Staffing Performance Standards for Metropolitan Cable TV Operations

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ABSTRACT

Demand maintenance, customer service and preventative maintenance are examples of operation areas where the staffing levels are a function of plant miles, number of subscribers and the ability of the operations staff to achieve various levels of efficiency in performing their tasks. This paper reviews these areas and others to define the staffing and performance criteria for determining the size of the operating group in cable TV systems.

INTRODUCTION

Providing cable T.V. to the larger Metropolitan cities presents a new set of challenges to the cable operator, due to the larger number of subscribers, additional complexities of multiple local studios and access facilities, and an increased region for maintenance support. This paper addresses the technical operations' staffing and productivity for the three different configurations of two-way addressable one-way addressable, and trapped/programmable converter systems. A typical organizational structure is defined for each of the three system configurations, and by using staffing productivity standards the number of employees needed are defined as a function of phone load, system size, and churn.

METROPOLITAN CABLE SYSTEM DESCRIPTION

Before a meaningful review can be made of productivity standards and operations results, it is necessary to define the types of Cable T.V. systems being analyzed. For this paper we will define a Metropolitan cable system as having over two-hundred thousand homes in an area that can be contiguously cabled by the cable company. Three types of cable systems will be compared in this paper, as shown in Table 1.0.

The system denoted as a "trapped" system utilizes negative traps for the three lowest churn pays, and these three pays are made available to both the tier I and tier II subscribers. The tier I subscribers have a conventional 22 channel standard converter that does not descramble. The tier II converter is a programmable converter that has an internal read-only memory (ROM) that can be set to allow the converter to descramble from one to three additional pay channels, depending on subscriber choice. Thus when a subscriber changes service,either a pole-action to reconfigure traps, and/or a home visit to change out the converter is required.

The system denoted as a One Way Addressable (OWA) system provides the same 6 pays except that all pays are scrambled and made available to the OWA (Tier II) subscribers only. The tier II subscriber receives 22 channels consisting of off-airs, several independent T.V. channels, local orgination, and community action/access channels. The tier II subscribers receive up to 6 pay channels, with each pay selection authorized or enabled by cable T.V. head control of the descrambling in that subscriber's converter. Thus in this system pay upgrades and downgrades are handled without truck trips being required, except for those cases where a tier change is involved.

The two way addressable system (TWA) provides the same 6 pays with a converter and plant design that allows for two-way operation. In this system trunk and feeder electronics have a return amplifier installed, and a transmit modem in each two-way subscribers' converter allows upstream transmission from each home. Pay Per View channels are offered and the system for this has easy Pay Per Event capability as well. For the tier I subscribers, a non-descrambling 22 channel conventional converter is utilized, with the same programming assumptions as the OWA system.

Each system design will be single cable 360MHz bandwidth, with 42 channel capacity, assuming allowance for channel loss due to FAA and off-air interference. The systems will be assumed to have been constructed over a period of 4 years. Table 2.0 shows the system build/extension rate, total miles of plant, penetration assumption, and total subscribers. These assumptions will be utilized throughout this paper.

We will assume a local origination capability, with at least 5 municipal access channels, creating the need for an operational studio, video tape playback, and a master control facility for program switching and routing. The office will be a stand-alone office in the areas of accounts payable and receivables,

Table 1.0 Metropolitan Cable System Configurations

	SYSTEM CONFIGURATION		
	Trapped System	OWA System	TWA System
Number of Channels/ Cables	42 channels, Single cable	42 channels, Single cable	42 channels, Single cable
Plant Miles (By Year 7)	1,200	1,200	1,200
# Homes Passed (By Year 7)	195,000	195,000	195,000
# Tiers # Pays	2 3 Trapped 3 Programmed	2 6 Addressable	2 6 Addressable 2 Pay Per View
Converters	Tier I - 22 Ch. Standard Tier II - 42 Ch. Programmable with Wireless Remote	Tier I - 22 Ch. Standard Tier II - OWA, 42 Ch., with Wireless Remote	Tier I - 22 Ch. Standard Tier II - 2-way, 42 Ch., with Wireless Remote
Aux. Outlet	22 Ch. Standard or 42 Ch. Prog.	22 Ch. Standard or 42 Ch. OWA	22 Ch. Standard or 42 Ch. TWA
% Tier I Subs % Tier II Subs	50 50	15 85	15 85

TABLE 2.0 COMPUTER MODEL INPUT FORMAT
Trapped System,Programmable Converters

NCTA84A NCTA PAPER 4/7/1984 System 1 MASTER	YEAR1	YEAR2	YEAR3	YEAR4	YEAR5	YEAR6	YEAR7	YEAR8	YEAR9	YEAR10
YEARLY CONSTRUCTED MILES	30	450	450	220	50	50	50	50	50	50
YEAR END MILES	30	480	930	1150	1200	1250	1300	1350	1400	1450
DENSITY, HOMES/Mi	150	150	150	150	150	150	150	150	150	150
YEAR END HOMES PASSED	4500	72000	139500	172500	180000	187500	195000	202500	210000	217500
% PENETRATION	0.30	0.35	0.40	0.45	0.48	0.50	0.50	0.50	0.50	0.50
YEAR END SUBSCRIBERS	1350	25200	55800	77625	86400	93750	97500	101250	105000	108750
BASIC CHURN/YEAR	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24
PAY CHURN/YEAR	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36
CONST. NEW SUBS	1350	23625	27000	14850	3600	3750	3750	3750	3750	3750
YEARLY TOTAL DISCONNECTS	324	6048	13392	18630	20736	22500	23400	24300	25200	26100
RECONNECT % OLD SUBS	0.00	0.00	0.00	0.50	0.50	0.50	0.75	0.75	0.75	0.75
YEARLY NEW CONNECTS	1674	29673	40392	24165	13968	15000	9600	9825	10050	10275
YEARLY RECONNECTS	0	0	0	9315	10368	11250	17550	18225	18900	19575
YEARLY UPGRADES	486	9072	20088	27945	31104	33750	35100	36450	37800	39150
YEARLY DOWNGRADES	486	9072	20088	27945	31104	33750	35100	36450	37800	39150
MKTG/CHURN REL. CALLS/MO	247.5	4488.7	7830	9000	8940	9687.5	10062.	10437.	10812.	11187.
% CALLS OF SUB BASE-OTHER	0.70	0.70	0.70	0.60	0.50	0.30	0.30	0.30	0.30	0.30
# PHONE CALLS/MONTH	1192.5	22128.	46890	55575	52140	37812.	39312.	40812.	42312.	43812.

and payroll. A billing and customer support system such as Cable Data or First Data Resources is assumed for primary data base and billing purposes. A mixture of direct sales and telephone sales will be assumed for marketing, and the system will offer a guide for sale.

It should be noted that the relative revenue generating capabilities of these systems are different, since the OWA system has a revenue opportunity of supplying Pay Per Event programs such as sports events, concerts, etc. Likewise, the TWA system offers Pay Per View events routinely, and thus offers wider viewer choice of programming plus the Pay Per Event programs. Also, the capitalization of the systems are different, since the converters, distribution and head-end facilities are different. Thus the absolute comparison of operating expenses or employee head-counts is not meaningful. However, as we will see in later sections, relative operations expense and head-count, as a function of employee productivity and churn, is very meaningful.

METROPOLITAN CABLE SYSTEM ORGANIZATION

The staffing organization for the baseline system is shown in Figure 1.0. The company is organized along functional lines, as shown, with the major areas of Marketing, Technical Operations, Finance, and Broadcast Operations reporting to the local general management. The general manager has a support staff of Legal, Human Resources, and Government Affairs that are combined and referred to as General and Administrative (G&A) Operations.

The Marketing organization is comprised of Direct Sales, Telephone Sales, Marketing, and Guide Production. Although the Customer Service Group can exist in marketing or operations, for this paper we will assume Customer Service to be in Operations.

The Finance organization is made up of accounts payable, payroll, subscriber billing resolution, and capital and expense accounting.

The Broadcast Operations organization consists of "Above the Line" and "Below the Line" programming staff, video support engineers, and management staff. There is also staff provided to support access studios and local origination.

For each of the three system configurations described above, there will be differences in the Marketing, Finance, and Broadcast Operations groups. For instance, in a Pay Per Event or Pay Per View system, some additional Finance operations cost is necessary to handle the billing and billing adjustments for the programs. This cost can be handled by the billing company, in-house, or a mixture of both. Clearly the incremental revenue should be compared with the incremental capital and operating expense in this and all areas, to determine the relative business advantages of each configuration. However, to limit the scope of this paper, we will only evaluate operations costs in technical operations, which we have found by experience to comprise well over 80 percent of the incremental operating expenses.

TECHNICAL OPERATIONS DESCRIPTION

Since the Technical Operations area is the focus of this paper, the group's organization is further defined as shown in Figure 2.0, with summary job descriptions given below.

Installers - This group installs all drops for new subscribers, reconnects for previously cabled homes, and disconnects for subscribers dropping service. For a system with traps or different converters for different levels of service, the installers also perform upgrades and downgrades of service. Past the initial construction period the installers are assumed to have completed a course in installation, and are company employees. Installers are managed by supervisors who provide quality control and problem solving.

Demand Maintenance Technicians - This group is responsible for responding to all trouble calls, and are trained to diagnose and resolve problems in the home, and the drop up to, and including, the tap. Demand Maintenance technicians have had installer training and Demand Maintenance training.

Preventative Maintenance Technicians -This group is responsible for continuous monitoring of the outside plant, to assure that the plant is tight from signal egress or ingress, and meets trunk end of line performance tests for such technical performance parameters as carrier to noise, bandpass flatness, and distortion products. This group repairs all trunk and feeder outages down to the tap.

Work in Process (WIPS) - The WIPS group is the support group for the installers. They process work orders, prepare installation kits for new installs, upgrades and downgrades, and close out work orders. They are provided inputs by the Data Base management system and provide daily activity summaries back to the data base.

Dispatch - The Dispatch group controls the field fleet for installs and Demand Maintenance Technicians. They monitor plant operation, and direct the P.M.'s to problem areas if outages occur. The installers and P.M.'s call in their activity to Dispatch, and Dispatch handles priority decisions each day.

Warehouse - The warehouse group handles all technical operations' inventory and distribution. This includes drop materials and converters, extension plant materials, and spares for all electronic and plant passives.

Figure 1.0 Metropolitan Cable System Organization

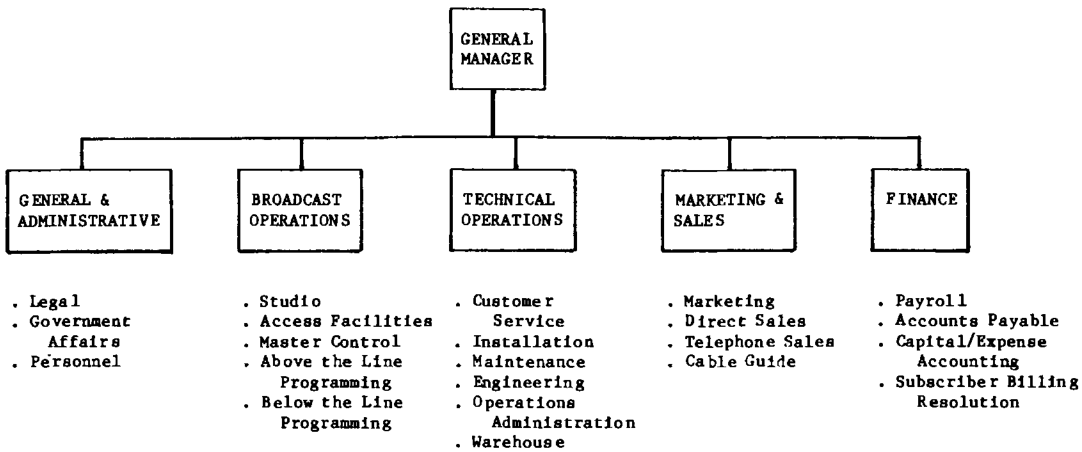
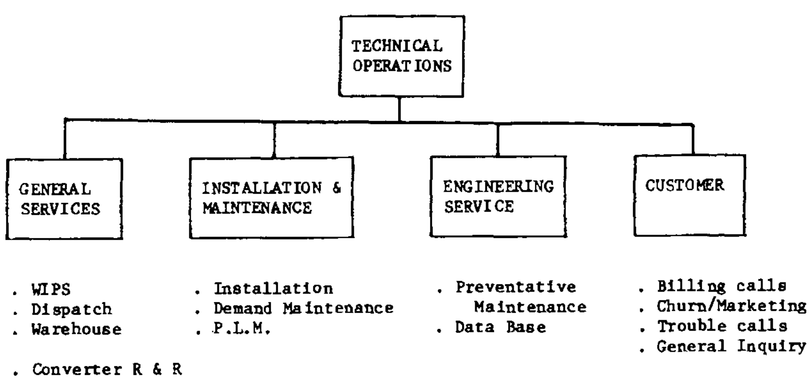


Figure 2.0 Technical Operations Organization



Engineering - The engineering group consists of the headend/master control engineer, the outside plant chief engineer, and the non-R.F. return engineer in two-way systems.

Pole-Line Maintenance - The PLM group is responsible for all pole adjustments, resolving clearance problems, and plant reconfiguration for pole moves and replacements.

Converter Refurbishment and Repair - This group is responsible for repair and refurbishment of all subscriber converters. Refurbishment includes cosmetic correction of returned converters, replacement of worn/used cords, etc. Repair consists of determining converter failure, and then returning the unit to the supplier for repair if justified. For repairing the more complex OWA and TWA converters, module fault isolation is assumed, with module or unit return to the supplier as warrented.

Customer Service - Customer service consists of telephone operators to handle all incoming phone calls for trouble calls, upgrades and downgrades, new installation requests, and reconnects and disconnects of service. This group also handles all general inquiry requests such as general information, and all billing resolution calls.

Finally, the Technical Operations organization and fixed overhead staffing is shown in Figure 2.0. This organization assumes districting, which is used for larger systems.

PRODUCTIVITY STANDARDS IN CATV TECHNICAL OPERATIONS

To define productivity standards in some areas, it is valuable to define a work standard to use as a guage. In this paper this work standard is the work unit (W.U.) defined as a 15-minute period. Thus 4 W.U.'s equal one hour and there are 32 W.U.'s in an eight-hour day. Also, 22 work days will be assumed as an average month.

Based on experience for well organized and trained operations' personnel, it is possible to define the number of work units required per technical operations' function, as shown in Table 3.0.

For the installation group, the amount of time for a new connect is higher for a two-way addressable system because the return path must be checked by a computer program link with the head end. The complexity of confirming a downstream configuration for the OWA is approximately balanced by the need to correctly install traps for the trapped system. Thus the amount of time needed to install a trapped system and a OWA are equal, with the TWA system requiring a slightly longer time. When second sets are considered at approximately 25 percent of the subscriber base, these productivity standards result in about 6 new installs per day for the trapped and OWA systems, and 5 per day for the TWA system.

Likewise, for pay upgrades and downgrades, the installer productivity is a function of system configuration and action. For the trapped system, a pay pole-only upgrade or downgrade takes one unit, thus 32 subscribers can be handled in an 8 hour work day. For tier changes or pay unit changes, which require customer access and converter change-out or modification, the average productivity is 2 work units per subscriber, or 16 subscribers per 8-hour work day. If we assume an even split of actions, then 24 subscribers per day are handled by each technician. For the addressable systems, all pay upgrades and downgrades are handled without truck calls and house calls are needed only for tier churn, to change out the converter. This action is only required in about one-fifth of the upgrades and downgrades, thus the number of install technicians needed for pay churn in addressable systems is about one-fifth the trapped system case.

For disconnects, we assume that the drop is disconnected at the pole in all systems, and the converter retrieved. There is no difference in three systems in this area. This assumption tends to penalize addressable systems, but is assumed due to the present inadequacy of scrambling systems.

For the trapped system, reconnects require a pole climb for trap reconfiguration, and a subscriber's house entry for converter installation. This can be done in two units, but when a 25 percent second set assumption is made, we can actually achieve 11 - 12 reconnects per 8 work hour day. For the OWA and TWA, we also have assumed pole climbs to reconnect the drop, and thus the same 2 work units are required. In addition, the TWA system requires return path confirmation, and thus the total reconnects per day for the OWA and TWA are 12 and 10, respectively. Again, it should be noted here that if signal piracy is not a serious threat due to scrambling security, the addressable systems would not be disconnected at the pole, and thus their productivity in disconnects would be higher. Finally, it should be stated that these work unit estimates per technician function take into account windshield time, set-up, etc., and can obviously vary from system to system depending on how spread-out the city is and the relative weather conditions during winter times.

For customer service calls, the productivity will be measured on the number of resolved phone calls handled per day per operator. By resolved we mean, if the purpose of the call was an upgrade, then the upgrade was handled by the CSO, with the subscriber on the phone. Also, trouble calls would result in a "talk down" approach to initially try to resolve the difficulty on the phone, with a work order scheduled if the "talk down" fails. Customer Service productivity for resolved calls, is shown in Table 3.0.

Trouble calls are from subscribers with T.V. reception problems. Billing calls are calls concerning billing expenses, procedures, and explanations. General Inquiry calls are all general purpose phone calls for information, future events, etc. Change of service calls are all calls for upgrades, downgrades, new service, and disconnects. The productivity for the TWA Systems is somewhat less due to the need to diagnose return path trouble symptoms, additional billing calls for Pay Per View, and additional Marketing (Subscriber retention) time needed to explain Pay Per View programming and options.

Finally, for the converter refurbishment and repair area, we assume the more complex addressable converters will be tested to the module/subassembly level, and faulty modules returned for repair. Also, the refurbishment of the two-way unit involves resetting a new address block, and slightly more cosmetic work, hence the lower number of units processed per day as shown in Table 3.0.

OPERATING RESULTS AND COMPARISONS

By using the three system configuration descriptions, Tables 2.0 and 3.0, and the organization and productivity assumptions, it is possible to compute the operations staffing and yearly expense, by assuming conventional overheads and salary structures. This approach is readily computer programmed to allow sensitivity studies of productivity variation impact on operations expense.

Tables 2.0 and 4.0 show the form of the computer program, and its output. For this paper we elected to determine the impact of subscriber churn on the operating expense of each type of system, and then the effect of reductions in productivity on operating expense and churn. An example of some of these results are shown in Table 5.0, with year 7 chosen as the comparison year since the system is built, has reached full penetration, and has stabilized operationally.

In Table 5.0, we see marked the "baseline" configuration for each type of system for a 2 percent per month basic churn (.24 of subscriber base per year), and a 3 percent per month pay churn (.36 of subscriber base per year). Note that since the TWA system has a return path and more complicated converters, the assumption is that 6 trouble calls (truck rolls) per 100 subscribers is the normal operating condition, where 4 trouble calls per 100 subscribers is the normal operating condition for the trapped and OWA systems. We should note that these trouble calls are actual field trouble calls, and should represent about one-third of the total trouble calls made per month.

By assuming the productivity defined in Table 3.0, we can evaluate the impact on staffing and expense of basic and pay churn. Figures 3 and 4 show these results for the total technical operations staffing, and shows the expected sensitivity of the trapped system to pay churn. Since the staffing levels and expense track each other very well, we will only plot staffing levels. Note that the technical operations staffing and expense of a trapped system exceeds the one-way levels, and approaches that of the more complex two-way system, for the case where there is increasing pay churn for a stable basic churn. In fact, as the pay churn goes up as shown, the installation group cannot keep up with the rate, and a disconnect backlog normally occurs. This causes additional phone calls, rescheduling, etc. such that the trapped system staffing impact and expense is in practice actually worse than that shown.

By varying productivity as shown in Table 3.0, it is possible to compare the three system types on staff and expense. Due to the relatively high number of install staff, even after the system is built, and the need to equip this staff with vehicles, etc., we have found that the install group's productivity variation has the highest single impact on staff and expense, with the Demand Maintenance group second. For instance, Figure 5 shows the staff impact as a function of 20, 40, and 60 percent reductions in installer productivity. Again note that as the productivity lowers the trapped system is proportionally worse than either addressable system.

Although installer productivity has a big impact on technical operations, we have found that if the plant is not well maintained, a "snowball" effect occurs that greatly increases technical operation's costs, and also greatly increases the work of other groups.

Recent studies of subscriber retention done for Warner Amex by external consultants, confirmed by internal staff, shows that customer dissatisfaction is heavily effected by system outages and equipment problems, and can easily effect overall churn by one percent per month or more. In our model we show this effect by assuming that if the system is not maintained, the trouble calls per 100 subscribers increases, and then the churn will increase as well. This effect is shown in Figures 6 and 7, and shows increase in one percent in basic/pay churn for a 2 unit increase in trouble calls per 100 subscribers. As the trouble calls per 100 subscribers increases still further, disconnects and downgrades increase also, creating the "snowball" effect. In Figures 6 and 7 the curves marked "XXXX/PROD." are the curves that show the "snowball" effect for each type of system, and the curves marked without the "PROD." label represent the staff impact without the "snowball" effect. Note the addressable systems are less sensitive to a reduction in maintenance than the trapped system, with the trapped system expense increase exceeding even the TWA system increase.

In conclusion, our experiences have shown that plant maintenance is the single most important factor in determining Technical Operations staffing levels and expense, for a particular type of system. The installation group productivity also has a substantial effect, with the trapped system in general being much more sensitive to both basic and pay service churn. As shown in the figures, a few percent change in churn can cause a large impact in technical operations staffing, and for increases beyond 10-20% of normal staffing, the operation typically cannot keep up with the rate of churn. In this case the back-logs increase, and this further increase needs, unless contractors are used. Finally, if the plant maintenance degrades, disconnects and down-grades increase, and a "snowball" effect occurs, further impacting the staffing and expense.

Table 3.0 Productivity Comparison of Three System Configurations

Group	Typical Parameter Ranges	Units Work Unit = W.U.	Baseline System Assumption: Trapped System	OWA System	TWA System
1. Installation					
New Install	4 - 8	W.U./Install	4	4	4-1/2
Reconnect, Home Conn.	2 - 4	W.U./Recon.	2	2	2-1/2
Upgrade, Pole Only	1 - 2	W.U./Upgd.	1	N/A	N/A
Upgrade, Tier Chan.	2 - 4	W.U./Upgd.	2	2	2
Downgrade, Pole Only	1 - 2	W.U./Downgd.	1	N/A	N/A
Downgrade, Tier Chan.	2 - 4	W.U./Downgd.	2	2	2
Disconnect, Home Conn.	2 - 3	W.U./Disc.	2	2	2
2. Demand Maintenance					
Trouble Call	2 - 4	W.U./Call	2	2	2-1/2
3. Preventative Maintenance					
P.M. Staffing	80 - 120	Miles/P.M.	150	150	110
4. Dispatch Operator Staffing	Total Techs/12	Dispatchers/ Test	See Model	See Model	See Model
5. Work in Process					
WIPS Staffing	80 - 150	W.O.'s/Day	125	125	125
6. Customer Services					
Billing Operators	50 - 90	Calls/Op./Day	70	70	60
Trouble Call Operators	50 - 90	Calls/Op./Day	80	80	70
Churn/Mktg Operators	60 - 100	Calls/Op./Day	70	70	65
General Inquiry Operators	70 - 120	Calls/Op./Day	100	100	90
7. Converter Refurb. & Repair					
Refurb. Staff	50 - 90	Units Refurb./Day	80	80	70
Repair Staff	30 - 50	Units Repaired/Day	50	40	30

TABLE 4.0 COMPUTER MODEL OUTPUT

'NCTA PAPER SYSTEM 1 (TRAPS,PROGRAMMABLE CONVERTERS)

MASTER

TECH. OPS. SUMMARY	YEAR1	YEAR2	YEAR3	YEAR4	YEAR5	YEAR6	YEAR7	YEAR8	YEAR9	YEAR10
INSTALLERS	2	26	40	35	31	33	35	35	35	35
DEMAND MAINTENANCE	1	4	8	11	12	13	13	14	14	15
PREVENTATIVE MAINTENANCE	1	5	8	10	10	10	12	12	12	13
CUSTOMER SERVICE	0	14	27	32	32	23	25	26	26	26
POLE LINE MAINTENANCE	5	5	5	5	5	5	5	5	5	5
WORK IN PROCESS	1	3	4	4	4	5	5	5	5	5
DISPATCH	2	2	3	3	3	3	3	4	4	4
CONVERTER REFURB & REPAIR	1	1	3	3	3	3	3	3	3	3
DATA BASE	1	3	3	2	1	1	1	1	1	1
WAREHOUSE	3	5	5	4	3	3	3	3	3	3
ENGINEERING	3	3	3	3	3	3	3	3	3	3
TOTAL STAFF	20	71	109	112	107	102	108	111	111	113
TOTAL EXPENSE (000'S)	632.1	1891.5	2814.7	2920.2	2803.8	2752.4	2933.5	3003.6	3003.6	3086.1

Table 5.0
Comparison of Year 7 Staff and Expense for Technical Operations as a Function of Average Yearly Churn

Yearly Churn	Trouble Calls/ I.O.	Trapped System Staff	Trapped System Exp. ($K)	OWA System Staff	OWA System Exp.	TWA System Staff	TWA System Exp. E
.24/.36							
	4	108	2934	96	2641	109	3041
	6	117	3197	105	2905	116	3216
	8	124	3413	112	3120	125	3510
	10	130	3601	118	3308	134	3788
.36/.48							
	4	121	3235	105	2884	121	3318
	6	130	3499	114	3108	129	3543
	8	137	3714	121	3324	138	3807
	10	143	3902	127	3511		
.48/.60							
	4	138	3633	121	3224	138	3715
	6	148	3918	131	3509	145	3920
	8	155	4133	138	3724	154	4183
	10	161	4321	144	3912	163	4462
.60/.72							
	4	158	4103	135	3546	152	3938
	6	167	4367	144	3810	159	4243
	8	174	4582	151	4025	168	4506
	10	180	4870	157	4213	177	4785
	12					184	5010

Legend

x/y = x% basic churn/yr.
y% pay churn/yr.

Exp $ = $ (000's)

Figure 3.0

STAFFING AS A FUNCTION OF BASIC CHURN

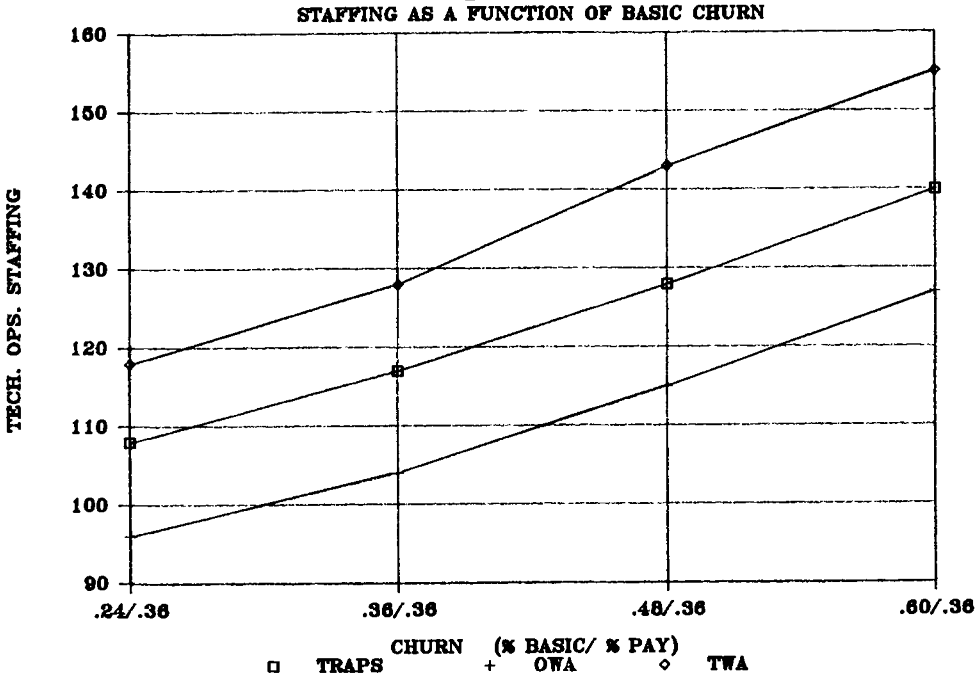


Figure 4.0

STAFFING AS A FUNCTION OF PAY CHURN

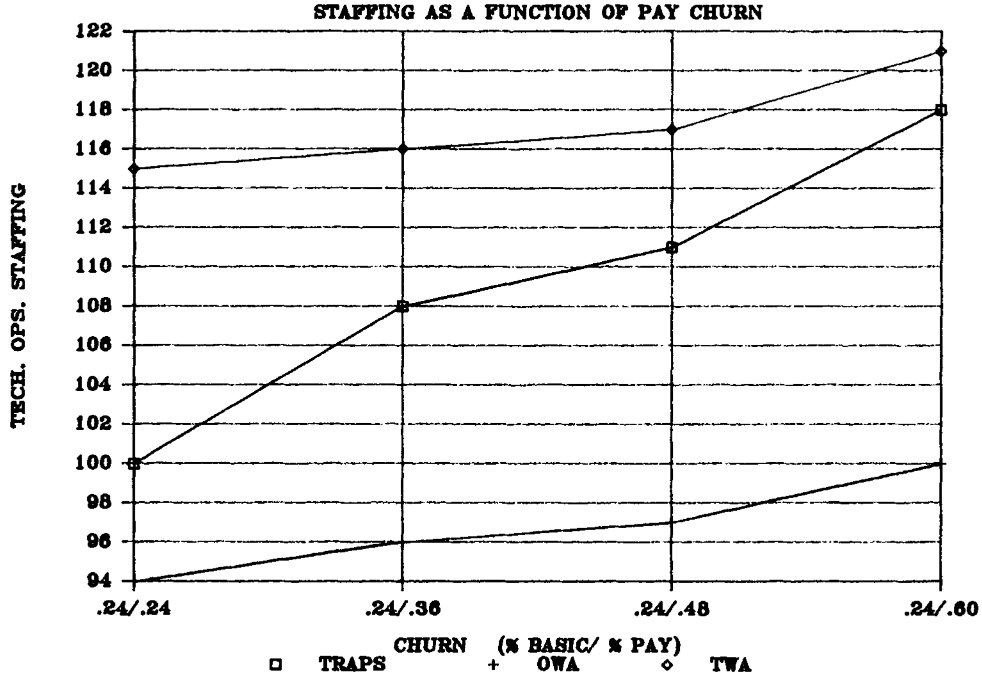


Figure 5.0

IMPACT OF INSTALLER EFFICIENCY

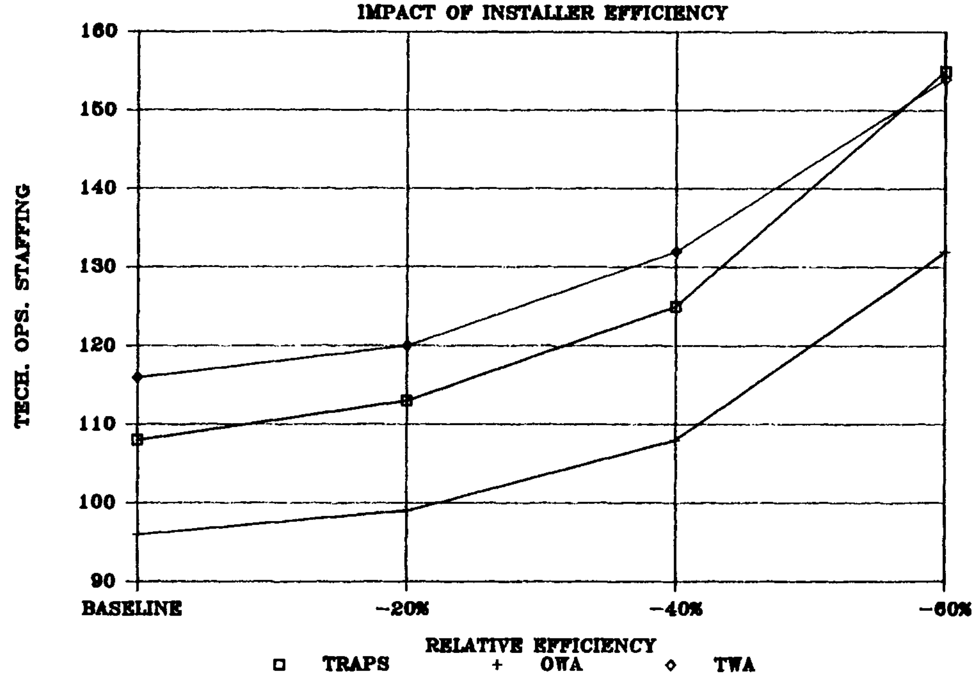


Figure 6.0

TRAPS – OWA SYSTEM COMPARISON

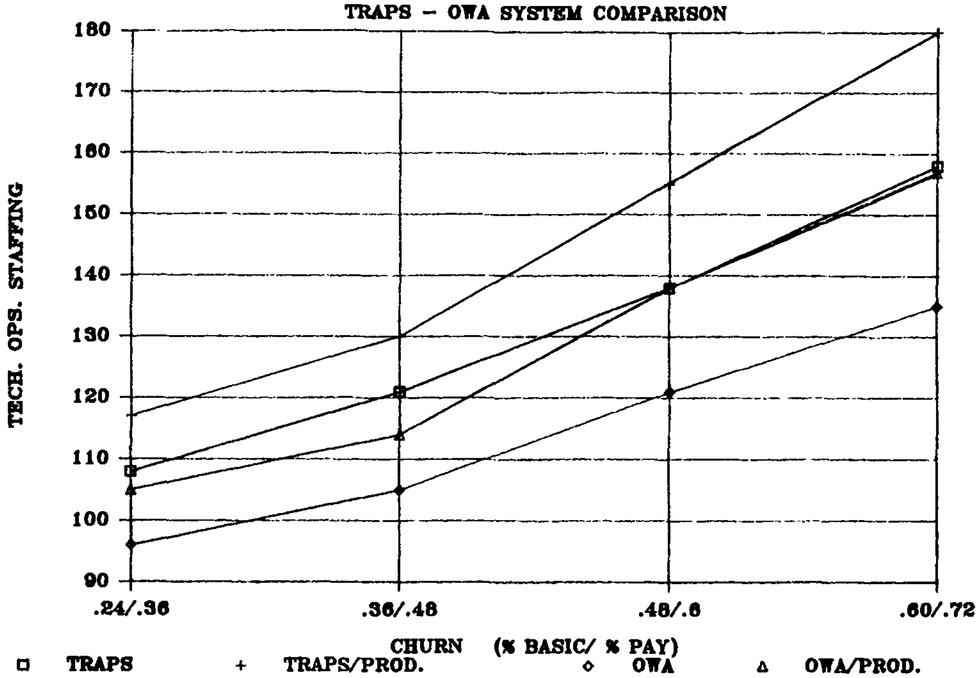


Figure 7.0

TRAPS – TWA SYSTEM COMPARISON