed as he paced his office.

Dover had enough sense to sit still and keep quiet, as it was always wiser to wait until the chief was done ranting before speaking. The chief continued.

"You can do this for me, can't you Dover? I mean, what exactly are your capabilities and responsibilities other than generating monthly reports based on the total number of index crimes?"

"Well chief, as you know, there are a lot of functions that a crime analyst is supposed to perform. Basically, and in no particular order, I can identify existing or evolving crime patterns and crime series. That's what you want me to do. But, I can also help predict future crime events based on past time, date, and locations. I can assist in developing target profiles and provide short-range tactical information to our investigators. Or I can help evaluate crime prevention programs and provide data to support our deployment planning. And I can assist in case clearance screening, identify longitudinal trends and seasonal variations in crime, and even geographically locate centers of concentrated criminal activity," Dover finished, slightly out of breath and hoping he had not forgotten anything.

"Did you forget anything?" the chief asked. "If you can do all that, then I don't think I need to worry about these car thefts do I?"

"No, sir, I'll get right on it and have something for you before the day ends," Dover replied as he prepared to get up.

"Good. Get on it and don't let me see you until you have a time, a date, and a location, whatever it was that you said you could get. Dismissed," the chief said as he waved his hand out the door.

Dover quickly rose and walked back to his desk. He sat down and pondered his role in the department. Just 30 minutes ago, he had no worries and no problems. Now, it felt like the weight of the entire village rested on his shoulders. His mind was racing.

Ok, first, what type of crime analysis do I need to do? Since there are three types, I need to choose one of them. Let me think. There is administrative crime analysis, which is based on economic, social, or other general law enforcement information. That's too basic. How about strategic crime analysis, which is based on trends in both geographic and statistical analysis? No, that is too focused on long term trends and is intended to understand crime over a long time. What I need to do is use tactical crime analysis techniques. That provides information to investigators in the identification of immediate crime situations, and is intended to result in the arrest of a suspect quickly. So tactical crime analysis it is, Dover thought.

The next step is to figure out what I need to conduct my analysis, Dover thought.

Dover remembered that the department (based on his suggestion) maintained records relating to the percentage of all reported crimes that are classified as "solvable" and "unsolvable". Since the village has so little crime, that is not going to be useful, he thought. The department also maintained statistics on the percentage of "solvable" crimes that were cleared, the *optimum* length of assigned cases, the *average* length of assigned cases, and the percentage of time an investigator spent in investigation and other duties. *None of these departmental statistics is going to be of any use*, Dover thought again. *Where do I go now and what am I looking for?*

As panic began to creep into his mind, he decided to relax and just think for a minute. The answer would come to him based on his training.

I know that the chief needs me to find out how many cars have been stolen. He already knows that there are more being stolen now than in the past. Where did he find this out? Dover wondered.

Wait a minute, hold the phone, and hang on a second! If the chief knew that car thefts were already up, then he had to have looked at the count of cars stolen. That means he looked at our index crime count statistics that are sent to the Illinois State Police. All I need to do is check the "Crime in Illinois" *publication for the number of cars stolen per year for the past couple of years and I'll have an answer to how many cars are generally stolen each year. Then, I'll find out the total number of cars that have been stolen by month during this year and see if they are rising. I should have no trouble finding out how many cars are stolen on average in my village. After this, I'll compare the numbers to other similar and nearby villages. Finally, I can graph these findings out and have a nice presentation for the chief*, Dover thought.

Officer Dover felt pretty good. He had figured out what the chief wanted within 10 minutes of leaving his office. At this point, he is only examining overall crime in his village. Basically, this involved identifying aspects of the community that either bear watching or are in need of investigative analysis. This process was simply sped up by the chiefs unplanned assignment.

The next step was to get the data together that's necessary for the analyses I have outlined and then I can figure out what to do with it, Dover thought.

Dover remembered from his one introductory crime analysis course that most crime analysis operations work best when applied to property crime such as burglary, larceny, fraud, and auto theft.

Dover further remembered that there are several general types of data elements that usually prove useful in any analyses. They are geographical, time of day, and day/date factors; victim, offender, property, vehicle and crime scene descriptions; and modus operandi patterns.

When a crime analyst has these data elements, it's like giving a loaded firearm to a patrol officer. It's only at this point that both are truly armed for battle, Dover thought to himself.

For the time being, Dover speculated that he would need very few of these incident-level data elements. Instead, the focus would be on the aggregated counts of cars stolen over the past decade, and of the number stolen over the past 12 months. He wanted to see if motor vehicle thefts had risen and aggregate counts would provide the appropriate answer.

The key questions now for Dover were where to get the total counts and what data analysis techniques to use.

With this in mind, Dover walked back to the research area of the department. His office, the departmental computer and printer, and the copier all worked here in harmony.

Additionally, Dover had put together a mini-library that contained departmental crime totals, formal yearly crime reports, state and federal criminal justice statistical reports (e.g. *Crime in Illinois*, *Sourcebook of Criminal Justice Statistics*), and miscellaneous statistical reports (e.g. *World Almanac*, *Statistical Abstract of the United States*) that had proven useful for other reports and projects.

So far, these reports had provided more information for monthly and yearly summary reports than for an actual case, but as of today they would become part of a live investigation.

Upon investigation of the yearly crime reports, Dover discovered his village seemed to have about 150 cars stolen each year, give or take a few. He decided to put these numbers into a table for future reference. That table looked like this:

Beaufort Yearly Motor Vehicle Thefts	
1990	151
1991	158
1992	161
1993	148
1994	155
1995	194
1996	140
1997	169
1998	172

Dover knew that this table was trying to tell him something, but he was unsure of what. He decided to look more closely at the number of motor vehicle thefts over the past nine years. To summarize his data, he figured he would need to calculate a **mean** (or the arithmetic average of all the numbers) and probably an upper and lower range that the numbers worked between.

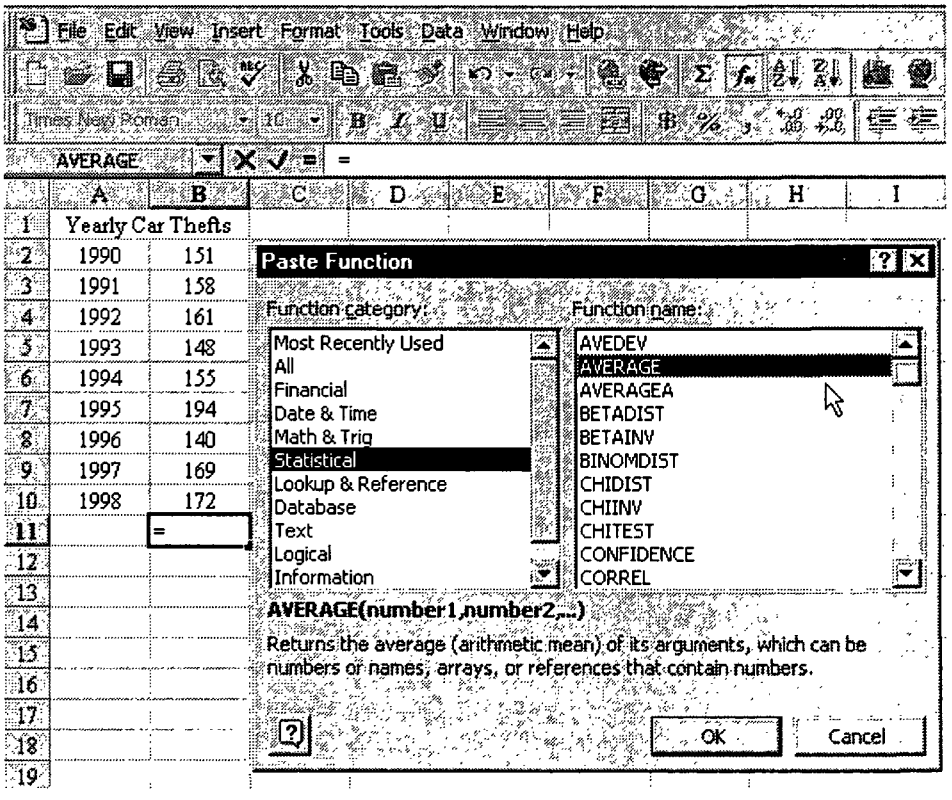
Rather than simply examining the highest and lowest numbers in the series, he recalled what his statistics instructor had called thresholds for acceptance. They are based on the calculated data's **standard deviation**, which is the best way to show how far the data range above and below the mean.

When the standard deviation is added to and subtracted from the mean it creates a threshold called the **confidence interval**. The confidence interval is a statistically accepted level of confidence a person has that the data under investigation fall between the previously defined upper and lower thresholds. The standard thresholds used are located at 68 percent (one standard deviation +/- the mean), 95 percent (two standard deviations +/- the mean), and 99 percent (three standard deviations +/- the mean).

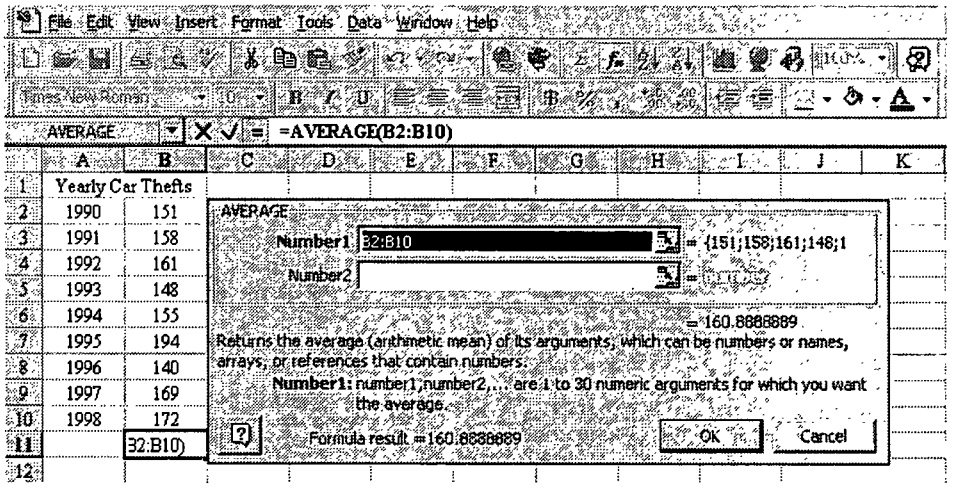
To calculate a mean, Dover would need to take the total number of yearly car thefts and added them up (called a sum). He would then divide the sum by the total number of years included in the analysis. He could do this by hand, with a calculator, or with a computer spreadsheet program such as Microsoft's Excel.

Dover decided that Excel would be a quicker way to accomplish his task, and so he opened a spreadsheet. He then created two columns, one that contained the year and one that contained the yearly total car thefts. He opened a statistical function by clicking on the FX button, which looks like this:

The FX button is located on the toolbar next to the sigma, Σ. This feature would open a wealth of features that would perform most calculations he would need. Once the FX button was pressed, the Paste screen function opened (shown below). Dover chose the Statistical function from the left category column, and then the AVERAGE function from the right name column. This feature would obtain the statistical average from the data that he had specified in column B.

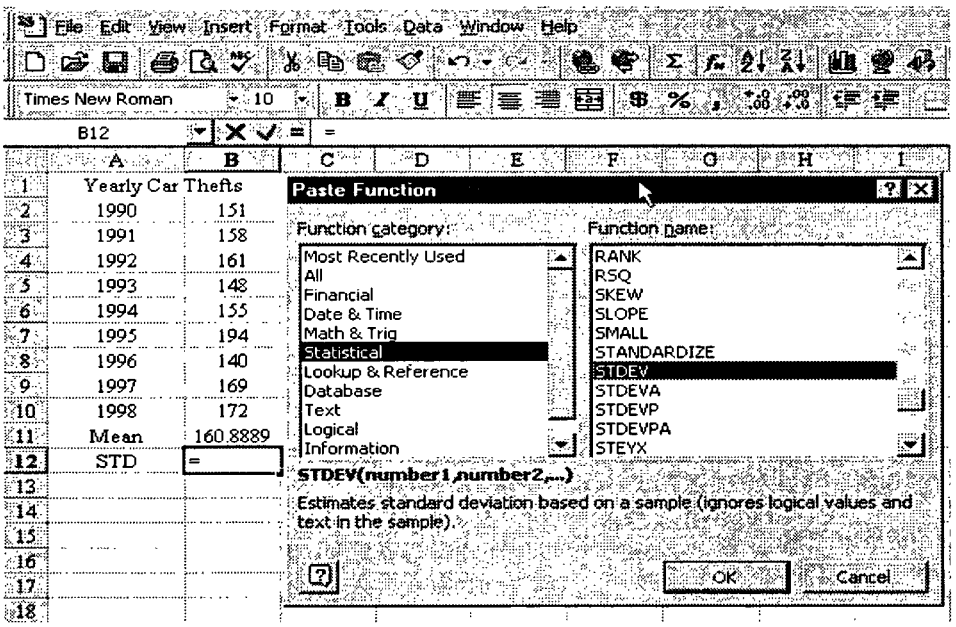


Dover then hit the OK button and Excel asked him for the range of data to calculate the average. The range of data is simply the cell locations of the data to be arranged. In this situation, the range was read as B2:B10. He entered the range and hit OK. The average appeared as the formula result at the bottom of the column.

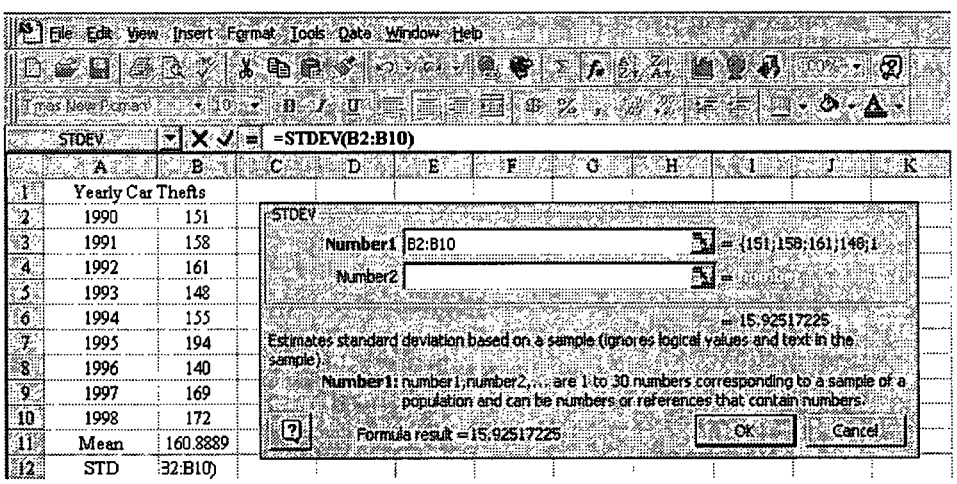


Dover learned that over the past nine years, an average of 161 cars were stolen each year in his village.

Next, he decided to examine the thresholds for these yearly crimes, using confidence intervals that are based on standard deviations. Again, with the same data in the same worksheet in Excel, Dover clicked the FX button, Statistical, and Standard Deviation.



Dover hit the OK button and Excel asked him for the appropriate value range. He entered in the same range as for the average used and hit OK.



According to the entered data, in an average year with 161 car thefts there may be an additional 16 cars stolen or 16 cars not stolen. One standard deviation around the mean is 16 cars. So, in an average year, a confidence interval of 145 to 177 cars may be stolen. This is helpful because it gave Dover a limit on how many cars are *usually* stolen, at least within 68 percent of the time. With this knowledge, he could examine what is happening over time to see if any increases had appeared.

Dover decided to examine the monthly data for the current year, 1999. This would tell him what was happening this year, by month, and point out any increases that appear to be related to a crime pattern. Upon examination of the monthly reports, Dover found that there did appear to be a rise in the number of cars stolen over the past six months. He created a table much like the one used in calculating the yearly figures.

Monthly Motor Vehicle Thefts	
January	8
February	14
March	21
April	25
May	33
June	?

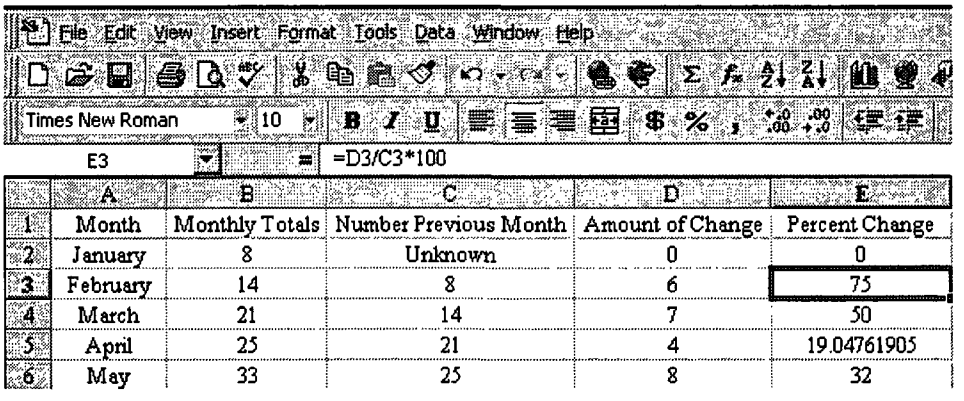
Dover again decided to calculate average monthly car thefts and the threshold around this average. Using the same procedures outlined earlier, Dover found that the average number of cars stolen this year was 20 and the standard deviation was 9.7 (rounded to 10). This created a large confidence interval of 10 to 30 cars stolen a month. Since this confidence interval was very large, Dover decided it was not very useful.

Based on his figures, 20 car thefts a month put Beaufort on pace for 242 car thefts this year compared to 161 in past years! This was most surely beginning to look like a crime series or pattern.

In order to confirm that these numbers were not wrong, Dover also examined the **median** and the **mode** for each grouping of data. The median is the middle of the data, if it were ordered from least to greatest. The median is more useful than the mean in situations where there are very few cases; there are great numerical differences between the values, or there are extreme values. The mode is the most common data occurrence.

The median for the yearly table of car thefts was 158 and the median for the monthly table of car thefts was 21. Since each is very close to the mean, this told Dover that the data was not "skewed" by either very high or very low numbers. The modes are not applicable in this situation because there are no repeated numbers in either data set. The median can be calculated similarly to the mean, by simply choosing FX, Statistical, Median, and OK.

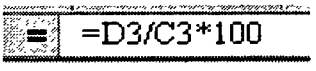
Now that Dover knew the average number of car thefts and the upper and lower limits around this average, he decided to focus on what appeared to be a recent rise in car thefts during the current year. He did this by calculating **percentage changes**.



	A	B	C	D	E
1	Month	Monthly Totals	Number Previous Month	Amount of Change	Percent Change
2	January	8	Unknown	0	0
3	February	14	8	6	75
4	March	21	14	7	50
5	April	25	21	4	19.04761905
6	May	33	25	8	32

To begin, he created a template in Excel that contained columns for the month, the monthly car theft totals, the previous months car theft totals, the amount of change between these columns, and finally the percent change.

Dover remembered that the formula for calculating a percent change was to subtract the *Old Number from the New Number, divide this number by the Old Number and then multiply the result by 100.* The formula for this in Excel is written as indicated in the picture and looked like this:



The unknown number in the previous month category (row 2) corresponds to last December. Dover could have derived that number, but wanted to keep his information confined to the current year, so he omitted it.

The percent change column shows substantial monthly increases in car thefts during the current year. Each month shows a percentage increase ranging from 19 percent to 75 percent. The overall mean of the percent change column (calculated as before using the percent change column data) was an increase of 44 percent. This was very high and definitely something the chief would be interested in hearing about.

To continue to provide a well-rounded picture, Dover also decided to compare his village's car thefts with those of nearby villages. In order to accomplish this task, Dover realized he would need to examine theft **rates per population**. He would need some of the information in his library for these calculations.

Dover knew that the point of a rate was to allow the analyst to compare variables (in this case, car thefts) with jurisdictions that have a different population base. To calculate the rate, then, the variable under study (car thefts) is divided by the population

and then divided by a standardized population base (100,000). The result is a way to compare crime in different areas according to a common base.

Dover was walking back to his desk when he realized that he would have to gather yearly car theft counts from *Crime in Illinois* and then use them to calculate rates. He could also use the Illinois Criminal Justice Information Authority's CJ DataNet Website, but his department was not completely connected to the Internet yet.

He would instead need to gather together the last nine consecutive years' worth of these publications and put the *Crime in Illinois* data into a table for comparison. By now, Dover firmly expected his monthly rates to be high but he had little idea as to how his village compared to other villages nearby on a yearly basis.

To first calculate the necessary rates, Dover created an Excel worksheet that looked like this. It contained columns for the Year, Yearly Total of car thefts, the Population at the time, and the car theft Rate per 1,000 people.

	A	B	C	D	E	F	G	H
1	Year	Yearly Total	Population	Rate Per 1,000	Month	Monthly Total	Population	Rate Per 1,000
2	1990	151	14955	10.097	NA	NA	NA	NA
3	1991	158	14955	10.565	NA	NA	NA	NA
4	1992	161	14955	10.766	NA	NA	NA	NA
5	1993	148	15250	9.705	NA	NA	NA	NA
6	1994	155	15250	10.164	NA	NA	NA	NA
7	1995	194	15250	12.721	NA	NA	NA	NA
8	1996	140	15740	8.895	NA	NA	NA	NA
9	1997	169	15740	10.737	NA	NA	NA	NA
10	1998	172	15740	10.928	NA	NA	NA	NA
11	1999	Unknown	15740	Unknown	January	8	15740	0.508
12			**Mean**	*10.509*	February	14	15740	0.889
13			**Median**	*10.537*	March	21	15740	1.334
14			**STD**	*1.045*	April	25	15740	1.588
15					May	33	15740	2.097
16							**Mean**	*1.283*
17							**Median**	*1.334*
18							**STD**	*0.615*

Dover also created columns for the monthly rates in 1999, with columns for the month, the monthly car theft totals, the population as of that year, and the calculated car theft rate per 1,000 people. Finally, for both the yearly and monthly rates, Dover calculated the mean, median, and standard deviation.

As he examined the data, it first seemed to him that car theft might not be a large problem in his village. The past nine years worth of data indicate that the average yearly car theft rate per 1,000 was only 10.5, with a median of 10.53 and a standard deviation of 1.04. So, it appeared that only about 11 cars (give or take one) were stolen for every 1,000 people in the village.

The monthly car theft rate, however, indicated that so far in 1999, an average of 1.28 cars were stolen for every 1,000 people which by the end of the year could produce a rate of 15.36 cars stolen annually for every 1,000 people (1.28 X 12). The median, at 1.33 and the standard deviation of .615 also confirm this. Dover had further evidence of a rise in car thefts so far this year.

But, did this rise mean that there was more car thefts in his village than other villages? To figure this out, Dover used *Crime in Illinois* to gather population figures and yearly crime totals for two villages that are within five miles of his city limits. One village (Cary) was closer to the major urban area than Beaufort and had a population ranging from 17,550 in 1990 to 18,985 in 1998. The other village (Wilson) was farther away from the urban area and had a population ranging from 12,150 in 1990 to 13,330 in 1998. Dover chose these two villages for comparison because they shared east and west boundary lines and were the two agencies most commonly associated with his village.

Dover created another table in Excel (he could have also altered the original rate table) to include the populations and yearly crime totals and rates. Even though this table looks very complicated, it only contains crime total percent changes and rates from year to year for three cities per 1,000.

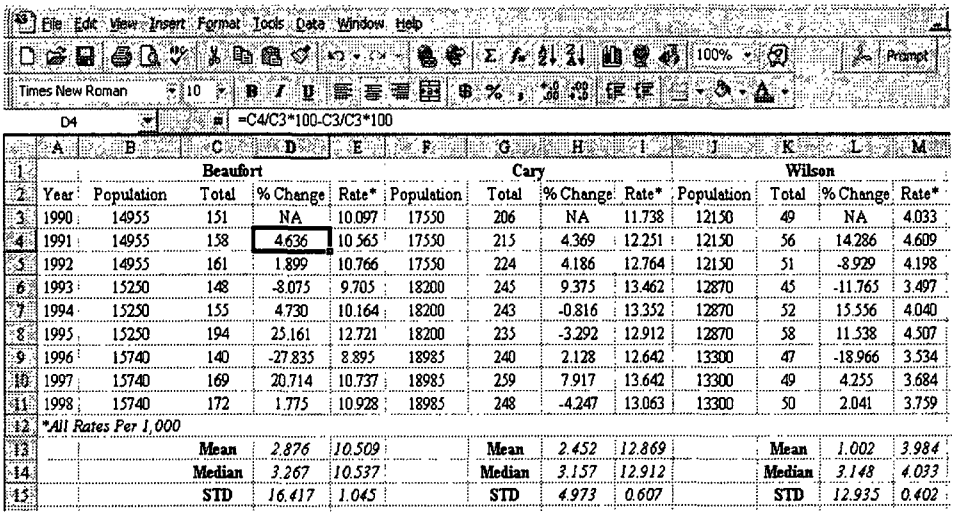
The formula for obtaining the *percentage change* is:

=C4/C3*100-C3/C3*100

The formula for calculating the *rate per population* is:

=C4/B4*1000

The table also contains the overall mean, median, and standard deviation for comparison between the villages.



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D4 =C4/C3*100-C3/C3*100

	A	B	C	D	E	F	G	H	I	J	K	L	M
1			Beaufort				Cary				Wilson		
2	Year	Population	Total	% Change	Rate*	Population	Total	% Change	Rate*	Population	Total	% Change	Rate*
3	1990	14955	151	NA	10.097	17550	206	NA	11.738	12150	49	NA	4.033
4	1991	14955	158	4.636	10.565	17550	215	4.369	12.251	12150	56	14.286	4.609
5	1992	14955	161	1.899	10.766	17550	224	4.186	12.764	12150	51	-8.929	4.198
6	1993	15250	148	-8.075	9.705	18200	245	9.375	13.462	12870	45	-11.765	3.497
7	1994	15250	155	4.730	10.164	18200	243	-0.816	13.352	12870	52	15.556	4.040
8	1995	15250	194	25.161	12.721	18200	235	-3.292	12.912	12870	58	11.538	4.507
9	1996	15740	140	-27.835	8.895	18985	240	2.128	12.642	13300	47	-18.966	3.534
10	1997	15740	169	20.714	10.737	18985	259	7.917	13.642	13300	49	4.255	3.684
11	1998	15740	172	1.775	10.928	18985	248	-4.247	13.063	13300	50	2.041	3.759
12	*All Rates Per 1,000												
13			Mean	2.876	10.509		Mean	2.452	12.869		Mean	1.002	3.984
14			Median	3.267	10.537		Median	3.157	12.912		Median	3.148	4.033
15			STD	16.417	1.045		STD	4.973	0.607		STD	12.935	0.402

As Dover examined the data, he found out several interesting facts for the chief. First, the average percentage change in Beaufort. With an average yearly increase of 2.876, his village was increasing its yearly motor vehicle thefts faster than either Cary (2.452) or Wilson (1.002). Additionally, the median was higher in all cases.

When the rates were examined, it appears that the overall car theft rate (10.5) is actually lower than that of Cary (12.869) although higher than Wilson (4.0). As Dover looked over the numbers, he also thought about the three golden rules of arithmetic work.

First, small numbers can produce big percentage changes. He knew to always be careful when comparing small totals, as they appear to make big differences.

Second, Dover knew to watch for decreasing numbers. In many situations, crime can rise over 100 percent. However, it cannot decrease by more than 100 percent. For example, a 100 percent decrease is an absolute decrease to 0. Thus, there is no possibility of falling below 0 or the idea of no crime (what 0 percent really means).

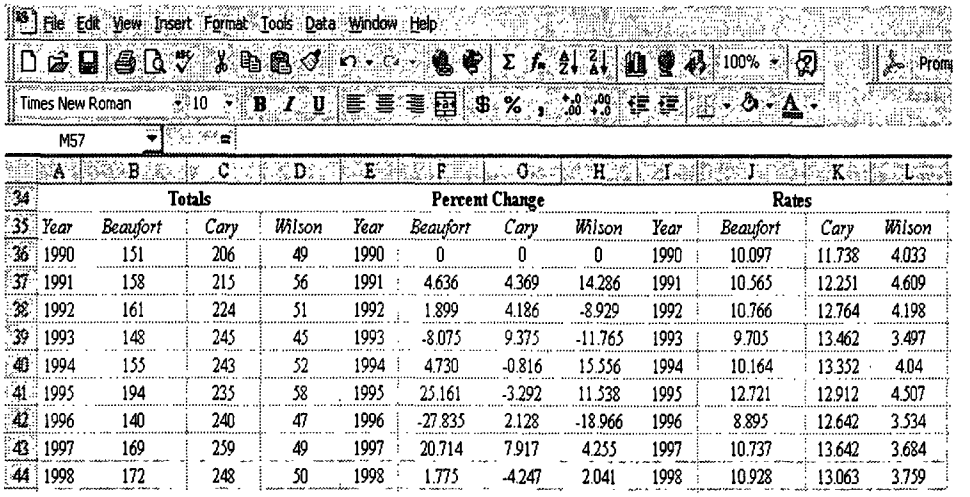
Third, Dover knew to watch zero carefully. The simple fact is no number can be divided by zero. This is important to the crime analyst because a reporting period (month or year) often has no reported crimes, followed by a reporting period with one or more crimes. Normally, the percent change requires dividing the difference by the total for the 1st reporting period. In this situation, however, the crime analyst will report the percent change as not calculable and instead report the absolute change (the number) rather than the percent. Using these data, this is not an issue for Dover as there are no zeros anywhere in the data set.

By now, Dover knew that car thefts in his village were up. There was proof that the increase also exceeded that of other nearby villages. However, what concerned him was that all he had were a bunch of tables to show the chief.

The next logical step was to create a series of charts and graphs that represented the tables accurately, but not in an intimidating manner.

A big problem was to decide what to put on what chart. Since there are so many different chart types, Dover decided to choose only those data that would impress the chief the most. He decided to use an **Area chart**, and a **Line chart** to graphically illustrate his points.

First, Dover created a table in Excel of the raw data like the one shown below. This chart would show the year, the total car thefts, the percentage change from year to year in car thefts, and the rate of car theft for all three villages.

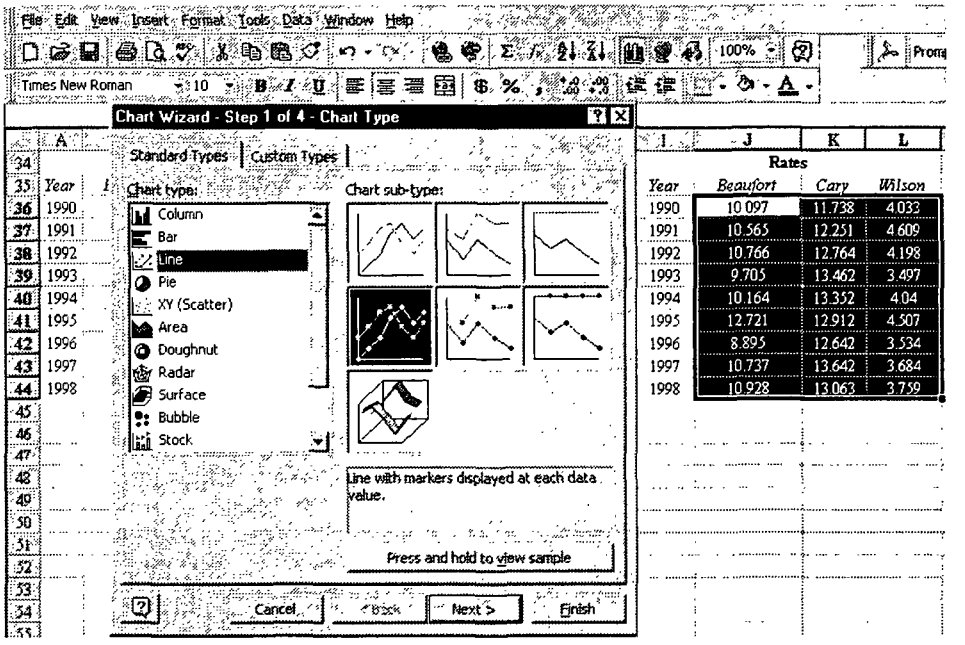


		Totals				Percent Change				Rates		
35	*Year*	*Beaufort*	*Cary*	*Wilson*	*Year*	*Beaufort*	*Cary*	*Wilson*	*Year*	*Beaufort*	*Cary*	*Wilson*
36	1990	151	206	49	1990	0	0	0	1990	10.097	11.738	4.033
37	1991	158	215	56	1991	4.636	4.369	14.286	1991	10.565	12.251	4.609
38	1992	161	224	51	1992	1.899	4.186	-8.929	1992	10.766	12.764	4.198
39	1993	148	245	45	1993	-8.075	9.375	-11.765	1993	9.705	13.462	3.497
40	1994	155	243	52	1994	4.730	-0.816	15.556	1994	10.164	13.352	4.04
41	1995	194	235	58	1995	25.161	-3.292	11.538	1995	12.721	12.912	4.507
42	1996	140	240	47	1996	-27.835	2.128	-18.966	1996	8.895	12.642	3.534
43	1997	169	259	49	1997	20.714	7.917	4.255	1997	10.737	13.642	3.684
44	1998	172	248	50	1998	1.775	-4.247	2.041	1998	10.928	13.063	3.759

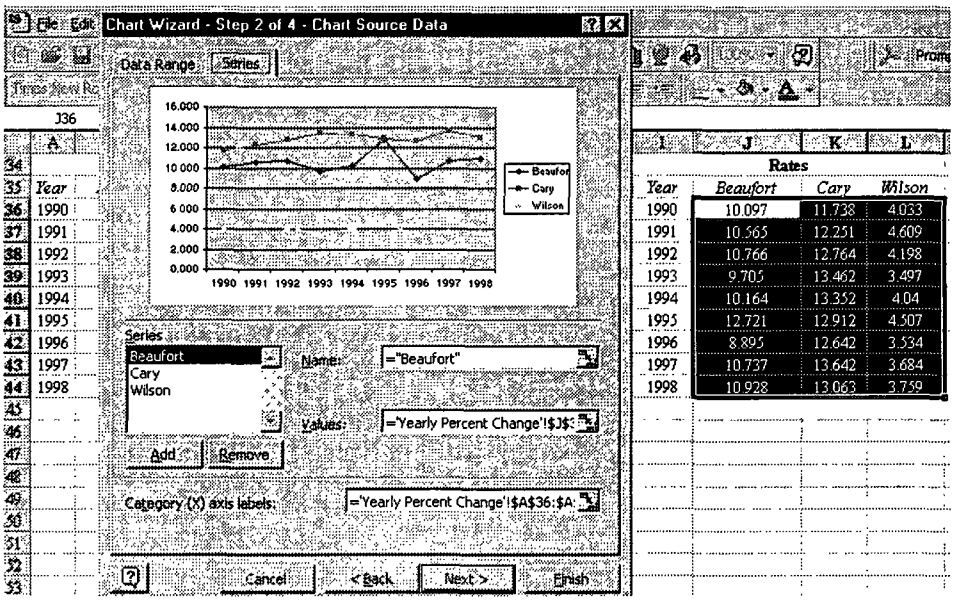
Next, Dover highlighted the cell ranges by column that corresponded to his desired chart and clicked the Chart button at the top of the screen. The chart button looks like this:

This brings up the chart wizard that is shown below. After the initial opening, the chart wizard will create a graph in four easy steps.

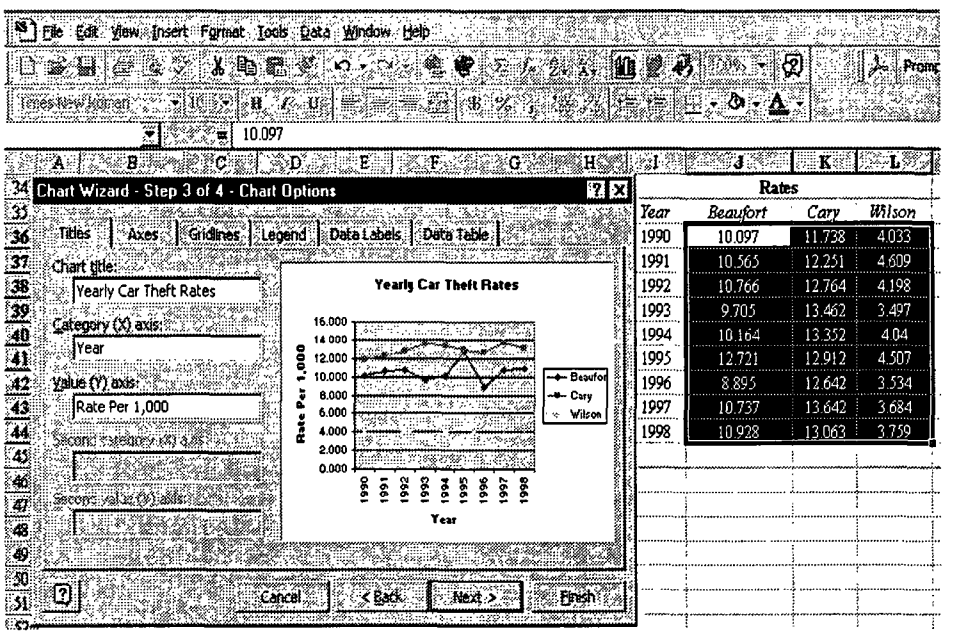
In step one, Dover decided to begin with a Line graph for the yearly rates of all three villages (which is useful for showing trends in data over time). He selected the line graph from the chart type left column and the chart sub-type from the right column. He selected that option among the chart types, and then pressed Next.



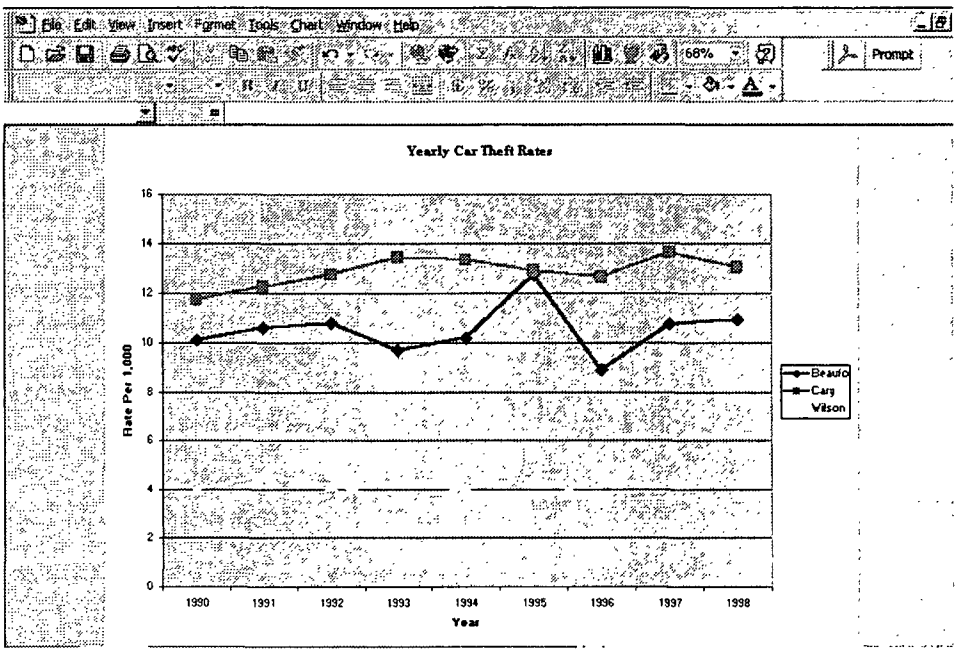
This moved him to the chart source data screen shown below for step 2. This screen asked Dover to label each data range and set an X-axis label. To do this, Dover had to take care of two tasks. First, under the Series tab, he needed to label each line on the chart by its appropriate village. This was accomplished by selecting the correct series in the Series column, typing a name in the Name column, and correcting it by clicking the Add button. The example shown is for Beaufort. After this was done for all three villages, Dover next labeled the X-axis. He did this by selecting the appropriate year range and entering it into the Category X-axis label area.



After carefully naming the lines and labeling the X-axis, Dover pressed Next and moved to step 3, the chart options screen shown below. The chart options screen let Dover enter a title, labels, and any other additional information he might need.



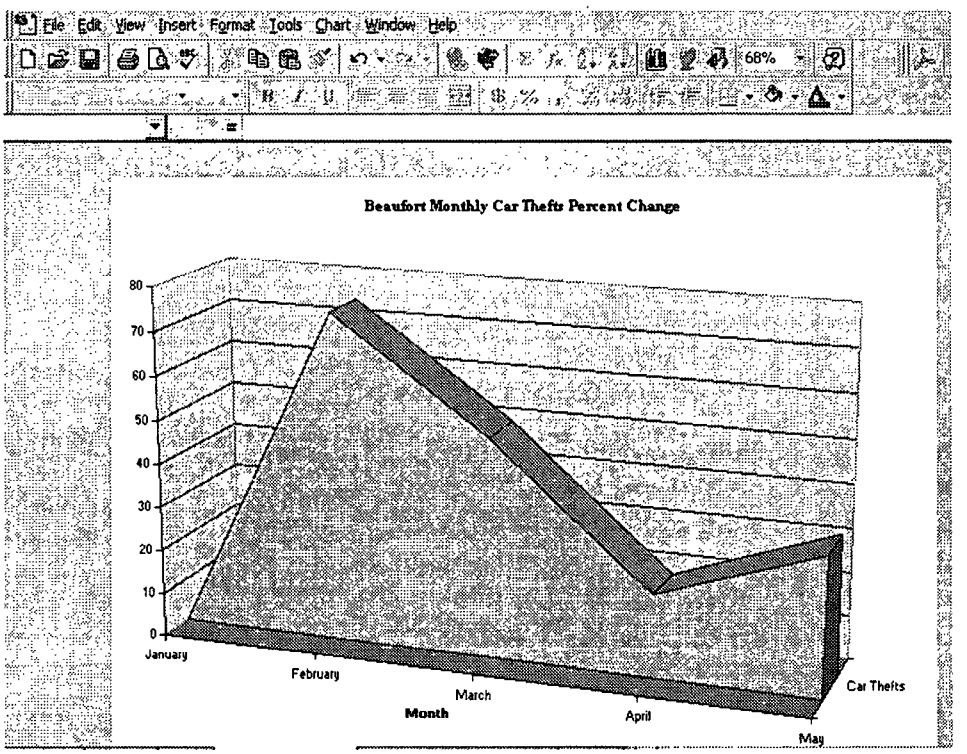
The final stage, step four, came after Dover pressed Next one last time. This took him to a screen that required a location for the chart (either a new tab at the bottom of the screen or as an imbedded object in the spreadsheet). After telling Excel where to keep the chart, the finished product (with the background lightened) looked like this.



The chart graphically illustrates what Dover had found out; namely that even though his village did not have the highest car theft rate (that was reserved for Cary), it did have a steady yearly increase, with increasingly higher rates since 1996.

Dover felt, though, the key was to show what was happening more recently. To do this, Dover decided to produce a graph showing the monthly percent change for the current year. Instead of a line graph, this time he would use an area graph, which emphasizes the magnitude of change over time, but also illustrates the contribution of each month to the yearly total collected thus far.

The area graph, upon completion, looked like the one shown below. Dover followed the same Excel steps as with the line graph (except for selecting an area graph rather than a line graph) and the result was striking. The data indicated that beginning in February, car thefts rose substantially in the village. Following this peak, car thefts then declined rapidly until they reached their lowest levels in April. However, and this was not good news, it appeared that beginning in May (the most recent month) there was a sharp increase in the number of cars stolen. This was a situation that definitely needed to be halted immediately!



Dover realized that he could continue to create other charts and graphs, but the strongest indicators of a crime pattern were right in his two charts. He decided to go to the chief with what he had created so far.

All I need to do is print out these charts, along with the data tables showing the percent changes and rates, and the chief will be satisfied. The patrol officers will know that there is an increase and we can tell them to keep their eyes open for suspicious people lurking around empty cars, Dover thought.

With his printing completed, Dover went to the chief's office with his information.

"Chief, I think I have what we're looking for," Dover proclaimed proudly.

The chief looked up from his desk "Really, well, bring it in."

Dover sat down and pulled up the first of his charts.

"What I decided to do was examine the past nine years worth of yearly car thefts for our village, and Cary and Wilson. I then calculated means and standard deviations to find out how many cars are usually stolen here and what was an acceptable upper and lower limit. That just means how many cars above or below average are "normal"."

"I know what an upper and lower limit is."

"Yes, sir. I then calculated yearly increases and decreases for each village and the car theft rate per 1,000 people in the village. Finally, I took a look at the past six months worth of car theft data, calculated percent changes, rates, and made a few graphs to show that it does appear like car thefts are rising in Beaufort," Dover announced.

"So, all this work tells you that car thefts are up?" The chief asked.

"Yes, sir, they do."

"Did I not sit here, just about 3 hours ago, and tell you the same thing?"

Dover shifted uncomfortably in his seat. "Yes, sir."

The chief rose from his desk and walked to the window.

"Then what, exactly, have you done other than waste the past three hours finding proof to tell me what I already know?"

Dover couldn't think of anything to say.

The chief continued, "Dover, what I want to know is where are these cars being stolen, what kinds of cars were they, and were there any similarities in the MO? Do you get me? I need information that will help us solve these crimes, not information that tells me I'm right. Now, do you think that this is information you can gather and use to provide me with investigative leads?"

Dover stood up. "Yes, sir, I will have something on your desk by the end of the day tomorrow."

"After wasting the morning, you'd better hope that there are no cars stolen tonight, or ... well, let's not think about that," the chief replied as he looked down at his desk and began to work. "Now, get out of here."

Dover headed back to his officer rather dejectedly. *Where am I going to find that kind of information*, he thought to himself, *if the investigators can't find it, how am I supposed to*? *I need more than just offense totals to uncover more details about these car thefts*. He faintly recalled his crime analysis course and something his instructor had told the class was just beyond his remembering.

Something very important.

Then it hit him.

Incident reports!

Chapter Two – Crime Data Analysis

Dover realized incident reports were the answer he was searching for. The investigators were looking for suspects by questioning witnesses. They were not analyzing the information already collected on the incident reports for clues! And, instead of aggregate counts, the incident reports would be able to give him specific information on those "what", "where", and "how" questions that the chief wanted answered.

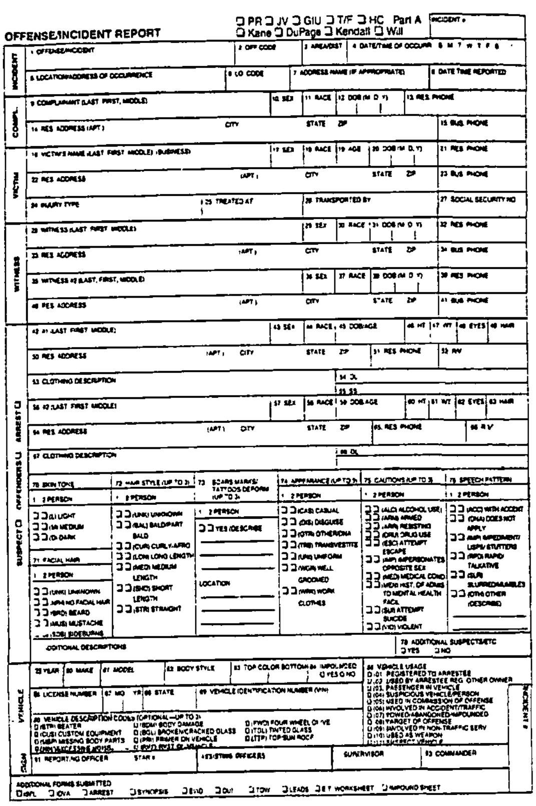
All he had to do was gather, collate, and analyze six months worth of car thefts. *Great, that should only take a week*, Dover thought. But, at least now he had an idea as to what he was going to do and where he should start.

Dover wished the process could have been made easier by having the incident data available in a computerized format. Unfortunately, this was not yet in place. All the data elements he needed were included in the Federal Bureau of Investigation's (FBI) National Incident Based Reporting System (NIBRS), but his state was still in the process of implementing that system. His police chief had decided to wait until those reporting formats were in place before he would seek to automate the village's police records management system.

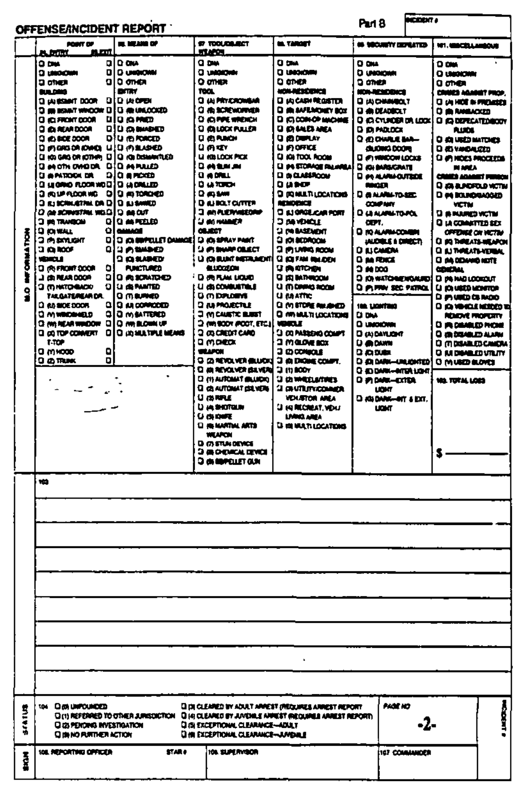
The first step would be to gather together the incident reports he needed. By first looking at the UCR offense code at the top of the incident reports, Dover pulled the 101 motor vehicle theft cases from the files and carried them back to his office. Just prior to Dover's hiring, the entire police department (and especially the research department) had been audited for the purpose of improving their records and analysis capabilities.

One of the principal changes instituted was an exhaustive new incident report that collected every data element that might be useful for crime analysis. The old incident report was found too vague for crime analysis purposes and eventually (when all incident data was computerized) would be phased out. The new incident report was designed to be compatible with the FBI's NIBRS system, and contained a series of questions in checkbox format.

One area of major change to this incident report was the expanded categories of both MO and suspect information. While Dover was unsure about its usefulness in analyzing motor vehicle thefts, he intended to use it for all it was worth. A copy of Dover's village's incident report is shown below. (For the full size reports, please see Appendix A).


OFFENSE/INCIDENT REPORT

Part A


OFFENSE/INCIDENT REPORT

Part B

The beauty of this new incident report was that it was designed with the needs of the crime analyst in mind. Dover could do analysis on the offense, the victim, the suspect, and the stolen property. He could even do analysis based on witness information that was generally only briefly described in the narrative section of the old report.

Another factor in Dover's favor was that the responding patrol officers did an exceptionally good job of filling out the reports. Dover had heard countless stories from older veterans who had worked in very large cities of patrol officers who were so careless in filling out the mounds of paperwork that crossed their desks they actually forgot to put the victims name on the incident report! Thankfully, that wasn't here.

So obtaining the information was not going to be a problem. Using incident reports would give Dover the ability to link together information about many different aspects of each motor vehicle theft.

Now that I have all this information, how in the world do I make some sense of it? I know that I am looking for patterns, but how do you find patterns in 101 documents? Dover thought, frustrated.

If I had some way to collate and organize that information, then I might be able to pull out a pattern. And, if I organize these incident reports first by month, then day, and then time, I might find a stack that is higher than the others. That would tell me that there are more car thefts happening at that time, on that day, in that month. Then the pattern analysis will be much simpler.

First, I'll need to create an ***information matrix form*** *to manually organize the data*, Dover said to himself as he began putting reports in different piles.

Dover knew he would need to develop an information matrix form that would capture data elements for each crime in a uniform fashion. Each specific incident report would have to be examined in order to transfer the information onto the paper matrix form. These manual processes of incident data collection were the only ones available to Dover, as computerized incident databases had not yet been introduced to his department.

Dover figured he needed information on a wide variety of data elements so he created his manual information matrix form accordingly. He included data pertaining to the offense, the offender, the victims, the property, and additional information taken from the narrative section of the offense report.

Knowing that there are many sources of internal data that he could have used (such as traffic citations, jail records, and field interview cards), Dover decided that the incident reports contained all the information he could possibly use. The matrix form is shown below and a full size version exists in Appendix A.

Crime Analysis Information Matrix					
Data Element	*Crime I*	*Crime II*	*Crime III*	*Crime IV*	*Crime V*
UCR Code					
Date					
Time					
Location					
Attempt/Complete					
Method of Entry					
Method of Exit					
Ransacked/Mischief					
Property Description					
Property Removed					
Type Property Loss					
Amount of Property Loss					
Value of Property					
Bias Motivation					
Weapons Used					
Tools Used					
Suspected Drug Type					
Suspected Drug Quantity					
Type of Target					
Type of Victim					
Age of Victim					
Race of Victim					
Sex of Victim					
Ethnicity of Victim					
Type of Victim Injury					
V/O Relationship					
Resident Status					
Age of Suspect					
Sex of Suspect					
Race of Suspect					
Ethnicity of Suspect					
Height					
Weight					
Hair					
Eyes					
Complexion					
Facial Hair					
Glasses					
Car Year					
Car Make					
Car Model					
Color					
License Number					

The information matrix form would ultimately help him decide what information he would enter into his personal computer for further analysis. His goal was to compare incident reports containing different data elements, to ultimately point towards a similar offender or offenders based on offense characteristics.

Dover's information matrix would be the first step in pinpointing the information that would need to be entered into the computer for basic statistical analysis. Without this form, the data would be merely disjointed incident reports that could not be connected together to identify a crime pattern.

In order to organize the data graphically, Dover decided it would be useful to create a **crime calendar**. The crime calendar would be useful for visualizing the dates and times, and the order that the pattern crimes have occurred. This particular form provides a good graphical representation of a potential crime pattern or series. It would allow Dover to determine if the motor vehicle thefts are actually taking place at a specific time period, which is one of the key determinants of a crime pattern. It would also show any day or date similarities that might be used to develop a response plan.

The crime calendar is exactly what it sounded like. Dover simply opened the Microsoft Outlook feature on his computer and printed off a monthly calendar to use in pinpointing when the crimes appeared to be taking place, according to the incident reports he pulled.

In this situation, Dover was examining the motor vehicle thefts for May, so he printed out a May calendar. Occasionally, it may be necessary to examine several months consecutively, when a crime series or pattern occurs over more than one month. These situations are relatively rare, unless the offender does not hit his targets with any

observable pattern or with a great deal of time between crimes. Generally, crime series or patterns that are observable are also obvious and thus discovered quickly. In many cases, only an analysis of one calendar month may be necessary.

Below is a copy of Dover's May crime analysis calendar, uncompleted. The full sized version is shown in Appendix A.

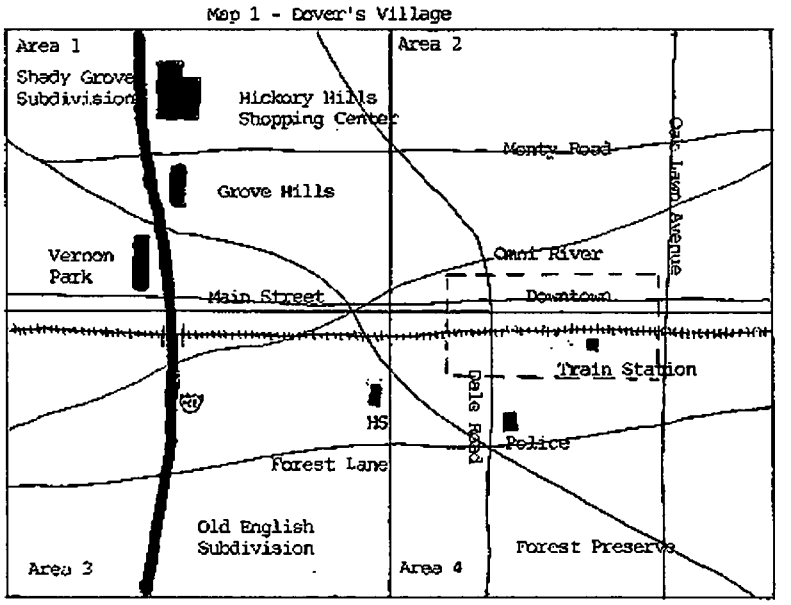
Crime Analysis Calendar

May

Monday	Tuesday	Wednesday	Thursday	Friday	Sat/Sun
April 27	28	29	30	May 1	2
					3
4	5	6	7	8	9
					10
11	12	13	14	15	16
					17
18	19	20	21	22	23
					24
25	26	27	28	29	30
					31

The usefulness of the crime calendar, unlike the information matrix, is to merely provide a visual understanding of when the crimes are occurring. The crime calendar is used to help identify days, dates, and times when similar crimes are occurring.

Dover also decided to create a very basic map of his village that he could use to show the location of all the motor vehicle thefts in May. His map is shown below, without any crime incidents listed. This was his **orientation map**.



That's not a bad rendition of Beaufort, Dover thought. *I'm not going to bother with the smaller streets, I'll just stick with the main thoroughfares and that should provide me with basic locations. It's too bad we don't have our computerized mapping program yet, as that would make this even easier. I hope we can get it before next year.*

What Dover was looking for was the existence of a crime pattern or crime series. The difference lies in the offender. A **crime pattern** is merely a set of similar offenses happening in a specific geographical area. That could be a village, a parking lot, or subdivision. The real challenge was to find information leading to a crime series. A **crime series** is a crime *pattern* that appears to be done by either the same person or group of persons. The discovery of a crime series is useful to the analyst because it allow him to create an offender profile, forecast future crime incidents based on MO information, and create specific investigation and patrol strategies.

Generally, the incident information that can lead to a crime being classified as part of a pattern or crime series include: geographical factors, time factors, property loss

descriptions, target descriptions, specific MO factors, suspect information, and physical evidence descriptors. It is also important to remember that specific crimes will require different data elements to establish the existence of a pattern or series (i.e., in sex crimes it may be important to know the victim/suspect relationship).

At this point, Dover knew that he needed to begin examining the incident reports for information that might suggest a specific pattern. He figured that he could examine modal categories (most frequent) in the information matrices for patterns by examining the types of cars stolen, the location, the time, and the date of the thefts, any witness statements concerning the suspects' behavior or dress, and possibly the method of entry. Hopefully, combined with the mapped locations, this would provide enough information to begin alerting patrol officers to where and when future crime may occur.

To begin, Dover examined the incident reports for 33 motor vehicle thefts occurring in May. Dover examined these incident reports for information that could be moved to the information matrix for specific crime investigations and response plans.

Dover first looked at the modal time of day the car was stolen, the modal location it was stolen from, the modal day and date of the theft, the modal method of entry, the modal type of vehicle, and any witness information. He then came to the conclusion that there were five motor vehicle thefts that seemed to be highly related in a variety of ways.

First, in Area 1 of Beaufort (the commercial shopping area), there were five luxury cars stolen within a half mile of the Hickory Hills Shopping Center (the area mall) and the Grove Hills and Vernon Park Shopping Centers. These cars were high value luxury vehicles (BMW, Lexus) that were relatively new (1993 and newer). None of the

incident reports indicated any window glass evidence, thus the MO appeared to be lock picking or pulling rather than a smash job.

To Dover, this meant that the cars could have been stolen for resale or resale parts, rather than joy rides. In addition, none of the incident reports indicated recovered vehicles, adding further evidence to the sale theory.

The victims' reports were similar. They had parked their cars either at the back or side of the lot, where pedestrian and car traffic was the lightest, in an effort to keep the doors from getting dinged. However, these areas are also the least lit and so made for an inviting target.

Each victim reported going to the shopping center after dusk and often staying until it closed at 9:00 p.m. In some cases, victims were inside the stores for less than a half-hour; possibly indicating the offender targeted the victim's car for theft upon sight.

As far as Dover could tell, the information appeared to be leading to the conclusion that a crime pattern or series was under way. The geographical locations appeared to be similar, when the time factor, suspect descriptors, and property loss/target information was taken into account.

Below is Dover's completed information matrix that he used for all statistical analyses. The full sized blank version is shown in Appendix A. The information contained is derived from the original 33 incident reports for May, of which it appears that five are part of a pattern/series. Basically, Dover took the information from the incident reports and filled in the corresponding blank space on the matrix. The matrix was set up so that the crime pattern number was listed along the top of the form and the various data elements that contained information were listed along the far-left column.

If there were additional data elements that were not included, Dover knew he could amend the form by creating another one in Excel and adding the data element.

Crime Analysis Information Matrix					
Data Element	*Crime I*	*Crime II*	*Crime III*	*Crime IV*	*Crime V*
UCR Code	240	240	240	240	240
Date	5/5	5/14	5/18	5/20	5/25
Time	8:30pm	9:00pm	7:30pm	6:00pm	8:00pm
Location	Hickory Hills	Target	Lone Star SC	Hickory Hills	Hickory Hills
Attempt/Complete	C	C	C	C	C
Method of Entry	Door	Door	Door	Door	Door
Method of Exit	NA	NA	NA	NA	NA
Ransacked/Mischief	NA	NA	NA	NA	NA
Property Description	93 Lexus SC300	94 BMW 325is	93 Mercedes 300CE	97 Chrysler Sebring	95 Land Rover Discovery
Property Removed	NA	NA	NA	NA	NA
Type Property Loss	Auto	Auto	Auto	Auto	Auto
Amount of Property Loss	1 Car	1 Car	1 Car	1 Car	1 Car
Value of Property	30,000	28,000	40,000	22,000	24,000
Bias Motivation	NA	NA	NA	NA	NA
Weapons Used	NA	NA	NA	NA	NA
Tools Used	Lock Pick	Lock Pick	Lock Pick	Lock Pick	Lock Pick
Suspected Drug Type	NA	NA	NA	NA	NA
Suspected Drug Quantity	NA	NA	NA	NA	NA
Type of Target	Luxury	Luxury	Luxury	Luxury	Luxury
Type of Victim	NA	NA	NA	NA	NA
Age of Victim	NA	NA	NA	NA	NA
Race of Victim	W	B	W	W	W
Sex of Victim	M	M	M	F	F
Ethnicity of Victim	NA	NA	NA	NA	NA
Type of Victim Injury	NA	NA	NA	NA	NA
V/O Relationship	Stranger	Stranger	Stranger	Stranger	Stranger
Resident Status	Resident	Resident	Resident	Resident	Resident
Age of Suspect	20-25	NA	NA	NA	Early 20's
Sex of Suspect	W	NA	NA	NA	W
Race of Suspect	M	NA	NA	NA	M
Ethnicity of Suspect	NA	NA	NA	NA	NA
Height	5'8"	NA	NA	NA	5'10"
Weight	150	NA	NA	NA	170
Hair	Short	NA	NA	NA	Short
Eyes	NA	NA	NA	NA	NA
Complexion	Medium	NA	NA	NA	Medium
Facial Hair	None	NA	NA	NA	None
Glasses	None	NA	NA	NA	None
Car Year	NA	NA	NA	NA	NA
Car Make	NA	NA	NA	NA	NA
Car Model	NA	NA	NA	NA	NA
Color	NA	NA	NA	NA	NA
License Number	NA	NA	NA	NA	NA

The data indicated that the thief prefers waiting until after dark and likes to work early in the week - of the five thefts, two were on Monday and one was on Tuesday.

There were also two witness statements that appear to describe the same person. Both witnesses identified a white male, between 20 and 25, about 5'8"-5'10" and weighting around 150-170 pounds.

In both situations, the suspect was dressed casually (jeans, sweater/sweatshirt, running shoes) and in one situation appeared to be carrying a backpack.

Both witnesses described the suspect as being Caucasian, with short hair and no facial hair. The suspect did not appear to stand out from any other persons in the lot.

One witness even stated that he grew suspicious when he observed a young man apparently trying to find his keys in his jeans pockets for a very expensive automobile. When the suspect realized he was being watched, he fled into the store. The witness then went to a security guard, but by the time the security guard agreed to come back outside to watch the car, the car was already gone. It was later reported stolen.

Now that Dover had the incident information on a collated matrix, he used it to complete his blank crime calendar. Shown below is Dover's completed crime analysis calendar. The information contained is derived from the incident reports. It basically details, by day, the time, location, area, and type of vehicle that was stolen as part of this particular series or pattern.

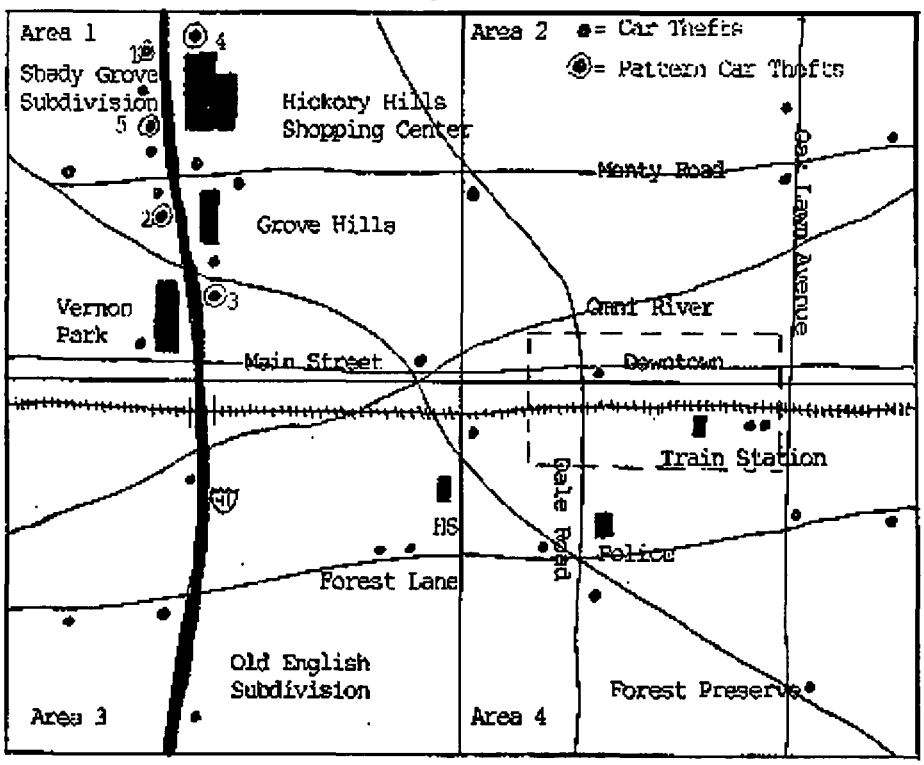
Crime Analysis Calendar

May

Monday	Tuesday	Wednesday	Thursday	Friday	Sat/Sun
April 27	28	29	30	May 1	2
					3
4	5	6	7	8	9
	8:30pm 1900 N HWY 41 Commercial 93 Lexus Hickory Hills Area 1				10
11	12	13	14	15	16
			9:00pm 1300 Dale Road Commercial 94 BMW Target Area 1		17
18	19	20	21	22	23
7:30pm 800 N HWY 41 Commercial 93 Mercedes Lone Star S. Area 1	Center	6:00pm 1600 N Hwy 41 Commercial 97 Chrysler Hickory Hills Area 1			24
25	26	27	28	29	30
8:00pm 1 Shopping Mall Drive Commercial 95 Land Rover Hickory Hills Area 1					31

Next, Dover placed the location of these patterned crimes on the blank map that he had created. To do this, he simply located the incident according to the address it corresponded to on the map. The completed map of Dover's village is shown below. It lists the locations of all 33 motor vehicle thefts in the village for the month of May. The circled car thefts indicate Dover's patterned car thefts based on an examination of the incident reports, the information matrix, and the crime calendar.

Map 2 - Dover's Village Motor Vehicle Thefts



Using simple incident reports, Dover had been able to pin-point a possible pattern, develop a suspect profile, a possible motive, and ascertain the types of cars being stolen and when.

The true test would be to try and predict the next location, the next time, the next day, the next date, and then place officers there waiting to intercept. This process is called **forecasting**.

The nice thing about this crime pattern is that the information I generate is going to be used by patrol officers, patrol supervisors, investigators, and tactical action teams to stop a crime. That sure beats the boring old monthly report, Dover thought.

Dover decided to continue using the computer and input the data into a spreadsheet program for analysis. He would have to create the formulas that assisted in the analysis, but he figured that would still be quicker than trying to do the math by hand with a calculator.

So far, Dover had analyzed the data and had identified information that could be used to create a **target profile report**, which is a document that identifies the types of people, cars, or buildings likely to be victimized. The target profile report is shown in its entirety in Chapter Three.

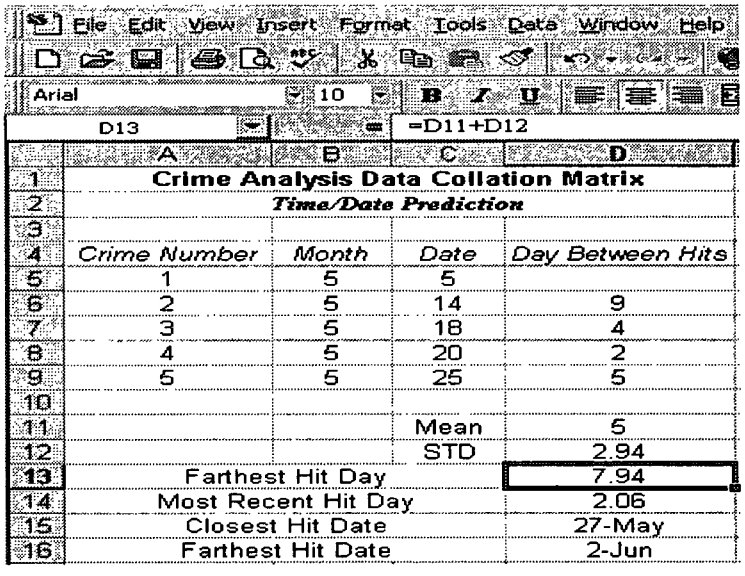
This report could be devised without any real statistical analysis. For example, in this situation, Dover had gathered the necessary information to create it by simply examining incident reports and noticing similarities in time, date, location, and witness statements that were entered into the information matrix.

This works well with only 33 incident reports and five patterned crimes, but when the number of incident reports rises, the process of identifying patterns becomes more difficult and the crime analyst must then use other analysis techniques to confirm his initial findings.

Dover had used basic statistical analysis methods such as means, medians, modes, and standard deviations to help identify the types of cars being stolen, their location, the time and day, and similar witness statements. Dover would now build on these efforts by using **time, date, and location analysis** and forecasting to predict the next crime.

To begin this statistical analysis, Dover felt he should begin by trying to predict the next *date of occurrence*. Since forecasting an individual date that the next crime will occur with complete accuracy is almost impossible, he would need to create thresholds (much as he did before with the aggregate statistics) within which to work. He decided to use one standard deviation added to and subtracted from the mean dates of occurrence to give him the threshold (called a confidence interval). This threshold would give him an idea when he could expect the next crimes to occur, much as he did before with the aggregate statistics. With only one standard deviation, he could be 68 percent sure that his predicted date was accurate within the limits he set for himself.

Basically, he needed to create a worksheet that contains for each motor vehicle theft the date of occurrence in the believed pattern, and the number of days from the last occurrence. He could then calculate the average days between hits, and then use this to predict when the next crime is likely to occur. By converting these thresholds into dates, he could predict (with 68 percent confidence) the soonest and farthest dates the next car might be stolen. These data are shown in the farthest and most recent hit days cells. The closest and farthest hit dates are the predicted times for the next car theft.



	A	B	C	D
1	**Crime Analysis Data Collation Matrix**			
2	***Time/Date Prediction***			
3				
4	*Crime Number*	*Month*	*Date*	*Day Between Hits*
5	1	5	5	
6	2	5	14	9
7	3	5	18	4
8	4	5	20	2
9	5	5	25	5
10				
11			Mean	5
12			STD	2.94
13	Farthest Hit Day			7.94
14	Most Recent Hit Day			2.06
15	Closest Hit Date			27-May
16	Farthest Hit Date			2-Jun

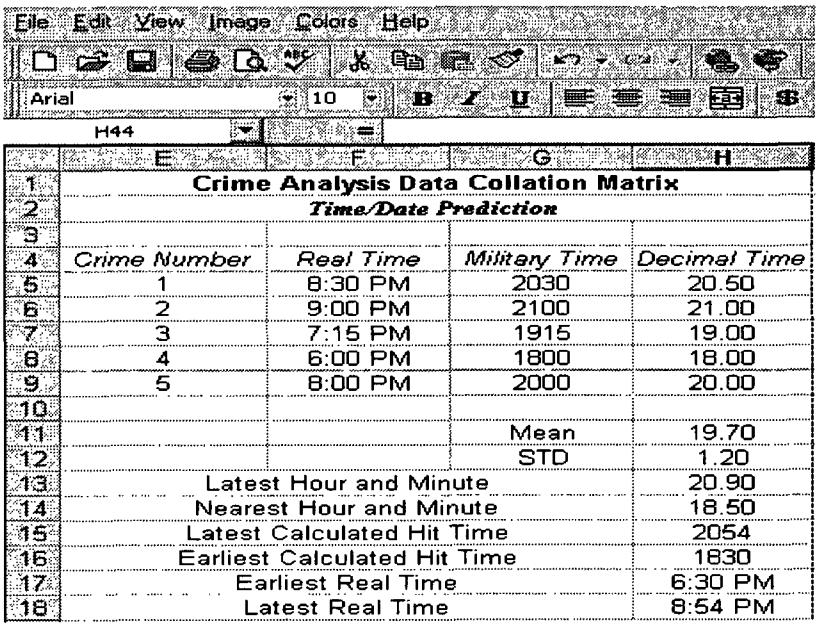
The screen above shows the time/date prediction spreadsheet that Dover created. It shows the number of pattern crimes, the month of occurrence (in numerical order 1=January, 2=February), the date of occurrence, and the number of days between crimes. Then, the calculations give the average day between crimes and the amount of time that varied above and below the average (i.e. the average is 5 days, give or take 3 days). The farthest hit day (the longest time from the last hit) is the mean and standard deviation added together (7.94), the most recent hit day (the closest time from the last hit) is the standard deviation subtracted from the mean (2.06).

The last patterned crime occurred on May 25 (crime number 5). Adding 7.94 days to May 25 gave Dover the farthest hit date or June 2. By subtracting the most recent hit day from May 25, Dover found that the next crime could occur as soon as May 27. So by calculating a mean day between hits and the amount of variation around this mean, the time period Beaufort could expect another car theft was May 27 to June 2.

The next step would be the calculation of the *time of occurrence*. This required Dover to convert actual time occurrences to military time and then to something called decimal time in order to predict the next time a car may be stolen.

First, Dover created columns in his spreadsheet titled Crime Number, Real Time, Military Time, and Decimal Time. All three are merely different way of expressing when the crime occurred.

The Decimal Time column is a simple conversion from Military Time, and is needed in order to undertake the predictions. Basically, some simple calculations must be conducted in order to standardize the times on a 24-hour clock.



	E	F	G	H
1	**Crime Analysis Data Collation Matrix**			
2	***Time/Date Prediction***			
3				
4	*Crime Number*	*Real Time*	*Military Time*	*Decimal Time*
5	1	8:30 PM	2030	20.50
6	2	9:00 PM	2100	21.00
7	3	7:15 PM	1915	19.00
8	4	6:00 PM	1800	18.00
9	5	8:00 PM	2000	20.00
10				
11			Mean	19.70
12			STD	1.20
13	Latest Hour and Minute			20.90
14	Nearest Hour and Minute			18.50
15	Latest Calculated Hit Time			2054
16	Earliest Calculated Hit Time			1830
17	Earliest Real Time			6:30 PM
18	Latest Real Time			8:54 PM

This is done by adding 2400 to each hour between midnight and noon (e.g. 0300 becomes 2700) and by dividing minutes by 60 (since there are 60 minutes in an hour) to convert minutes to their decimal equivalent of part of an hour.

An example would be the May 5th incident. The time is listed on the incident report as 8:30 PM. This converts to 2030 in military time and 20.50 in decimal time. Why 20.50? Because 30 minutes divided by 60 minutes gives .50.

For odd minute calculations such as 15 minutes, 45 minutes, or 33 minutes, round up or down based on the sections of the clock. Since all times get rounded to either the exact hour or 30 minutes past the hour, the only conversion to decimal time is 30/60=.50.

Dover next calculated the mean and one standard deviation for the Decimal Time column by utilizing the FX, Statistical, Average and Standard Deviation buttons. To obtain a 68% confidence interval around the mean, Dover added to it and subtracted from it the standard deviation. These calculations are derived in the same manner as the date of occurrence calculations.

The results of these calculations are shown in the earliest and latest hour and minute cells. The conversion to military time (from decimal time) is shown in the Latest and Earliest Calculated Hit Times.

To convert the decimal times back to military time, Dover had to do two things. First, if the numbers to the left of the decimal are less than 23, he left them alone. If they were greater than 24, he would subtract 24 from the number to the left of the decimal. Second, he multiplied all numbers to the right of the decimal by 60. The results are shown in the latest and earliest calculated hit times cells. The earliest and latest real time cells reflect the actual times that the criminal appears most likely to steal a car.

Based on his calculations the next car would be stolen between May 27 and June 2 and between the hours of 6:30 PM and 8:54 PM.

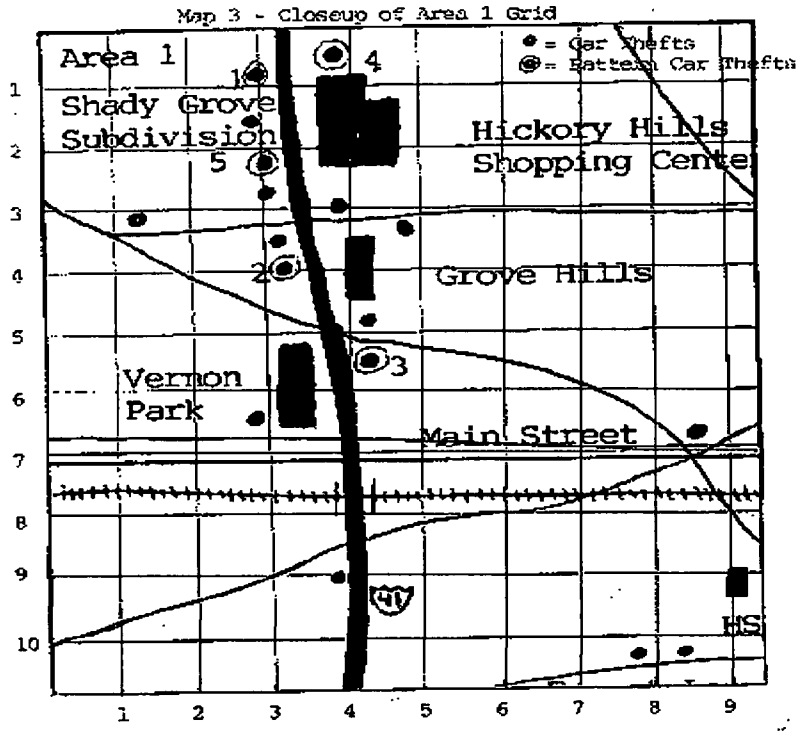
The next forecasting method would entail predicting the next *location of occurrence* of a car theft. In this analysis technique there are two separate events taking place together. First is to create a map. This is useful for showing the location of the crime incidents in relation to other attributes of the community (e.g., streets, and shopping centers). Second is the creation of an analysis spreadsheet. This holds the pattern data and helps facilitate mean and standard deviation analysis.

Dover created a new spreadsheet with columns for Crime Address, Geo-W and Geo-N. To do this, Dover referred back to his map. The table he created looked like this:

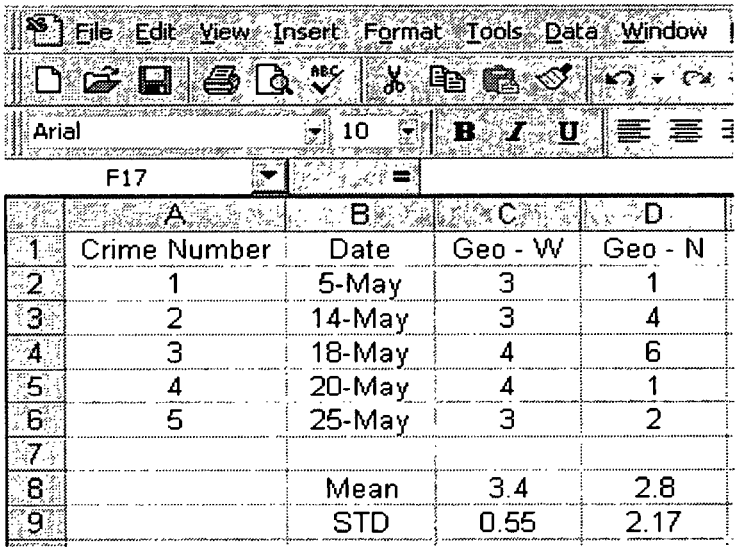
Crime Number	*Address*	*Date*	*Geo - W*	*Geo - N*
1	1900 N Hwy 41	May 5	3	1
2	1300 Dale Road	May 14	3	4
3	800 N Hwy 41	May 18	4	6
4	1600 N Hwy 41	May 20	4	1
5	1 Shopping Mall Drive	May 25	3	2

In this situation Dover would use his own hand-created map and simply applied a gridline every 1500 feet across Area 1 (the area under investigation). Then, he would label the X and Y-axes based on a sequential ordering of gridlines across the city from north to south, and from west to east.

Dover then filled in the map with crime locations according to their exact address, which also corresponded to a specific intersection of gridlines. It was these grid coordinates that would prove important for analysis. The location of the nearest grid coordinates corresponded to the North and West geo-coded location.



Dover then obtained the mean and standard deviation for the Geo-W and Geo-N columns through the same methods that had been used in both the date and time of occurrence techniques. Following this, he obtained a 68% confidence interval around the mean by adding and subtracting the standard deviation from the mean. The Excel spreadsheet looked like this:



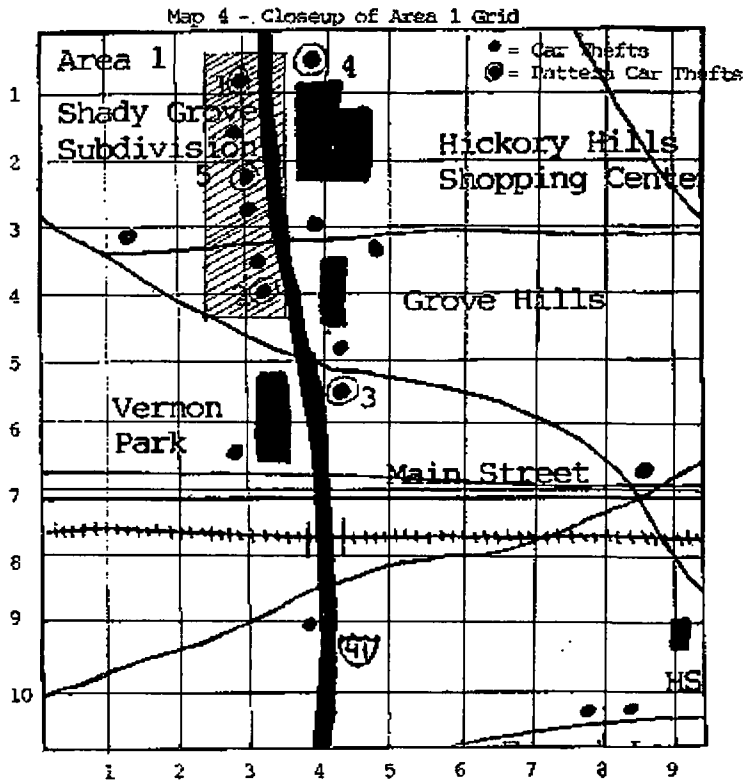
	A	B	C	D
1	Crime Number	Date	Geo - W	Geo - N
2	1	5-May	3	1
3	2	14-May	3	4
4	3	18-May	4	6
5	4	20-May	4	1
6	5	25-May	3	2
7				
8		Mean	3.4	2.8
9		STD	0.55	2.17

Using the average location as a starting point, Dover located the geographical average location for this crime series activity. Next, he utilized the upper and lower limits (mean plus or minus the standard deviation) to place markers at four grid locations (coinciding with north, south, east, and west locations) surrounding this average location.

These four markers form the north, south, east, and west boundaries for which most of the crime has occurred and future crime occurrences might potentially occur. This spatial confidence interval indicates the area that Dover is 68 percent confident will contain the next motor vehicle theft attempt.

The new map (shown below) indicated that the most likely location for additional car thefts in the May 27 to June 2 time period was along Highway 41, near both the

Hickory Hill Shopping Center and the Shady Grove subdivision. That was the area that would need focusing on by patrol officers.



Dover knew that he had little time to waste. According to his calculations, the thief was poised to strike very soon.

Basically, this crime pattern had to stop now if there was any hope in salvaging next year's figures and probably both mine and the chief's jobs. If I go to him with the future time, date, and location of the next crime, coupled with the fact that we are currently on pace to finish the year with a 44 percent higher car theft figure, the chief is not going to be happy. But, if I figure out what types of response techniques he can use to mobilize resources and manpower, he'll be ecstatic! Dover thought.

Chapter Three – Reporting and Response Techniques

Dover leaned back in his chair and recapped what he knew. Beaufort had a motor vehicle theft problem and so he had first analyzed the data for apparent patterns. He deduced that the same person apparently stole five cars. This put the crimes into his definition of a series (basically the identification of a specific and recurring modus operandi pattern). Dover decided that there were four basic plans that he could use to cover every facet of the investigation process and use to report to the chief.

The department has no physical evidence, no fingerprints, very few eyewitnesses, and no recovered cars. This means that whatever I have found through my analysis is the entire extent of what we know about these crimes, Dover thought.

Instead of going to the chief right away, I'll just come up with several different ways that we can respond to this situation and let him choose the one that makes the most sense to him.

The first report that Dover decided to create was a **crime pattern plan**. It was designed to be a summation of what the incident reports and witness statements have indicated so far. This would include information related to suspect descriptors and property information, modus operandi information, and eyewitness statements. Dover knew that the information provided on the five incident reports and by the two witnesses left a lot to be desired with regards to detail but, as of now, it was all he had to work with in determining his crime pattern plan.

The crime pattern plan indicated that the police in his village should be on the lookout for a white male between 20-25 years old, between 5'8" and 5'10" tall and weighing 150 to 170 pounds.

The suspect had short dark hair, medium coloring, and was usually casually dressed when he stole the cars. He liked to work the back or side areas of commercial parking lots around dusk or at night. He liked the area along Highway 41, near the Hickory Hills Shopping Center. He liked to work early in the week, probably because he either sold the cars or the car parts taken from the stolen vehicles later in the week. His usual method of entry was by picking the locks and he was apparently able to disable alarms quickly and easily. Finally, he also liked to steal expensive and luxury cars rather than either hot-rods or sports cars.

Dover's crime pattern plan was basically a summarization report of the information that had been pulled off the incident reports and information matrix. It would be disseminated to patrol officers and patrol supervisors as need-to-know information. It was not designed to fulfill any purpose other than provide information to the troops. A completed example is shown below.

Crime Pattern Profile			
	Offender		*Offense*
Sex	Male	*Tools Used*	Lock Pick, Lock Pull?
Race	White	*Point of Entry*	Driver or Passenger Doors
Age	20-25	*Point of Exit*	NA
Physical Description	Young	*Number of Pattern Crimes*	5
Body Marks	NA	*Pattern Locations*	Highway 41 and Hickory Hills
Height	5'8" to 5'10"	*Weapons*	NA
Weight	150-170	*Earliest Day*	Monday
Skin Color	Medium	*Latest Day*	Thursday
Eye Color	NA	*Most Frequent Day*	Monday
Hair Color	Short, Dark Hair	*Earliest Date*	5th
Last Known Address	NA	*Latest Date*	25th
Gang Type/Affiliation	NA	*Earliest Time*	6:00pm
Appearance	Casual	*Latest Time*	9:00pm
Speech Patterns	NA	*Average Time*	8:00pm
Deformities	NA	*Beat*	NA
Cautions	NA	*Sector*	NA
Place of Work	NA	*Area*	1
Hangouts	NA		
VIO Relationship	NA		

The second type of response plan that he decided to generate was the **directed patrol plan**. Directed patrol plans utilize accurate and timely information to predict where and when crimes are likely to be committed based on past data. This plan allowed Dover to advise the chief on the most effective manner in which to allocate police resources to apprehend the offender. This plan also encouraged patrol officers and crime analysts to develop proactive rather than reactive tactical responses to specific situations to a specific offense situation.

Dover knew that the most important information he could convey to his department's patrol supervisors was the nature of the problem, the type of targets that have been hit, the time frame and location of the crimes, any suspect information, and the predicted time, date, and location of the next offense. An example is shown below.

Beaufort Police Department
Internal Memorandum

To: All Patrol Supervisors
From: Officer William Dover, Crime Analyst
Regarding: Directed Patrol Plan

Nature of the Problem
Since the beginning of the year, our village has seen a rise in the number of motor vehicles stolen from all areas. The crime analysis unit has analyzed the past six months motor vehicle data and come to the conclusion that there appears to be a concentration of motor vehicle thefts beginning on or about May 5 that constitute the same offender or group of offenders. In an effort to apprehend this individual, we are calling for patrols that are specifically focused on the data contained within this memorandum.

Type of Target
The suspect appears to steal predominately late model, expensive luxury automobiles. These vehicles do have alarms and the suspect appears to have no problem quickly disabling them. Examples of stolen cars include Lexus, BMW, and Mercedes.

Time Frame
The suspect appears to work predominately between dusk and night. The earliest time recorded was 6:00pm and the latest time recorded was 9:00pm. He also appears to like to work early in the week, as most reports have occurred Monday-Wednesday.

Location
The suspect appears to work predominately along the Highway 41 corridor bordering the Shady Grove subdivision and the Hickory Hills Shopping Center. At least five cars appear to have been stolen within one mile of this area.

Suspect Information
Witnesses have described the suspect as being a white male, aged 20-25, 5'8" to 5'10", 150-170 pounds with short dark hair and medium coloring. He has been described as being casually dressed and in one instance was carrying a backpack. He also apparently likes to steal cars that are either parked out of direct sight or out of direct light. His method of entry appears to be by picking or pulling the car's door locks. There have been no recovered cars and no physical or forensic evidence.

Predicted Time, Date, and Location of Next Occurrence
Based on the analysis conducted by the Crime Analysis Unit, it appears that the suspect will next strike between May 27 and June 2, on or around 6:30pm to 8:54pm. Furthermore, he is most likely to strike west of Highway 41, in or around the parking lots surrounding the Hickory Hills Shopping Center.

Now that I have the information on an easy to read and understandable form, when I pass these out to the chief and the patrol supervisors, they can alter their personnel deployment assignment, Dover thought to himself.

Dover smiled to himself, *If we blanket the area with undercover officers in the predicted areas at the predicted times, we might have some luck in catching the offender.*

He leaned back in his chair and looked over his printouts, reports, graphs, and tables. *At least I've analyzed almost everything that could be analyzed*, he thought. *But, I still need to create a couple more reports.*

The third report Dover decided to create is called a **preliminary investigation plan**. Unlike the directed patrol plan, the preliminary investigation plan was designed to maximize the efficiency of the investigative component of the detective division; specifically it serves to increase apprehension efforts and provide investigators with information leading to an arrest.

The plan consisted of several pieces of information that he had already gathered for the directed patrol plan. These items included the type of offenses that have occurred, the location, time, and date, the identity of the victims or property description, any modus operandi information, and the type of response to take.

In addition, however, the preliminary investigation plan contained information to help detectives begin questioning suspects and planning the investigation. The plan included information on witnesses, suspect/offender arrest information on any named suspects, suspect location, any suspect personal or vehicle descriptions, additional property or victim information, more detailed modus operandi information, physical evidence, and arrest information.

An example of Dover's preliminary investigation's plan is shown below.

Beaufort Police Department
Internal Memorandum

To: All Patrol Supervisors
From: Officer William Dover, Crime Analyst
Regarding: Preliminary Investigation's Plan

Nature of the Problem
The crime analysis unit has analyzed the past six months motor vehicle data and come to the conclusion that there appears to be a concentration of motor vehicle thefts beginning on or about May 5 that constitute the same offender or group of offenders. In an effort to apprehend this individual, we are calling for patrols that are specifically focused on the data contained within this memorandum.

Type of Target
The suspect appears to steal predominately late model, expensive luxury automobiles. These vehicles do have alarms and the suspect appears to have no problem quickly disabling them.

Time Frame
The suspect appears to work predominately between dusk and night. The earliest time recorded was 6:00pm and the latest time recorded was 9:00pm. He also appears to like to work early in the week, as most reports have occurred Monday-Wednesday.

Location
The suspect appears to work predominately along the Highway 41 corridor bordering the Shady Grove subdivision and the Hickory Hills Shopping Center. At least five cars appear to have been stolen within one mile of this area.

Suspect Information
Witnesses have described the suspect as being a white male, aged 20-25, 5'8" to 5'10", 150-170 pounds with short dark hair and medium coloring. He has been described as being casually dressed and in one instance was carrying a backpack.

Suspect Modus Operandi
He also apparently likes to steal cars that are either parked out of direct sight or out of direct light near shopping areas. His method of entry appears to be by picking or pulling the car's door locks as no glass has been recovered on scene.

Predicted Time, Date, and Location of Next Occurrence
Based on the analysis conducted by the Crime Analysis Unit, it appears that the suspect will next strike between May 27 and June 2, on or around 6:30pm to 8:54pm. Furthermore, he is most likely to strike west of Highway 41, in or around the parking lots surrounding the Hickory Hills Shopping Center.

Witness Information
1. Bob Jones, White Male, 12/03/71, Dover's Village, IL. Report #0412.
2. Jay Peterman, White Male, 08/03/72, Dover's Village, IL. Report #0473.

Physical Evidence
There have been no recovered cars and no physical or forensic evidence.

Stolen Property Information
1. 1993 Lexus SC300, White/White. License 32160 IL, Expires 9/99. Report #0412.
2. 1994 BMW 325is, Green/Green. License 21635 IL, Expires 8/99. Report #0425.
3. 1993 Mercedes 300CE, Red/Red, License 14631 IL, Expires 10/99. Report #0440.
4. 1997 Chrysler Sebring, Black, Black. License 59155 IL, Expires 11/99. Report #0461.
5. 1995 Land Rover Discovery, Green, License 62135 IL, Expires 12/99. Report #0473.

In many ways, the preliminary investigation's plan was the equivalent of a case-screening plan. The information that was collated on this report allowed the detectives (and Dover) to examine a new car theft (if there was one) according to criteria for a pattern that had been previously developed and identified.

Therefore, the interested parties would be able to glance at a new incident report, match up the relevant information, notice any new information or differences, and decide if the same pattern is repeating itself as a series.

Dover also decided to include one final report type. Even thought he knew that his focus was on immediately solving the crime, he also figured it would be well worth his effort to devise a method of dealing with the long term implications of this crime pattern.

The shopping and commercial corridor along Highway 41 had always been an area ripe for car thefts, vandalism, and robberies as well as the usual property crimes. As the data showed, almost without exception, more cars were stolen in this area (especially since the Hickory Hills Shopping Center was built) than anywhere else in the village.

Dover decided he would create a basic **neighborhood watch plan** that would utilize the residents of the Shady Grove subdivision as additional eyes and ears both during this crime series and following its conclusion. By using citizens to help curb crime, Dover was utilizing techniques of community policing, a philosophy that his department had recently embraced.

In order to create a neighborhood watch program, Dover split up the plan into several interrelated sections. He decided to tell citizens what a neighborhood watch program is, why there is a need, and the goals of the plan. Using this as a building block, Dover also assigned duties and responsibilities to a neighborhood coordinator, a block captain, and a block watcher. These people, as well as other citizens, would be responsible for determining what is suspicious behavior (as defined by both Dover and the department), what to do if suspicious behavior is spotted, what information is most

needed when reporting this behavior, and some obvious and not so obvious things to look for. It was Dover's feeling that when this information was instituted, the citizens around Area 1 (detailed on the orientation map) would be able to help the village police with proactive crime prevention.

Neighborhood Watch Plan

Definition

A program involving the joint efforts of the police and the community that is designed to enhance neighborhood security, heighten citizen awareness, and encourage mutual assistance and concern among residents in order to prevent crime.

The plan is designed to facilitate the need for a crime prevention program that will enhance neighborhood security without the further addition of law enforcement officers.

Goals

1. Increase citizen awareness of property crimes and other neighborhood crime through a continuing information program of literature distribution from law enforcement.
2. Training citizens in the means of better property security and assist them in making their property more secure.
3. Develop a neighborhood action program where citizens help watch each other's property and report suspicious persons and activities to law enforcement.

Responsibilities and Duties

1. Neighborhood Coordinator – Coordinates activities of Block Captains and Block Watchers, recruits neighborhood residents for the program, and acts as a liaison with the village police.
2. Block Captain – Hosts neighborhood watch meeting, and acts as main recruiter for program. Also distributes crime prevention materials and cooperates with Neighborhood Coordinator.
3. Block Watcher – Acts as reporter for suspicious activity. Also checks neighbors' homes when they are out-of-town and assists the Block Captain.

What Suspicious Activity Should I Watch For?

1. A stranger entering your neighbor's house when it is unoccupied.
2. A scream heard anywhere nearby.
3. Offers of merchandise at ridiculously low prices.
4. Anyone removing accessories, license plates, or gas from a car.
5. Anyone peering into parked cars.
6. Persons entering or leaving a business after business hours.
7. A sound of breaking glass or loud explosive noises.

What Suspicious Activity Might I Not Watch For Regularly?

1. Someone going door-to-door in the neighborhood.
2. A person running while carrying an object.
3. A person exhibiting unusual mental or physical symptoms.
4. Irregular human traffic to and from a certain residence.
5. Any person taking a shortcut through a wooded area.
6. Any vehicle moving slowly and/or without lights.
7. Business transactions conducted from a vehicle.
8. Vehicles being loaded with valuables from a closed business.
9. Open or broken windows at a closed business or residence.
10. A beam from a flashlight in a neighbor's home.

What to do is Suspicious Activity is Heard and What to Report

Call 911 or your local law enforcement department immediately when you observe suspicious activity. Do not worry about bothering them or embarrassing yourself if you are wrong. Think instead about what could happen if you do not act.

Be prepared to report what happened, when, where, and whether anyone was hurt. Also note the description of the person and their vehicle.

Chapter Four – Evaluation and Assessment

Now that I've completed the response plans, the next step is to go see the chief, Dover said to himself.

Statistically, I've got some tables of averages and thresholds and I've used them to predict the time, day, date, and location for the next possible car theft. I've got charts and graphs and maps and most importantly, I've got response plans.

I've developed an offense profile plan, a directed patrol plan, a preliminary investigation/case-screening plan, and a neighborhood watch plan. Each one is capable of stopping the car thefts by themselves and combined, they should be an overwhelming law enforcement wave of trouble for this offender.

Dover gathered together his materials, made copies of everything for his records and for the chief and walked down the hall to the chief's office.

"Chief, do you have a couple of minutes?" Dover inquired.

The chief looked up from his work. He motioned to Dover to sit down.

"Have a seat, I've got 15 minutes before I have to give the weekly crime report to WCUB (the local television station)."

"You have to go on TV?" Dover asked. "What for, if you don't mind me asking?"

"Don't worry, it's not about the car thefts. Although if you don't have some answers by now I'm quite sure one of us will be dealing with them again very soon."

Dover began laying out copies of the tables showing the averages and thresholds and copies of the four different response plans.

"All right chief, don't worry, I think we have a solid handle on what is happening, where, when, and to what types of targets."

"It appears that a white male is hitting our village. He is between 20-25, between 5'8" and 5'10" and weighing around 150-170 pounds. The suspect has short dark hair, medium coloring, and was usually causally dressed when he stole the cars. He likes to work the back or side areas of commercial parking lots around dusk or at night. He especially likes the area along Highway 41, near the Hickory Hills Shopping Center. He likes to work early in the week, probably because he either sells the cars or the car parts taken from the stolen vehicles later in the week. His usual method of entry is by picking the locks and he is apparently able to disable alarms quickly and easily. Finally, he also likes to steal expensive cars, which might indicate that he wants to either resell all or part of them rather than simply cruise around."

"According to my calculations we can expect him to make his next hit within one mile of the Highway 41 shopping corridor, near the Hickory Hills Shopping Center. I expect him to hit between May 27 and June 2 and between 6:30 p.m. and 8:54 p.m. My best guess would be the west side of the highway, near the parking garages and lots and probably very early in the week, especially Monday or Tuesday."

"I think that if we create a multi-faceted approach to apprehension, then we will arrest a suspect during this time frame. Instead of simply focusing our efforts on one type of response technique, I've designed several that work interchangeably, to give us maximum investigation with minimal coverage and manpower."

"The way I have devised it, we have four basic response techniques, three of which are designed to be utilized right away. The first plan is an offense profile, which we have used to narrow down the list of times and locations for previous incidents. The second plan is a directed patrol plan, to blanket this predicted area with officers during

the predicted times and dates. The third plan is a preliminary investigation plan, which we can use to conduct the ongoing investigation after the next forecasted times and dates. The fourth plan is not really useful right away, but will prove useful after we catch this guy and prepare to return things to normal. It's a community policing/neighborhood watch program that will involve the local residents."

"Take a look at them and tell me what you think," Dover said as he sat back exhausted.

Silence from the other side of the desk.

Dover watched as the chief inspected the tables, raised eyebrows at the averages, thresholds, and predictions, and began to actually smile when he examined the response plans.

The chief leaned back. "I think they look good. The response plans are simple and easy to understand, even for a rookie officer. They allow the patrol supervisors the flexibility of changing work schedules without causing too many problems and they focus the effort around witness descriptions and statistically accurate predictions. I think the next step is for me to take these, stamp "approved" on the top, and have them distributed to our patrol supervisors, detectives, and others as needed. But what if this guy doesn't hit when you have predicted?"

"Well, that is a possibility, but I think it's unlikely. Research has shown that people in general, and especially successful criminals, are creatures of habit and this guy has a routine he is comfortable with. I think that by using directed patrols, which we could do with unmarked cars and undercover officers, we should simply be especially watchful of expensive cars between 6:00 p.m. and 9:00 p.m. The odds are he is going to

hit again and we just need to be where he'll be. If that fails, we will have profiles to work within and a preliminary investigation plan to guide us in questioning and interrogation," Dover said.

The chief stood up. "Good job, Dover. I knew that you could do it if we had to have it. I'll take these response plans, run them by the deputy chiefs and the patrol supervisors this afternoon and we'll probably begin putting them into play as early as tomorrow. You're dismissed."

As Dover retreated to his office, a jumble of thoughts ran through his mind. *What if I'm wrong in my predictions? What if we don't catch him with one of my response plans? What's for dinner?* The last one was obviously of the most importance, and, it being 5:00, Dover decided to take off for the day, confident in a job well done.

Dover knew that the odds were against the offender getting away with his crimes for much longer. It was nearly impossible for this offender to continue to steal cars without leaving some solid physical or forensic evidence and the more times he committed a crime, the more information he would leave behind for Dover to use. Regardless of what happened during his first predicted time frame or his fourth, Dover knew this guy was going to be arrested.

Over the next month, the chief did as he promised.

He instituted a directed patrol plan that used undercover agents as shoppers and increased the visible police presence around the shopping center during the hours and times Dover had predicted.

He issued copies of the offense profile to patrol officers and preliminary investigation plans to the detectives.

He began working with Area 1 patrol supervisors in an effort to alert both nearby residents and shoppers of the potential auto theft threats in their neighborhood, and informed them of what they could do to help prevent the crime.

Time passed slowly within the department. Detectives, patrol officers, and Dover himself waited anxiously for the start of the predicted time period.

May 27th came and went with no arrest, or even any report of suspicious activity.

The same thing happened on May 28th. And May 29th. And May 30th.

Then on May 31, just as Dover was beginning to contemplate a career in the food service industry, a report came across the wire at approximately 7:50 p.m. that a white male, aged 23 had been arrested trying to break into a 1996 Lincoln Town Car.

According to the incident, two undercover officers who were assigned to the parking lot across Highway 41 from the Hickory Hills Shopping Center spotted the suspect walking up and down aisles looking at cars. The officers witnessed him stopping and especially looking at late model luxury cars. They followed him on foot until he reached the very far-west side of the parking lot. They then witnessed him stopping next to the 1996 Lincoln Town Car, extracting a lock picking kit, and begin breaking into the automobile. The two officers then ran up and arrested him.

The offender's name was James Kelran. He was from the southeast side of Beaufort and had a history of juvenile trouble, including theft. He was 5'11" and weighted 176 pounds. His hair was light brown and cut short. When he was arrested he was wearing jeans and a black pullover and carried no weapons.

Dover felt vindicated. His offender profile was right on target and the detectives told him that the preliminary investigation plan that he developed (based on the offender profile) was very useful in planning the directed patrols and assigning undercover officers to specific areas.

The chief was ecstatic and the department's officers felt good about the help Dover was able to offer. The crime series appeared to have ended with the Kelran arrest. Kelran himself claimed that he was working alone on the car thefts; he stripped them of their VIN and other identification numbers and sold them out-of-state to used car dealers.

Basically, it was a money making scheme and he said he felt pretty sure that he would not have been arrested, what with all the human and car traffic near the Hickory Hills Shopping Center. He also said that he never counted on the department developing specific tactical plans based on an analysis of his past crimes. He figured that by not leaving any physical evidence behind, the police would have no fingerprints or hair samples to work with.

Kelran also said that he made sure if anyone saw him, he simply acted like it was his car and that he was trying to find his keys. He said it worked perfectly as a plan except for once, when a guy watched him try to find his keys but didn't seem to buy the rouse. He said the guy went back inside and he realized he had to hurry, because the guy was probably bringing back a security guard or cop. But, he had no trouble entering the car and actually watched from the edge of the parking lot after he had stolen the car as the guy returned 15 minutes later with a security guard.

Dover knew that his contribution to this arrest was huge. He and the chief began working to implement a neighborhood watch program with the citizens of all areas, but especially Area 1.

A couple of months passed and car thefts appeared to decrease. Then, on the first day of October the chief called Dover into his office.

"Dover, I want you to do a quick analysis and see if car thefts are actually back at their usual levels. As you know, that series of car thefts we had a couple of months ago appeared to set us up for a bad year. I want to know if we are going to have abnormally high car theft numbers for this year and if we have other car theft issues to worry about. Get it back to me by tomorrow. Dismissed."

Dover left the chief's office and went back to his own. Basically, what the chief was asking for was an evaluation of the past data. The chief wanted to know several things: if there was a real change in the car theft crime rate after Kelran was arrested, what proportion of this change could be attributed to the preventive measures taken, what side-effects might have resulted from response measures (for example; crime displacement), and what effect did it have on the village as a whole.

Dover figured the best way to see if stopping the car theft series had an noticeable effect on the overall car theft rate in his village was to utilize time series data in conducting moving average and seasonal indices analysis.

Dover remembered from his statistics classes that **time series analysis** generally requires a data file containing a set of observations (e.g. car theft occurrences) that occurred at different points in time.

Time series analysis also assumes that the length of time between these measurements was uniform (e.g. monthly totals). The analysis could be performed by recording measurements regularly over a period of time to observe changes in the data.

A time series consists of several elements. They are the secular trend (or just "trend"), seasonal variations, cyclical fluctuations, and irregular fluctuations. The two most important elements to examine in a time series are the secular trend and the seasonal variation as they are the most easily measurable and obvious changes in the data.

The *secular trend (trend)* is the most obvious part of the time series, as it is the part of the time series that represents the increase or decrease of a particular data element over a period of time. For example, a crime trend is merely the long-term variations (increase/decreases) in the data charted over time. Calculation of the trend line is useful in forecasting (see trend analysis) as it can be used with past data to predict long-term data changes. The trend is generally used to forecast long-term change

Seasonal variations are the movements in the data that occur regularly during the same times each year. For example, one particular crime that appears to vary regularly almost every year is burglary. Theoretically, these offenses can be expected to rise in the summer, as more people leave their windows open and their doors unlocked.

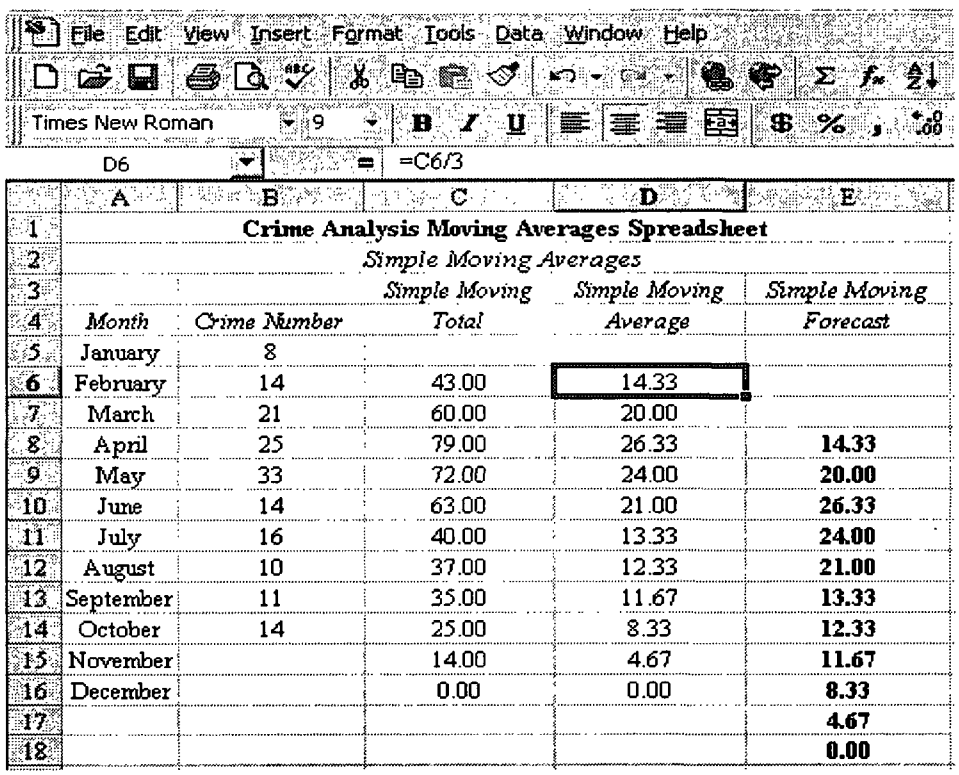
Since the chief had asked him to figure out what had happened to the car theft rates because of that past crime series, Dover decided to create an Excel spreadsheet that would calculate the three types of **moving averages**: *simple*, *weighted*, and *exponential.*

Dover knew that moving averages provided a means to eliminate the "up" and "down" appearance to his data as it appeared over time and as affected by seasonal

variation. It gave him a statistical method to smoothing out the data to observe any underlying trends (and in this case the effect of a short-term crime series).

The first type of average he would compute, the *simple moving average*, did not require intricate calculations. It simply required averaging the most recent data values and using that average as the forecast for the next time period.

Dover also knew that the most common method for doing this was to calculate the average from a recent three-month interval.



	A	B	C	D	E
1	**Crime Analysis Moving Averages Spreadsheet**				
2	*Simple Moving Averages*				
3			*Simple Moving*	*Simple Moving*	*Simple Moving*
4	*Month*	*Crime Number*	*Total*	*Average*	*Forecast*
5	January	8			
6	February	14	43.00	14.33	
7	March	21	60.00	20.00	
8	April	25	79.00	26.33	**14.33**
9	May	33	72.00	24.00	**20.00**
10	June	14	63.00	21.00	**26.33**
11	July	16	40.00	13.33	**24.00**
12	August	10	37.00	12.33	**21.00**
13	September	11	35.00	11.67	**13.33**
14	October	14	25.00	8.33	**12.33**
15	November		14.00	4.67	**11.67**
16	December		0.00	0.00	**8.33**
17					**4.67**
18					**0.00**

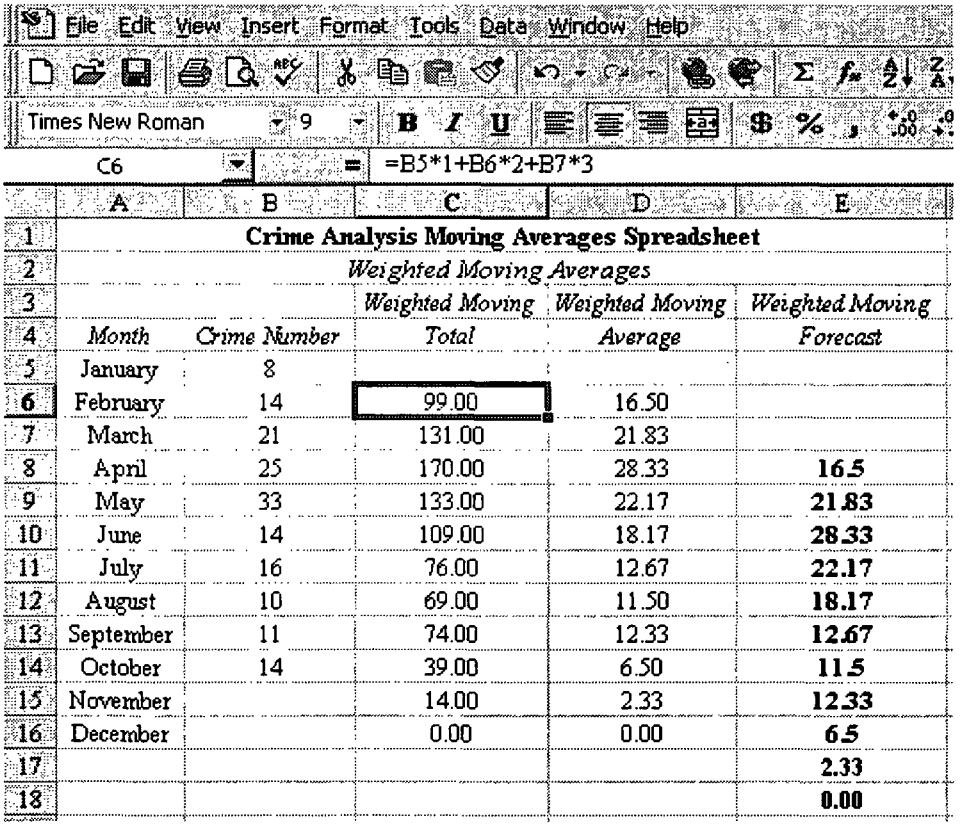
As indicated above, to create this spreadsheet and calculate a simple moving average, Dover created columns for month of the year and number of crimes. He then created tabular columns for a three-month moving total and a three-month moving average.

To calculate the three-month moving total, the formula was set up to add the three months total crimes together (i.e. January (8) + February (14) + March (21)) and to obtain the average of this number by divided by three (14.33). This number is then placed in the average column as the middle of the three months used to the total. For example, if January-March were used, the average would be beside February as it is the middle month.

To continue this process through the year, Dover simply dropped the first month of the original equation and added the next month. The computer then repeated the steps above. To *forecast* the next month, Dover created another tabular column (the one in bold) next to the previous two. In this column, he placed the average of the previous three months.

Dover knew that there was a strong possibility that the "ups" and "downs" in his data set would make it difficult to interpret. He remembered that the simple moving average was exactly that – simple. He decided to smooth out the "ups" and "downs" in the data by using a *weighted moving average*. Unlike the simple moving average, the weighted moving average assumed that the most recent data (for example, the most recent month) is of more importance to the calculation and thus assigns it a weight based on its location in the calculation. For example, in a crime situation covering January to March, March would be assigned a weight of 3 while January would be assigned a weight of 1. This is because in the weighted moving average formula, the most recent month (March) is considered to be more important in predicting the next month's crime average so it is assigned the strongest weight. Every procedure is similar to that of a simple moving average calculation, except for the calculation of the sum total.

In a weighted moving average, the three crime numbers comprising the sum total are multiplied by a 1, 2, or 3 based on their position. For example, a weight of one is multiplied by the oldest number, a weight of two is multiplied by the next oldest, and the most recent number is multiplied by three. Thus, this smoothing method assumes that the most recent number is of the most importance and multiplies it by a factor of three.



	A	B	C	D	E
1	**Crime Analysis Moving Averages Spreadsheet**				
2	*Weighted Moving Averages*				
3			*Weighted Moving*	*Weighted Moving*	*Weighted Moving*
4	*Month*	*Crime Number*	*Total*	*Average*	*Forecast*
5	January	8			
6	February	14	99.00	16.50	
7	March	21	131.00	21.83	
8	April	25	170.00	28.33	**16.5**
9	May	33	133.00	22.17	**21.83**
10	June	14	109.00	18.17	**28.33**
11	July	16	76.00	12.67	**22.17**
12	August	10	69.00	11.50	**18.17**
13	September	11	74.00	12.33	**12.67**
14	October	14	39.00	6.50	**11.5**
15	November		14.00	2.33	**12.33**
16	December		0.00	0.00	**6.5**
17					**2.33**
18					**0.00**

As the example above shows, Dover's weighted moving average spreadsheet consists of the same basic parts as the simple moving average. The formula for the weighted moving average calculation is shown in the formula box. This formula calculates the monthly averages based on their weighted position in the equation. The result is shown in the weighted moving average column. The final column, the forecast, is simply the weighted moving average value for the previous three months.

Dover noticed immediately that the weighted moving averages (and their forecasts) were different than those numbers provided by the simple moving average. He knew this was based on the formula. When there are any shifts in the most recent data, Dover knew that the weighted average could appear to jump higher or lower than the simple moving average.

Generally, he knew that he should examine the weighted moving average over the simple moving average because the weighted moving average is the most descriptive and accurate picture of the series or trend as it "fits" the data points over time better and smoother than the simple moving average.

The final method Dover decided to utilize was the *exponential moving average*. This method has the advantage of requiring less historical data than the other methods and is recommended for most analysis problems because it has the ability to correct for differences between past moving averages and the raw data.

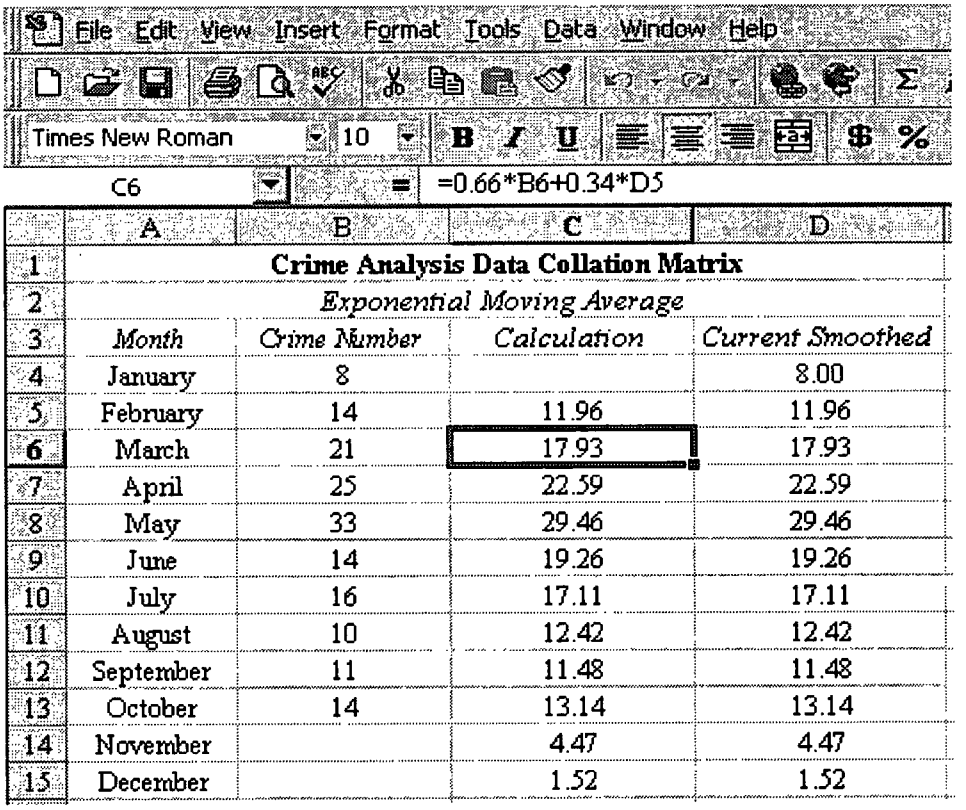
The exponential moving average is calculated by first creating what is known as a smoothing constant. This value can range from 0 to +1 and is derived by dividing the number of time intervals in the moving average by two.

The formula for deriving an exponential smoothing average is SV = SC*OV+(1-SC)*V, where SV = Current Smoothed Value, SC = Smoothing Constant, OV = Current Observed Value, and V = Previous Smoothed Value. Basically, using a three-month average, the SC = .66 and 1-SC = .34). OV is the second month in the three-month set and V is the first month in the three-month set.

For example, imagine the 1998 car thefts in Dover's village. In January there were 8 and 14 in February. This means that the formula for this calculation would be

.66(14)+(.34)(8) for a value of 11.96. This value is the smoothing constant and is used in the next month calculation, as the value for V.

Shown below is Dover's exponential moving average spreadsheet. As indicated it contains columns for the month, the crimes number, the calculation (also highlighted in the formula box), and the current smoothed value.



	A	B	C	D
1	**Crime Analysis Data Collation Matrix**			
2	*Exponential Moving Average*			
3	*Month*	*Crime Number*	*Calculation*	*Current Smoothed*
4	January	8		8.00
5	February	14	11.96	11.96
6	March	21	17.93	17.93
7	April	25	22.59	22.59
8	May	33	29.46	29.46
9	June	14	19.26	19.26
10	July	16	17.11	17.11
11	August	10	12.42	12.42
12	September	11	11.48	11.48
13	October	14	13.14	13.14
14	November		4.47	4.47
15	December		1.52	1.52

From Dover's perspective, the directed patrol, preliminary investigations, and neighborhood watch plans may be credited with also helping lower the car theft rate far below what would have been predicted by the moving averages, as residents took an active part in helping prevent crime.

The last technique Dover wanted to use to examine the effect that arresting Kelran and instituting a neighborhood watch program had on the car theft rate for his village was **seasonal indices**.

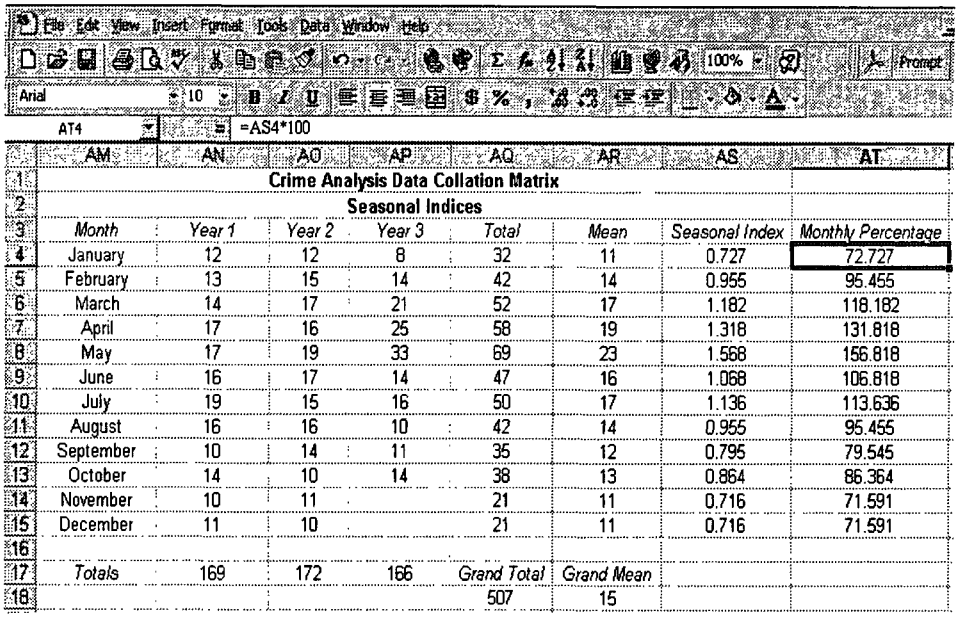
Since seasonal averages fluctuate so regularly, Dover knew that he could use them to predict the occurrence of crimes in specific times of the year.

Seasonal indices calculations provided Dover a means to figure out how one month compares to another month in terms of a percentage of the total crime activity over many months. This allowed Dover to make the determination of when a specific month is especially prone to criminal activity and this can lead to the formation of strategic response plans aimed at certain times of the year. This technique takes into account historical data, as it is calculated with more than one year worth of data.

To create a spreadsheet that would do the calculations for him, Dover began by creating columns for month, each year under study (Dover chose the years 1997-1999), the sum monthly totals, their means, and then the calculated seasonal index. Under each column (year 1, year 2, year 3) he also created a sum yearly total box. He then created a cell box that would hold the grand total for all the years under study and a cell box that will hold the grand mean for all the years under study.

Dover used these spreadsheets to help him determine which months are the most prone to criminal activity. Using this template of three years, Dover's spreadsheet first calculated the column year totals and the row monthly totals and means. With these numbers, the spreadsheet formulas then calculated the grand car theft total for all the years and obtained a grand yearly car theft mean.

Dover then divided each monthly mean by the grand mean. This results in the seasonal index, which is then multiplied by 100 to obtain a determination of monthly percentages. This number told Dover what months reflected higher crimes.



	AM	AN	AO	AP	AQ	AR	AS	AT
1	Crime Analysis Data Collation Matrix							
2	Seasonal Indices							
3	*Month*	*Year 1*	*Year 2*	*Year 3*	*Total*	*Mean*	*Seasonal Index*	*Monthly Percentage*
4	January	12	12	8	32	11	0.727	72.727
5	February	13	15	14	42	14	0.955	95.455
6	March	14	17	21	52	17	1.182	118.182
7	April	17	16	25	58	19	1.318	131.818
8	May	17	19	33	69	23	1.568	156.818
9	June	16	17	14	47	16	1.068	106.818
10	July	19	15	16	50	17	1.136	113.636
11	August	16	16	10	42	14	0.955	95.455
12	September	10	14	11	35	12	0.795	79.545
13	October	14	10	14	38	13	0.864	86.364
14	November	10	11		21	11	0.716	71.591
15	December	11	10		21	11	0.716	71.591
16								
17	*Totals*	169	172	166	*Grand Total*	*Grand Mean*		
18					507	15		

To interpret this spreadsheet, Dover knew that the higher the seasonal index, the more crime occurs in that month. For example, given a grand mean of 15 car thefts a month, the seasonal index of June is 1.06 or 106 percent. This means that June's car theft rate is 106 percent of the normal amount of car thefts. Therefore, June is a high month for car thefts. By comparison, January had a seasonal index of .72 or 72 percent. This means that the number of car thefts in January is only 72 percent of the normal amount. January was a low month for car thefts.

As the spreadsheet indicated, the months of March through July have been traditionally high months for car thefts. With the advent of the neighborhood watch program and the apprehension of Kelran, it appeared that the months immediately following the arrest (June) showed a rapid decline in the average number of cars stolen. In fact, examining June through October, it appeared that the village had definitely returned to normal and may have even showed a reduction in the number of cars that have been stolen.

Of course, to truly know where the difference was, Dover knew he would have to re-run the analyses performed in Chapter One on the aggregate statistics of the village to pinpoint where the car thefts are still occurring. That would be his next order of business.

But first, he had to tell the chief that things were back to normal and that their crime apprehension and prevention programs appeared to have a solid effect on lowering the car theft rate in his village to a level where it had been before the crime series.

As Dover walked down the hall toward the chief's office, several other officers gave him the thumbs-up and patted him on the back. With one major investigation under his belt, Dover felt the crime analysis position was finally being taken seriously. He felt good and knew that he had the knowledge and the tools (except for that darn mapping program) to investigate any crime series or pattern that might decide to raise its head in Beaufort.

Dover reached the chief's door and knocked on the frame.

"Chief, do you have a couple of minutes, I have some good news for you."

The chief looked up and grinned.

"Dover, just who I was hoping to hear from. You can tell me all about how we managed to catch Kelran and what that did to our yearly car theft totals and rates in a minute. But first, have a seat. I want to talk to you about a series of garage burglaries that appear to be happening on the south side of town".

Oh man, Dover thought as he sat down, *this stuff never ends.*

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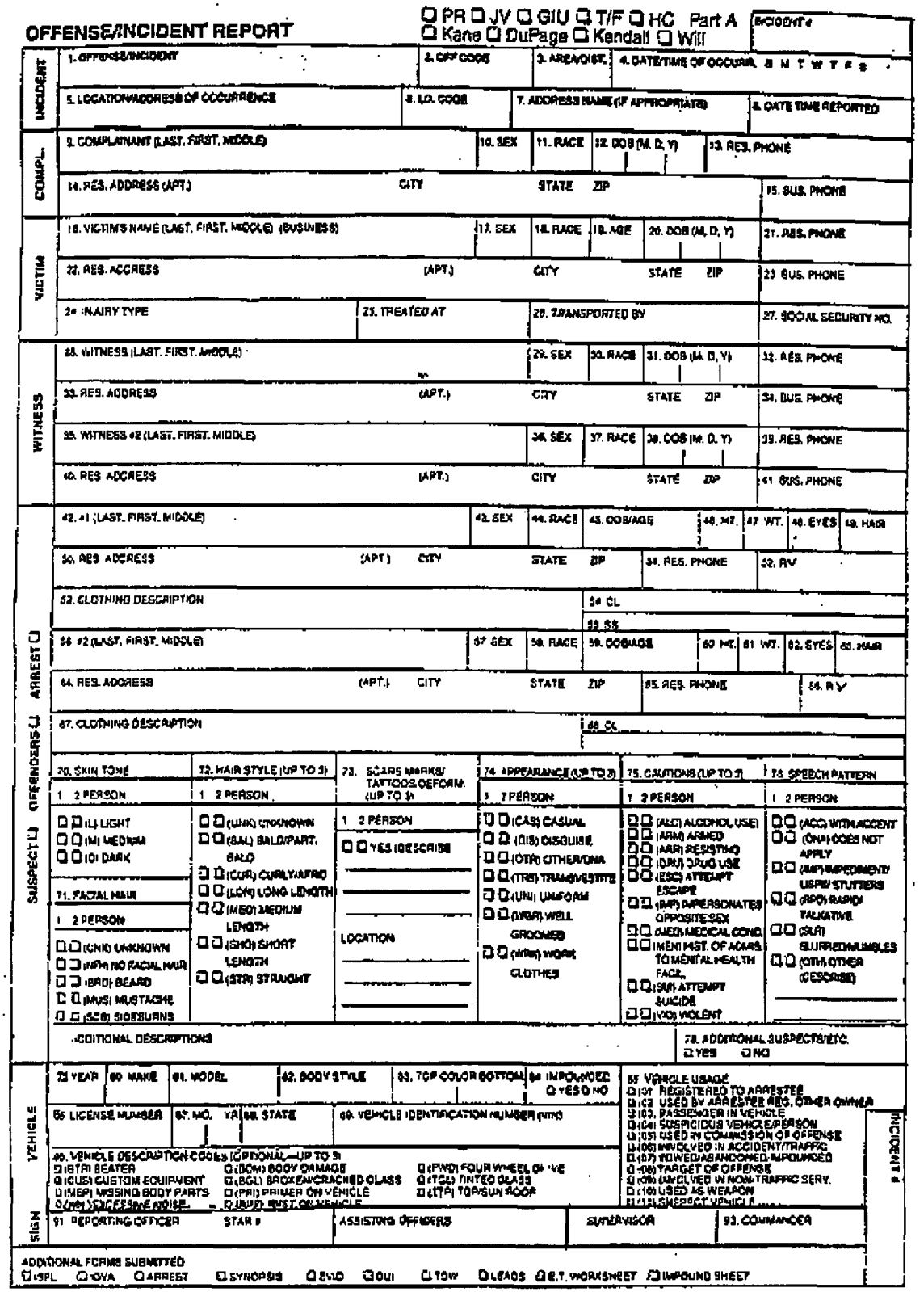
Appendix A



OFFENSE/INCIDENT REPORT

☐ PR ☐ JV ☐ GIU ☐ T/F ☐ HC Part A
☐ Kane ☐ DuPage ☐ Kendall ☐ Will

INCIDENT #

INCIDENT
1. OFFENSE/INCIDENT | 2. OFF CODE | 3. AREA/DIST. | 4. DATE/TIME OF OCCURR. S M T W T F S
5. LOCATION/ADDRESS OF OCCURRENCE | 6. I.O. CODE | 7. ADDRESS NAME (IF APPROPRIATE) | 8. DATE TIME REPORTED

COMPL.
9. COMPLAINANT (LAST, FIRST, MIDDLE) | 10. SEX | 11. RACE | 12. DOB (M, D, Y) | 13. RES. PHONE
14. RES. ADDRESS (APT.) CITY STATE ZIP | 15. BUS. PHONE

VICTIM
16. VICTIM'S NAME (LAST, FIRST, MIDDLE) (BUSINESS) | 17. SEX | 18. RACE | 19. AGE | 20. DOB (M, D, Y) | 21. RES. PHONE
22. RES. ADDRESS (APT.) CITY STATE ZIP | 23. BUS. PHONE
24. HAIRY TYPE | 25. TREATED AT | 26. TRANSPORTED BY | 27. SOCIAL SECURITY NO.

WITNESS
28. WITNESS (LAST, FIRST, MIDDLE) | 29. SEX | 30. RACE | 31. DOB (M, D, Y) | 32. RES. PHONE
33. RES. ADDRESS (APT.) CITY STATE ZIP | 34. BUS. PHONE
35. WITNESS #2 (LAST, FIRST, MIDDLE) | 36. SEX | 37. RACE | 38. DOB (M, D, Y) | 39. RES. PHONE
40. RES. ADDRESS (APT.) CITY STATE ZIP | 41. BUS. PHONE

SUSPECT(S) OFFENDERS ☐ ARREST ☐
42. #1 (LAST, FIRST, MIDDLE) | 43. SEX | 44. RACE | 45. DOB/AGE | 46. HT. | 47. WT. | 48. EYES | 49. HAIR
50. RES. ADDRESS (APT.) CITY STATE ZIP | 51. RES. PHONE | 52. RV
53. CLOTHING DESCRIPTION | 54. CL | 55. SS
56. #2 (LAST, FIRST, MIDDLE) | 57. SEX | 58. RACE | 59. DOB/AGE | 60. HT. | 61. WT. | 62. EYES | 63. HAIR
64. RES. ADDRESS (APT.) CITY STATE ZIP | 65. RES. PHONE | 66. RV
67. CLOTHING DESCRIPTION | 68. CL

70. SKIN TONE	72. HAIR STYLE (UP TO 3)	73. SCARS MARKS/ TATTOOS/DEFORM. (UP TO 3)	74. APPEARANCE (UP TO 3)	75. CAUTIONS (UP TO 7)	76. SPEECH PATTERN
1 2 PERSON	1 2 PERSON	1 2 PERSON	1 2 PERSON	1 2 PERSON	1 2 PERSON
☐☐ (L) LIGHT ☐☐ (M) MEDIUM ☐☐ (D) DARK	☐☐ (UNK) UNKNOWN ☐☐ (BAL) BALD/PART. BALD ☐☐ (CUR) CURLY/AFRO ☐☐ (LON) LONG LENGTH ☐☐ (MED) MEDIUM LENGTH ☐☐ (SHO) SHORT LENGTH ☐☐ (STR) STRAIGHT	☐☐ YES (DESCRIBE) LOCATION	☐☐ (CAS) CASUAL ☐☐ (DIS) DISGUISE ☐☐ (OTH) OTHER/ONA ☐☐ (TRS) TRANSVESTITE ☐☐ (UNI) UNIFORM ☐☐ (WGR) WELL GROOMED ☐☐ (WRK) WORK CLOTHES	☐☐ (ALC) ALCOHOL USE ☐☐ (ARM) ARMED ☐☐ (ARR) RESISTING ☐☐ (DRU) DRUG USE ☐☐ (ESC) ATTEMPT ESCAPE ☐☐ (IMP) IMPERSONATES OPPOSITE SEX ☐☐ (MED) MEDICAL COND. ☐☐ (MEN) HIST. OF ADMS. TO MENTAL HEALTH FACIL. ☐☐ (SUI) ATTEMPT SUICIDE ☐☐ (VIO) VIOLENT	☐☐ (ACC) WITH ACCENT ☐☐ (ONA) DOES NOT APPLY ☐☐ (IMP) IMPEDIMENT/ USP/S/ STUTTERS ☐☐ (RPD) RAPID/ TALKATIVE ☐☐ (SLR) SLURRED/MUMBLES ☐☐ (OTH) OTHER (DESCRIBE)

71. FACIAL HAIR
1 2 PERSON
☐☐ (UNK) UNKNOWN
☐☐ (NON) NO FACIAL HAIR
☐☐ (BRD) BEARD
☐☐ (MUS) MUSTACHE
☐☐ (SDB) SIDEBURNS

ADDITIONAL DESCRIPTIONS | 78. ADDITIONAL SUSPECTS/ETC. ☐ YES ☐ NO

VEHICLE
79. YEAR | 80. MAKE | 81. MODEL | 82. BODY STYLE | 83. TOP COLOR/BOTTOM | 84. IMPOUNDED ☐ YES ☐ NO | 85. VEHICLE USAGE
86. LICENSE NUMBER | 87. NO. | YR | 88. STATE | 89. VEHICLE IDENTIFICATION NUMBER (VIN)
90. VEHICLE DESCRIPTION CODES (OPTIONAL—UP TO 3)
☐(BTR) BEATER ☐(BOH) BODY DAMAGE ☐(FWD) FOUR WHEEL DRIVE
☐(CUS) CUSTOM EQUIPMENT ☐(BGL) BROKEN/CRACKED GLASS ☐(TGL) TINTED GLASS
☐(MEP) MISSING BODY PARTS ☐(PRI) PRIMER ON VEHICLE ☐(TPT) TOP/SUN ROOF
☐(VNV) EXCESSIVE NOISE ☐(RUST) RUST ON VEHICLE

SIGN
91. REPORTING OFFICER | STAR # | ASSISTING OFFICERS | SUPERVISOR | 93. COMMANDER

ADDITIONAL FORMS SUBMITTED
☐ I-SPL ☐ DVA ☐ ARREST ☐ SYNOPSIS ☐ EVID ☐ DUI ☐ TOW ☐ LEADS ☐ E.T. WORKSHEET ☐ IMPOUND SHEET

OFFENSE/INCIDENT REPORT

Part B

INCIDENT #

M.O. INFORMATION

95. POINT OF M. ENTRY / M. EXIT

- DNA
- UNKNOWN
- OTHER

BUILDING
- (A) BSMNT. DOOR
- (B) BSMNT WINDOW
- (C) FRONT DOOR
- (D) REAR DOOR
- (E) SIDE DOOR
- (F) GRG DR (DTHR)
- (G) GRG DR (OTHR)
- (H) OTH. DWHD DR.
- (I) PATIO DR. DR.
- (J) GRND. FLOOR WD
- (K) UP FLOOR WD
- (L) SCRN/STRM. DR.
- (M) SCRN/STRM. WD
- (N) TRANSOM
- (O) WALL
- (P) SKYLIGHT
- (Q) ROOF

VEHICLE
- (R) FRONT DOOR
- (S) REAR DOOR
- (T) HATCHBACK/ TAILGATE/REAR DR.
- (U) SIDE DOOR
- (V) WINDSHIELD
- (W) REAR WINDOW
- (X) TOP CONVERT. T-TOP
- (Y) HOOD
- (Z) TRUNK

96. MEANS OF

- DNA
- UNKNOWN
- OTHER

ENTRY
- (A) OPEN
- (B) UNLOCKED
- (C) PRIED
- (D) SMASHED
- (E) FORCED
- (F) SLASHED
- (G) DISMANTLED
- (H) PULLED
- (I) PICKED
- (J) DRILLED
- (K) TORCHED
- (L) SAWED
- (M) CUT
- (N) PEELED

DAMAGE
- (O) BB/PELLET DAMAGE
- (P) SMASHED
- (Q) SLASHED/ PUNCTURED
- (R) SCRATCHED
- (S) PAINTED
- (T) BURNED
- (U) CORRODED
- (V) BATTERED
- (W) BLOWN UP
- (X) MULTIPLE MEANS

97. TOOL/OR NOT WEAPON

- DNA
- UNKNOWN
- OTHER

TOOL
- (A) PRY/CROWBAR
- (B) SCREWDRIVER
- (C) PIPE WRENCH
- (D) LOCK PULLER
- (E) PUNCH
- (F) KEY
- (G) LOCK PICK
- (H) SLIM JIM
- (I) DRILL
- (J) TORCH
- (K) SAW
- (L) BOLT CUTTER
- (M) PLIER/VISEGRIP
- (N) HAMMER

OBJECT
- (O) SPRAY PAINT
- (P) SHARP OBJECT
- (Q) BLUNT INSTRUMENT/ BLUDGEON
- (R) FLAM. LIQUID
- (S) COMBUSTIBLE
- (T) EXPLOSIVE
- (U) PROJECTILE
- (V) CAUSTIC SUBST.
- (W) BODY (FOOT, ETC.)
- (X) CREDIT CARD
- (Y) CHECK

WEAPON
- (Z) REVOLVER (BLU/OX)
- (0) REVOLVER (SILVER)
- (1) AUTOMAT (BLU/BK)
- (2) AUTOMAT (SILVER)
- (3) RIFLE
- (4) SHOTGUN
- (5) KNIFE
- (6) MARTIAL ARTS WEAPON
- (7) STUN DEVICE
- (8) CHEMICAL DEVICE
- (9) BB/PELLET GUN

98. TARGET

- DNA
- UNKNOWN
- OTHER

NON-RESIDENCE
- (A) CASH REGISTER
- (B) SAFE/MONEY BOX
- (C) COIN-OP MACHINE
- (D) SALES AREA
- (E) DISPLAY
- (F) OFFICE
- (G) TOOL ROOM
- (H) STORAGE RM./AREA
- (I) CLASSROOM
- (J) SHOP
- (K) MULTI LOCATIONS

RESIDENCE
- (L) GRGE./CAR PORT
- (M) VEHICLE
- (N) BASEMENT
- (O) BEDROOM
- (P) LIVING ROOM
- (Q) FAM. RM./DEN
- (R) KITCHEN
- (S) BATHROOM
- (T) DINING ROOM
- (U) ATTIC
- (V) STORE RM./SHED
- (W) MULTI LOCATIONS

VEHICLE
- (X) PASSENG COMPT.
- (Y) GLOVE BOX
- (Z) CONSOLE
- (0) ENGINE COMPT.
- (1) BODY
- (2) WHEELS/TIRES
- (3) UTILITY/COMMER. VEH./STOR. AREA
- (4) RECREAT. VEH./ LIVING AREA
- (5) MULTI LOCATIONS

99. SECURITY DEFEATED

- DNA
- UNKNOWN
- OTHER

NON-RESIDENCE
- (A) CHAIN/BOLT
- (B) DEADBOLT
- (C) CYLINDER OR LOCK
- (D) PADLOCK
- (E) CHARLIE BAR—(SLIDING DOOR)
- (F) WINDOW LOCKS
- (G) BARS/GRATE
- (H) ALARM-OUTSIDE RINGER
- (I) ALARM-TO-SEC. COMPANY
- (J) ALARM-TO-POL. DEPT.
- (K) ALARM-COMBIN. (AUDIBLE & DIRECT)
- (L) CAMERA
- (M) FENCE
- (N) DOG
- (O) WATCHMEN/GUARD
- (P) PRIV. SEC. PATROL

100. LIGHTING
- DNA
- UNKNOWN
- (A) DAYLIGHT
- (B) DAWN
- (C) DUSK
- (D) DARK—UNLIGHTED
- (E) DARK—MOTR LIGHT
- (F) DARK—EXTER. LIGHT
- (G) DARK—INT. & EXT. LIGHT

101. MISCELLANEOUS
- DNA
- UNKNOWN
- OTHER

CRIMES AGAINST PROP.
- (A) HIDE IN PREMISES
- (B) RANSACKED
- (C) DEFECATED/BODY FLUIDS
- (D) USED MATCHES
- (E) VANDALIZED
- (F) HIDES PROCEEDS IN AREA

CRIMES AGAINST PERSON
- (G) BLINDFOLD VICTIM
- (H) BOUND/GAGGED VICTIM
- (I) INJURED VICTIM
- (J) COMMITTED SEX OFFENSE ON VICTIM
- (K) THREATS-WEAPON
- (L) THREATS-VERBAL
- (M) DEMAND NOTE

GENERAL
- (N) HAD LOOKOUT
- (O) USED MONITOR
- (P) USED CB RADIO
- (Q) VEHICLE NEEDED TO REMOVE PROPERTY
- (R) DISABLED PHONE
- (S) DISABLED ALARM
- (T) DISABLED CAMERA
- (U) DISABLED UTILITY
- (V) USED GLOVES

102. TOTAL LOSS

$ _____

103

104. STATUS
- (0) UNFOUNDED
- (1) REFERRED TO OTHER JURISDICTION
- (2) PENDING INVESTIGATION
- (9) NO FURTHER ACTION
- (3) CLEARED BY ADULT ARREST (REQUIRES ARREST REPORT
- (4) CLEARED BY JUVENILE ARREST (REQUIRES ARREST REPORT)
- (5) EXCEPTIONAL CLEARANCE—ADULT
- (6) EXCEPTIONAL CLEARANCE—JUVENILE

PAGE NO -2-

SIGN

105. REPORTING OFFICER | STAR # | 106. SUPERVISOR | 107. COMMANDER

INCIDENT #

SUPPLEMENTARY REPORT

INCIDENT #

INCIDENT

1. ORIGINAL OFFENSE

2. DATE & TIME OF THIS REPORT

3. OFFENSE CHANGED TO

4.
- ☐ FORM USED AS CONTINUATION SHEET FOR PRELIMINARY REPORT
- ☐ FORM USED TO REPORT FOLLOW UP INVESTIGATION

NARRATIVE

5.

PAGE OF PAGES

PAGE

STATUS

6.
- ☐ (0) UNFOUNDED
- ☐ (1) REFERRED TO OTHER JURISDICTION
- ☐ (2) PENDING INVESTIGATION
- ☐ (3) NO FURTHER ACTION
- ☐ (3) CLEARED BY ADULT ARREST (REQUIRES ARREST REPORT)
- ☐ (4) CLEARED BY JUVENILE ARREST (REQUIRES ARREST REPORT)
- ☐ (5) EXCEPTIONAL CLEARANCE-ADULT
- ☐ (6) EXCEPTIONAL CLEARANCE-JUVENILE

SIGN

7. REPORTING OFFICER — STAR #

8. SUPERVISOR

9. COMMANDER

Crime Analysis Information Matrix					
Data Element	*Crime I*	*Crime II*	*Crime III*	*Crime IV*	*Crime V*
UCR Code					
Date					
Time					
Location					
Attempt/Complete					
Method of Entry					
Method of Exit					
Ransacked/Mischief					
Property Description					
Property Removed					
Type Property Loss					
Amount of Property Loss					
Value of Property					
Bias Motivation					
Weapons Used					
Tools Used					
Suspected Drug Type					
Suspected Drug Quantity					
Type of Target					
Type of Victim					
Age of Victim					
Race of Victim					
Sex of Victim					
Ethnicity of Victim					
Type of Victim Injury					
V/O Relationship					
Resident Status					
Age of Suspect					
Sex of Suspect					
Race of Suspect					
Ethnicity of Suspect					
Height					
Weight					
Hair					
Eyes					
Complexion					
Facial Hair					
Glasses					
Car Year					
Car Make					
Car Model					
Color					
License Number					

Crime Analysis Calendar

May

April

S	M	T	W	T	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

May

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

Monday	Tuesday	Wednesday	Thursday	Friday	Sat/Sun
April 27	28	29	30	May 1	2
					3
4	5	6	7	8	9
					10
11	12	13	14	15	16
					17
18	19	20	21	22	23
					24
25	26	27	28	29	30
					31

Crime Pattern Profile			
Data Element	*Offender Information*	*Data Element*	*Offense Information*
Sex		*Tools Used*	
Race		*Entry Point*	
Physical Description		*Exit Point*	
Body Marks		*Crime Number*	
Height		*Locations*	
Weight		*Weapons*	
Skin Color		*Earliest Day*	
Eye Color		*Latest Day*	
Hair Color		*Most Frequent Day*	
Last Address		*Earliest Date*	
Gang Affiliation		*Latest Date*	
Appearance		*Earliest Time*	
Speech Patterns		*Latest Time*	
Place of Work		*Average Time*	
Hangouts		*Beat/Sector*	
V/O Relationship		*Area/District*	

Beaufort Police Department
Internal Memorandum

To: All Patrol Supervisors
From: Officer William Dover, Crime Analyst
Regarding: Directed Patrol Plan

Nature of the Problem

Since the beginning of the year, our village has seen a rise in the number of motor vehicles stolen from all areas. The crime analysis unit has analyzed the past six months motor vehicle data and come to the conclusion that there appears to be a concentration of motor vehicle thefts beginning on or about May 5 that constitute the same offender or group of offenders. In an effort to apprehend this individual, we are calling for patrols that are specifically focused on the data contained within this memorandum.

Type of Target

The suspect appears to steal predominately late model, expensive luxury automobiles. These vehicles do have alarms and the suspect appears to have no problem quickly disabling them. Examples of stolen cars include Lexus, BMW, and Mercedes.

Time Frame

The suspect appears to work predominately between dusk and night. The earliest time recorded was 6:00pm and the latest time recorded was 9:00pm. He also appears to like to work early in the week, as most reports have occurred Monday-Wednesday.

Location

The suspect appears to work predominately along the Highway 41 corridor bordering the Shady Grove subdivision and the Hickory Hills Shopping Center. At least five cars appear to have been stolen within one mile of this area.

Suspect Information

Witnesses have described the suspect as being a white male, aged 20-25, 5'8" to 5'10", 150-170 pounds with short dark hair and medium coloring. He has been described as being casually dressed and in one instance was carrying a backpack. He also apparently likes to steal cars that are either parked out of direct sight or out of direct light. His method of entry appears to be by picking or pulling the car's door locks. There have been no recovered cars and no physical or forensic evidence.

Predicted Time, Date, and Location of Next Occurrence

Based on the analysis conducted by the Crime Analysis Unit, it appears that the suspect will next strike between May 27 and June 2, on or around 6:30pm to 8:54pm. Furthermore, he is most likely to strike west of Highway 41, in or around the parking lots surrounding the Hickory Hills Shopping Center.

Beaufort Police Department
Internal Memorandum

To: All Patrol Supervisors
From: Officer William Dover, Crime Analyst
Regarding: Preliminary Investigation Plan

Nature of the Problem

After analysis of the past six months motor vehicle data and come to the conclusion that there appears to be a concentration of motor vehicle thefts beginning on or about May 5 that constitute the same offender or group of offenders. In an effort to apprehend this individual or individuals, we are calling for patrols that are specifically focused on the data contained within this memorandum.

Type of Target

The suspect appears to steal predominately late model, expensive luxury automobiles. These vehicles do have alarms and the suspect appears to have no problem quickly disabling them.

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The suspect appears to work predominately between dusk and night. The earliest time recorded was 6:00pm and the latest time recorded was 9:00pm. He also appears to like to work early in the week, as most reports have occurred Monday-Wednesday.

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The suspect appears to work predominately along the Highway 41 corridor bordering the Shady Grove subdivision and the Hickory Hills Shopping Center. At least five cars appear to have been stolen within one mile of this area.

Suspect Information

Witnesses have described the suspect as being a white male, aged 20-25, 5'8" to 5'10", 150-170 pounds with short dark hair and medium coloring. He has been described as being casually dressed and in one instance was carrying a backpack.

Suspect Modus Operandi

He also apparently likes to steal cars that are either parked out of direct sight or out of direct light near shopping areas. His method of entry appears to be by picking or pulling the car's door locks as no glass has been recovered on scene.

Predicted Time, Date, and Location of Next Occurrence

Based on the analysis conducted by the Crime Analysis Unit, it appears that the suspect will next strike between May 27 and June 2, on or around 6:30pm to 8:54pm. Furthermore, he is most likely to strike west of Highway 41, in or around the parking lots surrounding the Hickory Hills Shopping Center.

Witness Information

Bob Jones, White Male, 12/03/71, Dover's Village, IL. Report #0412.
Jay Peterman, White Male, 08/03/72, Dover's Village, IL. Report #0473.

Physical Evidence

There have been no recovered cars and no physical or forensic evidence.

Stolen Property Information

1993 Lexus SC300, White/White. License 32160 IL, Expires 9/99. Report #0412.
1994 BMW 325is, Green/Green, License 21635 IL, Expires 8/99. Report #0425.
1993 Mercedes 300CE, Red/Red, License 14631 IL, Expires 10/99. Report #0440.
1997 Chrysler Sebring, Black, Black, License 59155 IL, Expires 11/99. Report #0461.
1995 Land Rover Discovery, Green, License 62135 IL, Expires 12/99. Report #0473.

Beaufort Neighborhood Watch Plan

Definition

A program involving the joint efforts of the police and the community that is designed to enhance neighborhood security, heighten citizen awareness, and encourage mutual assistance and concern among residents in order to prevent crime.

The plan is designed to facilitate the need for a crime prevention program that will enhance neighborhood security without the further addition of law enforcement officers.

Goals

1. To increase citizen awareness of property crimes and other neighborhood crime through a continuing information program of literature distribution from law enforcement.
2. Training citizens in the means of better property security and assisting them in making their property more secure.
3. Develop a neighborhood action program where citizens help watch each other's property and report suspicious persons and activities to law enforcement.

Responsibilities and Duties

1. Neighborhood Coordinator – Coordinates activities of Block Captains and Block Watchers, recruits neighborhood residents for the program, and acts as a liaison with the village police.
2. Block Captain – Hosts neighborhood watch meeting, and acts as main recruiter for program. Also distributes crime prevention materials and cooperates with Neighborhood Coordinator.
3. Block Watcher – Acts as reporter for suspicious activity. Also checks neighbors' homes when they are out-of-town and assists the Block Captain.

What Suspicious Activity Should I Watch For?

1. A stranger entering your neighbor's house when it is unoccupied.
2. A scream heard anywhere nearby.
3. Offers of merchandise at ridiculously low prices.
4. Anyone removing accessories, license plates, or gas from a car.
5. Anyone peering into parked cars.
6. Persons entering or leaving a business after business hours.
7. A sound of breaking glass or loud explosive noises.

What Suspicious Activity Might I Not Watch For Regularly?

1. Someone going door-to-door in the neighborhood.
2. A person running while carrying an object.
3. A person exhibiting unusual mental or physical symptoms.
4. Irregular human traffic to and from a certain residence.
5. Any person taking a shortcut through a wooded area.
6. Any vehicle moving slowly and/or without lights.
7. Business transactions conducted from a vehicle.
8. Vehicles being loaded with valuables from a closed business.
9. Open or broken windows at a closed business or residence.
10. A beam from a flashlight in a neighbor's home.

What to do if Suspicious Activity is Heard and What to Report

Call 911 or your local law enforcement department immediately when you observe suspicious activity. Do not worry about bothering them or embarrassing yourself if you are wrong. Think instead about what could happen if you do not act.

Be prepared to report what happened, when, where, and whether anyone was hurt. Also note the description of the person and their vehicle.

Glossary

Area Chart – An area chart emphasizes the magnitude of change over time. By displaying the sum of the plotted values, an area chart also shows the relationship of parts to a whole.

Confidence Interval – A range of values constructed around a point estimate (usually the mean) that makes it possible to state that an interval contains the desired value between the upper and lower limits.

Crime Calendar – A way of visually observing the dates, the times, and the order in which crimes occurred during an investigation.

Crime Pattern – The occurrence of similar offenses in a defined geographic area.

Crime Pattern Plan – A plan designed to be a summation of what incident reports and witness statements indicate on an Information Matrix Form. This would include information related to suspect descriptors and property information, modus operandi information, and eyewitness statements.

Crime Series – A crime pattern committed by a single person or set of persons.

Date Prediction Analysis – The forecasted date of a future crime based on when the past crimes occurred.

Directed Patrol Plan – A plan which utilizes accurate and timely information to predict where and when crimes are likely to be committed based on past data. It allows the crime analyst to allocate police resources in the most effective manner to apprehend an offender. It also encourages patrol officers and crime analysts to develop proactive rather than reactive tactical responses to specific situations of a specific offense situation. The most important information included is the nature of the problem, the type of targets that have been hit, the time frame and location of the crimes, any suspect information, and the predicted time, date, and location of the next offense.

Forecasting – A statistical analysis method that attempts to predict the next crime instance in a crime series or pattern for the purpose of police interception.

Information Matrix Form – A spreadsheet form that captures data elements for each crime in a crime series or crime pattern in a uniform fashion. These data elements generally include information on the offense, the suspect, the victim, and the property/crime scene.

Line Chart – A line chart shows trends in data at equal intervals.

Location Prediction Analysis – An analysis technique which results in a forecasted location of a future crime based on either the similarity of crimes or the occurrence of multiple crimes in a defined geographic area.

Mean – The arithmetic average of a set of data in which the values of all observations are added together and divided by the number of observations.

Measure of Central Tendency – Statistical measures that reflect a typical or average characteristic of a set of data values. Examples include the mean, median, mode.

Measure of Dispersion – Statistics whose objective is to convey information about the spread of values around a central point. Measures of dispersion, such as the standard deviation, indicate how much values deviate from some typical score.

Median – The outcome that divides an ordered distribution of data exactly into halves.

Mode – The single category among all categories in a distribution with the largest number or highest percentage of observations.

Moving Averages – An arithmetic method of smoothing out the peaks and valleys associated with trend data. Once the data is smoothed out, via either a simple, weighted, or exponential average, the underlying trend can be examined for variation.

Neighborhood Watch Plan – A program involving the joint efforts of the police or sheriff's department and the community, designed to enhance neighborhood security, heighten the community's power of observation, and to encourage mutual assistance and concern among neighbors.

Percentage Change – An arithmetic method of determining how much change has occurred between two numbers over time.

Preliminary Investigation Plan – A plan designed to increase apprehension efforts and provide investigators with information leading to an arrest. Generally, the plan includes items such as the type of offenses that have occurred, the location, time, and date, the identity of the victims or property description, any modus operandi information, and the type of response to take. In addition, however, the preliminary investigation plan contains information to help detectives begin questioning suspects and planning further investigation strategies. It includes information on witnesses, suspect/offender arrest information on any named suspects, suspect location, any suspect personal or vehicle descriptions, property or victim information, modus operandi information, physical evidence, and arrest information.

Rates Per Population – An arithmetic method of standardizing different values by a common population for analysis and comparison.

Seasonal Indices – An arithmetic method that provides the crime analyst with a means of determining how one month compares to another month as a percentage of the total crime activity. Thus, a crime analyst can easily determine what month is likely to demand the greatest amount of police manpower.

Standard Deviation – The spread or dispersion of a set of scores around some central value, generally the mean. The standard deviation is used to determine the normal limits around the mean and is useful in performing forecasting and prediction analysis.

Target Profile Report – A report that details the type of person, structure, or vehicle that is likely to be the target of a crime. This report will attempt to provide guidance to patrol officers in the suppression and prevention of crime situations.

Time Prediction Analysis – The forecasted time of a future crime based on the temporal patterning of past crimes.

Time Series Analysis – An arithmetic method of examining data element movements over time. In general, there are only two types of time series that prove useful for the crime analyst: the secular trend and the seasonal variation.