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COMPETITION IN THE LOCAL EXCHANGE TELEPHONE SERVICE MARKET

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SUMMARY

The level of competition faced by local exchange telephone companies has important implications for a variety of policy issues, including state and federal regulatory treatment of basic and enhanced telephone services, charges for access to interstate services, and the current review of the Modified Final Judgment in United States v. AT&T. While resolution of such issues may turn on the decision makers' assessments of the degree to which local exchange telephone companies experience competition, there has been a notable lack of detailed information concerning competitive activities in local markets.

To begin to address such information needs, NTIA gathered data from the Bell Operating Companies ("BOCs"), their competitors, long distance telephone carriers and large communications user groups. From this database we draw some useful conclusions about the characteristics and competitiveness of certain local exchange telephone markets:

- While figures vary among the BOCs, a relatively small percentage of high volume customers generate a disproportionate share of company revenues for four major non-residential services. BOC revenues also tend to be concentrated geographically.

- While such revenue concentration may suggest that the BOCs are vulnerable to competitive entry, they have not experienced significant revenue losses.

- There is evidence of revenue erosion, particularly for Centrex, switched access, and intraLATA private line services.

- The appearance of alternative suppliers in the local exchange telephone market is a relatively recent phenomenon, with the most growth occurring during the last decade.

- Alternative systems are being used principally for interexchange access or for private line services.

- Private microwave systems are very diverse and continue to be the most widely developed serving alternatives.

- Prospective customers for the competitive local fiber systems appear to be interexchange carriers, government agencies, and private corporations principally interested in interexchange access and private networks.

- While cable television companies reach 46 percent of all U.S. households, only a small number of these systems are equipped to handle voice and data transmission. More than 200 more specialized two-way cable systems are presently equipped for these applications.

- Despite the thousands of license applications, only 74 licenses for digital termination systems have been approved.

- More than 20 teleports are currently operating with between 10 and 20 more planned or under construction.

- Despite a recent "shakeout" in the market, more than 200 shared tenant service developments continue to operate in over 30 cities.

The data indicate that although vulnerable, the BOCs do not yet face a high degree of competition for many of their services and customers. Some market demand for alternative services is being met by new entrants, but, thus far, competitors have not fully exploited the BOCs' vulnerability to competitive entry.

NTIA welcomes clarifications as well as comments. Please address them to Alfred Lee or Tim Sloan, Office of Policy Analysis and Development, NTIA/Suite 4725, U.S. Department of Commerce, Washington, D.C. 20230; (202) 377-1880.

I. INTRODUCTION

One of the fundamental issues in telecommunications policymaking is the degree to which local exchange telephone companies ("LECs") experience competition for their service offerings. The level of competition faced by LECs has important implications for a variety of policy issues. For example, the Federal Communications Commission ("FCC") is currently considering the conditions under which LECs may offer enhanced services[1/]. The FCC has expressed concern about those companies' potential ability to harm competition for enhanced services through the exercise of market power derived from their control of local exchange facilities. Considering the FCC's strong market orientation, the nature of the regulatory safeguards prescribed may be influenced by the FCC's assessment of the amount of competition faced by the LECs.

The FCC is also weighing modifications to the current access charge plan which would recover a greater portion of certain interstate access costs through flat fees paid directly by telephone subscribers, while also reducing the usage-based access charges paid by long distance carriers to the LECs.[2/] One of the stated reasons for recovering more of those costs directly from subscribers rather than from carriers is to eliminate pricing distortions which may cause carriers and high volume customers to abandon the public switched network. Such occurrences will likely be more frequent as the number of non-LEC providers of alternative services increases. The amount of competition to LEC services may therefore influence the speed with which the FCC moves to recover the remaining interstate access costs directly from subscribers.

Some state regulators are also evaluating whether to reduce the level of regulation for LECs subject to their jurisdiction. The manner and extent of future regulatory scrutiny by the state authorities may depend upon an evaluation of the competition faced by the LECs.

1/ Amendment of Sections 64.702 of the Commission's Rules and Regulations (Third Computer Inquiry), Report and Order, CC Docket No. 85-229, FCC 86-252 (released June 16, 1986); Amendment of Sections 64.702 of the Commission's Rules and Regulations (Third Computer Inquiry), Supplemental Notice of Proposed Rulemaking, CC Docket No. 85-229, Phase II, FCC 86-253 (released June 16, 1986)

2/ MTS/WATS Market Structure, Further Notice of Proposed Rulemaking, CC Docket No. 78-72, Mimeo No. 5537 (released July 2, 1986).

Finally, to many, the extent of local exchange competition is directly relevant to review of the Modified Final Judgment ("MFJ") in United States v. AT&T.[3/] Besides implementing the breakup of the Bell System, the MFJ limits the business activities in which the divested Bell Operating Companies ("BOCs") and their parent Regional Holding Companies ("RHCs") can engage.[4/] These "line of business" restrictions were deemed necessary, in large part, to prevent the RHCs from using their control over "monopoly" local exchange facilities to gain an unfair advantage in competitive markets.

Resolution of a wide range of policy issues may thus turn on the decision makers' assessments of the degree to which LECs experience competition. There is, however, a notable lack of detailed market information concerning local competition. The unavailability of such information is one facet of a larger information problem. One byproduct of the FCC's deregulatory initiatives, perhaps unintended, has been a reduction in the amount of information collected regarding the telecommunications industry. Private sources have not yet filled the vacuum. As a result, policy makers face a critical lack of market intelligence upon which to base their decisions.

In an effort to generate useful information about competition in the local telecommunications marketplace, NTIA initiated a study to assess the level of competitive activity in LEC markets. While our study eventually will incorporate data on the entire LEC market, the initial phase has been limited to the RHCs. They are the primary providers of local exchange service, serving approximately 80 percent of all telephone subscribers. Moreover, they provide services to most metropolitan areas -- where competition may be expected to appear initially. Finally, many current policy issues, including the Administration's review of the MFJ, have direct implications for the RHCs.

The following analysis is based on a database which was generated in three stages. First, a questionnaire was sent

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3/ United States v. AT&T, 552 F. Supp. 131 (D.D.C. 1982), aff'd sub nom. Maryland v. United States, 460 U.S. 1001 (1983).

4/ The RHCs were created at divestiture to assume ownership of the 22 BOCs that were spun-off by AT&T pursuant to the MFJ. The seven RHCs, and the number of BOCs owned by each, are: NYNEX (2); Bell Atlantic (7); BellSouth (2); Ameritech (5); Southwestern Bell (1); US West (3); and Pacific Telesis (2).

to the RHCs requesting, on a confidential basis, detailed revenue and customer information, including data on the distribution of their service revenues geographically and among customer groups. We asked the RHCs to quantify, in confidence, the level of competitive activity (e.g., number of competitors, technologies used, subscribership and revenues) within their operating territories for each year from 1981 through 1985. Additionally, for that same period, we requested confidential information on the RHCs' largest losses of business to competitors.

Second, to supplement and verify data received from the RHCs, we distributed questionnaires to several long distance carriers and large communications user groups. Finally, we gathered information on firms currently providing service in competition with the RHCs by reviewing the trade literature and contacting individual firms.

Although the accumulated database is substantial, it is by no means complete. All companies responding could not provide the same amount of detail for each question posed. Moreover, while the information collected does not identify all competitive providers of local exchange services, it does provide valuable descriptive detail regarding a number of firms. A second problem is the lack of data for a number of consecutive years. Nevertheless, this limited database does allow us to draw some useful conclusions about the characteristics and competitiveness of certain RHC markets.

II. THE LOCAL EXCHANGE MARKET

The local exchange market and associated market activities can be defined in a number of ways. This report takes a simple approach of considering competitive activities on a service-by-service basis. Thus, after describing the geographical boundaries of the RHCs' operations, we briefly discuss the types of services they offer. Finally, we suggest which of those services may be most susceptible to competitive entry.

Geographic limitations on the RHCs' operating territories have been fixed by judicial decree. Under the terms of the MFJ, the RHCs may provide service only within

designated Local Access and Transport Areas ("LATAs").[5] These LATAs vary in size from state to state and do not necessarily conform to service markets which the RHCs might prefer operationally. Instead, LATAs were configured to strike a balance between ensuring the financial viability of the RHCs (by creating LATAs of sufficient size) and promoting maximum competition for interLATA services (by restricting LATA size).

Within each LATA, an RHC provides a myriad of services. These services can be divided into two basic categories--access and transport. Access services connect customers to long distance carriers designated by the customer.[6] The RHCs most frequently provide access services through their public switched networks (hence the term "switched access services") and also through private lines (known as "special access".) Switched access entails the connection of the customer through one or more RHC switching offices to a point-of-presence ("POP")[7] of the long distance carrier selected. The long distance carrier (and indirectly its customer) pays the RHC a connection charge for each minute of traffic carried over that access facility.

At certain usage levels, however, it may be more economical for a customer to utilize a direct, nonswitched facility between its premises and that of the long distance carrier.[8] To do so, a customer could obtain special access services from an RHC, based upon a flat monthly

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5/ The RHCs do not, of course, provide local services directly. Such services are instead furnished by the various BOCs owned by each RHC. For convenience, however, references herein to RHC services and facilities will denote services and facilities provided by the RHCs' BOC subsidiaries.

6/ These calls are usually between two LATAs, which may be within a single state or in different states. In some cases, however, state regulators also permit non-RHC firms to handle calls within a LATA.

7/ A POP serves as an entry point to a long distance carrier's network. Long distance carriers have multiple POPs in some LATAs.

8/ The precise determination of the "crossover point" depends upon the pricing of respective services.

charge.9/ Alternatively, a customer could obtain direct access to a POP by constructing its own private transmission facility, by sharing such a facility with another firm, or by leasing facilities from a non-RHC supplier. These alternative arrangements thus compete with both switched and special access services provided by the RHCs. Moreover, because dedicated access to a long distance carrier involves only the provision of a nonswitched facility between two points, it can often be provided at a relatively small cost. As a result, RHC access services to customers with a high volume of long distance calling may be highly susceptible to competitive provisioning.

The other basic category of RHC services is transport, which permits the movement of information within the LATA. Transport services can be further divided into three subcategories: point-to-point, point-to-multipoint, and multipoint-to-multipoint.

Most RHC private line services are point-to-point offerings. As the term suggests, point-to-point services are nonswitched, dedicated facilities between two discrete locations. As with access services, a customer may be able to replace RHC-provided point-to-point private lines at relatively low cost with customer-owned facilities or facilities obtained from a non-RHC supplier. Accordingly, the RHCs' point-to-point private line services may be similarly susceptible to competitive provisioning.

Point-to-multipoint facilities permit the transmission of information from a single point to several other points. Like point-to-point services, point-to-multipoint facilities are dedicated to a single customer, but unlike point-to-point services, they involve some switching capabilities. As a result, it is more costly for customers or competitive providers to duplicate point-to-multipoint services. Such RHC services, therefore, may be less subject to competition.

Multipoint-to-multipoint services are switched offerings that give customers access to other customers connected to a particular network. The basic local exchange services that

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9/ Special access service is thus substitutable for switched access service in some cases. On the other hand, the availability of special access service from an RHC does not represent competition to that same RHC because a shift from switched access to special access simply involves the replacement of one RHC service with another. Where there are no alternative serving arrangements, a customer desiring access to a long distance carrier must take service from the RHC.

form the core of the RHCs' businesses are the most familiar example of multipoint-to-multipoint services. RHC toll services within a LATA (i.e., intraLATA MTS services) are also in this category. Because provision of multipoint-to-multipoint services involves an extensive network of facilities and a large investment in switching equipment, they are the most difficult RHC services to replicate. Accordingly, they may be the least susceptible to competitive entry.10/

The foregoing market description provides the framework for this report. Section III reviews changes in the market environment that have increased opportunities for firms to compete with RHC services. Section IV identifies RHC services that appear vulnerable to competitive provisioning. Section V provides details on the amount of entry that has already occurred and considers prospects for future competitive entry.

III. FACTORS CREATING INCREASED OPPORTUNITIES FOR COMPETITIVE ENTRY

For the greater part of this century, the LECs were largely immune from competition. Regulatory policies generally permitted only one firm within each designated local franchise area. Entry by competitors was typically prohibited unless the prospective entrant could demonstrate that the franchised firm was not providing adequate service and could not do so within a reasonable time.11/ More recently, however, several developments have increased opportunities for firms to provide services that were once within the exclusive province of the local telephone companies.

10/ One exception appears to be Centrex service. Centrex is a multipoint-to-multipoint service because it gives Centrex customers ubiquitous access to all other network subscribers. Centrex service also switches calls among a customer's internal telephone stations (intercom calls). This latter feature can be replaced (and Centrex service rendered unnecessary) by a PBX switch placed on the customer's premises. In order to maintain ubiquitous access to other subscribers, however, the customer must still connect its PBX to a multipoint network.

11/ See, e.g., Neb. Rev. State Sec. 75-604.

A. Technological Changes

The most far-reaching of these developments has been technological change, which has resulted in a proliferation of new transmission media to supplement or replace twisted pair cable.[12] Additionally there has generally been a steady reduction in the cost of new transmission media. Between 1950 and 1976, for example, the cost per circuit mile for microwave transmission declined about 80 percent.[13] Moreover, the costs of fiber optic cable and microwave systems are projected to continue to decline considerably through the year 1992.[14]

New technological applications have also produced equipment that can expand the capabilities of transmission facilities. Multiplexing devices can divide a single circuit into a number of separate channels, permitting transmission of several simultaneous conversations over one transmission facility. Innovative signal processing electronics has expanded the capacity of existing circuits from 24 to 48 or more voice channels.[15] Data Over Voice technology allows twisted wire pairs to carry voice and data traffic simultaneously.[16]

12/ As the name implies, twisted pair cable is composed of individual strands of insulated wire (usually copper) twisted together in pairs. Many pairs are combined into binder groups which, in turn, are aggregated to form a cable. See Engineering and Operations in the Bell System 201-02 (2d ed. 1983).

13/ See National Telecommunications and Information Administration, Issues in Domestic Telecommunications: Directions for National Policy 12 (1985) ("Domestic Study").

14/ See Coopers & Lybrand, Gateway, Vol. 3, No. 1, at 10 (1986). Projected reductions in hardware costs may be offset in part by increases in construction expenses. It is also necessary to factor in the costs of rights-of-way (for fiber) and antenna sites (for microwave).

15/ One of the most significant developments in multiplexers is the advent of ADPCM technology which allows 1.5 Mbps lines to carry 48 rather than 24 voice channels. GTE Laboratories has recently reported a new multiplexing technology which allows that rate to be doubled. When such technology comes to the market, a 1.5 Mbps line may carry 96 voice channels instead of 24 channels.

16/ See Domestic Study at 21.

Technology-induced reductions in telecommunications equipment costs increase customer options to use different types of transmission media. Decreases in the cost of PBX equipment, for example, have made it attractive for more customers, either individually or on a shared basis, to switch and route traffic via a PBX. Since those customers no longer need LEC-provided switching services, they can transmit some or all of their traffic over dedicated, non-switched facilities that can be economically supplied by the customers themselves or by non-telephone company vendors.

B. Regulatory Changes

Regulatory decisions have increasingly removed legal barriers to competitive entry in local markets. While such policy changes have been driven to some extent by the technological developments discussed above, they also reflect many regulators' beliefs that competitive provision of telecommunications services should maximize benefits to consumers.

Until very recently, regulatory activity fostering competition has occurred mostly at the Federal level. In 1959, for example, the FCC fostered the growth of private telecommunications systems by allocating microwave frequencies for use by companies on a non-common carrier basis for their own communications needs.[17/]

In 1971, the FCC authorized firms to construct and operate competitive common carrier microwave systems.[18/] In the following year, the FCC authorized competitive provision of communications services via satellite.[19/] Following court decisions in the Execunet cases in 1978, competitive

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17/ Allocation of Frequencies in Bands Above 890 Mc., 27 FCC 359 (1959), recon., 29 FCC 825 (1960).

18/ Specialized Common Carrier Services, 29 FCC 2d 870, recon., 31 FCC 2d 1106 (1971), aff'd sub nom. Washington Util. and Transp. Comm'n, 513 F.2d 1142 (9th Cir.), cert. denied, 423 U.S. 836 (1975).

19/ Domestic Communications Satellite Facilities, 22 FCC 2d 86 (1970), 35 FCC 2d 844 (1972), aff'd sub nom. Network Project v. FCC, 511 F.2d 786 (D.C. Cir. 1975).

long distance service was feasible on a limited basis.[20] Finally, in 1980, the FCC authorized competitive provision of all interstate long distance services.[21]

Although these FCC actions primarily involved interstate services,[22] the FCC also took steps to foster competitive developments in local markets. One approach was to promote the growth of alternative local distribution technologies. Thus, the FCC authorized digital termination systems ("DTS")[23] and cellular radio services.[24] Recently, it increased the potential for private radio services to compete directly with local exchange services by allowing certain private microwave licensees to lease excess capacity on their systems to other entities for use on a non-common carrier basis.[25]

Additionally, the FCC has sought to further its market-opening decisions by preempting state entry and interconnection restrictions on facilities used in whole or in part to provide interstate services.[26] The FCC has

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20/ See MCI Telecommunications Corp. v. FCC , 580 F.2d 590 (D.C. Cir.) cert. denied, 439 U.S. 980 (1978) ("Execunet II"); MCI Telecommunications Corp. v FCC, 561 F.2d 365 (D.C. Cir. 1977), cert. denied, 434 U.S. 1040 (1978)("Execunet I").

21/ MTS/WATS Market Structure, 81 FCC 2d 177 (1980).

22/ These decisions have indirectly increased pressures for alternative provision of interexchange access services. The competitiveness of the long distance market has induced providers to seek ways to minimize the costs of access for their customers. It is thus no coincidence that many providers of competitive local facilities also offer services to long distance carriers. See Section V., infra.

23/ Digital Termination Systems, 86 FCC 2d 360 (1981). DTS is an omnidirectional microwave service which permits local transmission of data and voice, as well as access to interstate services.

24/ Cellular Communications Systems, 86 FCC 2d 469 (1981).

25/ Operational Fixed Microwave Service, 57 R.R. 2d 1486 (1985), recon., 59 R.R. 2d 1471 (1986).

26/ American Tel. and Tel. Co., 56 FCC 2d 14 (1975), aff'd sub nom. California v. FCC, 567 F.2d 84 (D.C. Cir. 1977).

preempted state entry restrictions on DTS licensees, cellular radio licensees and cable television systems that provide interstate services.[27] It has also prohibited state regulation of private operational fixed and private mobile radio licensees.[28] These preemptive actions have greatly expanded opportunities for firms to furnish services and facilities in competition with the RHCs, including those used to provide access to interstate networks.

Although historically most state regulators favored monopoly provision of telecommunications services, many have recently become more receptive to competitive provision of intrastate services.[29] For example, of the 38 multi-LATA states, 36 have authorized facilities-based competition for intrastate, interLATA services. All 38 of those states permit competition on a resale basis.

Further, 15 states currently allow facilities-based competition for intrastate, intraLATA services, and four more will permit it as of January 1, 1987. Another eight states are currently considering the issue. Although it is not certain how much regulatory control these states intend to exercise over competitive providers of intraLATA services, there is a clear trend towards allowing more liberal entry and easing regulatory scrutiny.

C. Market Changes

The opportunities for new entry created by regulatory and technological changes are reinforced by customer demand. The telephone network was designed primarily to carry voice

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27/ See Digital Termination Systems 86 FCC 2d at 390; Cellular Communications Systems, 86 FCC 2d at 505; Cox Cable Communications, 102 FCC 2d 110 (1985).

28/ See Operational Fixed Microwave Service, note 25, supra; 47 U.S.C. § 332 (c) (3) (1984) (Private mobile radio).

29/ See National Telecommunications and Information Administration, Telephone Competition and Deregulation: A Survey of the States (1986) ("NTIA State Report").

traffic and is still used predominantly for that purpose.30/ With the increased use of computers and the increasing need to transfer large amounts of information, however, more users are demanding facilities for the transmission of data. Network facilities previously designed to carry voice traffic are often ill-equipped to carry data traffic at the high speeds and error-free transmission rates desired by users. Although the RHCs have worked to rectify this situation, evidence suggests they have had difficulty providing high speed, digital facilities that meet all customers' data needs. Such circumstances have helped create market opportunities for competitive suppliers.

Additionally, as telecommunications has become an increasingly important component of many companies' resource bases, firms have felt the need to exercise greater control over their telecommunications services and expenditures. Some companies have reduced expenditures by obtaining facilities and services from non-RHC suppliers. Cost reduction is not the only motive, however, for choosing an alternative supplier. Other reasons include the need for greater management control, special requirements not easily met by the RHCs, greater reliability or security, faster installation of service, or broader flexibility in rates or terms of service. Whatever the reasons, the increasingly sophisticated needs of many customers have increased market opportunities for new firms.

D. Pricing Policies

The pricing of local services has created financial incentives for entry. In an effort to keep residential rates low, regulators historically supported the existence of an elaborate system of interservice subsidies. The most frequently cited of these subsidies involves the recovery of non-traffic sensitive ("NTS") costs, essentially costs of the local loop which are fixed and do not vary with the usage of those facilities.

30/ A survey by the International Communications Association, an association of large telecommunications users, revealed that 23 percent of its members' annual telecommunications expenditures in 1984 were for data communications. See Comments of the International Communications Association in CC Docket No. 78-72, Phase I, Attachment at 12 (filed May 21, 1984). The amount of data traffic among smaller users is, of course, considerably less.

For many years, as much as 25 percent of those NTS costs have been recovered on a usage sensitive basis through interstate long distance rates. Under the FCC's Access Charge Plan, NTS costs are recovered by LECs in part through flat rate charges paid by all subscribers ("subscriber line charges"), and in part through usage based charges ("carrier common line charges") paid by long distance companies.[31/] Since the latter charges are generally passed through to customers of long distance carriers, high volume users in effect subsidize low volume users. This subsidy persists even though the FCC has gradually increased the amount of NTS costs recovered through subscriber line charges.

Various intrastate rate structures exhibit subsidy arrangements similar to those inherent in recovery of interstate NTS costs. The Oregon Public Utility Commissioner has estimated, for example, that residential rates in Oregon cover only 41 percent of the fixed cost of providing service. The balance of those costs are recovered through intrastate toll rates and local business rates.[32/] Intrastate toll and local business services commonly subsidize residential rates in other jurisdictions as well.

The pricing distortions produced by these interservice subsidies are exacerbated by the fact that local telephone companies generally average their prices throughout their service areas.[33/] Averaged cost pricing, combined with subsidy pricing, creates many instances where prices paid by particular customers exceed the actual costs of providing service to them. As a result, those customers have an incentive to seek service from other sources whose prices more closely reflect actual costs. Moreover, because competitive suppliers are not obligated to price services

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31/ MTS/WATS Market Structure, Third Report and Order, 93 FCC 2d 241 (1983), modified on recon., 97 FCC 2d 682 (1983), further modified on recon., 97 FCC 2d 834 (1984), aff'd in principal part and remanded in part sub nom. National Ass'n of Regulatory Util. Comm'rs v. FCC, 737 F.2d 1095 (D.C. Cir. 1984), cert. denied, 105 S.Ct 1224 (1985), modified on further recon., 99 FCC 2d 708 (1984), 101 FCC 2d 1222 (1985), aff'd on further recon., 102 FCC 2d 849 (1985), appeal docketed, No. 84-115 (D.C. Cir. Mar. 23, 1984).

32/ See NTIA State Report at 14-15.

33/ We recognize that average cost pricing may be desirable as a matter of social policy. We merely point out one potential problem that may result from it.

based on average costs, they may be able to offer alternative services at lower rates than the RHCs.

IV. VULNERABILITY OF THE RHCS TO COMPETITIVE ENTRY

The market developments and policy determinations outlined above have expanded opportunities and incentives for competitive entry into local service markets. In this section of the report, we assess the extent to which the RHCs are vulnerable to competition for their services. We also consider whether they have experienced revenue losses attributable to competitive entry. In the following section, we present and analyze specific data on competitive entry--that is, the number of alternative providers, revenues and services provided, their impact on the RHCs, and potential impediments to their future growth.

Given the prevailing system of interservice subsidies (i.e., interstate subsidizing intrastate, toll subsidizing local, business subsidizing residential), one would expect competitive entry to appear initially for those services supplying the subsidies (e.g., interstate services, intrastate toll, and local business exchange services). To test this hypothesis, we obtained from the seven RHCs extensive customer and revenue data concerning their services. In most cases, we requested that the data be provided for the BOCs owned by each RHC. In some cases, however, we asked the RHCs to supply revenue and traffic data for certain cities and wire centers.[34/] The data, supplemented by information from other sources, provide some indications of the degree to which the RHCs may be vulnerable to competition.

A. Evidence of Revenue Concentration for RHC Services

The data show a heavy concentration of revenues within certain customer groups. The figures vary from BOC to BOC and from service to service, but, as Figures IV-A through IV-D indicate, the pattern is consistent: a relatively small percentage of high volume customers (those using more than 11

34/ Given the proprietary nature of this information, we have, where possible, aggregated individual BOC, state/city, and wire center data supplied by each RHC to produce consolidated statistics for that RHC. In those instances where an RHC could not provide data for all of its BOCs, we have aggregated individual city/state or wire center data to produce consolidated statistics for each BOC for which complete information was submitted.

FIGURE IV - A

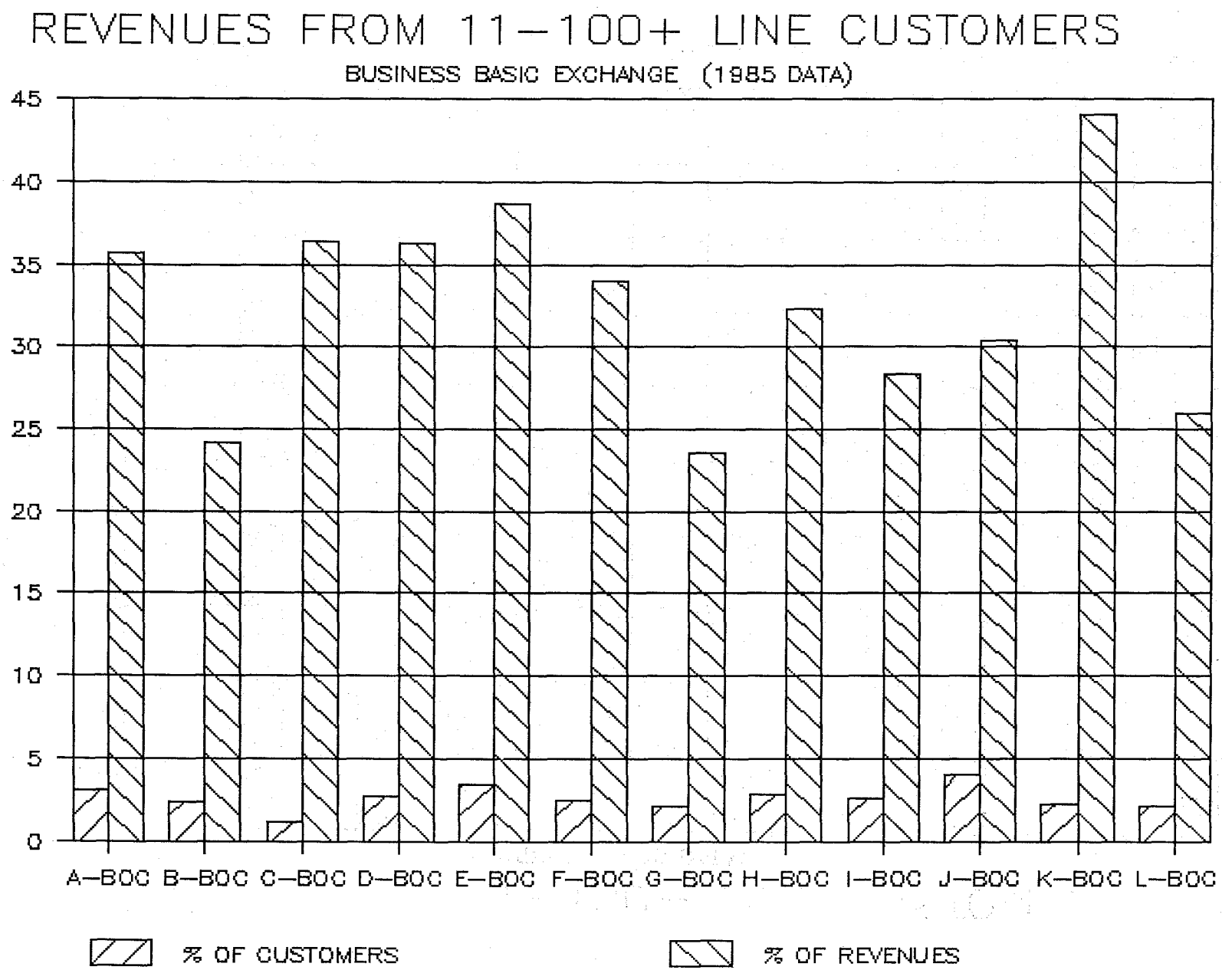

REVENUES FROM 11-100+ LINE CUSTOMERS
BUSINESS BASIC EXCHANGE (1985 DATA)
45
40
35
30
25
20
15
10
5
0
A-BOC
B-BOC
C-BOC
D-BOC
E-BOC
F-BOC
G-BOC
H-BOC
I-BOC
J-BOC
K-BOC
L-BOC
% OF CUSTOMERS
% OF REVENUES

FIGURE IV - B

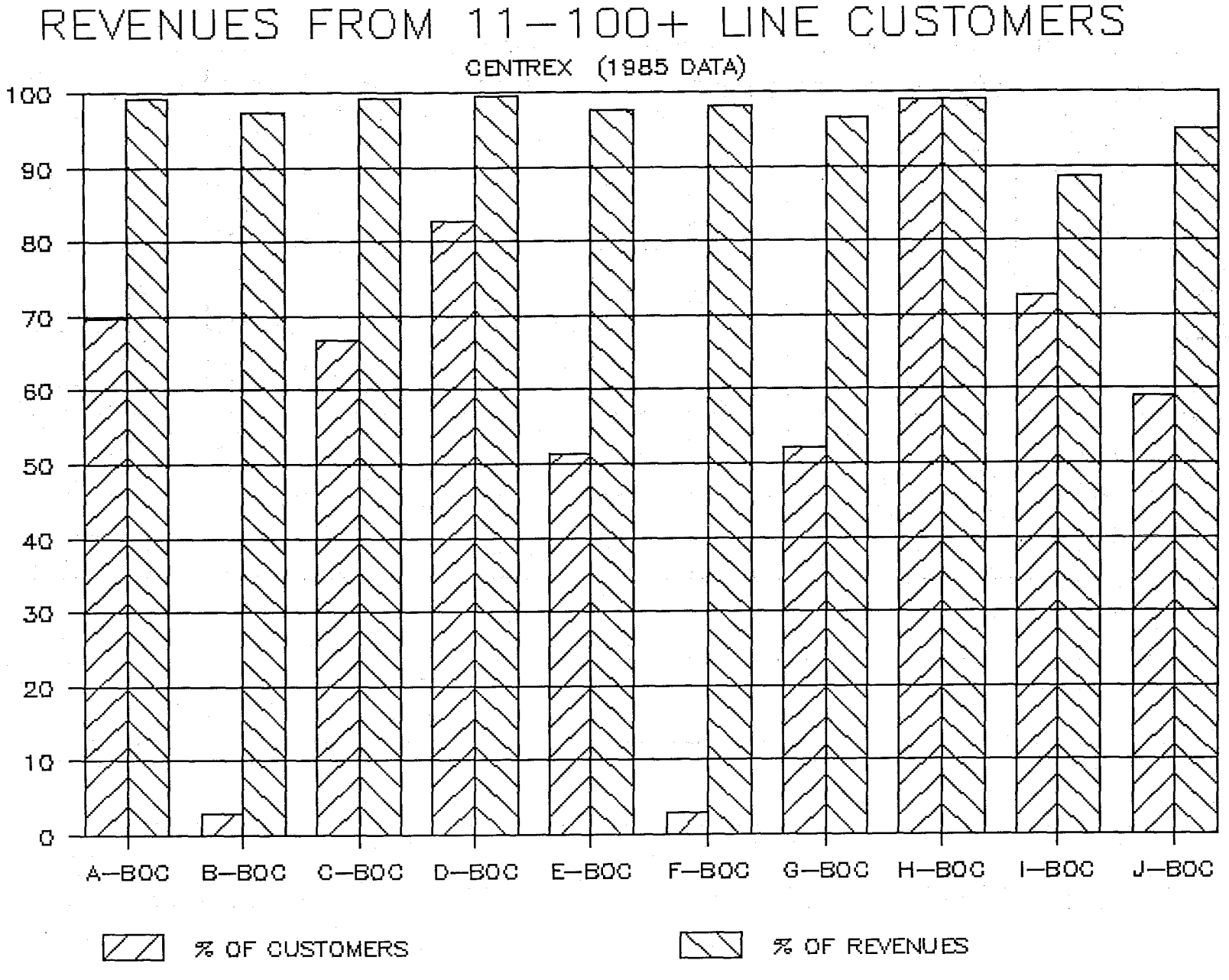

REVENUES FROM 11—100+ LINE CUSTOMERS
CENTREX (1985 DATA)
100
90
80
70
60
50
40
30
20
10
0
A—BOC
B—BOC
C—BOC
D—BOC
E—BOC
F—BOC
G—BOC
H—BOC
I—BOC
J—BOC
% OF CUSTOMERS
% OF REVENUES

FIGURE IV - C

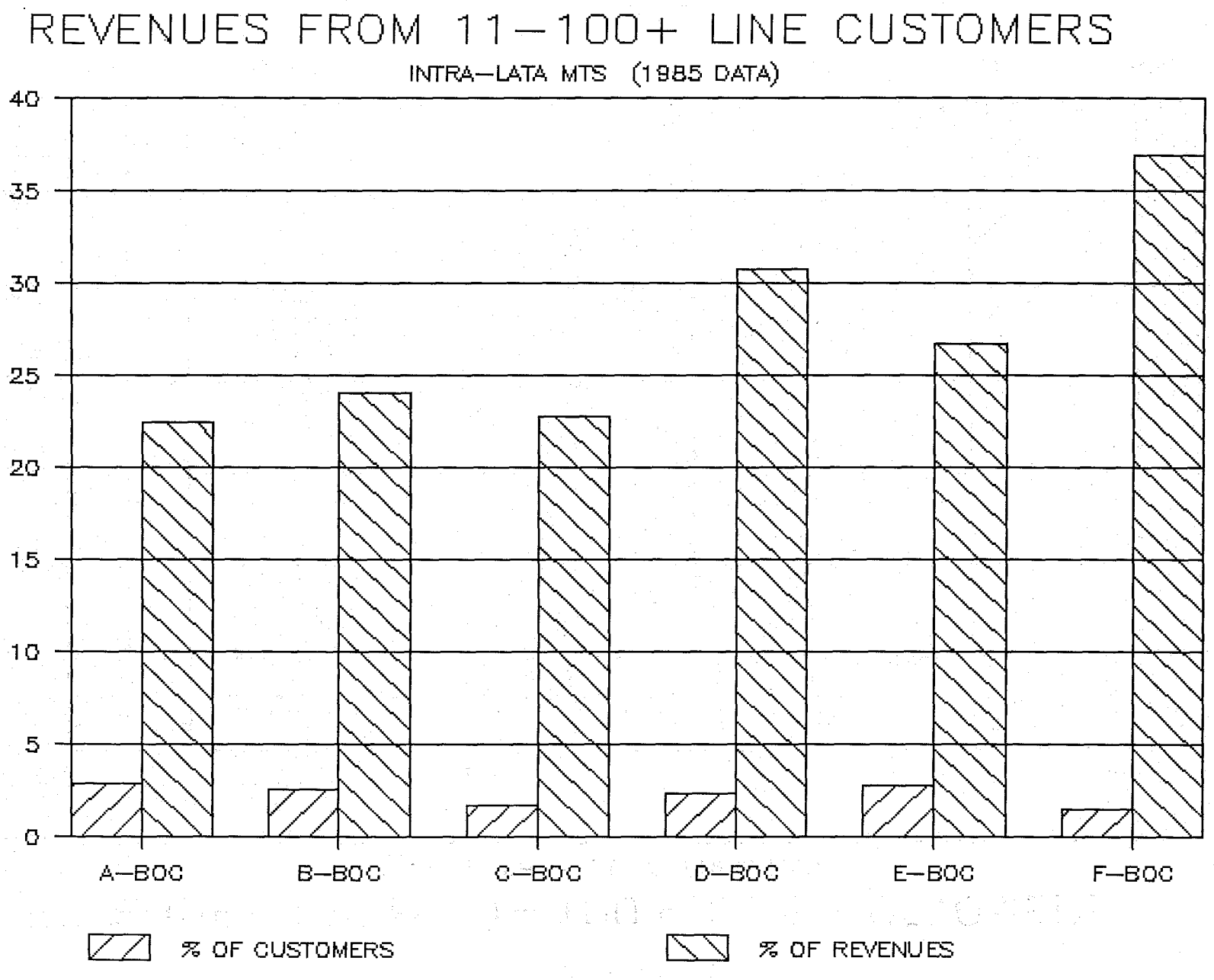
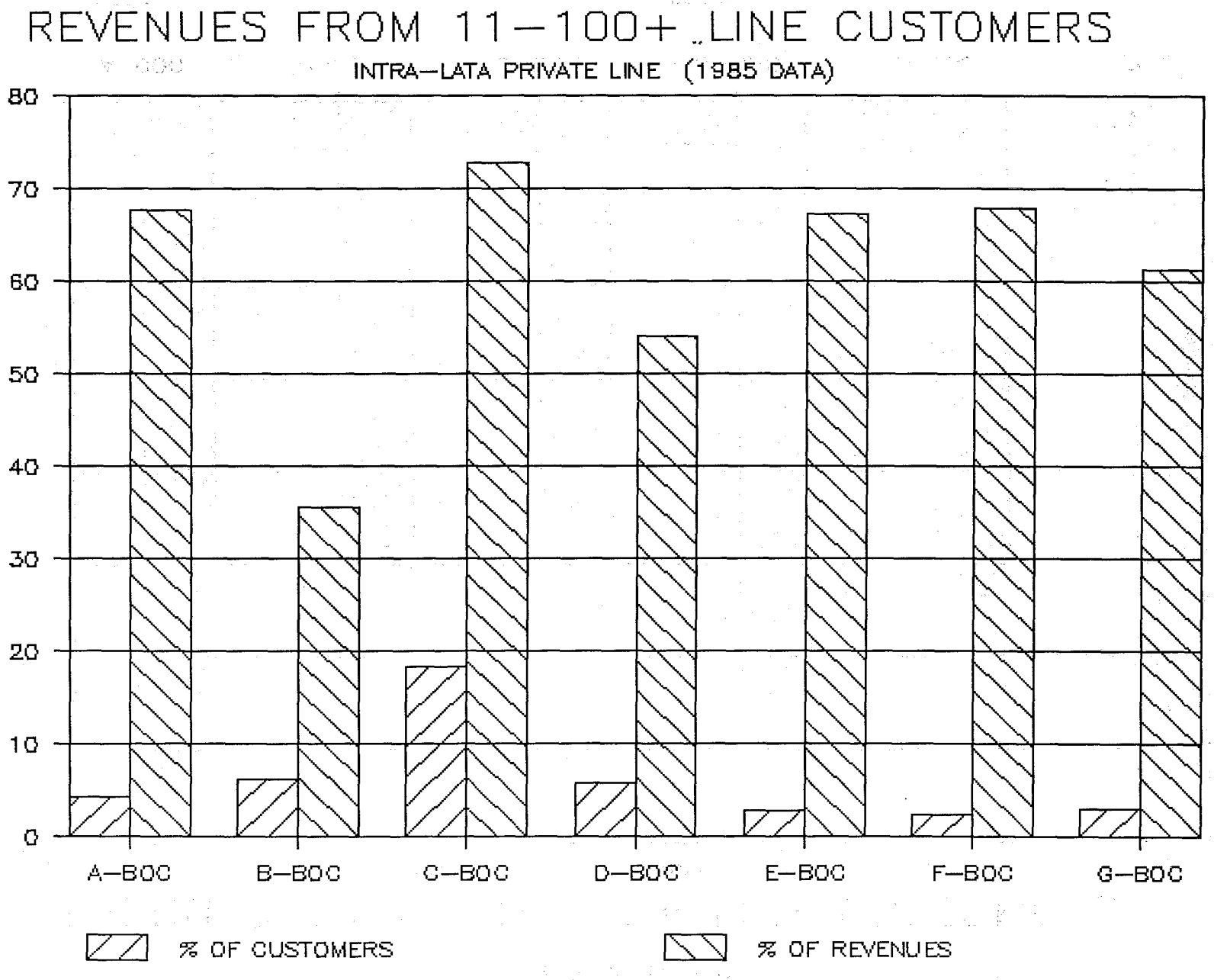

REVENUES FROM 11—100+ LINE CUSTOMERS
INTRA—LATA MTS (1985 DATA)
40
35
30
25
20
15
10
5
0
A—BOC
B—BOC
C—BOC
D—BOC
E—BOC
F—BOC
% OF CUSTOMERS
% OF REVENUES

FIGURE IV - D


REVENUES FROM 11–100+ LINE CUSTOMERS
INTRA–LATA PRIVATE LINE (1985 DATA)
80
70
60
50
40
30
20
10
0
A–BOC
B–BOC
C–BOC
D–BOC
E–BOC
F–BOC
G–BOC
% OF CUSTOMERS
% OF REVENUES

lines) generate a disproportionate share of the revenues for each of four major non-residential services.

The data also suggest that RHC revenues tend to be concentrated geographically within their respective operating territories. For example, between 11 and 21 percent of each RHCs' total operating revenues in 1985 were produced by business accounts located in the 20 largest cities in each RHC region.[35/] Moreover, for each RHC, between 51 and 66 percent of those 20 city revenues were derived from the region's five most populous metropolitan areas. Given that each RHC's 1985 operating revenues exceeded $6 billion, a potential entrant could attain a critical mass of revenues by successfully targeting business accounts in only a few large cities.

A competitive supplier's incentive to target metropolitan area business accounts is reinforced by the fact that those accounts appear to be more lucrative than business accounts generally.[36/] Ameritech has noted, for example, that monthly revenue per business account in downtown Chicago is about twice as large as for other areas served by Illinois Bell.[37/] RHC data concerning their busiest wire centers produce a similar result. Specifically, average annual revenue per business account in each of the RHCs' 20 busiest wire centers is from 26 percent to 230 percent greater than the average for each RHC's 20 largest cities. Because the busy wire centers typically serve a disproportionate

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35/ This statement is based upon data from four RHCs. Data from a fifth RHC show that one of its BOCs generated more than 31 percent of its total operating revenues from business accounts in the seven largest cities in that BOC's operating area.

36/ This analysis assumes it would be more cost effective, and thus more attractive, for a firm to serve an account which generates a large amount of revenue per month or year than an account which produces fewer dollars over the same period.

37/ See Reply Comments of the Ameritech Operating Companies in FCC Docket No. 85-229, App. B at 6 (filed Jan. 20, 1986).

percentage of business accounts,[38] and because the busy wire centers are usually concentrated in a smaller number of large cities, a competitive supplier could further minimize its entry costs by targeting only those customers in the busiest wire centers in a few large cities.

The geographic concentration of revenues is even more evident for the RHCs' switched access services. In 1985, for example, the RHCs derived between 39 and 73 percent of their switched access revenues from the 20 largest metropolitan areas in their respective regions.[39] Further, for four RHCs who provided switched access revenue data by wire center,[40] the 20 busiest wire centers in their respective regions produced between 15 and 20 percent of their 1985 switched access revenues.[41]

B. Implications of Revenue Concentration for the RHCs

This concentration of revenues has several implications for the RHCs. In theory, concentration of revenues within particular customer groups should make competitive entry more attractive. Generally speaking, a firm must be assured of generating a critical mass of revenues in order to make entry

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38/ For one RHC, business account ratios (i.e., the ratio of business accounts to total customer accounts) in its 20 busiest wire centers in 1985 were between 223 percent and 275 percent greater than business account ratios in its 20 largest cities. Moreover, the ratios in the 20 wire centers were between 253 percent and 663 percent greater than the average business account ratio for the remainder of the RHCs operating territories.

39/ This statement is based upon data submitted by five RHCs. The sixth RHC could not provide switched access data on a city-by-city basis. The seventh was not able to furnish any useful data in this area.

40/ A wire center is a local switching office connecting various subscriber lines to the local exchange network.

41/ We also requested revenue data for the RHCs' special access services. Unfortunately, the data were too incomplete to permit generalizations about geographic concentration of special access service. However, one RHC reported generating about 59 percent of its 1985 special access revenues from its 20 largest metropolitan areas. In the same year, two other BOCs derived more than 79 percent of their special access revenues from the seven largest cities in their respective territories.

viable. In turn, entry is more feasible if that critical mass can be generated from a smaller number of customers, because the marketing costs needed to identify and serve those customers will be less than if the same level of revenues was spread among a larger group of customers.

Concentration of revenues geographically is also important because revenue concentration within certain customers may not induce competitive entry if the targeted customers are too widely dispersed geographically. For example, a firm may be reluctant to make the requisite investment to serve 50 high revenue customers located in 50 different states. On the other hand, if those same customers are located in a single city, or even a single state, the firm's interest in serving those customers may be increased.

The geographic concentration of the RHC's switched access services, in particular, is significant for several reasons. First, switched access services generated between 16 and 30 percent of each RHC's total 1985 operating revenues. Second, as noted above, switched access services are highly susceptible to competition because they can often be replaced at relatively low cost by nonswitched facilities and customer premises switching obtained from a non-RHC supplier.[42/] Finally, the subsidies embedded in switched access rates create incentives for some customers, particularly high volume business users and long distance carriers, to seek alternative access arrangements,[43/] thereby increasing market opportunities for competitive entrants.

On the other hand, while concentration of revenues geographically and/or within customer groups may increase opportunities for competitive entry in theory, other factors may limit the incidence of competitive entry in practice. For instance, even where customers secure transmission capacity from non-RHC sources, they seldom abandon the local

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42/ See pp. 7-8, supra.

43/ See pp. 18-19, supra.

exchange network totally.[44] While it can be advantageous for firms to use non-RHC facilities for communications in certain locations (e.g., company offices within a city), organizational and individual calling requirements generally necessitate access to a calling universe outside of the firms' private networks and hence connection to an RHC network switch (and probably to an interexchange switch as well).

Further, competitive transmission systems frequently are unable economically to duplicate the redundant connectivity of RHC facilities.[45] Therefore, users continue to connect to the local exchange network to ensure reliable communications should their own facilities fail under certain conditions (e.g., power outages). Connection to an RHC network also allows users of private communications systems to engineer their systems to handle less than peak traffic (and recognize savings in the cost of the system), since RHC facilities can be relied upon to accommodate peak traffic overflow from their private systems.

44/ Generally, a multiline user substitutes only some local distribution facilities with a bypass facility. Sufficient local facilities are retained to handle the subscriber's local exchange call needs and receipt of incoming public network calls.

Comments of the Ameritech Operating Companies in Response to Commission's Request for Data, Information, and Studies Pertaining to Bypass of the Public Switched Network, at 15 (filed May 23, 1984).

See also U.S. General Accounting Office, Telephone Communications: Bypass of the Local Telephone Companies 41 (Aug. 1986) ("GAO Report") (indicating that, for companies currently using some non-LEC facilities, LECs still carry between 75 and 90 percent of the companies' total telecommunications traffic); National Regulatory Research Institute, The Bypass Issue: An Emerging Form of Competition in the Telephone Industry ix (Dec. 1984) ("... in no case have all bypassers with the equivalent service capability in their bypass system reduced their use of telephone company services").

45/ Redundant connectivity enables a particular call to be routed and completed over alternative transmission pathways in the event that the primary circuit is out of service or engaged.

Moreover, for some services, high levels of revenue concentration may be misleading. For example, although larger customers generate a substantial percentage of the RHCs' business exchange services, those customers may not be viable targets for competitive providers. The RHCs' business exchange services give customers access to all other telephones within the designated exchange area. A competitor would not likely incur the massive facility and switching investment required to duplicate that calling capability.[46/]

Care must also be taken in assessing the implications of switched access revenue concentration in the largest metropolitan areas. Geographic concentration of those revenues may not be significant if the revenues are not also concentrated among customers who can afford alternative facilities. This does not appear to be the case. Of the 100 cities for which the RHCs submitted data, less than one-third had business account ratios (i.e., the ratio of business accounts to total customer accounts) more than 50 percent greater than the company-wide averages of approximately 10 percent.[47/] Accordingly, a substantial portion of the switched access revenues in those cities could be attributable to non-business users who typically lack the traffic volumes to justify direct connections to a long distance carrier. For this reason, the high concentration of switched access revenues in large cities may not imply a commensurate level of competitive vulnerability.

A different conclusion appears warranted, however, regarding concentration of switched access revenues in the busiest wire centers. Of the 80 wire centers for which we have complete data, 52 had business account ratios at least 50 percent greater than the company-wide average. In more than one-half of the 80, the business account ratios were more than twice as great as the company-wide average; in 25, the ratios were more than three times as great. Accordingly, in busy wire centers, it is far more likely that switched access traffic is generated by business customers who may

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46/ This analysis does not, of course, pertain to the non-switched services that can replace the RHCs' point-to-point services, such as private lines and switched and special access.

47/ Ameritech has stated that the business account ratio for Illinois Bell is about 10 percent. See Reply Comments of the Ameritech Operating Companies in FCC Docket No. 85-229, note 38 supra, App. B at 5. Available evidence indicates that company-wide business account ratios for the other RHCs do not significantly exceed 10 percent.

have traffic volumes sufficient to justify direct connections to long distance networks.

C. Impact of Competitive Entry on RHC Revenues

Whatever the precise degree of RHC vulnerability attributable to concentration of revenues, the RHCs have thus far not experienced significant revenue losses. Business exchange service revenues, though significantly concentrated among high volume customers, increased for all RHCs between 1984 and 1985.[48/] IntraLATA private line revenues, which are even more concentrated among high volume users, also increased between 1984 and 1985, in a majority of cases in excess of 15 percent.

It is difficult to draw definitive conclusions about switched access services because the data are sparse. Two RHCs which submitted 1984 and 1985 data, however, experienced aggregate increases in minutes of use of 4.7 percent and 13.8 percent, respectively. Revenues for those companies increased by 4 and 6 percent. For the same period, a BOC reported aggregate increases in revenues and minutes of use of 23 and 32 percent, respectively. Interestingly, for each of these companies, the rates of increase in revenues and minutes of use in the largest metropolitan areas and the busiest wire centers -- two areas where competitive encroachment would seem most likely -- generally matched or exceeded company-wide growth rates.

The most frequently mentioned threat to switched access revenues is "service bypass," instances where a customer replaces switched access service with RHC-supplied special access facilities. There is some evidence of this

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48/ Use of revenue increases alone has its shortcomings, because rate hikes may produce greater revenues even if the number of customers declines. Thus, one RHC reported an aggregate 10.6 percent increase in intraLATA private line revenues between 1984 and 1985, yet the number of private lines in its twenty busiest wire centers declined by more than 15 percent over the same period.

Conversely, a decrease in revenues may reveal a price reduction, rather than a loss of business. One BOC experienced an aggregate 3.4 percent decline in special access revenues in several of its operating jurisdictions. Yet, the number of special access circuits installed in those same jurisdictions increased by a combined 4.6 percent over the time period.

phenomenon. One long distance company, for example, reported a 44 percent increase in the number of special access circuits connected to its POPs between July 1984 and December 1985. Another indicated that, as of December 1985, approximately 28 percent of the circuits connected to its POPs were special access facilities.[49/]

The service bypass phenomenon, however, may be abating.[50/] The migration to special access has been due largely to the inefficient pricing of switched access service.[51/] The FCC is attempting to correct this problem by, among other things, lowering carrier common line charges on interstate minutes of use.[52/] One RHC has acknowledged

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49/ Interestingly, there is little evidence of so-called "facilities bypass", where a customer replaces RHC-provided switched access service with a private link to a POP or with facilities obtained from a non-RHC provider. AT&T's most recent report to the FCC identifies only three instances where AT&T secured non-RHC facilities to connect one of its customers to an AT&T POP. The report also cited only eight cases where customers obtained such facilities on their own. See Communications Daily, Oct. 22, 1986, at 1-2. MCI, the second largest long distance carrier, has indicated that, as of the first quarter of 1986, only eighteen of its customers were using non-RHC facilities to connect their premises to MCI POPs. See MCI's Response to Certain Questions Concerning the Continuing Need for Line-of-Business Restrictions on the Bell Companies at 15 (June 18, 1986) (filed with Peter Huber).

50/ The phenomenon is unlikely to disappear completely, even if switched access rates are ultimately priced in line with actual costs. As long as switched access rates are usage based while special access facilities (or competing non-RHC facilities) are offered at uniform monthly rates, at certain levels of usage it will always be more economical for a customer to replace switched access facilities with special access or other private facilities. Economically efficient pricing of switched access would simply make the "crossover point" occur at a higher volume of usage.

51/ See Section III.D, supra.

52/ See WATS-Related and Other Amendments of Part 69 of the Commission's Rules, 59 R.R. 2d 1418 (1986). In this Order, the FCC also froze the carrier common line charge on terminating interstate minutes through December 31, 1987.

that such reductions will limit the potential for uneconomic shifts by customers between switched and special access services.[53] Two long distance carriers suggest that, as a result of reductions in carrier common line charges, it will be more economical to replace many of their customers' special access lines -- as many as two-thirds -- with switched access service.[54] The data reveal some revenue erosion, however, for certain RHC services. With respect to Centrex, five out of the six RHCs providing multiple year data experienced revenue losses between 1984 and 1985.[55] In all but one case, the revenue losses were attributable to the loss of customers using more than 100 Centrex lines.

53/ See New England Tel. Co. Tariff FCC No. 40, Description and Justification at 1-6.

54/ The potential for migration from switched to special access can be reduced further by raising special access rates. In this regard, NYNEX recently increased those rates by more than 19 percent. In the Matter of New York Telephone, Revisions to Tariff F.C.C. No. 41 and New England Telephone and Telegraph Company, Revisions to Tariff F.C.C. No. 40, Mimeo 6324 (released Aug. 12, 1986). US West has increased special access rates in Oregon by nearly 34 percent. In the Matter of Pacific Northwest Bell Telephone Company, Revisions to Tariff F.C.C. No. 8, Mimeo 5516 (released June 30, 1986). Although these rate hikes are intended to increase rates of return for the companies' special access services to authorized levels, they will reduce the instances where special access would be an economic alternative to switched access.

Of course, increases in special access rates also increase the possibility that some customers may engage in facilities bypass. Given this fact, some RHCs' decisions to raise their special access rates may reflect their assessment of the amount of competition to their special access services.

55/ However, these losses do not necessarily indicate an increase in competitive provision of local exchange services because, in most cases, the replacement of Centrex service by a PBX does not entail abandonment of the local exchange network entirely. Instead, the customer merely substitutes one type of telephone company service -- PBX trunks -- for another -- Centrex lines. The reduction in Centrex revenues is thus offset in part by the increase in PBX trunk revenues.

Although intraLATA private line and intraLATA MTS revenues generally increased between 1984 and 1985, some RHCs experienced revenue declines. Others reported either declines or below average growth among larger customers. Several RHCs experienced losses in revenues generated by business accounts in some of their busiest wire centers. Similarly, with respect to switched access services, some RHCs reported a number of cities and wire centers where revenues and/or minutes of use either declined or lagged behind company-wide rates of increase. In each case, however, it is difficult to detect a pattern, either among the RHCs or within a particular RHC's operating territories.

Thus, revenues for many RHC services do appear to be concentrated geographically or within customer groups. Moreover, there is evidence of some revenue erosion, particularly for Centrex, switched access, and intraLATA private line services. To determine whether that revenue erosion may be attributable to competitive entry, we turn to an examination of the competitive suppliers.

V. INCIDENCE AND IMPACT OF COMPETITIVE ACTIVITIES

The following discussion of competitive activities is presented in four parts. Initially we identify the various technologies used by alternative suppliers and discuss the advantages, disadvantages and costs of each. Second, to the extent available, we present market data on the firms providing alternative services, including services offered, subscribership levels, and revenues. We then analyze the impact which these competing providers may have had on the RHCs. Finally, we identify certain impediments to continued growth of competitive activities.

A. Technologies Used by Competitive Suppliers

Communication systems are often characterized in terms of the primary transmission technology used. Underlying the various serving arrangements which are alternatives to RHC services are the technologies which together form transmission, switching, aggregation, and multiplexing

subsystems.[56] Depending upon service needs, a facility arrangement may also employ a mix of transmission subsystems and additional switching, aggregation, or multiplexing equipment. It should be noted that these technologies may be used readily by the RHCs as well, particularly when expanding or replacing embedded plant.

Much has been said about the ability of a multitude of transmission systems to facilitate service development in competition with the RHCs' local transmission networks. The literature is replete with statements describing the promise of such technologies as cellular radio, DTS, satellite systems, microwave radio, coaxial cable systems, local area networks, digital carriers, and infrared and fiber optic systems.[57] While there is much variation in capital costs, monthly operating costs, and message handling capacity of these oft-mentioned transmission subsystems, there are several common characteristics.

Electronic communications systems operate in two basic modes, either as radio-based media or via some form of guiding media. Familiar examples of radio-based systems include DTS, satellite, microwave and cellular radio. Guided communication systems include fiber optic and coaxial cable systems, and copper wire loops. There are important differences between the two modes, affecting both

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56/ Aggregation, switching and multiplexing subsystems play important roles in alternative serving arrangements by concentrating and preparing traffic for transmission. Included within the term aggregation subsystems are facilities such as utility closets and ducting used to connect or link locations within a building or an industrial park. Such aggregation facilities can be used, to varying degrees, with PBX switches and transmission facilities to build local area networks, teleports, intelligent buildings and shared tenant facilities. Multiplexing subsystems allow traffic to be combined in a way which makes the most efficient use of high capacity transmission subsystems. See note 16, supra. These three subsystems often play a critical role in aggregating enough traffic in a single location to make an alternative serving arrangement worthwhile.

57/ In a 1984 survey of bypass studies, the FCC's Common Carrier Bureau noted 36 studies, many of which extolled the virtues of a large number of transmission technologies. See Common Carrier Bureau, Federal Communications Commission, Bypass of the Public Switched Network, App. No. 6 (Dec. 1984) ("CCB Bypass Study").

construction and operation of alternative serving arrangements.

The principal difference between these two types of systems is that guided systems require the use of rights-of-way (usually conduit or pole space) while radio systems do not. As a result, guided systems may require more capital investment and higher operating budgets than radio-based systems; they can be much more costly to build and can require much more installation time. In addition, guided systems may be more expensive to operate because of high recurring right-of-way charges and very costly field repair procedures. These potential problems are likely to be less severe outside of the largest metropolitan areas.

One constraint on radio-based systems, not applicable to guided systems, is the amount of electromagnetic spectrum allocated to each system. While FCC allocations limit the capacity or potential market possibilities of all radio systems, particular systems may be more constrained than others in serving local exchange needs.

The FCC's Common Carrier Bureau calculated that the 300 MHz of bandwidth available for DTS systems could provide a maximum of 1.6 million alternative local loops nationwide, equivalent to only 1.7 percent of all domestic local loops.[58/] Similarly, with frequency reuse, limited subscriber use and other favorable conditions, cellular radio systems may accommodate approximately 100,000 subscribers in each major metropolitan area.[59/] For some radio-based systems, however, such as satellite and the higher frequency microwave services (e.g., 18 GHz, 23 GHz, and 31 GHz), such capacity limitations have not yet been encountered.

Before briefly reviewing the potential advantages and disadvantages of particular transmission alternatives and related subsystems, a caveat concerning costs is appropriate. Estimated costs of the technologies discussed below are commonly expressed in terms of cost per voice grade equivalent channel. These estimates can be problematic because they often exclude site specific costs such as right-of-way, tower construction, or engineering costs. They also may not incorporate backup facilities, equipment, maintenance and operating costs, or extra equipment needed to achieve a high grade of service. This is due in part to the wide variability of these factors over the range of specific applications, not the least of which are varying transmission

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58/ See CCB Bypass Study, App. 5 at 6.

59/ See id. App. 5 at 11.

distances, grade-of-service requirements, and right-of-way costs. Thus, voice channel estimates vary considerably. They generally cover equipment investment costs, but understate the true costs per channel of alternative serving arrangements. The discussion of costs of each technology will therefore include a range of estimates.

1. Microwave radio systems

Microwave radio can be a most attractive transmission medium for a variety of long-haul and local distribution applications. This is due principally to relatively low system costs and the absence of right-of-way problems. Microwave systems do, however, require unobstructed line-of-sight transmission paths for proper operation.

Such systems have been used increasingly over the last four decades to the point they now carry the vast majority of all domestic long distance traffic. In more recent times, microwave systems, operating in the higher frequency bands,[60] have been used for local, short-haul systems. In the major urban areas, frequency congestion in the lower bands has stimulated the development of radio systems operating at higher frequency bands. Radio systems working at higher frequencies have a more limited range than those at lower frequencies due to greater attenuation during rainfall and fog conditions.[61]

Private microwave systems have been quite popular with high volume users since the FCC's Above 890 Mc decision allocating certain frequencies for private use by non-common carriers.[62] Such systems carry voice traffic and transmit high-speed data at rates up to 45 Mbps or more. The FCC's decision to allow private licensees to lease excess capacity for profit could further increase microwave traffic quite substantially.[63]

60/ In this report we will refer to frequencies of 18 GHz and above as the higher frequency bands, and frequencies below 18 GHZ as the lower frequency bands.

61/ Thus, single-hop 18 and 23 GHz systems, which operate most efficiently in the 3-8 mile range (depending upon regional climate), can be very appropriate for local, short-haul applications.

62/ Allocation of Frequencies in Bands Above 890 Mc., note 18, supra.

63/ See Operational Fixed Microwave Service, note 26, supra.

Microwave radio system costs vary depending upon siting costs, transmission distance, and the frequencies at which a particular system operates. First costs generally consist of the radio equipment and antennae, and interconnection links and siting, if necessary. Typical short-haul systems would have an investment cost of between $500 and $800 per channel.[64] Additional maintenance and operating costs are relatively low. With the cost of electronics continuing to fall about 20 percent annually, some reduction in microwave system capital costs are likely in the near term, perhaps making them an even more popular alternative.

2. Fiber optic systems

Fiber optic systems are also highly attractive alternatives in situations involving large traffic volumes where necessary rights-of-way are available. Unlike microwave systems, fiber system capacity is not limited by FCC spectrum allocations and, if privately operated, would not require FCC authorization prior to construction.[65] Two types of optical fiber are currently in wide use, one requiring repeaters every 10 miles and one requiring repeaters every five miles.[66]

Generally, the cost of the fiber itself is trivial in comparison to its installation costs.[67] The magnitude of

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64/ Such systems, assuming no repeaters, backup facilities, or tower construction requirements, have from 24 to 48 voice grade equivalent channels.

65/ See In re Lightnet, 58 R.R. 2d 182 (1985).

66/ Ongoing research is aimed at increasing the transmission distance of repeaterless fiber systems.

67/ The cost of fiber may be as low as 10 cents per foot, while the installed cost of a cable with up to twelve fibers will be $7-8 per foot. Policy and Planning Division, California Public Utility Commission, Charting a Sustainable Regulatory Course In Telecommunications App. A at 42 (Oct. 1985) ("Cal. PUC Study").

Fiber termination equipment costs $10,000 per unit for a 96 voice channel system and $35,000 per unit for a 672 channel system. For a 96 voice channel capacity system, covering up to eight miles in transmission distance, assuming no back up facilities and no right-of-way costs, equipment costs per channel will be between $535 and $700.

installation and right-of-way costs can influence the viability of new systems. With new developments in electronics, the very high transmission capacities achievable over fiber systems could make them increasingly cost competitive for high volume traffic requirements.68/

3. Cable television systems

As an alternative serving arrangement, existing coaxial cable television systems have a decided advantage. Their right-of-way privileges and access to 46 percent of all households substantially diminish a potentially severe problem facing developers of other guided systems. To be used as two-way voice and data systems, however, current cable systems would generally require some network redesign and additional equipment.69/

At present, most cable television systems are equipped to distribute a large amount of video traffic to users by means of a tree-like network structure.70/ Modification of such systems for two-way communication would, at a minimum, require installation of two-way amplifiers, redesign of media for transmission in two directions, equipment to connect together subscribers wishing to communicate, and transmission

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68/ While fiber pairs today can carry 1344 simultaneous voice conversations using current multiplexer electronics, each pair capacity is expected to grow to more than 24,000 simultaneous conversations in the near future. See Hofacker and Jacobs, "The Wideband World of Fiber," Record, AT&T Bell Laboratories, March, 1986.

69/ Coaxial cable technology can be appropriate for both voice and data transmission. Telephone companies currently use this medium to move large traffic volumes among their central offices.

70/ Using a tree structure, a cable system typically transmits a large group of signals from the head end to a community of users over shared trunk cables. In contrast, telephone companies generally use a star-like topology in which each customer has a dedicated line to his serving central office. Thus, cable systems are designed to distribute a package of signals in a "one-to-many fashion", while telephone local loops are designed principally for "one-to-one" communications.

equipment at each subscriber location.[71] There could also be message security problems on modified systems due to the "one-to-many" transmission characteristics of current cable network designs. With two way repeaters, a 10 mile system with 96 voice grade equivalent channels will cost between $650 and $750 per channel.

4. Twisted wire pair-based systems

The great bulk of physical plant used by the exchange carriers for local loop distribution consists of twisted wire pairs. While most of this technology is used for analog voice band transmission, digital signals ranging from 56 Kbps to 1.5 Mbps can be carried up to two miles without special regeneration equipment. The cost per voice grade equivalent channel, which varies depending on distance from the serving switch and the number of channels, ranges from $140 to $555 per channel.

5. Cellular radio systems

Cellular radio systems are developing rapidly, particularly in major urban markets. FCC allocations allow two providers to exist in each market, generally one LEC and a second non-LEC supplier. As currently designed, cellular services may not be as appropriate for providing either non-mobile or nonswitched services as other alternatives.[72] Additionally, current service costs[73] may make cellular service undesirable as a substitute for local service except in areas where local service costs are particularly high,

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71/ Modems could be supplied in the $200-500 range per subscriber. More expensive equipment would be required for higher speed applications. Cal. PUC Study, App. A at 40.

72/ Cellular mobile radio systems employ elaborate switching equipment to maintain call connection when a caller is changing cells. If used in a fixed application, such equipment would be unnecessary. Cellular frequency loading depends upon fairly brief communications, which is not characteristic of private line usage. Long holding times by a significant number of users in an area could effectively block others from using the service and dramatically degrade service quality.

73/ The average price for a mobile telephone is $1350, while the average monthly cost for 250 minutes of use ranges from $93 to $158. See Cal. PUC Study, App. A at 10.

where frequencies are not congested, and where cellular signal propagation is favorable. Under proper conditions, cellular systems can be designed to support upwards of 100,000 subscribers in a particular service area.

Construction costs for cellular systems depend upon both geographic coverage area and the number of subscribers to be served. Current investment in equipment is approximately $500,000 per cell, with the greatest proportion of that cost attributable to the cellular switch. One study estimates that firms will incur plant investment costs of $2000-4000 per subscriber.74/

6. Digital termination systems

DTS are two-way microwave systems operating in the 10 GHz and 18 GHz frequency bands, designed to transmit over a wide range of data speeds (between 1.2 Kbps and 1.544 Mbps) at very low error rates. In point-to-point applications, DTS have a range of about 15 miles; the range is about one-half that distance for point-to-multipoint applications. Because frequency reuse is costly and is a common characteristic of DTS designs, it may render such systems less cost competitive for high volume continuous data transmission needs. Also, because such systems operate at high frequencies, DTS may have problems similar to those of other microwave systems (e.g., acquiring clear line-of-sight, weather interference). For even minimally configured systems, cost per voice channel equivalent is likely to be much higher than microwave systems.75/

7. Satellite systems

Satellite systems are comprised of two components: earth stations and transponders located on geosynchronous orbiting satellites. These systems, which operate in three

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74/ Id. App. A at 10. Since a cellular communications channel can be shared among a number of users, the plant costs per voice grade channel will typically be higher than the costs per subscriber.

75/ Bell Communications Research estimates that even for minimally configured systems, the costs per voice channel will exceed $7850. See Bell Communications Research, The Impact of Access Charges on Bypass in Universal Telephone Service, App. A, at 4 (Sept. 1984). One RHC suggests that the cost per voice equivalent channel would be in the $3,000 to $5,000 range.

frequency bands,[76] are most cost-effective for high traffic volume, long-haul applications. They are especially economical for transmission distances greater than 200 miles. A 96 channel system with leased transponders will cost approximately $2,000 per voice channel.[77] Because satellite facilities allow customers to bypass all public telecommunications networks, local and long distance alike, a growth in satellite traffic would likely result, among other things, in a loss of access traffic to RHCs.

8. Other transmission systems

Other transmission systems sometimes mentioned as viable alternatives include infrared systems and FM broadcast subcarriers. Infrared systems, which transmit optical signals over-the-air, have limited application; they are appropriate for short distance communications because of their susceptibility to weather conditions. FM subcarriers are one-way media potentially usable for paging applications, or one-way, low-speed data transmission rates up to 9.6 Kbps.

B. Some Characteristics of Alternative Activities

The activities of competitive service providers reveal a number of distinctive trends. The appearance of alternative suppliers is a relatively recent phenomenon, with most growth occurring during the last decade. Such services are to a large degree nonswitched. Data transmission speeds vary widely ranging from a low of 2.4 Kbps up to 45 Mbps, with many customers using higher speeds of 1.5 Mbps. Some customers are also using alternative services for video transmission.

Alternative systems are being used principally for interexchange access or for private line services. Switching

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76/ C-band stations transmit at 6 Ghz and receive at 4 Ghz frequencies. Newer Ku-band systems, such as those offered by Satellite Business Systems (recently purchased by MCI), operate in the 10.9-35 GHz frequencies. The Ka-band to date has been used principally for experimental purposes.

77/ A satellite transponder with 36 MHz will accommodate 1920 full duplex voice channels. The principal deterrents to satellite system use are echo and delay problems and the high cost of earth stations, although that cost continues to fall. Even the very small duplex earth stations presently cost between $5000-20,000.

functions, underlying intelligent buildings and shared tenant service ("STS") developments, are generally used to distribute or aggregate traffic at either end of these services. We describe current alternative activities in more detail below.

1. Private microwave systems

Private microwave systems are very diverse and continue to be the most widely developed serving alternatives.[78] Such systems are used extensively for voice and data transmission among geographically dispersed facilities of companies (e.g., office and plant facilities.) Seven frequency bands are dedicated to seven user classifications as shown in Table V-A. Systems operating in the 18 GHz and 23 GHz frequency bands are becoming increasingly popular for local communications.

Several RHCs have documented significant amounts of alternative activities.[79] For example, since 1983 the State of New York has been using a microwave system with a 240 voice grade channel capacity. Additionally in New York City alone, numerous firms including Citicorp, Chemical Bank, Manufacturers Hanover Corp., J.P. Morgan, New York Times, Chase Manhattan, and Morgan Guarantee Trust, have built microwave systems to link their geographically dispersed facilities. Further, in a recent semiannual report to the California Public Utility Commission ("Cal. PUC"), Pacific Bell reported six new instances of facilities bypass

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78/ The FCC's Common Carrier Bureau has estimated that, in the five years prior to 1984, private microwave circuit miles grew approximately 5 percent annually. With respect to specific frequency bands, the Bureau in 1984 identified approximately 400 one-way links at 23 GHz being used by common carrier and private entities for non-video transmission. Five hundred 18 GHz links were devoted to similar use. Over the entire private fixed service, the Bureau found 20,000 stations 1984, a 25 percent increase in 5 years. See CCB Bypass Study at 14.

79/ Based upon 1984 data, 143 private microwave licenses were authorized to operate in New York State. See Exhibit Referred to in the Rebuttal Testimony of A. Noel Doherty in NYPSC Case 28961 ("NYS PSC testimony"). A 1986 survey of private systems within the Ameritech region identified 380 users. In 1985, 488 users were identified within the US West region.

TABLE V - A

PERCENT OF PRIVATE RADIO LINKS PER BAND BY TYPE OF USER

Frequency MHz -	952-960	1850-1860	2130-2150 2180-2200	6526-6875	12,200- 12,700	17,700- 19,700	21,200- 23,600
Common Carrier	0	0	0	0	0	11.4%	0.7%
Petroleum	13.9%	30.4%	30.6%	19.2%	2.8%	28.1%	3.8%
Power Companies	17.3%	37.2%	22.8%	37.4%	3.3%	1.4%	2.0%
Railroads	7.5%	11.7%	7.7%	22.9%	4.4%	.0%	0.8%
Government 1/	36.1%	18.8%	29.4%	18.4%	25.6%	8.4%	9.7%
Business	7.4%	0.5%	5.7%	1.2%	47.1%	26.7%	69.1%
Other	17.8%	1.4%	3.8%	0.9%	16.8%	24.0%	13.9%

1/ Includes local government and government service such as fire/police, highway maintenance, etc. Courtesy, Office of Science and Technology (EMELF Computer data file).

Source: Common Carrier Bureau, Federal Communications Commission, Bypass of the Public Switched Network, App. 5, Table VIII (Dec. 1984).

involving microwave systems during the prior six months surveyed.[80]

2. Fiber systems

Our database reveals 33 users of local fiber systems. Citicorp uses a private network to link some of its Manhattan locations, while Corning Glass Works and Reader's Digest similarly link geographically dispersed facilities in Corning and Pleasantville, New York, respectively. M&T Bank of Buffalo is leasing excess capacity on its fiber network to the NFTA Transit Authority. Pacific Bell reported to the Cal. PUC four new cases of fiber use in the period from November 1985 to April 1986.

At least four alternative commercial fiber systems are being planned or developed in several metropolitan areas, including Chicago, Washington, D.C., and San Francisco. In addition, the New York Teleport already operates a fiber system connected to its satellite facilities. These systems provide or plan to provide primarily private line services or interexchange access.

The fiber system now being designed to compete with Illinois Bell's Novalink system in Chicago[81] will be about 16 miles long. The New York Teleport has constructed 150 miles of fiber cable, connecting various boroughs of New York City with Northern and Central New Jersey. In the Baltimore-Washington area, two systems are currently under development. One system already has 56 miles of fiber cable in place, while the other system is still in the planning phase. The San Francisco system will be a municipal network designed to connect 52 buildings in a 49 square mile area.[82] Investment costs of these systems range from $4.5 million to $30 million.

The developers of these systems are marketing 1.5 Mbps and 45 Mbps services, suggesting that they are targeting customers who have enough traffic to use efficiently either 24 or 672 voice grade equivalent channels. The New York

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80/ Pacific Bell, Competitive Impacts: A report on bypass, at 29 ("Pacific Bell Bypass Report"). These cases should be added to an earlier cumulative estimate of 1867 users.

81/ See note 106, supra.

82/ "Frisco Fiber: City Upgrades Net," Communications Week, Aug. 11, 1986, at 1.

system currently has about 25 customers, including 5 broadcasters transmitting both audio and video signals, 12 interexchange carriers, and 8 corporations with private networks. The developers of the aforementioned Chicago system are involved in discussions with four interexchange carriers. In the Baltimore-Washington area, contracts are being negotiated with interexchange carriers and the Federal government.

Based upon these activities, prospective customers for competitive fiber systems appear to be interexchange carriers, governments, and private corporations principally interested in interexchange access and private networks. In some cases, users may be interested in communicating with others on a common fiber network.[83/]

3. Cable television systems

As mentioned previously, while there are a very large number of cable television companies, with combined access to 46 percent of all U.S. households, only a small number of those systems are equipped to handle voice and data transmission. Our database identified more than 300 two-way cable systems in operation. A recent survey of cable developments identified 210 specialized two-way cable systems (known as institutional networks or I-nets) representing about 12,000 miles of plant.[84/] Approximately 120 of these I-nets use some portion of the cable systems' general subscriber networks, while the remaining 90 are separate systems. Further, a recent survey by New York Telephone identified 12 I-nets within that state.[85/] Pacific Bell has identified seven I-nets planned or already in place in California.[86/]

Our survey examined 30 locations with cable systems equipped to handle two-way data and voice transmission. These systems provide lower speeds of 9.6 Kbps up to high speed services of 1.5 Mbps and above. Users include

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83/ A petition by the New York Teleport to provide intracity, intertenant calling is pending before the New York Public Service Commission. See Telecommunications Reports, July 7, 1986, at 30.

84/ "Cable's back burner filling up with successful I-net projects," Cablevision, July 21, 1986, at 50.

85/ NYS PSC testimony, note 80, supra.

86/ Pacific Bell Bypass Report, at 18.

interexchange carriers, government offices, banks, brokerage houses, insurance companies, computer companies, schools, and automobile manufacturers.87/

In eight additional locations, the demand for I-nets has flattened or become severely curtailed. In other locations where there is demand, however, it is for private line data, voice or video transmission or for interexchange access. For the competitive service providers willing to provide us with data, we were able to identify 1985 aggregate gross revenues of almost $8 million. We were unable to estimate from this limited data the total revenue generated from all systems.88/ However, the ELRA Group, a California consulting firm, estimates that there has been a total investment of $250 million in I-net development thus far, which has produced total revenues of $20 million annually.89/

4. Cellular radio systems

There are approximately 129 cellular systems currently operating in 85 cities, representing a capital investment of over $911 million. During 1985, the growth of such systems was substantial, with the number of cell sites increasing from 346 to 913. Subscribership levels recently have been

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87/ Cable companies have installed dedicated private nets in many of these locations. One cable firm, for example, has constructed a private networks for IBM in Austin, Texas. Colony Communications constructed and currently operates private networks for IBM in upstate New York and for Wang Laboratories in Lowell, Massachusetts. See "Cable's back burner filling up with successful I-net projects," Cablevision, July 21, 1986, at 50. IBM's system spans 30 miles and links 25 buildings, while the Wang network is 50 miles long. IBM has also built its own two mile network in Rochester, Minnesota.

88/ Colony's operation of the Wang and IBM networks produced annual revenues of $1.2 million. See id.

89/ See id. at 51. ELRA notes that about 70 percent of all I-net use is attributable to local cable franchising authorities which typically take service at no charge. ELRA estimates that such local represents about $40 million in potential revenues annually. See id.

estimated to be 462,000 users, generating approximately $650 million in annual revenues.[90/]

As noted above, the FCC originally authorized two franchise holders in each market -- the local telephone company and a non-LEC supplier. In each of the major markets, the LECs have played a major role in developing cellular services. In recent months, however, RHCs have also been acquiring cellular franchises outside of their respective regional operating territories. In several areas, cellular services are thus offered by affiliates of two RHCs.

5. Digital termination systems

Through the end of the first quarter of 1986, despite thousands of license applications, the FCC had approved only 74 DTS licenses, of which two were awarded to affiliates of RHCs. We have examined activities in 60 of these locations. One-third of these systems had no customers; the remaining two-thirds (which were all in operation) provided a range of data speeds from 2.4 Kbps to 1.544 Mbps. Revenue figures were not available, but it appears that DTS has not yet fulfilled the promise envisaged by its proponents.

6. Teleports

While there are divergent estimates of the number of teleports in operation or under development, the numbers indicate substantial activity. One source reports 22 operating teleports and 20 more currently under construction.[91/] The American Teleport Association claims that 34 teleports are in various states of development in 27 cities.[92/] Many of the currently operational facilities are clustered in the eastern portion of the country (see Figure V-A). Several cities including Washington, Chicago, Houston, and Atlanta, have more than one teleport.

The most publicized teleport is the New York Teleport, a joint venture among Merrill Lynch, Western Union, and the Port Authorities of New York and New Jersey. This teleport, one of the most extensive to date, has approximately 25

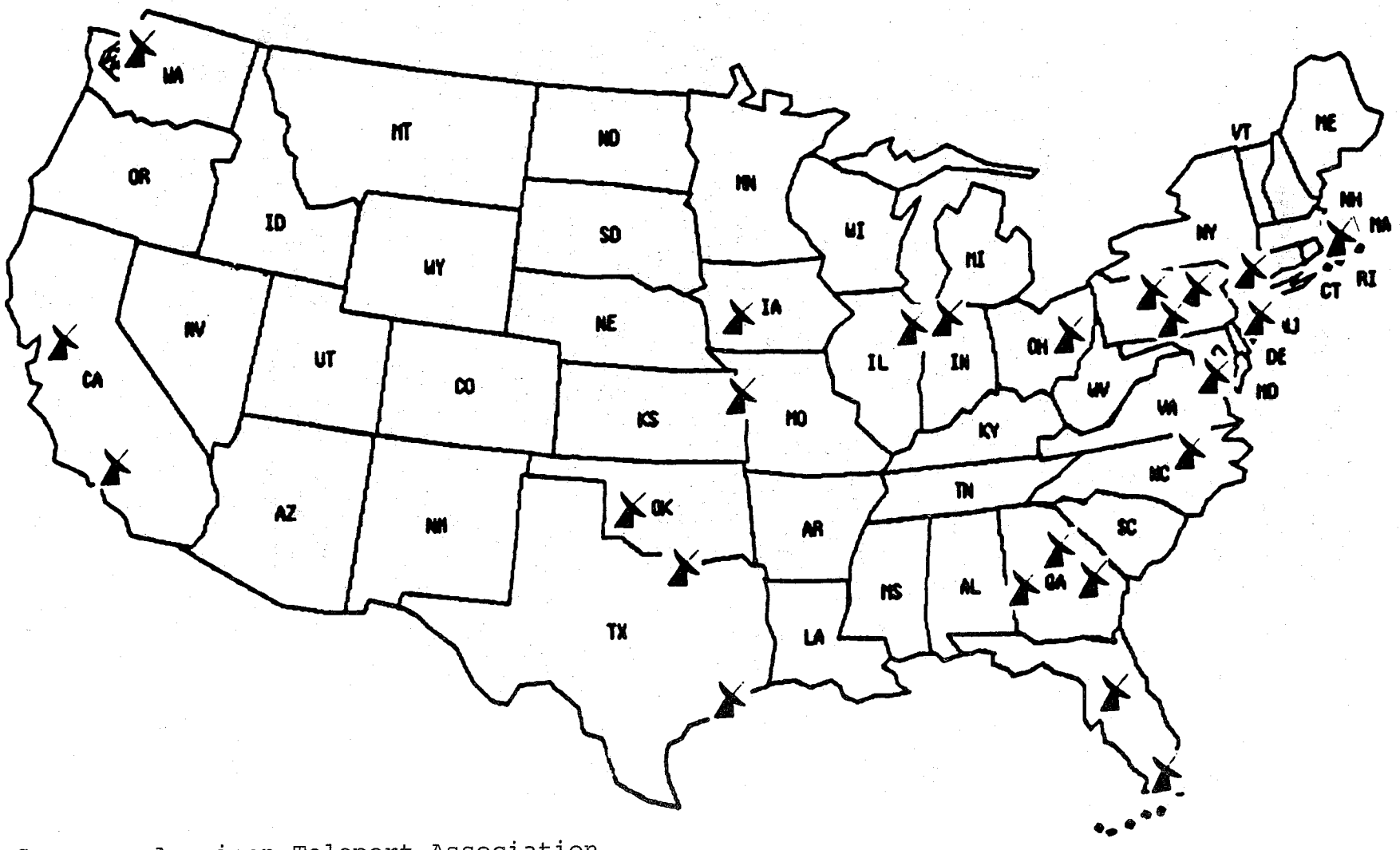
90/ See "Mobile Phone Rivals Are Being Consolidated," Wash. Post Business Magazine, Aug. 11, 1986, at 1.

91/ Communications Daily, July 16 1986, at 7.

92/ Twenty-four are considered operational, while 10 are in the planning stage.

FIGURE V - A

TELEPORTS IN THE UNITED STATES
Location of Operational Facilities



Source: American Teleport Association

customers in more than 40 buildings, including banks, financial firms, and interexchange carriers. In general, teleports are being designed to offer a mix of video, data and voice transmission capabilities. While teleports originally had been marketed as interexchange access facilities, associated distribution facilities are being used for private line and, perhaps, other local services. Developers claim that service rates are substantially lower than rates companies are currently paying for other arrangements, "as [little] as 65 percent of what companies are paying in private and long-distance lines today."93/

7. Satellite systems

Domestic satellite operations have grown rapidly since 1973. Since that time, many carriers and private individuals have entered the field. A recent estimate identified 350 transmit/receive earth stations operated by common carriers and 650 installed by others for video origination and distribution and voice and data transmission.94/ In terms of space segment transponder availability, a recent survey identified more than 400 C-band and approximately 106 Ku band transponders available in 1986.95/ Since the bandwidth of these transponders is quite large, satellite systems represent a very large transmission resource.

Satellite systems are being used in interesting applications. In New York, the Stock Exchange is distributing Big Board ticker tape quotations via satellite under agreement with Equatorial Communications. E.F. Hutton plans to link its 400 offices via a nationwide satellite network.

8. Shared tenant services ("STS")

The growth of STS has been rapid since its emergence during this decade. Further expansion, however, depends not only upon the developers' abilities to serve particular market niches, but also state and Federal regulatory developments. Our questionnaire identified 230 STS

93/ See "Carley Capital Group Buys Telecommunications Company," Wash. Post Business Magazine, Aug. 11, 1986, at 19.

94/ Electronic Industries Association, Telecommunications, Trends and Directions at 8 (1985).

95/ Communications Daily, Apr. 18, 1986, at 4-5.

developments. In a 1985 survey of the market, Telestrategies found 151 STS projects underway in 33 cities. Dallas had the largest number of STS with 22 projects. BellSouth Systems Technology, a subsidiary of the BellSouth RHC, has been a major developer, with STS in 17 buildings in 7 cities.[96] While data on subscribership levels were not generally available, monthly revenue of STS developers was estimated to range from $70 to $150 per telephone line served.

The STS market, however, has been undergoing a "shakeout",[97] and "developers and providers of services are reevaluating many of the rosy predictions . . . that accompanied the industry's birth."[98] STS operations may therefore be successful only in particular market niches. Buildings above some minimum size will probably remain attractive for STS development. But high volume users with sufficient traffic to justify their own switching and transmission services, as well as very low volume users, may not require STS services. Thus, the most desirable niche may be for medium volume users in larger buildings.

C. Implications of Alternative Activities

The impact of alternative activities on the RHCs is difficult to measure precisely for a variety of reasons. First, there is great difficulty in estimating the magnitude of alternative arrangements and the revenues associated with such operations. Second, it is difficult to assess objectively the impact on RHC revenues. For example, an RHC may argue that, as a monopoly provider of local exchange service, it is entitled to all subscriber revenue. That RHC may therefore consider any revenue generated by a competitor to be lost revenue, even though there has been no reduction in the RHC's existing revenue base. Competitors, of course, would not agree. Further, the revenue impact of competitive activities becomes even more difficult to evaluate when a competitor provides a service that is not available from an RHC. Competitors would not consider the revenue generated from this situation to be lost revenue for the RHC.

96/ That number is growing. BellSouth Systems Technology will provide a PBX for the World Trade Center in Boston for a multitenant telecommunications system. Telecommunications Reports, July 14, 1986, at 39.

97/ For example, ShareTech, an early joint venture by AT&T and United Technologies, has withdrawn from the field.

98/ "Shared Tenant-Services Field Undergoes an Early Shakeout," Wall St. J., Feb. 5, 1986, at 31, col.1.

We asked the RHCs for revenue loss figures resulting from competitive activities. We also requested data on the size and nature of the 30 largest competitive losses for each of the last 5 years. While the data provided by the RHCs was by no means complete, several trends were apparent. Most of the losses experienced by the RHCs were from Centrex services. It is plausible that customers decided to substitute PBX services for Centrex services. Of the more than 400 competitive losses reported over the five year survey period, 63 percent involved CPE, including PBX equipment. In aggregate, the RHCs reported losses of $180 million, about 60 percent of which were losses in Centrex revenues.[99/]

Two BOCs have recently provided their respective state regulatory commissions with specific examples of alternative activities in their operating areas. Pacific Bell found that 56 percent of their top 500 customers are currently bypassing or plan to bypass Pacific Bell's network.[100/] It also identified 29 customers with more than 100 equivalent bypass access lines and estimated the revenue loss to be approximately $86 million.[101/] For 1986 and 1987, Pacific Bell estimated revenues losses of $478 million and $637 million, respectively, 26 percent of which will be attributable to private systems.[102/] In a submission to the New York Public Service Commission, New York Telephone estimated competitive losses from its 400 largest customers in 1986 and 1987 would be $94.5 million and $140 million, respectively.

99/ Although these figures represent losses among the RHCs' largest customers, they may still significantly understate the RHCs' annual revenue losses. The figures detail only recorded losses in excess of $100,000 per account. In contrast, a recent summary of 1984 bypass loss projections cites estimates ranging from $4 billion to $10 billion. See GAO Report at 5 (citing estimated losses in LEC interstate access revenues generated by FCC and Bellcore by means of economic simulation models).

100/ See Pacific Bell Bypass Report at 27.

101/ See id. at 28. Of those 29 customers, 20 were utilizing private facilities.

102/ See id. at 1.

D. Impediments to the Growth of Alternative Activities

The data indicate that although vulnerable, the RHCs do not yet face a great deal of competition for many of their services and customers. Some market demand for new services is being met by new entrants, but, thus far, competitors have not fully exploited the vulnerability of the RHCs. The following discussion suggests reasons for this circumstance.

1. Regulatory barriers

Regulatory barriers to entry continue to exist at the state level for alternative service providers. In 1983, for example, the Nebraska Public Service Commission ("PSC") ordered Cox Cable to cease providing data services in Omaha until Cox received authorization from the PSC. Cable systems in other states have also suffered delays in offering similar services as a result of state commission proceedings considering whether the cable systems should be subject to state regulation. For example, another cable system provides interstate but not intrastate services for fear that the system would be subjected to state regulation. A third company decided not to offer telecommunications services over its cable systems because of restrictions and delays threatened by state regulation. Instead, the company intends to concentrate on providing private microwave systems and local area networks, which are less subject to state regulatory scrutiny.

State regulatory barriers may also have hampered the growth of STS. Some state commissions have prohibited STS as unlawful resale of local service. Other states require that STS operators use partitioned switches. In such cases, each STS customer must obtain a separate access line from the STS switch to the RHC central office, thus eliminating possible cost savings from shared local transmission facilities. The impact of this restriction is difficult to evaluate. While one STS operator has declined to provide service if required to use a partitioned switch, most STS providers use partitioned switches, even if not required to do so by their state commissions.[103/]

2. Economic and technical barriers

Technical and economic factors also constrain the growth of competitive services. Cable television systems, for

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103/ Some voluntarily partition their switches to provide greater security and flexibility for their customers.

example, are not typically equipped to provide switched services. Further, several cable firms have informed us that data services provided over cable television facilities cannot compete with telephone company facilities at transmission speeds below 19.2 kbps. This economic constraint limits the number of cable television systems serving the point-to-point data services market.

DTS is subject to similar constraints on development. Each operator is licensed to use a limited amount of spectrum in a particular geographic area. There is thus a ceiling on the amount of service that can be provided. DTS growth is also hampered by high subscriber equipment costs. Receiving equipment at the subscriber's location costs about $10,000 and is economical only for a large volume of traffic.104/

A potential problem faced by most competitive providers involves availability and cost of rights-of-way. Cable systems typically rent pole and conduit space from local telephone companies, which may be costly. Cable systems may be authorized to use some public rights-of-way as part of their franchise, however, which may mitigate some of their rights-of-way costs.

Fiber optic networks must acquire rights-of-way, which may be time consuming and costly. For example, one fiber network operator required four years to secure conduit space from the local telephone company at satisfactory rates. Another fiber network saw a dramatic increase in conduit fees after the city received public complaints about the rates it was charging the fiber network.

While microwave systems face less serious rights-of-way problems, operators of such systems must still obtain space for their transmission equipment (so-called "roof rights"). This may create problems in some cases. For example, one DTS operator pays about 40 percent of its revenues for roof rights in two major metropolitan areas. A second operator was denied access to a choice roof site in another large city.

3. Competitive response by the RHCs

Competitive responses by the RHCs may also affect the growth of competitive services. Not only might the RHCs attempt to reprice their existing services in response to competition, they might also develop new services relying

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104/ Equipment costs could fall with greater demand, but the current high equipment costs continue to dampen demand.

upon the same technologies used by competitors. For example, some RHCs are currently installing large amounts of fiber optic cable, enabling them to provide state of the art digital services.105/

By providing such new services, RHCs may dissuade customers from abandoning RHC networks for serving arrangements supplied by competitive vendors.106/ For instance, one cable operator constructed a dedicated system for a customer because the local RHC could not offer 1.5 Mbps data service. But once the RHC began to provide such service, the customer began obtaining 1.5 Mbps circuits from the RHC. Similarly, one DTS provided 1.5 Mbps circuits to a customer in New York City until New York Telephone began offering comparable facilities. Although the customer had been satisfied with the quality of the DTS service, it soon migrated to the New York Telephone offering.

4. Other barriers

Other restraints on competitive growth may be due to a lack of customer confidence or perceptions concerning the quality of alternative services. As noted earlier, few customers wholly abandon RHC networks, even if they obtain some services from competitive providers. A customer may be especially cautious if the cost/performance measures of the competitively-provided facilities are not perceived to exceed those achieved by RHC services.

The slow growth of competitive entry may also be due in part to simple inertia. One of the major restraints on the expansion of competitive services via cable television systems, for example, appears to be the attitudes of many

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105/ For example, Illinois Bell is expanding its high speed, high-capacity fiber optic service, Novalink, by 383 miles. By early 1987, virtually all Chicago customers will be able to have point-to-point digital transmission at speeds of up to 45 Mbps. Telecommunications Reports, July 14, 1986, at 19.

106/ In the last few years, RHCs have developed or introduced a variety of new digital service offerings and options that increase customer control of facilities. Several RHCs are planning to implement "flexnet" capabilities, which will allow customers to select a variety of data transmission services on demand. Further development of intelligent networks will make new service introduction even easier.

cable system managers. Many managers see their primary businesses as providing video entertainment services and are reluctant to incur the marketing, facilities, and personnel costs needed to furnish competitively viable non-video services.107/

5. Cost factors

Finally, cost is a major factor in market activity. Numerous studies of alternative systems show a wide range of investment costs. This is partially due to different assumptions regarding payback period, costs of capital for the prospective providers, and right-of-way costs. Whatever the basis of the projected investment per channel, it must be judged against a BOC average capital investment in local loop plant of $400-600 per channel.

VI. POSTSCRIPT

There are increasing opportunities for firms to offer services in competition with the RHCs. As noted above, technological changes have produced (and lowered the cost of) various transmission media and equipment that can be employed by users or alternative providers. Federal regulatory decisions have fostered competition by reducing legal barriers to entry and authorizing new service arrangements for local distribution of traffic. Finally, greater sophistication of many users and changing communications needs are generating new market niches for competitive suppliers.

Coincidentally, the concentration of RHC revenues, both geographically and within certain customer groups, makes the economics of entry more attractive in some cases.108/ Our analysis of RHC data indicates that concentration of revenues

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107/ For example, a cable engineer proposed constructing a backbone network along a high density traffic corridor in the eastern part of the country. Once constructed, the network would generate revenues comparable to the company's annual video service revenues. Company executives, however, did not approve the project.

108/ Although RHC revenues have probably been concentrated for years, the competitive implications of that concentration are greater now that regulatory, technological, and market developments are making competitive entry more feasible.

among customers is greatest for intraLATA private line service. Geographic concentration of revenues appears greatest for switched access service and, perhaps special access service as well. Each of those services can be replaced by nonswitched, point-to-point facilities, the very facilities which can most easily and most economically be provided by non-RHC suppliers.

Although concentration of revenues does not necessarily equate with vulnerability to competitive entry, it is significant for two reasons. First, concentration of revenues, whether geographically or across customer groups, facilitates competitive entry by increasing the chances that a new entrant can generate an entry-sustaining level of revenues with a smaller investment in plant and marketing costs. Second, concentration of revenues among nonswitched, point-to-point services means an alternative supplier can provide service without making large investments in switching facilities that would dramatically increase its costs.

Growth rates vary among competitive offerings. DTS, for example, has not developed as rapidly as was initially anticipated.[109/] Similarly, cable systems are not aggressively tapping the market for data or voice communications. On the other hand, construction of local fiber networks is increasing, although most firms appear to be in the start-up phase. Similarly, there seems to be a healthy market for private microwave systems and private networks.

Although we cannot predict the future growth of these and other competitive alternatives, we nevertheless believe that regulatory decisions at the state and Federal levels will have a major impact. For example, state regulatory proceedings have, in some cases, delayed cable television systems from providing competitive intrastate communications services.[110/] State regulatory barriers may have also impeded the growth of STS, either by prohibiting STS operations entirely or by imposing conditions (e.g., use of partitioned switches) that deny STS users the full economic efficiencies obtainable from shared switching capacity. However, given the trend among states to permit greater entry into intrastate telecommunications markets, legal barriers to entry may become a less serious obstacle to the growth of alternative suppliers.

109/ See Straus, "Whatever happened to DTS?" Data Communications, Mar. 1986, at 78.

110/ See Cox Cable Communications, 102 FCC 2d 110 (1985).

Even where competitive entry is legally permitted, it may not occur if new entrants face state regulation of their services. The FCC has pointed out, for example, that the threat of rate regulation may deter firms from offering new services.[111/] In fact, several cable systems appear to have turned down customer requests for intrastate transmission services for fear that provision of such services would be subject to state regulation. Relaxation or elimination of rate regulation for alternative suppliers should enable them to respond more quickly to market demand. In this regard, we again note the trend appears to be toward lesser state regulation of intrastate telecommunications services.

The growth of competitive alternatives may also be affected by changes in the ways Federal and state authorities regulate the RHCs. If depreciation schedules are too long, for example, the RHCs may be deterred from upgrading their networks sufficiently to provide high speed, high reliability data transmission services increasingly demanded by customers. As a result, those customers may satisfy their service needs by constructing private systems or by obtaining facilities from non-RHC suppliers, thus stimulating growth of alternative local services.

Changes in pricing policies may have a similar impact. As noted above, one of the principal reasons for the growth in alternatives to the RHCs' switched access services has been the inefficient recovery of NTS costs through switched access rates. As those rates are aligned more closely with economic costs, however, customers will have fewer incentives to replace switched access service with nonswitched facilities (either RHC-provided special access lines or non-RHC supplied circuits).[112/] Consequently, there may be fewer market opportunities for alternative providers.

If the RHCs are given greater flexibility to price services in accordance with economic costs, instances where service prices far exceed the cost of providing them should

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111/ See Amendment of Section 64.702 of the Commission's Rules and Regulations (Second Computer Inquiry), 77 FCC 2d 384, 426 (1980).

112/ Thus, two long distance carriers informed us recent reductions in switched access rates will make it more economical for them to replace many of their customers' special access facilities with switched access. See pp. 32-33, supra. Additionally, one cable television company told us that switched access rate reductions have made it more difficult for the company to compete with RHC switched access services.

diminish. As a result, customers could be less inclined to seek services from non-RHC suppliers. Cost-based pricing of RHC services may also tend to produce competitive entry only where the alternative supplier can provide service at a truly lower economic cost.

This interplay between regulatory decisions and the growth of competitive alternatives to RHC services presents an important challenge to Federal and state policymakers. If competitive entry is promoted, but the RHCs are not allowed to respond flexibly to the new entrants, services may not be provided in every instance by the most efficient provider. In such cases, increased competitive entry may waste resources. On the other hand, if the RHCs are allowed to respond, there may be a reduction in competitors where the RHCs are the most efficient providers. The character of tomorrow's telecommunications market will be influenced by the manner in which Federal and state regulators resolve this tension between competition and economic efficiency.

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NTIA gathered revenue and market data from the Bell Operating Companies ("BOCs"), their competitors, long distance telephone carriers and large communications user groups. From this database some useful conclusions are drawn about the characteristics and competitiveness of certain local exchange telephone service markets.

16. Key Words *(Alphabetical order, separated by semicolons)*

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