

Memo

Date: March 4, 2004
Memo to: David Manning
From: Kim McDoniel
Regarding: 800 MHz Capacity Study

As a follow up to issues arising during the Police audit implementation, you asked Internal Audit to coordinate an analysis of the 800 MHz radio communication system's projected capacity for the next three to five years. We contracted with Federal Engineering, Inc. to conduct that study, and their analysis and conclusions are attached. In summary, Federal Engineering has concluded that Metro's 800 MHz network has sufficient capacity to meet Metro's anticipated growth over the next five years.

Please let me know if you have any questions or need additional information.

Copy: Nancy Whittemore
Metropolitan Council Audit Committee



Federal Engineering, Inc.

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PROJECT NAS-WNPM-CAP
METRO 800 MHz PSMR NETWORK CAPACITY ANALYSIS
Final Capacity Plan Report – March 1, 2004

Section 1 - Introduction

Two recent changes in the 800 MHz systems used by Metro Nashville/Davidson County prompted the need to develop an overall capacity utilization plan for the systems:

- Metro and NES (Nashville Electric Service) recently converted channels 17 and 18 of System B of the 800 MHz voice system to the mobile data system. The data system now has four channels with three channels being dedicated to Police and Fire and one channel being dedicated to NES.
- The “Metro Nashville VHF/UHF Mobile Radio Assessment” report recommended that a number of agencies make the transition from their outdated radio system to the 800 MHz system. These new additions have no quantitative history upon which to base trended forecasts.

FE was engaged to assess the impacts of these changes by developing a five-year capacity plan, taking the following into account:

- The capacity of System A of the 800 MHz voice system given the growth of the agencies using the system.
- The capacity of System B of the 800 MHz voice system given the growth of the agencies using the system, the number new agencies of transitioning to the system, and the reduction in the number of channels due to the data system.
- The capacity of the Metro data system given the addition of the Fire data units.
- The capacity of the NES data system given the addition of 200 data units.



Section 2 - Executive Summary

A comprehensive evaluation of the Metro/NES voice and data system capacity was required to assess the impacts of changes in system configuration, the anticipated yearly growth in the number of voice and data units, and the anticipated addition of voice and data units for new user agencies. Metro/NES originally had two 18-channel 800 MHz trunked systems and two mobile data channels. The mobile data channels became overloaded with traffic and the message response times to the field units were becoming increasingly longer. Metro/NES converted two channels from one of the voice systems to data. Metro is using three of the data channels and NES is using one of the data channels.

In 2002, **FE** submitted a report to Metro/NES which was entitled “Metro Nashville VHF/UHF Mobile Radio Assessment”. In this report, **FE** made recommendations on which agencies to transition to the two lightly loaded 18 channel 800 MHz trunked radio systems. With the conversion of the two voice channels to data, the voice system capacity needed to be reevaluated in order to adequately accommodate the agencies that **FE** recommended for addition. Since the time of the **FE** report, other agencies expressed a desire to make a transition to the voice system. The Fire Department and NES also expressed a desire to add data units to the expanded data system.

FE has developed a five-year capacity plan and prepared projections of the utilization for the two 800 MHz trunked voice systems and the data system. It appears that there is adequate capacity in all systems currently in use by Metro/NES throughout the planning period. The detailed results are outlined in Section 5 of this report. The utilization for the two voice systems, the Metro data system, and the NES data system is summarized in Exhibit 1 below:

Year	Sys. A - Voice	Sys. B- Voice	Metro Data		NES Data	
	Utilization (%)	Utilization (%)	Inbound Utilization (%)	Outbound Utilization (%)	Inbound Utilization (%)	Outbound Utilization (%)
2004	31	16	34	15	25	25
2005	32	17	34	15	27	27
2006	33	18	35	15	30	30
2007	35	19	35	15	33	32
2008	36	21	35	15	36	35

Exhibit 1 – Overall System Utilization Forecasts

FE recommends that Metro and NES proceed with the transition of voice units to the 800 MHz system. Even with the conversion of two voice channels to data, the voice system is lightly loaded and should accommodate the five-year growth, the agencies **FE** recommended for transition in “Metro Nashville VHF/UHF Mobile Radio Assessment” report, and the agencies that expressed a desire to



be transitioned to the 800 MHz voice system since the publishing of the **FE** report.

Given the data message profiles used in this report, **FE** recommends that the Fire Department and NES proceed with the addition of data units for the mobile data system. If the message profiles change significantly from the ones used in this report, the data capacity should be reevaluated for the new message profiles to see if additional channels or a data system with a higher data rate is required.

Although the future is always difficult to predict, and many factors can alter utilization forecasts, the systems are conservatively sized and have sufficient “head room” to absorb demand in the foreseeable future.

Section 3 - Methodology

A comprehensive list of the number of non-fixed units (i.e., mobile and portable radios) for the agencies using the Metro/NES voice system was provided to **FE** by the Metro Radio Shop. Survey forms were also given to the Metro agencies and NES to gather current and future system use. The following agencies provided completed survey forms to **FE**:

- Police
- Fire
- Sheriff
- NES
- Public Works
- Water and Sewer
- Office of Emergency Management
- Radio Shop

FE used two different sources to validate utilization information. The Metro Radio Shop survey stated that the peak utilizations for System A and System B is 30% and 7% respectively. Channel utilization charts in the “Metro Nashville and NES 800 MHz Radio System MRAM Performance Report”, dated September 18, 2003, show that the peak utilization for System A and System B were 26% and 8.4% respectively.

In order to promote conservative analyses, the voice system growth projections were based on the higher documented peak utilization for each system. Thus, 30% was used for System A and 8.4% was used for System B.

Information describing the characteristics of the Metro data system was derived from the “Metro Nashville Data System Throughput” spreadsheet which is included as Attachment A. The spreadsheet included a list of the message blocks, the message block sizes, and the number of messages per unit per hour



for both inbound and outbound directions. The spreadsheet also included the inbound and outbound data system utilization for one channel and two channels for a various number of units.

Information describing the characteristics of the NES data system was taken from the NES survey form. The survey form contains the number of messages per five-minute intervals and the message size.

Section 4 – Findings and Projections

The first step in projecting the future growth of the voice system was calculating the number of push-to-talks (PTTs) per unit. To accomplish this, the number of call seconds used in the busy hour was calculated by multiplying the peak utilization percentage times the number of channels times 3600 seconds. An assumption of four seconds was used for the average call length. The average call length was divided into the number of call seconds in the busy hour to give the number of PTTs. The number of units was divided into the number of PTTs to yield the number of PTTs per unit. These calculations are shown in Tables 1 and 2 for System A and System B respectively. A breakdown of the number of PTTs and call seconds by agency is also shown in these tables.

Growth projections for the voice system were estimated over a five-year period for NES and the Metro agencies. The growth of most of the agencies was based on a one percent (1%) growth per year in the number of units and per unit PTTs. This was used as an assumption absence any survey data provided by the agency, based on guidance received from Metro. The following exceptions from the underlying assumptions were used based on information provided in the surveys and by Metro and NES:

- A 1.1% growth per year was used for the Fire Department to achieve the 50-unit growth over five years that was stated in their survey form.
- A 4% growth per year was used for the Park Rangers to achieve the 10-unit growth over five years that was stated in their survey form.
- A 3.5% growth per year was used for NES to achieve the 100-unit growth over five years that was stated in their survey form.
- A 3% growth per year was used for the Sheriff's Department to achieve the 50-unit growth over five years that was stated in their survey form. The Sheriff's department is looking at transitioning their jail units to the 800 MHz system. The 130 units for the jail systems were added to the Sheriff's Department's first-year unit count.



- A 13% growth per year was used for Public Works to achieve growth and account for the transition from their existing 200 VHF radios to the 800 MHz system that recently completed.
- A 5.8% growth per year was used for the Board of Education to achieve growth and account for the transition of the Public School's 693 UHF radios to the 800 MHz system. The Public Schools' present UHF system is inadequate for the amount of traffic during severe storms. Public Schools is applying for funding to initially place 500 units on the 800 MHz system.
- A 3% per year growth in the number of PTTs per unit was used for the Sheriff, Police, and Fire to account for the increased amount of traffic typical of the public safety agencies that use the system heavily.

The growth projections also took into account the other agencies that are to make a transition to the 800 MHz system. They include the following:

- 40 units for Water and Sewer. These units are to be added as a fallback to the Nextel system. The Nextel system was compromised after a severe storm.
- 30 units for the Health Department. The Health Department's transition was recommended by **FE** in the "Metro Nashville VHF/UHF Mobile Radio Assessment".
- 213 units for MTA. MTA's transition was recommended by **FE** in the "Metro Nashville VHF/UHF Mobile Radio Assessment".

With these the assumptions, the number of units was multiplied by the number of PTTs per unit derived in Table 1 and Table 2 and the average call time of four seconds for each agency on a yearly basis. The sum of the agencies' call times were divided by the number of channels and 3600 seconds to calculate the overall peak voice system utilization for that year. The utilization rates for the data systems were derived by starting with the number of bytes used by the 200, 400, and 600 units and dividing these into the amount of utilization air time for that particular number of units to derive multipliers. This was done for the one channel and two channel configuration for inbound and outbound data traffic. An average was taken from the individual multipliers to derive an overall inbound and outbound multiplier. These calculations are shown in Tables 3 and 4.

Growth projections were estimated over a five-year period for the NES data system and the Metro data system. Police and Fire are the users of the Metro data system. The growth of the Police and Fire data units was based on a one percent (1%) growth per year based upon the projection of units for Police and using guidance provided by Metro for Fire. Fire desires to start with 200 units on



the data system. NES currently has 75 data units on their data system. NES hopes to place 100 units on the system during year 1 and grow to 275 units after five years. The 9.5% growth per year used in the spreadsheet reflects this growth.

With these assumptions, the number of units was multiplied by the message size and the number of messages per unit per hour to derive the number of bytes used during the peak hour on a yearly basis. Conservatively, sixty percent of the units were assumed to be on the air during the peak busy hour. The number of bytes used was multiplied by the average multiplier in Tables 3 and 4 to derive the overall call-seconds. The call-seconds were divided by 3600 seconds and the number of channels to derive the overall peak data system utilization for that year.

Section 5 – Capacity Estimates

System A: Tables 5-9 show the growth capacity for System A in years 1-5. Even with the unit growth, the peak utilization only increased from 31% to 35% after five years.

System B: Tables 10-14 show the growth capacity for System B in years 1-5. The addition to the Public Schools, MTA, Public Works, and Sheriff units has a significant impact on the peak utilization of the system, although still leaving sufficient capacity for the planning period. The peak utilization increased to 21% after five years.

Metro Data: Tables 15-19 show the inbound growth capacity for the Metro data system in years 1-5. Tables 20-24 show the outbound growth capacity for the Metro data system in years 1-5. The third data channel has significantly alleviated the congestions problems that the Police experienced on the data system. The inbound utilization for two channels was 49% and the outbound utilization for two channels was 20%. With the third channel, the year 5 inbound utilization is 35% and the year 5 outbound utilization is 15%.

NES Data: Tables 25 and 26 show the five year inbound and outbound growth capacity for the NES single channel data system. The year 5 inbound utilization is 36% and the year 5 outbound utilization is 35%.

Section 6 – Conclusions

System A has enough capacity to accommodate the anticipated growth. System B is currently lightly loaded and has more than enough capacity to accommodate the projected growth in the number of units. **FE** recommends Metro and NES



proceed with transitioning MTA, Public Schools, Water and Sewer, Health Department, and Sheriff's Department units to System B.

The three-channel Metro data system has sufficient capacity to accommodate the Police traffic and the additional Fire data units if the message profiles remain the same as the ones shown in Tables 3 and 4. If applications requiring message sizes significantly greater than the ones shown in Tables 3 and 4, the capacity should be evaluated with the new message profiles. However, the overall system should have enough capacity to absorb such anomalies.

Along the same lines, the single data channel for the NES data system has enough capacity to accommodate the 275 units that NES plans to place on the system if the message sizes remain at 70 bytes per message. If applications requiring message sizes significantly greater than 70 bytes are used in this analysis, the capacity should be reevaluated with the new message profiles. Again, the overall system should have enough capacity to absorb such anomalies.

Metro and NES should continue to monitor the utilization of the voice system on a monthly basis. Metro and NES should also migrate agencies with large numbers of units onto the system in stages. The utilization for a new agency should be evaluated for a one-month period before adding the next agency. If the peak utilization exceeds 65%, additional channels would be required before additional units are added. With the low utilization of the system, *FE* does not expect the system to reach 65% peak utilization with the envisioned addition of units over the anticipated time frame.

For the data system, it is recommended that Metro and NES acquire software for monitoring the utilization of data traffic on a monthly basis. This would be especially important if new applications that require large message sizes are added to the data system. Only one major new application or large feature within an existing application should be added at a time. The peak utilization should be evaluated for a month after the application or major feature is added to determine if it causes too much strain on the system and the message response time.

In closing, it appears that Metro Nashville has taken a conservative approach to system design; an approach that has yielded sufficient overall system capacity to absorb future users and to accommodate statistical anomalies should future usage exceed current utilization projections.

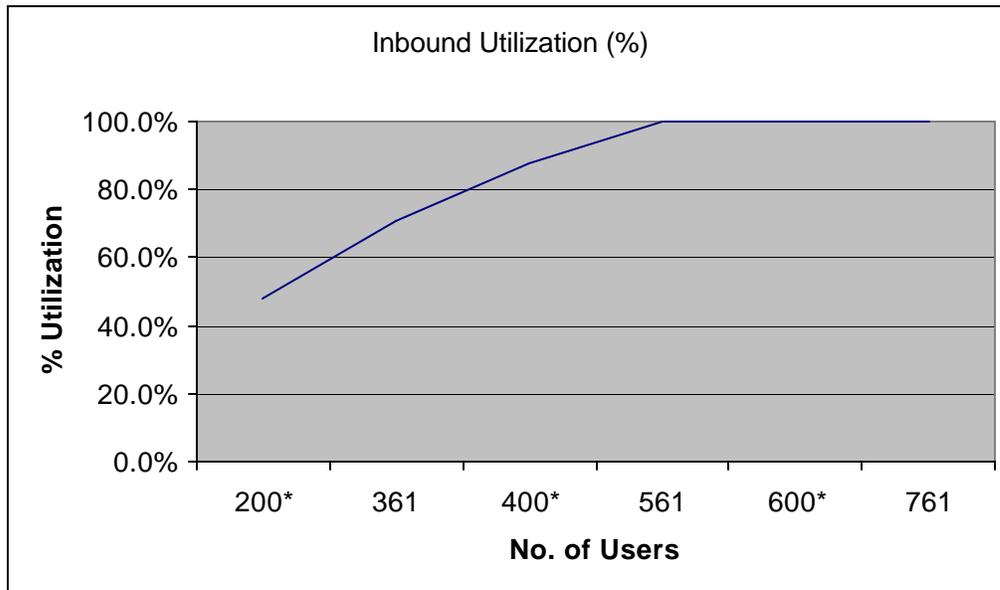


Attachment A - Metro Nashville Data System Throughput

Single RD-LAP (19.2) Channel

Number of Users	Inbound Utilization (%)	ACK Response Time (s)	Outbound Utilization (%)	ACK Response Time (s)
200*	48.2%	1.85	20.1%	1.7
361	70.9%	2.46	33.8%	2.61
400*	87.5%	2.39	41.9%	2.26
561	100.0%		44.0%	2.25
600*	100.0%			
761	100.0%			

MNPD Users only for 200, 400 and 600; Load profiles obtained from RNC in Dec. 2001.
 161 Users and load profiles comprised of defined users in original Bid Spec issued in 1998
 Individual Site capacities exceeded starting at 400 Users (1-site exceeded).

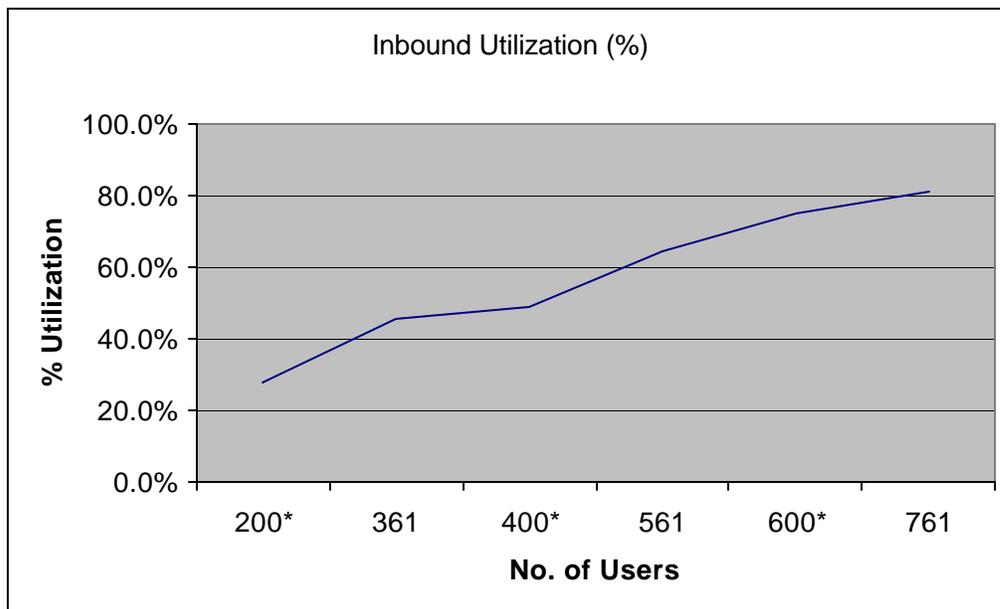


Attachment A - Metro Nashville Data System Throughput (continued)

Two RD-LAP (19.2) Channels

Number of Users	Inbound Utilization (%)	ACK Response Time (s)	Outbound Utilization (%)	ACK Response Time (s)
200*	27.8%	1.46	11.1%	1.58
361	45.7%	2.14	18.6%	2.2
400*	49.1%	1.67	20.1%	1.77
561	64.6%	2.24	28.4%	2.26
600*	75.1%	2.03	33.9%	2.09
761	80.9%	2.46	40.8%	2.56

MNPD Users only for 200, 400 and 600; Load profiles obtained from RNC in Dec. 2001.
 161 Users and load profiles comprised of defined users in original Bid Spec issued in 1998



Police Department Inbound

Message Type	Bytes	Message/Unit/Hr
Block0	12	12.683
Block1	24	3.446
Block2	36	4.380
Block3	48	0.823
Block4	60	0.485
Block5	72	2.020
Block6	84	0.923
Block7	96	0.765
Block8	108	0.650
Block9	120	0.914
Block10	132	0.092
Block13	168	0.057



Attachment A - Metro Nashville Data System Throughput (continued)

Police Department Outbound

Block0	12	8.727
Block1	24	0.665
Block2	36	0.823
Block3	48	0.137
Block4	60	0.169
Block5	72	0.159
Block6	84	0.161
Block7	96	0.149
Block8	108	0.160
Block9	120	0.057
Block10	132	0.091
Block11	144	0.069
Block12	156	0.123
Block20	252	0.057
Block23	288	0.069
Block26	324	0.057
Block27	336	0.080
Block31	384	0.056
Block35	432	0.092

Codes Inbound

Message Type	Bytes	Message/Unit/Hr
Building Insp	15	0.1
Electrical Insp	15	0.07
Plumbing Insp	15	0.06
Mechanical Insp	15	0.09
Housing Insp	15	0.02
Zoning Insp	15	0.03
Insp Itinerary	15	0.33
Permit Inq	15	0.06
Office Tx	15	0.08

Codes Outbound

Message Type	Bytes	Message/Unit/Hr
Building Insp	1250	0.1
Electrical Insp	1250	0.07
Plumbing Insp	1250	0.06
Mechanical Insp	1250	0.09
Housing Insp	1250	0.02
Zoning Insp	1250	0.03
Insp Itinerary	1250	0.33
Permit Inq	2040	0.06
Office Tx	1250	0.08



Attachment A - Metro Nashville Data System Throughput (continued)

Fire Inbound

Message Type	Bytes	Message/Unit/Hr
Dispatch	20	0.6

Fire Outbound

Message Type	Bytes	Message/Unit/Hr
Dispatch	500	0.6

Juvenile Court Inbound

Message Type	Bytes	Message/Unit/Hr
Juve Warrants	1920	8
Juve Traffic	1920	1
Juve Network	1920	10
Juve NCIC	1920	1
Juve Metro Warrant	1920	3

Juvenile Court Outbound

Message Type	Bytes	Message/Unit/Hr
Juve Warrants	1920	8
Juve Traffic	1920	1
Juve Network	1920	10
Juve NCIC	1920	1
Juve Metro Warrant	1920	3

Water Inbound

Message Type	Bytes	Message/Unit/Hr
Cust Svc On-Off	150	0.17
Eng Survey	1920	0.01
Sewer Complaint	100	0.01
Sewer WO	100	0.002
Emergency Complaint	60	0.02

Water Outbound

Message Type	Bytes	Message/Unit/Hr
Cust Svc On-Off	120	0.17
Eng Survey	1920	0.01
Sewer Complaint	100	0.01
Sewer WO	120	0.002
Emergency Complaint	100	0.02

OEM Inbound

Message Type	Bytes	Message/Unit/Hr
Dispatch	20	0.6
ACC Rpt2	2040	0.02



Attachment A - Metro Nashville Data System Throughput (continued)

OEM Outbound

Message Type	Bytes	Message/Unit/Hr
Dispatch	500	0.6

Parks Inbound

Message Type	Bytes	Message/Unit/Hr
Park Ranger NCIC	1920	0.5
Warrants	1920	0.5
Ranger Req	1920	1.1
Ranger Inv	1920	1.1

Parks Outbound

Message Type	Bytes	Message/Unit/Hr
Park Ranger NCIC	1920	0.5
Warrants	1920	0.5
Ranger Req	1920	1.1
Ranger Inv	1920	1.1

Sheriff Inbound

Message Type	Bytes	Message/Unit/Hr
Database Inq	1920	4
Jail Mngmt	1920	2
NCIC	1920	3
Warrants	1920	3
Sheriff Req	1920	6

Sheriff Outbound

Message Type	Bytes	Message/Unit/Hr
Database Inq	1920	4
Jail Mngmt	1920	2
NCIC	1920	3
Warrants	1920	3
Sheriff Req	1920	6



Table 1. System A Current Use

Agency	No.# of Units	No.# PTT's	Total Call Time (sec)
A.T.F.	4	3.91	15.63
Airport	311	303.85	1215.40
Archaeology	1	0.98	3.91
Arson & Bomb	13	12.70	50.80
Belle Meade	36	35.17	140.69
Berry Hill	24	23.45	93.79
Board of Health	12	11.72	46.90
CSX Railroad	1	0.98	3.91
D.A.	19	18.56	74.25
E.C.C.	61	59.60	238.39
F.B.I.	9	8.79	35.17
Fire Dept.	922	900.80	3603.22
Fleet Motor Pool	28	27.36	109.43
Forest Ranger	3	2.93	11.72
Goodlettsville	43	42.01	168.05
Juvenile Court	45	43.97	175.86
Lake Wood	12	11.72	46.90
Media	56	54.71	218.85
Medical Examiner	5	4.89	19.54
O.E.M.	200	195.40	781.61
Opryland	3	2.93	11.72
Pardons & Parole	4	3.91	15.63
Park Rangers	23	22.47	89.89
Police	2602	2542.18	10168.74
Radio Communication	35	34.20	136.78
Red Cross	2	1.95	7.82
Secret Service	2	1.95	7.82
State Fair Board	3	2.93	11.72
System	1	0.98	3.91
T.B.I.	26	25.40	101.61
T.H.P.	44	42.99	171.95
Taxi - Wrecker	5	4.89	19.54
T-Dot	12	11.72	46.90
Traffic Violations	6	5.86	23.45
U.S. Marshals	4	3.91	15.63
Vanderbilt	121	118.22	472.87
Total	4698	4590	18360
Busy Hour Seconds Used:	18360		
Average Call Length (sec):	4		
No.# of PTT's:	4590		
No.# of PTT's per Unit:	0.98		
Peak Utilization (%):	30		



Table 2. System B Current Use

TABLE 2

Agency	No.# of Units	No.# PTT's	Total Call Time (sec)
Beer Board	7	6.76	7
Board of Education	22	21.23	22
Codes	79	76.24	79
F.B.I.	10	9.65	10
M.T.A.	1	0.97	1
NES	538	519.23	538
Park Rangers	24	23.16	24
Public Works	263	253.82	263
Sheriff Dept.	187	180.47	187
State Trial Courts	41	39.57	41
Water & Sewer	3	2.90	3
Total	1175	1134	1175
Busy Hour Seconds Used:	4536		
Average Call Length (sec):	4		
No.# of PTT's:	1134		
No.# of PTT's per Unit:	0.97		
Peak Utilization (%):	8.4		



Table 3. Inbound Peak Use Estimates

Message Type	Bytes/Message	Message/Unit/Hr	Bytes/Hr		
			(200 units)	(400 units)	(600 units)
Block0	12	12.68	30438.79	60877.58	91316.38
Block1	24	3.45	16542.15	33084.30	49626.45
Block2	36	4.38	31538.02	63076.05	94614.07
Block3	48	0.82	7901.75	15803.50	23705.25
Block4	60	0.49	5821.07	11642.15	17463.22
Block5	72	2.02	29092.13	58184.27	87276.40
Block6	84	0.92	15512.58	31025.15	46537.73
Block7	96	0.77	14694.26	29388.53	44082.79
Block8	108	0.65	14038.62	28077.24	42115.85
Block9	120	0.91	21945.79	43891.57	65837.36
Block10	132	0.09	2427.59	4855.17	7282.76
Block13	168	0.06	1926.27	3852.53	5778.80
Total			191879.02	383758.04	575637.06

Number of Channels	Number of Users	Inbound Utilization (%)	Channel Time (sec)	Multiplier (sec/Byte)
1	200	48.2	1735.20	0.0090
1	400	87.5	3150.00	0.0082
2	200	27.8	2001.60	0.0104
2	400	49.1	3535.20	0.0092
2	600	75.1	5407.20	0.0094
Average				0.0093



Table 4. Outbound Peak Use Estimates

<u>Message Type</u>	<u>Bytes/Message</u>	<u>Message/Unit/Hr</u>	Bytes/Hr		
			(200 units)	(400 units)	(600 units)
Block0	12	8.73	20945.07	41890.13	62835.20
Block1	24	0.66	3191.93	6383.86	9575.78
Block2	36	0.82	5925.24	11850.48	17775.71
Block3	48	0.14	1316.61	2633.22	3949.84
Block4	60	0.17	2032.90	4065.80	6098.70
Block5	72	0.16	2283.21	4566.42	6849.63
Block6	84	0.16	2703.45	5406.90	8110.34
Block7	96	0.15	2856.64	5713.27	8569.91
Block8	108	0.16	3458.93	6917.86	10376.79
Block9	120	0.06	1379.31	2758.62	4137.93
Block10	132	0.09	2412.60	4825.20	7237.80
Block11	144	0.07	1986.21	3972.41	5958.62
Block12	156	0.12	3838.57	7677.14	11515.71
Block20	252	0.06	2896.55	5793.10	8689.65
Block23	288	0.07	3972.41	7944.83	11917.24
Block26	324	0.06	3682.53	7365.06	11047.59
Block27	336	0.08	5397.36	10794.72	16192.08
Block31	384	0.06	4315.17	8630.34	12945.51
Block35	432	0.09	7932.57	15865.13	23797.70
Total			82527.25	165054.50	247581.75

Number of Channels	Number of Users	Outbound Utilization (%)	Channel Time (sec)	Multiplier (sec/Byte)
1	200	20.1	723.60	0.0088
1	400	41.9	1508.40	0.0091
2	200	11.1	799.20	0.0097
2	400	20.1	1447.20	0.0088
2	600	33.9	2440.80	0.0099
Average				0.0092



Table 5 System A Year 1 Estimates

Agency	No.# of Units	Growth Units	# of PTT's per Unit	Call Time (sec)	Growth per Year (%)
A.T.F.	4	4	0.99	15.84	1.00
Airport	311	314	0.99	1243.19	1.00
Archaeology	1	1	0.99	3.96	1.00
Arson & Bomb	13	13	0.99	51.47	1.00
Belle Meade	36	36	0.99	142.53	1.00
Berry Hill	24	24	0.99	95.02	1.00
Board of Health	12	12	0.99	47.51	1.00
CSX Railroad	1	1	0.99	3.96	1.00
D.A.	19	19	0.99	75.22	1.00
E.C.C.	61	62	0.99	245.47	1.00
F.B.I.	9	9	0.99	35.63	1.00
Fire Dept.	922	932	1.01	3763.04	1.10
Fleet Motor Pool	28	28	0.99	110.86	1.00
Forest Ranger	3	3	0.99	11.88	1.00
Goodlettsville	43	43	0.99	170.25	1.00
Juvenile Court	45	45	0.99	178.16	1.00
Lake Wood	12	12	0.99	47.51	1.00
Media	56	57	0.99	225.67	1.00
Medical Examiner	5	5	0.99	19.80	1.00
O.E.M.	200	202	0.99	799.76	1.00
Opryland	3	3	0.99	11.88	1.00
Pardons & Parole	4	4	0.99	15.84	1.00
Park Rangers	23	24	0.99	95.02	4.00
Police	2602	2628	1.01	10610.81	1.00
Radio Communication	35	35	0.99	138.57	1.00
Red Cross	2	2	0.99	7.92	1.00
Secret Service	2	2	0.99	7.92	1.00
State Fair Board	3	3	0.99	11.88	1.00
System	1	1	0.99	3.96	1.00
T.B.I.	26	26	0.99	102.94	1.00
T.H.P.	44	44	0.99	174.20	1.00
Taxi - Wrecker	5	5	0.99	19.80	1.00
T-Dot	12	12	0.99	47.51	1.00
Traffic Violations	6	6	0.99	23.76	1.00
U.S. Marshals	4	4	0.99	15.84	1.00
Vanderbilt	121	122	0.99	483.02	1.00
Total	4698	4743		19057.59	

Average Call Length (sec): 4.0
 Year 1 Utilization (%): 31.14



Table 6 System A Year 2 Estimates

Agency	No.# of Units	Growth Units	# of PTT's per Unit	Call Time (sec)	Growth per Year (%)
A.T.F.	4	4	1.00	16.00	1.00
Airport	311	317	1.00	1267.62	1.00
Archaeology	1	1	1.00	4.00	1.00
Arson & Bomb	13	13	1.00	51.98	1.00
Belle Meade	36	37	1.00	147.96	1.00
Berry Hill	24	24	1.00	95.97	1.00
Board of Health	12	12	1.00	47.99	1.00
CSX Railroad	1	1	1.00	4.00	1.00
D.A.	19	19	1.00	75.98	1.00
E.C.C.	61	62	1.00	247.93	1.00
F.B.I.	9	9	1.00	35.99	1.00
Fire Dept.	922	942	1.04	3917.52	1.10
Fleet Motor Pool	28	29	1.00	115.96	1.00
Forest Ranger	3	3	1.00	12.00	1.00
Goodlettsville	43	44	1.00	175.95	1.00
Juvenile Court	45	46	1.00	183.94	1.00
Lake Wood	12	12	1.00	47.99	1.00
Media	56	57	1.00	227.93	1.00
Medical Examiner	5	5	1.00	19.99	1.00
O.E.M.	200	204	1.00	815.75	1.00
Opryland	3	3	1.00	12.00	1.00
Pardons & Parole	4	4	1.00	16.00	1.00
Park Rangers	23	25	1.00	99.97	4.00
Police	2602	2654	1.04	11037.26	1.00
Radio Communication	35	36	1.00	143.96	1.00
Red Cross	2	2	1.00	8.00	1.00
Secret Service	2	2	1.00	8.00	1.00
State Fair Board	3	3	1.00	12.00	1.00
System	1	1	1.00	4.00	1.00
T.B.I.	26	27	1.00	107.97	1.00
T.H.P.	44	45	1.00	179.95	1.00
Taxi - Wrecker	5	5	1.00	19.99	1.00
T-Dot	12	12	1.00	47.99	1.00
Traffic Violations	6	6	1.00	23.99	1.00
U.S. Marshals	4	4	1.00	16.00	1.00
Vanderbilt	121	123	1.00	491.85	1.00
Total	4698	4793		19741.34	
Average Call Length (sec):	4.0				
Year 2 Utilization (%):	32.26				



Table 7 System A Year 3 Estimates

Agency	No.# of Units	Growth Units	# of PTT's per Unit	Call Time (sec)	Growth per Year (%)
A.T.F.	4	4	1.01	16.16	1.00
Airport	311	320	1.01	1292.41	1.00
Archaeology	1	1	1.01	4.04	1.00
Arson & Bomb	13	13	1.01	52.50	1.00
Belle Meade	36	37	1.01	149.43	1.00
Berry Hill	24	25	1.01	100.97	1.00
Board of Health	12	12	1.01	48.47	1.00
CSX Railroad	1	1	1.01	4.04	1.00
D.A.	19	20	1.01	80.78	1.00
E.C.C.	61	63	1.01	254.44	1.00
F.B.I.	9	9	1.01	36.35	1.00
Fire Dept.	922	953	1.07	4082.17	1.10
Fleet Motor Pool	28	29	1.01	117.12	1.00
Forest Ranger	3	3	1.01	12.12	1.00
Goodlettsville	43	44	1.01	177.71	1.00
Juvenile Court	45	46	1.01	185.78	1.00
Lake Wood	12	12	1.01	48.47	1.00
Media	56	58	1.01	234.25	1.00
Medical Examiner	5	5	1.01	20.19	1.00
O.E.M.	200	206	1.01	831.99	1.00
Opryland	3	3	1.01	12.12	1.00
Pardons & Parole	4	4	1.01	16.16	1.00
Park Rangers	23	26	1.01	105.01	4.00
Police	2602	2681	1.07	11484.04	1.00
Radio Communication	35	36	1.01	145.40	1.00
Red Cross	2	2	1.01	8.08	1.00
Secret Service	2	2	1.01	8.08	1.00
State Fair Board	3	3	1.01	12.12	1.00
System	1	1	1.01	4.04	1.00
T.B.I.	26	27	1.01	109.05	1.00
T.H.P.	44	45	1.01	181.75	1.00
Taxi - Wrecker	5	5	1.01	20.19	1.00
T-Dot	12	12	1.01	48.47	1.00
Traffic Violations	6	6	1.01	24.23	1.00
U.S. Marshals	4	4	1.01	16.16	1.00
Vanderbilt	121	125	1.01	504.85	1.00
Total	4698	4843		20449.09	
Average Call Length (sec):	4.0				
Year 3 Utilization (%):	33.41				



Table 8 System A Year 4 Estimates

Agency	No.# of Units	Growth Units	# PTT's per Unit	Call Time (sec)	Growth per Year (%)
A.T.F.	4	4	1.02	16.32	1.00
Airport	311	324	1.02	1321.65	1.00
Archaeology	1	1	1.02	4.08	1.00
Arson & Bomb	13	14	1.02	57.11	1.00
Belle Meade	36	37	1.02	150.93	1.00
Berry Hill	24	25	1.02	101.98	1.00
Board of Health	12	12	1.02	48.95	1.00
CSX Railroad	1	1	1.02	4.08	1.00
D.A.	19	20	1.02	81.58	1.00
E.C.C.	61	63	1.02	256.99	1.00
F.B.I.	9	9	1.02	36.71	1.00
Fire Dept.	922	963	1.10	4248.75	1.10
Fleet Motor Pool	28	29	1.02	118.30	1.00
Forest Ranger	3	3	1.02	12.24	1.00
Goodlettsville	43	45	1.02	183.56	1.00
Juvenile Court	45	47	1.02	191.72	1.00
Lake Wood	12	12	1.02	48.95	1.00
Media	56	58	1.02	236.59	1.00
Medical Examiner	5	5	1.02	20.40	1.00
O.E.M.	200	208	1.02	848.47	1.00
Opryland	3	3	1.02	12.24	1.00
Pardons & Parole	4	4	1.02	16.32	1.00
Park Rangers	23	27	1.02	110.14	4.00
Police	2602	2708	1.10	11947.68	1.00
Radio Communication	35	36	1.02	146.85	1.00
Red Cross	2	2	1.02	8.16	1.00
Secret Service	2	2	1.02	8.16	1.00
State Fair Board	3	3	1.02	12.24	1.00
System	1	1	1.02	4.08	1.00
T.B.I.	26	27	1.02	110.14	1.00
T.H.P.	44	46	1.02	187.64	1.00
Taxi - Wrecker	5	5	1.02	20.40	1.00
T-Dot	12	12	1.02	48.95	1.00
Traffic Violations	6	6	1.02	24.48	1.00
U.S. Marshals	4	4	1.02	16.32	1.00
Vanderbilt	121	126	1.02	513.98	1.00
Total	4698	4892		21177.10	
Average Call Length (sec):	4.0				
Year 4 Utilization (%):	34.60				



Table 9 System A Year 5 Estimates

Agency	No.# of Units	Growth Units	#PTT's per Unit	Call Time (sec)	Growth per Year (%)
A.T.F.	4	4	1.03	16.48	1.00
Airport	311	327	1.03	1347.23	1.00
Archaeology	1	1	1.03	4.12	1.00
Arson & Bomb	13	14	1.03	57.68	1.00
Belle Meade	36	38	1.03	156.56	1.00
Berry Hill	24	25	1.03	103.00	1.00
Board of Health	12	13	1.03	53.56	1.00
CSX Railroad	1	1	1.03	4.12	1.00
D.A.	19	20	1.03	82.40	1.00
E.C.C.	61	64	1.03	263.68	1.00
F.B.I.	9	9	1.03	37.08	1.00
Fire Dept.	922	974	1.14	4426.20	1.10
Fleet Motor Pool	28	29	1.03	119.48	1.00
Forest Ranger	3	3	1.03	12.36	1.00
Goodlettsville	43	45	1.03	185.40	1.00
Juvenile Court	45	47	1.03	193.64	1.00
Lake Wood	12	13	1.03	53.56	1.00
Media	56	59	1.03	243.08	1.00
Medical Examiner	5	5	1.03	20.60	1.00
O.E.M.	200	210	1.03	865.19	1.00
Opryland	3	3	1.03	12.36	1.00
Pardons & Parole	4	4	1.03	16.48	1.00
Park Rangers	23	28	1.03	115.36	4.00
Police	2602	2735	1.14	12428.81	1.00
Radio Communication	35	37	1.03	152.44	1.00
Red Cross	2	2	1.03	8.24	1.00
Secret Service	2	2	1.03	8.24	1.00
State Fair Board	3	3	1.03	12.36	1.00
System	1	1	1.03	4.12	1.00
T.B.I.	26	27	1.03	111.24	1.00
T.H.P.	44	46	1.03	189.52	1.00
Taxi - Wrecker	5	5	1.03	20.60	1.00
T-Dot	12	13	1.03	53.56	1.00
Traffic Violations	6	6	1.03	24.72	1.00
U.S. Marshals	4	4	1.03	16.48	1.00
Vanderbilt	121	127	1.03	523.23	1.00
Total	4698	4944		21943.16	
Average Call Length (sec):	4.0				
Year 5 Utilization (%):	35.85				



Table 10 System B Year 1 Estimates

Agency	No.# of Units	Growth Units	#PTT's per Unit	Call Time (sec)	Growth per Year (%)
Beer Board	7	7	0.98	27.43	1.00
Board of Education	522	557	0.98	2182.77	6.80
Codes	79	80	0.98	313.50	1.00
F.B.I.	10	10	0.98	39.19	1.00
Health Department	30	30	0.98	117.56	1.00
M.T.A.	213	215	0.98	842.54	1.00
NES	538	557	0.98	2182.77	3.50
Park Rangers	24	25	0.98	97.97	4.00
Public Works	263	297	0.98	1163.88	13.00
Sheriff Dept.	317	327	1.00	1306.82	3.00
State Trial Courts	41	41	0.98	160.67	1.00
Water & Sewer	40	40	0.98	156.75	1.00
Total	2084	2186		8591.87	
Average Call Length (sec):	4.0				
Year 1 Utilization (%):	15.91				



Table 11 System B Year 2 Estimates

Agency	No.# of Units	Growth Units	#PTT's per Unit	Call Time (sec)	Growth per Year (%)
Beer Board	7	7	0.99	27.71	1.00
Board of Education	522	595	0.99	2355.00	6.80
Codes	79	81	0.99	320.60	1.00
F.B.I.	10	10	0.99	39.58	1.00
Health Department	30	31	0.99	122.70	1.00
M.T.A.	213	217	0.99	858.88	1.00
NES	538	576	0.99	2279.80	3.50
Park Rangers	24	26	0.99	102.91	4.00
Public Works	263	336	0.99	1329.88	13.00
Sheriff Dept.	317	336	1.03	1383.07	3.00
State Trial Courts	41	42	0.99	166.24	1.00
Water & Sewer	40	41	0.99	162.28	1.00
Total	2084	2298		9148.65	
Average Call Length (sec):	4.0				
Year 2 Utilization (%):	16.94				



Table 12 System B Year 3 Estimates

Agency	No.# of Units	Growth Units	#PTT's per Unit	Call Time (sec)	Growth per Year (%)
Beer Board	7	7	1.00	27.98	1.00
Board of Education	522	636	1.00	2542.45	6.80
Codes	79	81	1.00	323.80	1.00
F.B.I.	10	10	1.00	39.98	1.00
Health Department	30	31	1.00	123.92	1.00
M.T.A.	213	219	1.00	875.47	1.00
NES	538	596	1.00	2382.55	3.50
Park Rangers	24	27	1.00	107.93	4.00
Public Works	263	379	1.00	1515.08	13.00
Sheriff Dept.	317	346	1.06	1466.96	3.00
State Trial Courts	41	42	1.00	167.90	1.00
Water & Sewer	40	41	1.00	163.90	1.00
Total	2084	2415		9737.93	
Average Call Length (sec):	4.0				
Year 3 Utilization (%):	18.03				



Table 13 System B Year 4 Estimates

Agency	No.# of Units	Growth Units	#PTT's per Unit	Call Time (sec)	Growth per Year (%)
Beer Board	7	7	1.01	28.26	1.00
Board of Education	522	679	1.01	2741.49	6.80
Codes	79	82	1.01	331.08	1.00
F.B.I.	10	10	1.01	40.38	1.00
Health Department	30	31	1.01	125.16	1.00
M.T.A.	213	222	1.01	896.33	1.00
NES	538	617	1.01	2491.16	3.50
Park Rangers	24	28	1.01	113.05	4.00
Public Works	263	429	1.01	1732.11	13.00
Sheriff Dept.	317	357	1.09	1559.01	3.00
State Trial Courts	41	43	1.01	173.61	1.00
Water & Sewer	40	42	1.01	169.58	1.00
Total	2084	2547		10401.23	
Average Call Length (sec):	4.0				
Year 4 Utilization (%):	19.26				



Table 14. System B Year 5 Estimates

Agency	No.# of Units	Growth Units	#PTT's per Unit	Call Time (sec)	Growth per Year (%)
Beer Board	7	7	1.02	28.55	1.00
Board of Education	522	725	1.02	2956.49	6.80
Codes	79	83	1.02	338.47	1.00
F.B.I.	10	11	1.02	44.86	1.00
Health Department	30	32	1.02	130.49	1.00
M.T.A.	213	224	1.02	913.45	1.00
NES	538	639	1.02	2605.79	3.50
Park Rangers	24	29	1.02	118.26	4.00
Public Works	263	485	1.02	1977.79	13.00
Sheriff Dept.	317	367	1.12	1650.76	3.00
State Trial Courts	41	43	1.02	175.35	1.00
Water & Sewer	40	42	1.02	171.27	1.00
Total	2084	2687		11111.53	
Average Call Length (sec):	4.0				
Year 5 Utilization (%):	20.58				



Table 15 Metro Inbound Data Year 1 Estimates

Message Type	Bytes/Message	Message/Unit/Hr	No.# of Units	Growth Units	Growth per Year (%)	Units on Air	Bytes
Police Block0	12	12.68	675	682	1.00	409	62247.33
Police Block1	24	3.45	675	682	1.00	409	33828.69
Police Block2	36	4.38	675	682	1.00	409	64495.26
Police Block3	48	0.82	675	682	1.00	409	16159.08
Police Block4	60	0.49	675	682	1.00	409	11904.10
Police Block5	72	2.02	675	682	1.00	409	59493.41
Police Block6	84	0.92	675	682	1.00	409	31723.22
Police Block7	96	0.77	675	682	1.00	409	30049.77
Police Block8	108	0.65	675	682	1.00	409	28708.97
Police Block9	120	0.91	675	682	1.00	409	44879.13
Police Block10	132	0.09	675	682	1.00	409	4964.41
Police Block13	168	0.06	675	682	1.00	409	3939.21
Fire Dispatch	20	0.60	200	202	1.00	121	1452.00
Total							393844.60
Multiplier (sec/Byte):		0.0093					
Call Time (sec):		3662.75					
Three Channel Utilization (%):		33.91					



Table 16 Metro Inbound Data Year 2 Estimates

Message Type	Bytes/Message	Message/Unit/Hr	No.# of Units	Growth Units	Growth per Year (%)	Units on Air	Bytes
Police Block0	12	12.68	675	689	1.00	413	62856.11
Police Block1	24	3.45	675	689	1.00	413	34159.54
Police Block2	36	4.38	675	689	1.00	413	65126.02
Police Block3	48	0.82	675	689	1.00	413	16317.12
Police Block4	60	0.49	675	689	1.00	413	12020.52
Police Block5	72	2.02	675	689	1.00	413	60075.25
Police Block6	84	0.92	675	689	1.00	413	32033.47
Police Block7	96	0.77	675	689	1.00	413	30343.66
Police Block8	108	0.65	675	689	1.00	413	28989.75
Police Block9	120	0.91	675	689	1.00	413	45318.05
Police Block10	132	0.09	675	689	1.00	413	5012.97
Police Block13	168	0.06	675	689	1.00	413	3977.74
Fire Dispatch	20	0.60	200	204	1.00	122	1464.00
Total							397694.18
Multiplier (sec/Byte):	0.0093						
Call Time (sec):	3698.56						
Three Channel Utilization (%):	34.25						



Table 17 Metro Inbound Data Year 3 Estimates

Message Type	Bytes/Message	Message/Unit/Hr	No.# of Units	Growth Units	Growth per Year (%)	Units on Air	Bytes
Police Block0	12	12.68	675	695	1.00	417	63464.88
Police Block1	24	3.45	675	695	1.00	417	34490.38
Police Block2	36	4.38	675	695	1.00	417	65756.78
Police Block3	48	0.82	675	695	1.00	417	16475.15
Police Block4	60	0.49	675	695	1.00	417	12136.94
Police Block5	72	2.02	675	695	1.00	417	60657.10
Police Block6	84	0.92	675	695	1.00	417	32343.72
Police Block7	96	0.77	675	695	1.00	417	30637.54
Police Block8	108	0.65	675	695	1.00	417	29270.52
Police Block9	120	0.91	675	695	1.00	417	45756.97
Police Block10	132	0.09	675	695	1.00	417	5061.52
Police Block13	168	0.06	675	695	1.00	417	4016.27
Fire Dispatch	20	0.60	200	206	1.00	124	1488.00
Total							401555.76

Multiplier (sec/Byte): 0.0093
 Call Time (sec): 3734.47
 Three Channel Utilization (%): 34.58



Table 18 Metro Inbound Data Year 4 Estimates

Message Type	Bytes/Message	Message/Unit/Hr	No.# of Units	Growth Units	Growth per Year (%)	Units on Air	Bytes
Police Block0	12	12.68	675	702	1.00	421	64073.66
Police Block1	24	3.45	675	702	1.00	421	34821.22
Police Block2	36	4.38	675	702	1.00	421	66387.54
Police Block3	48	0.82	675	702	1.00	421	16633.19
Police Block4	60	0.49	675	702	1.00	421	12253.36
Police Block5	72	2.02	675	702	1.00	421	61238.94
Police Block6	84	0.92	675	702	1.00	421	32653.97
Police Block7	96	0.77	675	702	1.00	421	30931.43
Police Block8	108	0.65	675	702	1.00	421	29551.29
Police Block9	120	0.91	675	702	1.00	421	46195.88
Police Block10	132	0.09	675	702	1.00	421	5110.07
Police Block13	168	0.06	675	702	1.00	421	4054.79
Fire Dispatch	20	0.60	200	208	1.00	125	1500.00
Total							405405.34

Multiplier (sec/Byte): 0.0093
 Call Time (sec): 3770.27
 Three Channel Utilization (%): 34.91



Table 19 Metro Inbound Data Year 5 Estimates

Message Type	Bytes/Message	Message/Unit/Hr	No.# of Units	Growth Units	Growth per Year (%)	Units on Air	Bytes
Police Block0	12	12.68	675	709	1.00	425	64682.43
Police Block1	24	3.45	675	709	1.00	425	35152.07
Police Block2	36	4.38	675	709	1.00	425	67018.30
Police Block3	48	0.82	675	709	1.00	425	16791.22
Police Block4	60	0.49	675	709	1.00	425	12369.78
Police Block5	72	2.02	675	709	1.00	425	61820.78
Police Block6	84	0.92	675	709	1.00	425	32964.22
Police Block7	96	0.77	675	709	1.00	425	31225.31
Police Block8	108	0.65	675	709	1.00	425	29832.06
Police Block9	120	0.91	675	709	1.00	425	46634.80
Police Block10	132	0.09	675	709	1.00	425	5158.62
Police Block13	168	0.06	675	709	1.00	425	4093.32
Fire Dispatch	20	0.60	200	210	1.00	126	1512.00
Total							409254.92

Multiplier (sec/Byte): 0.0093
 Call Time (sec): 3806.07
 Three Channel Utilization (%): 35.24



Table 20 Metro Outbound Data Year 1 Estimates

Message Type	Bytes/Message	Message/Unit/Hr	No.# of Units	Growth Units	Growth per Year (%)	Units on Air	Bytes
Police Block0	12	8.73	675	682	1.00	409	42832.66
Police Block1	24	0.66	675	682	1.00	409	6527.49
Police Block2	36	0.82	675	682	1.00	409	12117.11
Police Block3	48	0.14	675	682	1.00	409	2692.47
Police Block4	60	0.17	675	682	1.00	409	4157.28
Police Block5	72	0.16	675	682	1.00	409	4669.17
Police Block6	84	0.16	675	682	1.00	409	5528.55
Police Block7	96	0.15	675	682	1.00	409	5841.82
Police Block8	108	0.16	675	682	1.00	409	7073.51
Police Block9	120	0.06	675	682	1.00	409	2820.69
Police Block10	132	0.09	675	682	1.00	409	4933.77
Police Block11	144	0.07	675	682	1.00	409	4061.79
Police Block12	156	0.12	675	682	1.00	409	7849.88
Police Block20	252	0.06	675	682	1.00	409	5923.45
Police Block23	288	0.07	675	682	1.00	409	8123.59
Police Block26	324	0.06	675	682	1.00	409	7530.78
Police Block27	336	0.08	675	682	1.00	409	11037.60
Police Block31	384	0.06	675	682	1.00	409	8824.52
Police Block35	432	0.09	675	682	1.00	409	16222.10
Fire Dispatch	20	0.60	200	202	1.00	121	1452.00

Total **170220.23**

Multiplier (sec/Byte): 0.0092
 Call Time (sec): 1566.03
 Three Channel Utilization (%): 14.50



Table 21 Metro Outbound Data Year 2 Estimates

Message Type	Bytes/Message	Message/Unit/Hr	No.# of Units	Growth Units	Growth per Year (%)	Units on Air	Bytes
Police Block0	12	8.73	675	689	1.00	413	43251.56
Police Block1	24	0.66	675	689	1.00	413	6591.33
Police Block2	36	0.82	675	689	1.00	413	12235.62
Police Block3	48	0.14	675	689	1.00	413	2718.80
Police Block4	60	0.17	675	689	1.00	413	4197.94
Police Block5	72	0.16	675	689	1.00	413	4714.83
Police Block6	84	0.16	675	689	1.00	413	5582.62
Police Block7	96	0.15	675	689	1.00	413	5898.96
Police Block8	108	0.16	675	689	1.00	413	7142.69
Police Block9	120	0.06	675	689	1.00	413	2848.28
Police Block10	132	0.09	675	689	1.00	413	4982.02
Police Block11	144	0.07	675	689	1.00	413	4101.52
Police Block12	156	0.12	675	689	1.00	413	7926.65
Police Block20	252	0.06	675	689	1.00	413	5981.38
Police Block23	288	0.07	675	689	1.00	413	8203.03
Police Block26	324	0.06	675	689	1.00	413	7604.43
Police Block27	336	0.08	675	689	1.00	413	11145.55
Police Block31	384	0.06	675	689	1.00	413	8910.82
Police Block35	432	0.09	675	689	1.00	413	16380.75
Fire Dispatch	20	0.60	200	204	1.00	122	1464.00

Total **171882.77**

Multiplier (sec/Byte): 0.0092
 Call Time (sec): 1581.32
 Three Channel Utilization (%): 14.64



Table 22 Metro Outbound Data Year 3 Estimates

Message Type	Bytes/Message	Message/Unit/Hr	No.# of Units	Growth Units	Growth per Year (%)	Units on Air	Bytes
Police Block0	12	8.73	675	695	1.00	417	43670.46
Police Block1	24	0.66	675	695	1.00	417	6655.17
Police Block2	36	0.82	675	695	1.00	417	12354.12
Police Block3	48	0.14	675	695	1.00	417	2745.14
Police Block4	60	0.17	675	695	1.00	417	4238.60
Police Block5	72	0.16	675	695	1.00	417	4760.49
Police Block6	84	0.16	675	695	1.00	417	5636.69
Police Block7	96	0.15	675	695	1.00	417	5956.09
Police Block8	108	0.16	675	695	1.00	417	7211.87
Police Block9	120	0.06	675	695	1.00	417	2875.86
Police Block10	132	0.09	675	695	1.00	417	5030.27
Police Block11	144	0.07	675	695	1.00	417	4141.24
Police Block12	156	0.12	675	695	1.00	417	8003.42
Police Block20	252	0.06	675	695	1.00	417	6039.31
Police Block23	288	0.07	675	695	1.00	417	8282.48
Police Block26	324	0.06	675	695	1.00	417	7678.08
Police Block27	336	0.08	675	695	1.00	417	11253.50
Police Block31	384	0.06	675	695	1.00	417	8997.13
Police Block35	432	0.09	675	695	1.00	417	16539.40
Fire Dispatch	20	0.60	200	206	1.00	124	1488.00

Total **173557.32**

Multiplier (sec/Byte): 0.0092
 Call Time (sec): 1596.73
 Three Channel Utilization (%): 14.78



Table 23 Metro Outbound Data Year 4 Estimates

Message Type	Bytes/Message	Message/Unit/Hr	No.# of Units	Growth Units	Growth per Year (%)	Units on Air	Bytes
Police Block0	12	8.73	675	702	1.00	421	44089.36
Police Block1	24	0.66	675	702	1.00	421	6719.01
Police Block2	36	0.82	675	702	1.00	421	12472.63
Police Block3	48	0.14	675	702	1.00	421	2771.47
Police Block4	60	0.17	675	702	1.00	421	4279.26
Police Block5	72	0.16	675	702	1.00	421	4806.16
Police Block6	84	0.16	675	702	1.00	421	5690.76
Police Block7	96	0.15	675	702	1.00	421	6013.22
Police Block8	108	0.16	675	702	1.00	421	7281.05
Police Block9	120	0.06	675	702	1.00	421	2903.45
Police Block10	132	0.09	675	702	1.00	421	5078.53
Police Block11	144	0.07	675	702	1.00	421	4180.97
Police Block12	156	0.12	675	702	1.00	421	8080.19
Police Block20	252	0.06	675	702	1.00	421	6097.24
Police Block23	288	0.07	675	702	1.00	421	8361.93
Police Block26	324	0.06	675	702	1.00	421	7751.73
Police Block27	336	0.08	675	702	1.00	421	11361.44
Police Block31	384	0.06	675	702	1.00	421	9083.43
Police Block35	432	0.09	675	702	1.00	421	16698.05
Fire Dispatch	20	0.60	200	208	1.00	125	1500.00

Total **175219.86**

Multiplier (sec/Byte): 0.0092
 Call Time (sec): 1612.02
 Three Channel Utilization (%): 14.93



Table 24 Metro Outbound Data Year 5 Estimates

Message Type	Bytes/Message	Message/Unit/Hr	No.# of Units	Growth Units	Growth per Year (%)	Units on Air	Bytes
Police Block0	12	8.73	675	709	1.00	425	44508.27
Police Block1	24	0.66	675	709	1.00	425	6782.85
Police Block2	36	0.82	675	709	1.00	425	12591.13
Police Block3	48	0.14	675	709	1.00	425	2797.80
Police Block4	60	0.17	675	709	1.00	425	4319.91
Police Block5	72	0.16	675	709	1.00	425	4851.82
Police Block6	84	0.16	675	709	1.00	425	5744.83
Police Block7	96	0.15	675	709	1.00	425	6070.35
Police Block8	108	0.16	675	709	1.00	425	7350.22
Police Block9	120	0.06	675	709	1.00	425	2931.03
Police Block10	132	0.09	675	709	1.00	425	5126.78
Police Block11	144	0.07	675	709	1.00	425	4220.69
Police Block12	156	0.12	675	709	1.00	425	8156.96
Police Block20	252	0.06	675	709	1.00	425	6155.17
Police Block23	288	0.07	675	709	1.00	425	8441.38
Police Block26	324	0.06	675	709	1.00	425	7825.38
Police Block27	336	0.08	675	709	1.00	425	11469.39
Police Block31	384	0.06	675	709	1.00	425	9169.73
Police Block35	432	0.09	675	709	1.00	425	16856.71
Fire Dispatch	20	0.60	200	210	1.00	126	1512.00

Total **176882.41**

Multiplier (sec/Byte): 0.0092
 Call Time (sec): 1627.32
 Three Channel Utilization (%): 15.07



Table 25 NES Data Inbound Estimates Years 1-5

Year	Bytes/Message	Message/Unit/Hr	No.# of Units	Growth Units	Growth per Year (%)	Units on Air	Bytes	Call Time (sec)	Channel Utilization (%)
1	70	12.00	175	192	9.50	115	96600.00	898.38	24.96
2	70	12.00	175	210	9.50	126	105840.00	984.31	27.34
3	70	12.00	175	230	9.50	138	115920.00	1078.06	29.95
4	70	12.00	175	252	9.50	151	126840.00	1179.61	32.77
5	70	12.00	175	275	9.50	165	138600.00	1288.98	35.81

Multiplier 0.0093
(sec/Byte):



Table 26 NES Data Outbound Estimates Years 1-5

Year	Bytes/Message	Message/Unit/Hr	No.# of Units	Growth Units	Growth per Year (%)	Units on Air	Bytes	Call Time (sec)	Channel Utilization (%)
1	70	12.00	175	192	9.50	115	96600.00	888.72	24.69
2	70	12.00	175	210	9.50	126	105840.00	973.73	27.05
3	70	12.00	175	230	9.50	138	115920.00	1066.46	29.62
4	70	12.00	175	252	9.50	151	126840.00	1166.93	32.41
5	70	12.00	175	275	9.50	165	138600.00	1275.12	35.42

Multiplier 0.0092
(sec/Byte):

