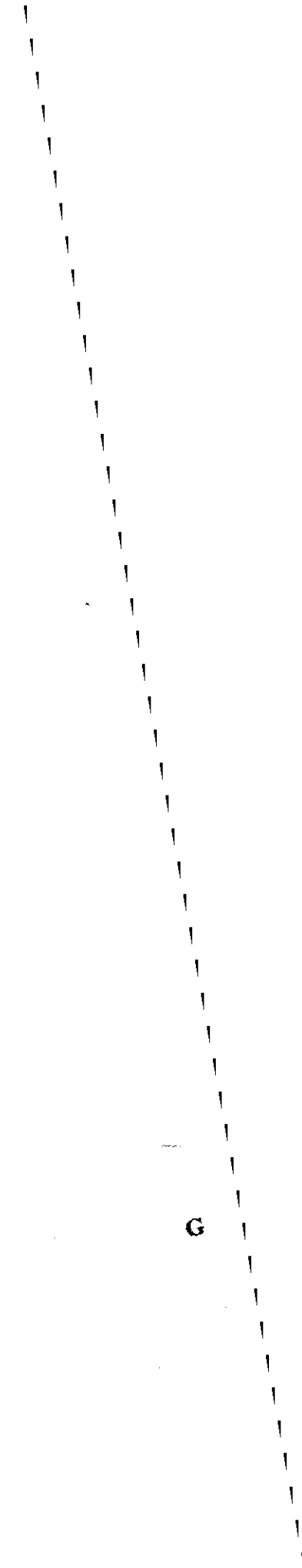
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The Impact of Cable Modem Service on the Public Right of Way

Prepared by:

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June 2002

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APPENDIX A Comments of Alliance of Local Organizations Against Preemption

I. Executive Summary

Cable modem service burdens the public rights of way (ROW) significantly more than does video-only cable service, because modem service requires a far more elaborate cable system than does video.[1]

This Report evaluates the different types of systems necessary to support video-only service, as opposed to cable modem service. The Report concludes that cable modem service necessitates construction that burdens the ROW more than does video-only service because of construction of (1) far more cable to existing and new plant areas; and (2) more and larger equipment and equipment containers, such as power supplies, cabinets, and vaults, with associated impact on aesthetics, noise, and public safety.

Cable companies did not undertake the last round of upgrades[2] in the late 1990s and early 2000s to offer video services. Indeed, most cable systems, as they existed in the early and mid-1990s, needed relatively little new cable construction to offer the analog and digital video-only services available today.

Rather, cable companies undertook the major upgrades of recent years to offer advanced services over cable modems. Recent upgrades have focused on expanding bandwidth and reliability to residential areas and on building virgin plant to business areas and buildings. These upgrades and new construction have had enormous impact on the public ROW:

- With respect to residential customers, they have entailed the construction of fiber optic cable and large equipment and facilities far "deeper" into the cable systems than was ever done, or necessary, for video-only services.

- With respect to business customers, new construction is often in areas where cable companies have never before built plant.

Both trends are likely to continue as cable operators further upgrade their plant to offer more sophisticated, advanced two-way services. In particular, new construction to commercial areas will likely increase dramatically in coming years as the cable industry attempts to grow beyond its traditional residence-only customer base. These upgrades placed, and continue to place, greater burdens on the public ROW. Similarly, future upgrades in the ROW will be for purposes of offering advanced services, not primarily to offer the video-only services that were adequately supported by most systems before the last round of upgrades.

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[1] This Report refers frequently to "video-only" or "video" cable services. These terms are meant to refer to both analog and digital cable services, including traditional broadcast, pay-per-view, and multiple-channel programming (such as sports events with choice of camera angle or audio).

[2] This Report uses the term "upgrade" to refer to the cable construction of the late 1990s and early 2000s, much of which is still ongoing. The same analysis applies to "overbuild" cable systems built by new competitors, as well as to "rebuilds" of existing systems.

II. Cable Modem Service Necessitates More Cable Construction in the ROW

One of the most intrusive aspects of a cable system upgrade is the construction of the cable in the public ROW. Modern cable construction involves placing fiber optic and coaxial cable on utility poles or underground. An upgrade of an existing cable system requires placement of new fiber optic cable and coaxial cable to replace old or damaged cable and to serve new areas and customers.

The objectives of the cable upgrades of the late 1990s and early 2000s were 1) to make the cable systems capable of two-way operation, 2) to increase system capacity for advanced two-way services, and 3) to increase system reliability for advanced two-way services. At the core of an effective rebuild is construction of fiber optic cable. Fiber optics provides a logical choice for an advanced two-way communications platform because of its nearly limitless capacity, ts reliability, and its lack of susceptibility to interference from outside signals.

Such construction is far more extensive and time-consuming than if the system were designed to offer video-only services. Rather, the construction requirements are primarily driven by the interest in rolling out advanced two-way services such as Voice over IP or other forms of telephony. This additional construction burdens the public ROW in the following ways, among others:

2.1 Rebuilding of Cable in Residential Areas

2.1.1 Segmentation Necessary for Advanced Two-Way Services

Constructing fiber optics is costly, so most communications companies limited their recent fiber deployment to a backbone and connectivity to individual neighborhoods, and tried to continue using their existing coaxial cable for the last mile to the home. This architecture is known as hybrid fiber-coax (HFC). Its great benefit is that the fiber from the headend to the neighborhoods segmented the system into discrete pieces. For example, a community of 60,000 residences could be broken into 60 "node service areas" of 1,000 residences.

With the system broken into node service areas, the cable operator is in a workable position to offer two-way services. Current interactive video services such as pay-per-view place only limited demands per subscriber on upstream capacity. Large node sizes could accommodate these functions. But advanced two-way services place significant and growing demands on upstream capacity. In order to provide the necessary bandwidth upstream, nodes must be placed ever closer to the subscriber to provide smaller node service areas and, as a result, more upstream capacity per subsriber. With respect to capacity, cable modem technology works in a similar manner to a shared party line or office local area network, where the users share the bandwidth.

The "noise" on a cable system leaking from residences and generated by system amplifiers is funneled from all parts of the system to the headend on the upstream channels, the portion of the cable system transmitting from the users to the network. The connection of 60,000 subscribers on a single segment would create so much noise on the system that it would be impossible to operate advanced two-way services, although this would not impact video-only service, which makes limited (in the case of interactive set-top converters) or no use of the upstream capacity. However, small segments would generally not create too much noise for advanced services. In our experience, some operators are building to nodes of 450 or less primarily to accommodate expected demand for cable modem services that potentially include Voice over IP. The upgrade of Adelphia systems in Los Angeles and the Greater Los Angeles area, for example, has resulted in nodes of approximately 150 homes.

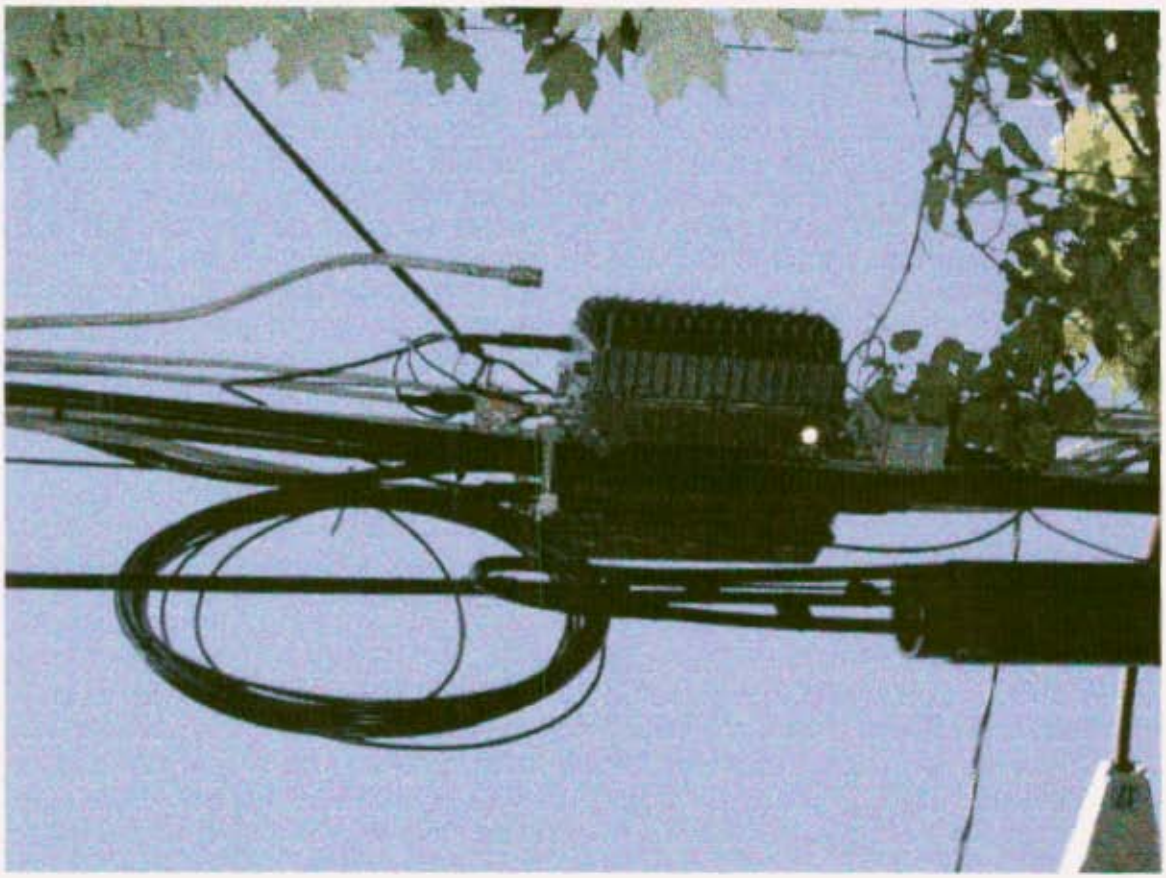
2.1.2 Aerial Construction

Construction of fiber to the neighborhood is accomplished in areas of aerial utility construction generally by hanging the fiber on existing cable plant, which is known as "overlashing." Overlashing increases the weight of the cable attachment and creates larger cable bundles on the poles. In addition, aerial fiber optic plant has large cylindrical splice enclosures (Photograph1) and spare fiber attached in snowshoes or hanging in loops[3] (Photograph 2).

Photograph 1

[3] A significant safety hazard is created by hanging spare fiber in loops.

Photograph 2



2.1.3 Underground Construction

In areas of underground construction, the cable company must create trenches in the ROW or use directional boring. Roads, sidewalks, and lawns must be disrupted. Additional hand holes, pedestals, vaults, and cabinets must be constructed to place the nodes, cable and store slack cable and fiber splice enclosures (Photograph 3).

Photograph 3

Mistakes in the course of construction can disrupt utility service, leading to costly interruptions of service, property damage, or, in the worst case, injury or death to workers or citizens. Construction can also result in road closures, traffic delay, and the resulting needs for local government personnel to address these issues.

Once the work is completed, the company must undertake restoration of the ROW. The construction may leave damaged roads, sidewalks, and lawns unless there are adequate restoration practices. Even if a road is properly patched, the affected area will likely be degraded from its pre-cut condition, will be more susceptible to potholes, and will have a reduced lifetime. In the worst case, construction can create significant hazards to public safety.

2.1.4 Additional Coaxial Construction

In addition to the fiber construction, there may need to be additional coaxial cable construction in circumstances where an old stretch of coaxial cable is damaged. Some

older systems require replacement of all coaxial cable to be upgraded for advanced two-way services.

As with new fiber, additional coaxial cable in aerial utility areas is generally overlashed to the existing cable bundle. Even where the old cable is being replaced, industry practices are to overlash new cable and leave the old cable on the pole, in order to reduce costs and minimize interruption of service. In underground areas, trenching and directional boring may be necessary and are just as disruptive to the ROW as they are for installation of fiber optic cable.

2.1.5 Amplification

Advanced two-way services such as cable modem service also need higher capacity, which limits the maximum distance a coaxial cable can run without amplification. As a result, the cable company may need to make design changes and install additional amplifiers, known as "respacing."

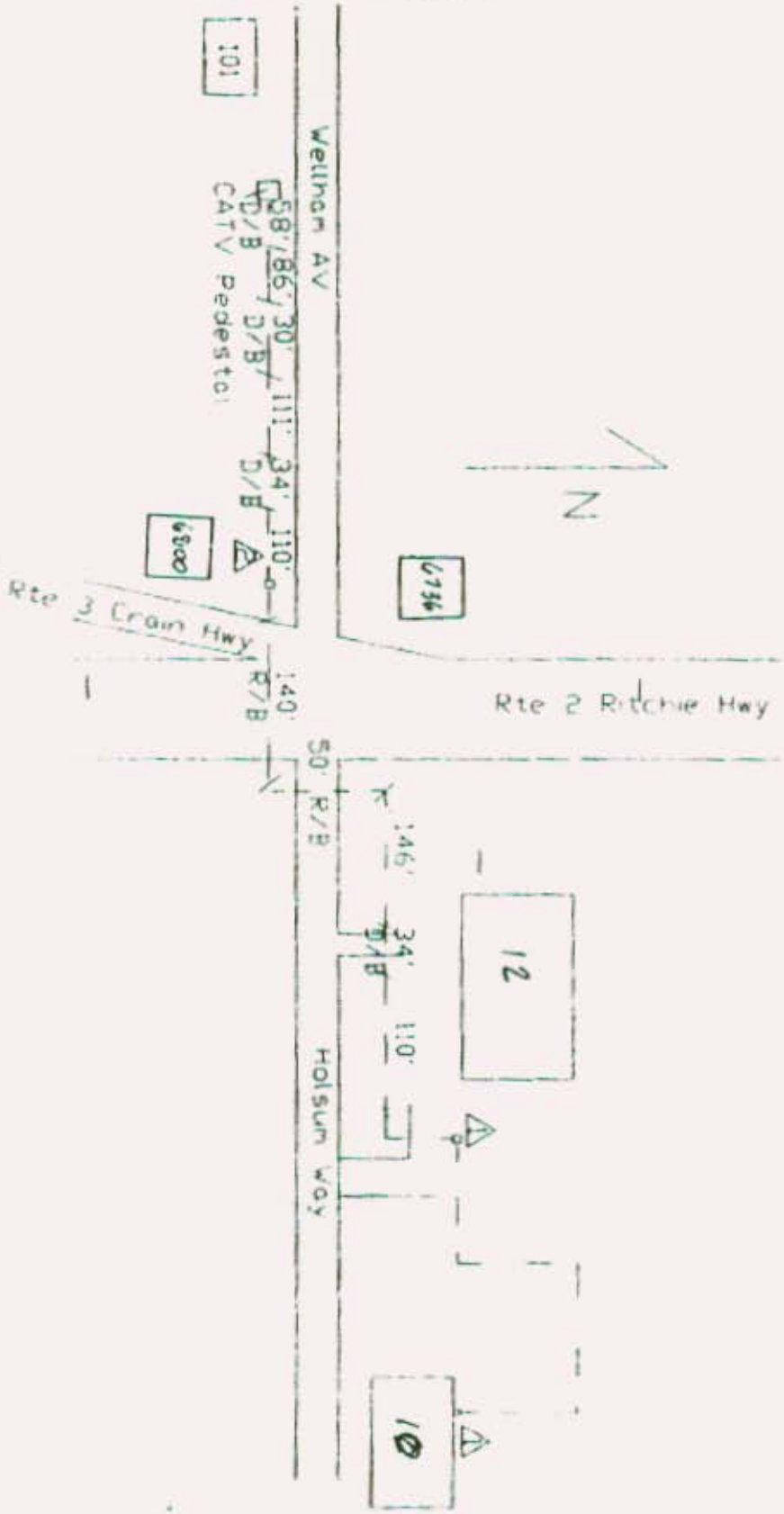
2.2 Virgin Construction to Business Areas

Where cable companies offer only video services, their systems generally serve primarily residential areas – on the assumption that most business customers are not willing to pay for a video-only service. In contrast, extensive fiber must be built out to business areas and buildings in order to offer cable modem services to businesses. This process entails burdening the public ROW in the same ways as discussed in Section 2.1.

For example, in Anne Arundel County, Maryland, Comcast is constructing cable in a number of commercial-only areas, presumably for advanced two-way services. This new construction is highly disruptive to the local community and burdensome to the ROW. In one example, the local government has noted the disruption caused by the ongoing construction across Maryland Routes 2 and 3, one of the busiest intersections in the state. Comcast's construction is intended to enable it to provide commercial services over a dedicated coaxial link to a business near that location. This construction might not take place absent Comcast's choice to provide cable modem services to a new group of customers—businesses located away from residential neighborhoods.

Figure 1 is the diagram of Comcast's construction that was filed by Comcast as part of its permit request to the Anne Arundel County Department of Public Works. The diagram details the construction Comcast anticipated undertaking in order to provide cable modem services to the business at that intersection.

Figure 1



101
Wellham AV
58' D/B
86' D/B
30' D/B
111'
34' D/B
110'
CATV Pedestal
6800
6736
N
Rte 3 Crain Hwy
140' R/B
Rte 2 Ritchie Hwy
50' R/B
146'
34' D/B
110'
12
Holsum Way
10

2.3 Construction of Redundant Routes

Cable companies are improving the reliability of their systems through redundant routing (construction of new, multiple paths of fiber to the neighborhood node facility), because cable modem services necessitate far greater reliability than video, and redundantly routed fiber can continue to operate in the event of damage. However, construction of redundantly routed fiber imposes the same impact on the public ROW as installation of fiber discussed in Section 2.1.

In addition, some redundant routes must be constructed in areas where cable plant does not yet exist. In those areas, aerial construction may require a new attachment to utility poles, which may disrupt the existing utilities or, where pole space is limited, require the attachment of unsightly attachment arms off the utility poles to maintain clearance from other utilities (Photograph 4). If underground construction is necessary, there will be trenching or directional boring, resulting in extensive impact on the ROW and requiring restoration, as discussed in Section 2.1.

Photograph 4

Cable companies will not be able to serve business customers if they provide unreliable Internet or telephony services. Similarly, cable companies will not be able to provide telephony services to residential customers unless they provide phone-company-level reliability. As a result, many cable systems offering telephone service have redundantly-routed their fiber optic cable.[4] Depending on the density of the area, redundantly routing

[4] Traditional phone service, for example, is generally considered 99.9 percent reliable, a level of reliability the cable industry has never tried to achieve technically for video-only services but that will be essential for telephony.

all fiber optics results in a 33 percent to 100 percent increase in the mileage of fiber optic plant. In addition, node equipment in the ROW must be equipped with dual sets of optical equipment, requiring use of additional modules within the node enclosure and additional power (Section 3.1). Within the hub, two sets of fibers may be dedicated to each node and two sets of fiber must be terminated for each node, doubling the space and resources for optics and fiber termination and increasing the size of the building or vault for the hub facility (Section 3.3).

In contrast, redundant routing is virtually nonexistent in video-only systems because cable video services have traditionally not required the levels of reliability consumers anticipate from telephone companies. Therefore, video-only systems require much less fiber optic cable and significantly fewer hub facilities than cable systems offering two-way advanced services such as cable modem service.

2.4 Replacement of Microwave Links

Fiber construction must replace microwave links between hubs, which were common on video-only cable systems, because microwave bandwidth is limited and cannot support high-speed two-way services and therefore cannot support cable modem services system-wide. This new construction increases the burden on the public ROW in all the ways detailed in Section 2.1.

III. Cable Modem Service Necessitates More and Larger Equipment in the ROW

Extensive equipment in the public ROW is necessary to provide advanced two-way services. Each level of advanced services requires additional equipment (as well as additional fiber and node segmentation.) The new, larger equipment most significantly creates the following burden on the public ROW:

3.1 Power Supplies

Power supplies must be constructed in the ROW to power the new services and increase the level of reliability in the event of commercial power operations. A power supply connects the cable system to the power utility and provides backup power in the event of a power outage. Since the mid-1980s, most video-only cable systems were designed for two-hours of stand-by power. In contrast, many cable companies are currently designing their systems for four hours of power to offer reliable data or advanced services. As more advanced services are offered, even larger power supplies are necessary.

Power supplies and additional batteries are usually located in cabinets on poles, in ground-level cabinets, or in underground vaults. In general, the longer the required backup time, the larger the size of the cabinet for the power supply, with sizes ranging from a large toaster oven to a large refrigerator; examples are discussed in Section 3.2.

Provision of advanced services also requires a significant increase in the number of power supplies. A typical rebuild of the late-1990s or early-2000s increases the number of power supplies by a factor of three in the public ROW.

An additional burden is created by the danger inherent in placing such large power supplies in the public ROW. Because they contain batteries and connect to the power service, power supplies require scrutiny from utility inspectors in order that they not provide a hazard to the public or utility workers.

Systems designed for video-only services require much less power than systems designed for two-way advanced services. The relatively small amount of fiber optics in a video-only system, without redundant optical components, requires a smaller number of power supplies. Video-only systems are not required to operate for long periods of time in the event of power failure, so fewer batteries are needed, and smaller power supplies are adequate.

3.2 Equipment Cabinets

In addition to those that house power supplies, cabinets of sufficient number and size are installed on poles and on the ground in order to hold equipment such as nodes, slack cable, splice enclosures, multiplexers, and other equipment necessary to provide cable

modem service. Taken together, design enhancements for two-way advanced services require equipment located in numerous new pedestals and cabinets, which proliferate as a cable system is upgraded. Moreover, based on our experience with the most advanced cable systems, the cabinets and pedestals will increase in number and size as more advanced two-way services are provided over the cable system.

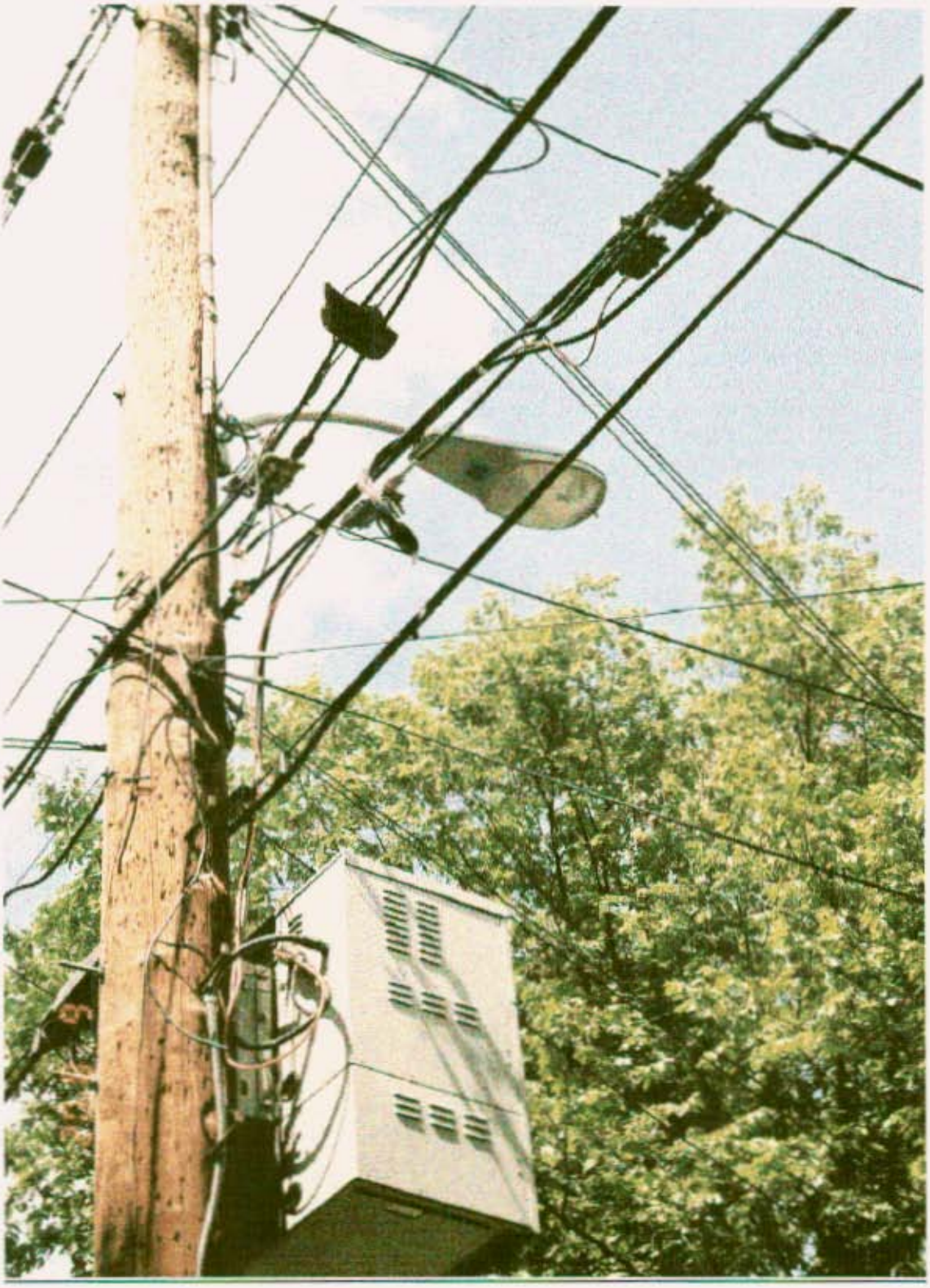
Cabinets installed in the late-1990s and early-2000s are significantly larger than those used in video-only systems, as illustrated by the cabinets currently deployed in the public ROW in the city of Takoma Park, Maryland. In this community, the incumbent operator, Comcast, has rebuilt to a standard hybrid fiber-coaxial system and deployed many new power supplies in the rebuild. Its cabinets (Photograph 5) are approximately the size of a microwave oven, and are adequate for provision of video and first-generation two-way services.

Photograph 5

In the same jurisdiction, Starpower Communications, has "overbuilt" Comcast with a more advanced system designed for even more advanced services such as circuit-based telephony. Starpower's cabinets (Photographs 6 and 7) are the size of a refrigerator and are two to three times more numerous than those of Comcast. Starpower's construction offers a preview of what the future holds for the public ROW when cable companies upgrade further to offer future generations of advanced services over the cable modem.

Photograph 6

Photograph 7



3.3 Prefabricated Buildings and Equipment Vaults

Hubs or optical transition node (OTN) facilities are constructed in rebuilt systems to serve areas of 10,000 to 30,000 customers and house cable modem routers, backbone fiber optic electronics, fiber termination panels, telephone multiplexer equipment, power supplies, and power generators. They are typically located in prefabricated buildings on private or public property or underground. They usually connect over redundantly routed fiber to a cable headend or network operations center. These hubs and OTNs are necessary to aggregate two-way traffic for customers into a reliable network backbone. In contrast, video-only systems usually have no need for hubs or OTNs and simply directly connected a headend to the cable plant without all the intermediate buildings necessary to provide advanced two-way services.

In some cases, cable modem upgrades have shifted much of the equipment burden from private property to the public ROW. In areas where real estate costs are high and zoning laws are strict, it may be more cost effective for a cable operator to locate its hubs in underground vaults in the public ROW than in prefabricated buildings. For example, in Skokie, Illinois, AT&T Broadband located much of its equipment in vaults installed in the public ROW rather than, as in the past, on private property in enclosed buildings. The result is the deployment of room-sized vaults under the ROW (Photograph 8) and all the attendant burden on the public land above and around the vaults.

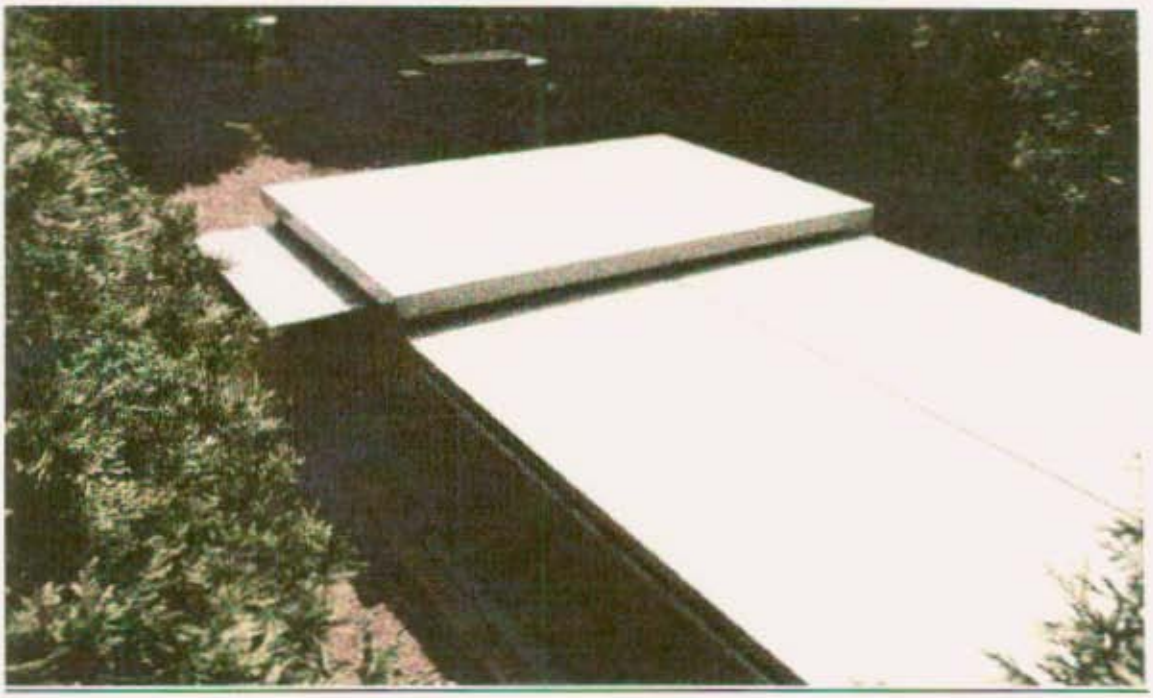
Photograph 8

The size and number of these vaults will continue to increase as cable companies offer more advanced services to greater numbers of customers. Skokie also has an overbuilt system[5] that represents one of the most technologically sophisticated systems in the country. The system was designed and engineered to enable the provision of many of the advanced services currently being considered by the entire cable industry, including commercial-quality voice and data services. Three underground vaults were constructed. Each vault is living-room size and necessitates independent power service, air conditioners, and generators (Photographs 9 and 10).[6] All of the vaults are located on public property – two in the public ROW and one on Village property.

[5] The system is currently owned and operated by RCN Communications. The system was constructed in the late 1990s by 21st Century Communications.

[6] The local government in Skokie received numerous citizen complaints about the noise made by one of the air conditioners, which was then replaced by RCN.

Photograph 9



Photograph 10

3.4 Power Passing Taps and Plates

The tap is the point of demarcation between the cable on the public ROW and the drop cable serving an individual subscriber. A tap is located on the cable on a utility pole or in a small pedestal on the curb. Power passing taps are constructed for each residence or business served, in order to enable the provision of power to support such advanced services as telephony. Most cable companies either put in new taps or replace the tap plate. This new construction exists solely for the provision of cable modem and advanced services and serves no purpose with respect to video-only services.

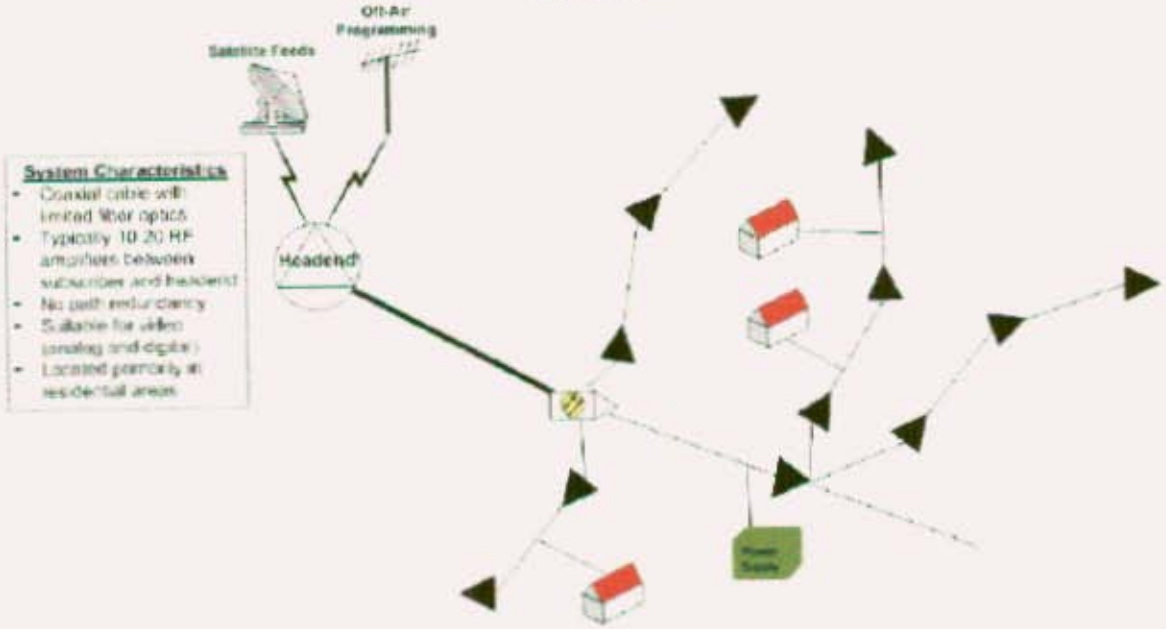
3.5 Electrical Protection Devices

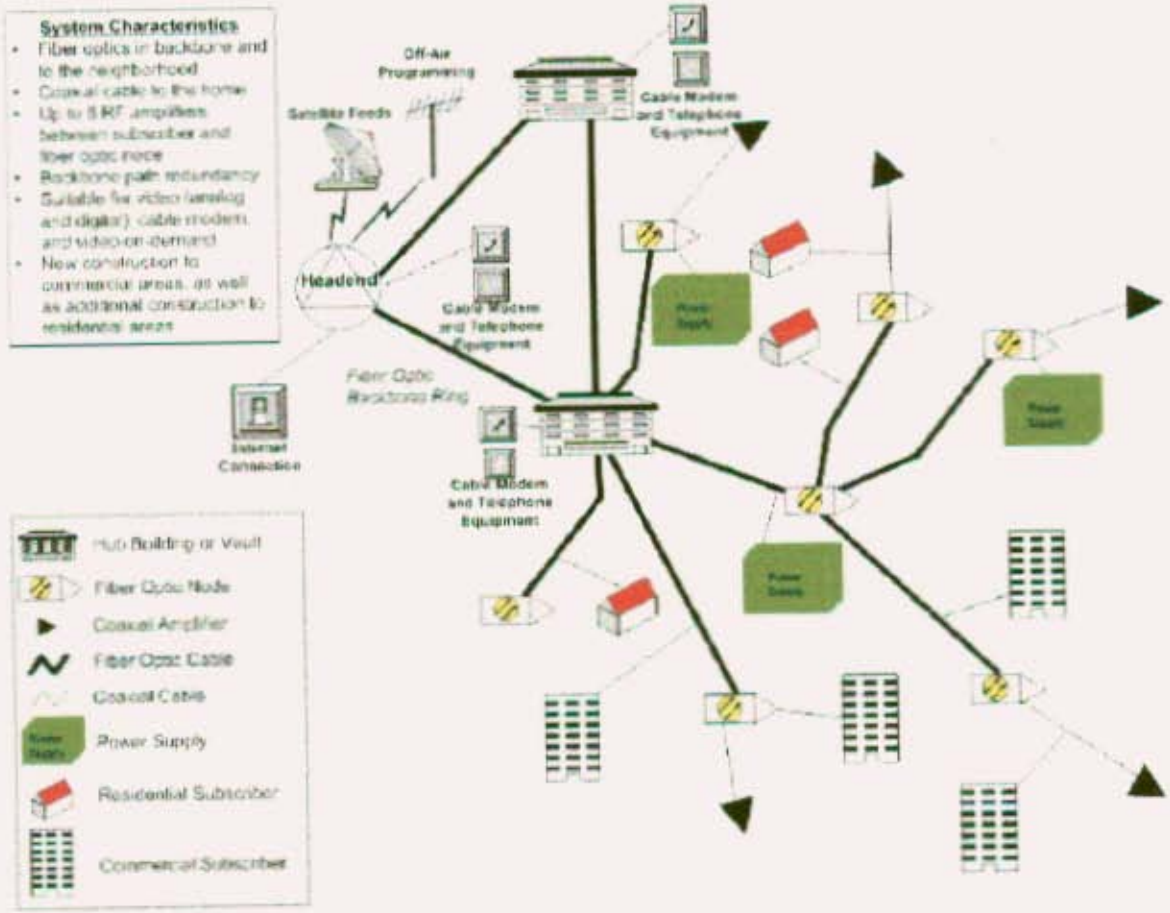
Electrical protection devices are added at the tap in the ROW, before each subscriber drop, to eliminate the possibility of electrical shock in the event the drop is cut, is disconnected, or malfunctions. As with power-passing taps, these devices are unnecessary for the provision of video-only services and were not contemplated by cable companies until they began to engineer their systems to enable advanced services such as telephony.

3.6 Fiber Receivers and Lasers

Additional fiber receivers and lasers may be constructed in every node in order to meet consumer expectations of reliability for data and voice services. Many systems have placed dual receivers and lasers in each node in order to support the redundant routing that is essential to offering some advanced services such as voice-over-IP. For example, some of the upgraded systems in the greater Los Angeles area were designed with this dual equipment, because the future provision of advanced services over cable modems was considered in engineering the upgraded systems. Similar increases in equipment will be necessary for other cable operators who wish to offer similar advanced systems.

Figure 2


Off-Air Programming
Satellite Feeds
System Characteristics
Coaxial cable with limited fiber optics
Typically 10-20 RF amplifiers between subscriber and headend
No path redundancy
Suitable for video (analog and digital)
Located primarily in residential areas
Headend
Power Supply


System Characteristics
Fiber optics in backbone and to the neighborhood
Coaxial cable to the home
Up to 5 RF amplifiers between subscriber and fiber optic node
Backbone path redundancy
Suitable for video (analog and digital), cable modem, and video-on-demand
New construction to commercial areas, as well as additional construction to residential areas
Off-Air Programming
Satellite Feeds
Headend
Cable Modem and Telephone Equipment
Fiber Optic Backbone Ring
Internet Connection
Power Supply
Hub Building or Vault
Fiber Optic Node
Coaxial Amplifier
Fiber Optic Cable
Coaxial Cable
Power Supply
Residential Subscriber
Commercial Subscriber

V. All These Trends Will Continue

As a result of all these needs, cable companies have deployed fiber optics deep into their systems and have done so in a way that will enable them to build out fiber even further in coming years, possibly even to individual homes ("fiber to the curb") and into the home itself ("fiber to the home"). All these developments result in increased impact, both now and in the future, on the ROW.

RCN's cutting-edge systems in Takoma Park and Skokie illustrate the future of cable systems in the ROW: a future of more and larger pedestals, cabinets, vaults, and power supplies. As fiber is extended from the neighborhood node to the immediate neighborhood (as in Skokie and Takoma Park), then to the curb, then to the home (or business), fiber optic cable will need to be lashed to aerial cable, or trenched, or bored beneath the ROW. Where the fiber travels and terminates, it will need to be stored and connected to electronics. The electronics, in turn, will need to be powered, and will require power supplies, batteries, and inspection.

It is our experience that such upgrades result in resident complaints about noise, appearance, and disruption, as well as in the need for local governments to increase electrical and other inspections to verify that public safety is not compromised. These trends will only continue and increase in response to the rapid advance of technology and the consumer demand for more advanced two-way services.

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APPENDIX A

COMMENTS OF ALLIANCE OF LOCAL ORGANIZATIONS AGAINST PREEMPTION ("ALOAP")

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
Inquiry Concerning High Speed Access to the Internet Over Cable and Other Facilities	)	GN Docket No. 00-185
Internet Over Cable Declaratory Ruling	)	
Appropriate Regulatory Treatment for Broadband Access to the Internet Over Cable Facilities	)	CS Docket No. 02-52

COMMENTS OF ALLIANCE OF LOCAL ORGANIZATIONS AGAINST PREEMPTION ("ALOAP")

DECLARATION OF ANDREW AFFLERBACH, Ph.D.

1. My name is Andrew Afflerbach. I am Principal Engineer for Columbia Telecommunications Corporation. I hold a Ph.D. and M.S. in astronomy from the University of Wisconsin and a B.S. in physics from Swarthmore College. I have served as an engineer in evaluating and overseeing cable company design and construction full-time for the past six years and part-time for the previous ten years. I specialize in oversight of cable system upgrades and in analysis of emerging technologies. I have published extensively in scholarly journals and trade association publications, including an extensive primer on cable technology that was published by the International County/City Management Association.

2. I am the author of the June 2002 Columbia Telecommunications Corporation Report titled "The Impact of Cable Modem Service on the Public Right of Way." Based on my knowledge and experience, the Report is accurate.

Verification

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief, and that this declaration was executed on June 12, 2002, in Columbia, Maryland.

Andrew Afflerbach

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
Inquiry Concerning High Speed Access to the Internet Over Cable and Other Facilities	)	GN Docket No. 00-185
Internet Over Cable Declaratory Ruling	)	
Appropriate Regulatory Treatment for Broadband Access to the Internet Over Cable Facilities	)	CS Docket No. 02-52

COMMENTS OF ALLIANCE OF LOCAL ORGANIZATIONS AGAINST PREEMPTION ("ALOAP")

DECLARATION OF DAVID L. RANDOLPH

1. My name is David L. Randolph. I hold a professional engineer (P.E.) license and a Masters of Science in Electrical Engineering. I have thirty-five years of experience in the cable industry, including operation, construction of new cable systems, rebuilds, and upgrades of over 200 cable systems using microwave, fiber optics, and active reverse. The cable systems I built or upgraded provide services including both analog and digital addressable technology, and high-speed two-way services. Most recently, I served as Regional Vice President for Engineering for Adelphia Cable for the West Coast and Southwest regions. In that capacity, I

oversaw the consolidation, upgrade, and rebuild of numerous cable systems for such services as digital TV, high-speed data, and voice over IP.

2. I contributed to the June 2002 Columbia Telecommunications Corporation Report titled "The Impact of Cable Modem Service on the Public Right of Way." Based on my knowledge and experience, the Report is accurate.

Verification

I declare under penalty of perjury that the foregoing is true and correct to the best of my knowledge and belief, and that this declaration was executed on June 12, 2002, in Columbia, Maryland.

David Randolph

David Randolph

H

MediaOne
Law & Public Policy Department
214 East Fourth Street
St. Paul, Minnesota 55101

Telephone: 651-228-3065
Facsimile: 651-228-3931

David G. Seykora
Director – Law & Public Policy

RECEIVED
MAR 31

MediaOne
This is Broadband. This is the way.

March 29, 1999

Ms. Holly M. Hansen
Cable Communications Officer
City of St. Paul
Suite 68, City Hall
15 West Kellogg Boulevard
St. Paul, MN 55102

Re: Subscriber Privacy Notice

Dear Holly:

I have again reviewed our Customer Privacy Notice and Section 206 of the St. Paul Cable Communications franchise. Section 206 states that the Company shall not collect, compile or retain subscriber data except as necessary for internal business purposes. The Customer Privacy Notice describes the type of subscriber data collected for internal business purposes. It goes on to describe how the Company carefully maintains the confidentiality of the data. The Notice further describes the potential for disclosure of subscriber list information unless the subscriber objects to being included on such a list, but also clearly states that "we do not presently sell our subscriber list or otherwise disclose it to commercial or charitable users . . . ." Finally, the Notice also describes how long the data is retained, and the subscriber's rights to inspect the data.

We believe the Notice complies with all applicable laws, as well as the franchise requirements. If you have any further questions on this matter, please feel free to call me at 651-228-3065.

Sincerely,

David G. Seykora
Director – Law & Public Policy

DGS/aps

MediaOne

CUSTOMER PRIVACY NOTICE

As a subscriber to cable television service, you are entitled under Section 631 of the Cable Communications Policy Act of 1984 (the "Cable Act") to know the limitations imposed upon cable operators in the collection and disclosure of personally identifiable subscriber information, the type of personally identifiable information collected, how subscriber information is used, under what conditions it is disclosed, the period during which it is maintained and the rights of subscribers concerning such information and its disclosure.

This law relates only to personally identifiable information. It also applies only to information that you furnished to us or certain information that is transmitted over our cable facilities. Some of our services permit you to direct communications outside of our system. This law does not apply to information in communications you have directed outside of our system, for example, over the facilities of on-line providers or over the Internet.

1. Collection & Use. To continue providing reliable and high quality service to you, we keep regular business records that contain the following types of personally identifiable information: your name, address, telephone numbers, social security number, credit information, driver's license number and subscriber correspondence. MediaOne reserves the right to verify credit worthiness prior to establishing an account. Our records include information on billing, payment, damage and security deposits, maintenance and repairs, how many television sets are in your home, the service options you have chosen, your PC configuration (for cable information services including Internet access), and the number (and location) of converters or other cable equipment installed in your home. We maintain records of research concerning subscriber satisfaction and viewing habits, which are obtained from subscriber interviews and questionnaires. (We also keep records showing the movies and events you have ordered on our pay-per-view channels.) Additionally, if you rent your home, we may have a record of whether landlord permission was required prior to installing our cable facilities as well as your landlord's name and address. For data and Internet access service, the cable system automatically collects information on subscriber use of the Service, including information on the choices that a subscriber makes along the range of services offered, when a subscriber visits a site, and how long he or she visits the site.

Without appropriate written or electronic consent from you, we cannot collect personal information over the cable systems unless it is necessary to provide cable or other service you have requested or to prevent unauthorized access to services or to subscriber data. We collect information contained in cable information and Internet access service transmissions directed to MediaOne because it is necessary to provide a service you have requested.

Our detailed business records are used (and personal information contained in them disclosed) generally to help ensure you are being properly billed for the services you receive, to send you pertinent information regarding your cable services, to improve the quality of the services we provide, and for all tax and accounting purposes. Specifically, the information in these records is used to sell, install, maintain, and disconnect services; to bill and collect service-related charges; to measure

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subscriber satisfaction and improve marketing and progra. .ecisions; to mail related materials; to ensure compliance with relevant law and contractual provisions; and to answer questions from subscribers. Information collected about cable information services including Internet access service is used to understand subscriber reactions to the gateways and services we offer and to evaluate the network. It helps us to customize the data and Internet services based on the interests of subscribers, and helps us to be more selective in the types of commercial communications we address to you. We take all reasonable precautions to prevent unauthorized access to this information.

2. Disclosure. MediaOne considers the information contained in the business records we keep to be confidential. Unless prior written or electronic consent is obtained, personal information which we maintain related to our subscribers may be disclosed to a third party only if: (1) it is necessary to render or conduct a legitimate business activity related to the cable and other services we provide; (2) such disclosure is required by court order and you are notified of such order; or (3) for mailing lists as described below. In the course of our cable and other services we may make your records available to employees, agents and contractors in order to install, market, provide and audit service on each occasion that access to the information is needed. We may also occasionally release our subscriber list to consumer and market research organizations, software vendors, and merchants or advertisers offering services to you over the data and Internet access service. Access for these purposes is routine, and does not occur with any specific frequency. Further, we make our subscriber records available each month or as needed to an independent billing house for billing purposes; to mailing services and programmers each month for program guide distribution; to programmers and outside auditors when required; to attorneys and accountants on a continuous basis to render service to the company; to potential purchasers in connection with a system sale which occurs only at the time such sale is completed; to franchising authorities to demonstrate compliance, whenever such concerns are raised; to collection services if required to collect past due bills at such time as bills are submitted for collection; to law enforcement when required to prevent network damage or the unauthorized reception of service; to the United States Postal Service, when required, in connection with mailing. The Cable Act also provides that a governmental entity may obtain disclosure of personally identifiable information by court order if it offers evidence that such records are material to a criminal case, and if you are given the opportunity to appear and contest the evidence.

3. Mailing lists. Although we do not presently sell our subscriber list or otherwise disclose it to commercial or charitable users, we may include your name and address on mailing lists and to disclose that information for other purposes unless you object to such disclosure. In no event do we disclose the extent of your viewing or use of a particular service or the nature of any transaction you make over the cable system, but we may disclose that you are among those who subscribe to a particular cable service or other service.

4. Retention. We maintain information about you for as long as we provide service to you, and for a longer time if necessary for our business purposes. When information is no longer necessary for our purposes, we will periodically destroy the information, unless there is a legitimate request or order to inspect the information still outstanding.

5. Subscriber Rights. You have the right to inspect the records we keep that contain information about you and to correct any error in our information. If you wish to inspect those records that pertain to you, please notify us in writing and an appointment will be arranged promptly during our regular business hours. The Cable Act allows you to enforce your rights in court if you believe they have been violated.