1 BOCs to be $102, and by independents to be $235, in 1995."[15] Mr. Raley
2 in his rebuttal testimony provides further explanation of SWBT switch
3 investment.

4 • Secondly, SWBT's investment in power equipment and buildings
5 necessary to support the switching system are substantially greater than
6 the "wirecenter" investment in the Hatfield Model.

7 • In addition to these factors, SWBT's switching annual cost factor and the
8 common cost fixed allocator are greater than the Hatfield values.

9 Each of these factors contribute to SWBT's higher end office switching costs.

15 Model Description, Hatfield Model, Version 2.2, Release 2, pages 24-25.

1 ANNUAL COST FACTORS

2 Q. IN DESCRIBING LOOP AND END OFFICE SWITCHING COSTS YOU
3 REFERRED TO DIFFERENCES IN SWBT AND HATFIELD MODEL ANNUAL
4 COST FACTORS. WHAT DO YOU MEAN BY ANNUAL COST FACTORS, AND
5 WHY ARE THEY DIFFERENT BETWEEN THE STUDIES?

6 A. Annual costs consist of *capital costs* and *operating expenses*. Capital costs
7 include *depreciation*, the *cost of money* and *income taxes* associated with plant
8 investment. In the SWBT cost studies, operating expenses include *plant*
9 *maintenance*, *administrative expenses*, and *taxes on property and gross*
10 *receipts*. The Hatfield Model defines *network and support expenses* as
11 operating expenses.[16]

12 The SWBT and Hatfield models compute capital costs and operating expenses
13 using different costing methodologies and, in some cases, different cost data.
14 These differences contribute to the differences in network element costs. In
15 order to compare annual capital costs and operating expenses between the
16 models, they were expressed as percentages of plant investment or annual cost
17 factors. Exhibits 15, 16 and 17 compare these factors for total annual costs,
18 capital costs and operating expenses.

19 Q. ARE THE DIFFERENCES SIGNIFICANT?

---

16 Common costs also are operating expenses; however, capital costs and operating expenses are being compared before the allocation of common costs in the SWBT cost studies or variable overhead in the Hatfield Model.

1 A. Yes. Exhibit 15 indicates SWBT's annual cost factors for circuit equipment and
2 switching are substantially greater than those in the Hatfield Model. It also
3 suggests SWBT's feeder distribution annual cost factor is greater than the
4 Hatfield Model, since the annual cost factors for all three cable accounts are
5 above the annual cost factor for feeder distribution in the Hatfield Model.
6 Q. WHAT CAUSES THE DIFFERENCES IN ANNUAL COST FACTORS?
7 A. As shown in Exhibit 16 the Hatfield Model capital cost factors are less than those
8 of SWBT. Exhibit 18 shows this is due to several factors, the primary ones being
9 the Hatfield Model uses longer service lives, does not reflect the negative net
10 salvage for cable and wire facilities, and has a slightly lower cost of money.
11 Q. ARE THE OPERATING EXPENSE FACTORS IN THE TWO MODELS VERY
12 DIFFERENT?
13 A. Exhibit 17 indicates the operating expense factors for switching and loop feeder
14 are significantly lower in the Hatfield Model than in SWBT's cost studies. Circuit
15 and loop distribution operating expense factors appear to be about the same.
16 Exhibit 19 provides the calculation of the operating expense factors.
17 Q. CAN THE DIFFERENCES IN CAPITAL COSTS AND OPERATING EXPENSE
18 FACTORS BETWEEN THE STUDIES BE RECONCILED?
19 A. Yes, although because of differences in the methodologies inherent in the
20 models, it would require some effort. Capital cost data such as service lives,

cost of money, etc. can be modified in the models.[17] Adjusting operating expenses can be done as well, although this would require more effort because of differences in the SWBT and Hatfield methodologies.

RECONCILING DIFFERENCES BETWEEN THE MODELS

Q. WHAT IS YOUR OVERALL CONCLUSION ABOUT THE REASONABLENESS OF THE DIFFERENCES BETWEEN COSTS ESTIMATED BY THE HATFIELD MODEL AND SWBT'S COSTS?

A. Differences in the results of the SWBT cost studies and the Hatfield Model are too great to be reasonable. My analysis and comparison show there are fundamental differences in the way the Hatfield Model represents SWBT's network of the future and the future network characteristics actually anticipated by SWBT. There also are significant differences in key cost data.

Q. WHAT CAN THE KANSAS COMMISSION DO TO RECONCILE THE DIFFERENCES IN LOOP AND END OFFICE SWITCHING COSTS AND THE NETWORK ELEMENT RATES PROPOSED BY SWBT AND AT&T?

A. My testimony point outs the key factors which make the Hatfield Model costs so much lower than SWBT's costs. (See Exhibit 4.) Other witnesses for Southwestern Bell offer rebuttal testimony which show that several aspects of the Hatfield Model, such as average distribution cable length, average

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17 The Hatfield Model input does not allow for net salvage values, so other input data would have to be adjusted accordingly.

1 distribution cable size, end office switching investment and others, are incorrect.
2 The values for these key cost drivers are the result of the inherent methodology
3 of the Hatfield Model. As a consequence, my recommendation is to not use the
4 Hatfield Model to determine network element costs and rates. Instead, the
5 SWBT cost studies can and should be used. If certain factors underlying the
6 SWBT costs are in dispute, these can be addressed individually and adjustments
7 made as necessary. I believe my work to identify the differences in the cost
8 studies is evidence that the SWBT models can be evaluated by the Commission
9 and AT&T.
10 Q. DOES THIS CONCLUDE YOUR TESTIMONY?
11 A. Yes.

CAPs Network Presence in SWBT's Serving Area by City

PLACE NAME	CAPs
ARKANSAS	
Alexander town	MCI
Cammack Village city	AT&T
Jacksonville city	MCI, SPRINT
Little Rock city	ACSI, AT&T, BROOKS, MCI, SPRINT
Maumelle city	SPRINT
Mulberry city	ACSI, AT&T, MCI, SPRINT
North Little Rock city	ACSI, AT&T, MCI, SPRINT
Sherwood city	MCI
Wrightsville city	AT&T, SPRINT
KANSAS	
Agra city	KINNET
Albert city	KINNET
Alexander city	KINNET
Alton city	KINNET
Andover city	KINNET
Arlington city	KINNET
Assaria city	KINNET
Athol city	KINNET
Axtell city	KINNET
Bazine city	KINNET
Beattie city	KINNET
Bennington city	KINNET
Beverly city	KINNET
Bluff City city	KINNET
Bonner Springs city	KINNET
Brookville city	KINNET
Bunker Hill city	KINNET
Burdett city	KINNET
Burlingame city	KINNET
Bushton city	KINNET
Caldwell city	KINNET
Carlton city	KINNET
Cassoday city	KINNET
Cedar Vale city	KINNET
Centralia city	KINNET
Chautauqua city	KINNET
Cherryvale city	KINNET
Cimarron city	KINNET
Coats city	KINNET
Colby city	KINNET
Copeland city	KINNET
Cunningham city	KINNET
Damar city	KINNET

CAPs Network Presence in SWBT's Serving Area by City

Dearing city	KINNET
Derby city	MULTIMEDIA
Dexter city	KINNET
Dodge City city	KINNET
Dorrance city	KINNET
Dresden city	KINNET
Dwight city	KINNET
Eastborough city	KINNET
Edmond city	KINNET
Edwardsville city	KINNET
El Dorado city	KINNET
Elgin city	KINNET
Emporia city	KINNET
Ensign city	KINNET
Eskridge city	KINNET
Everest city	KINNET
Galva city	KINNET
Garden City city	KINNET
Garfield city	KINNET
Geuda Springs city	KINNET
Gorham city	KINNET
Gove City city	KINNET
Grainfield city	KINNET
Grinnell city	KINNET
Gypsum city	KINNET
Hanston city	KINNET
Hardtner city	KINNET
Havana city	KINNET
Haviland city	KINNET
Hays city	KINNET
Haysville city	MULTIMEDIA
Hazelton city	KINNET
Hepler city	KINNET
Hesston city	KINNET
Holyrood city	KINNET
Hope city	KINNET
Hugoton city	KINNET
Hunnewell city	KINNET
Huron city	KINNET
Hutchinson city	KINNET
Ingalls city	KINNET
Iola city	KINNET
Iuka city	KINNET
Jennings city	KINNET
Jetmore city	KINNET
Kansas City city	KINNET
Kechi city	MULTIMEDIA

CAPs Network Presence in SWBT's Serving Area by City

Kensington city	KINNET
Kincaid city	KINNET
Kinsley city	KINNET
Kiowa city	KINNET
La Crosse city	KINNET
La Cygne city	KINNET
Latimer city	KINNET
Lawrence city	KINNET
Lecompton city	KINNET, MULITMEDIA
Lenexa city	KINNET
Lenora city	KINNET
Leona city	KINNET
Liberal city	KINNET
Liberty city	KINNET
Lincolnville city	KINNET
Logan city	KINNET
Lost Springs city	KINNET
Louisburg city	KINNET
Lucas city	KINNET
Medicine Lodge city	KINNET
Miltonvale city	KINNET
Montezuma city	KINNET
Morland city	KINNET
Moundridge city	KINNET
Muscotah city	KINNET
Nashville city	KINNET
Natoma city	KINNET
Ness City city	KINNET
Niotaze city	KINNET
Oaklawn-Sunview CDP	MULTIMEDIA
Osawatomie city	KINNET
Otis city	KINNET
Ottawa city	KINNET
Overland Park city	KINNET
Oxford city	KINNET
Palco city	KINNET
Paola city	KINNET
Park City city	MULTIMEDIA
Parsons city	KINNET
Partridge city	KINNET
Paxico city	KINNET
Phillipsburg city	KINNET
Plainville city	KINNET
Pratt city	KINNET
Protection city	KINNET
Quinter city	KINNET
Ransom city	KINNET

Rantoul city	KINNET
Rozel city	KINNET
Rush Center city	KINNET
Russell city	KINNET
Salina city	KINNET
Satanta city	KINNET
Selden city	KINNET
Severance city	KINNET
Sharon city	KINNET
Sharon Springs city	KINNET
Shawnee city	KINNET
Smith Center city	KINNET
South Haven city	KINNET
South Hutchinson city	KINNET
St. George city	KINNET
Stafford city	KINNET
Sublette city	KINNET
Sylvan Grove city	KINNET
Tescott city	KINNET
Timken city	KINNET
Tipton city	KINNET
Topeka city	KINNET
Turon city	KINNET
Ulysses city	KINNET
Utica city	KINNET
Vermillion city	KINNET
Victoria city	KINNET
Waldron city	KINNET
Wamego city	KINNET
Wellington city	KINNET
Wellsville city	KINNET
White City city	KINNET
Whiting city	KINNET
Wichita city	KINNET, MULTIMEDIA
Wilson city	KINNET
Winfield city	KINNET
Winona city	KINNET
Woodbine city	KINNET
Zurich city	KINNET
MISSOURI	
Affton CDP	DIGITAL TELEPORT
Battlefield town	TCI
Bel-Ridge village	DIGITAL TELEPORT
Bellefontaine Neighbors cit	DIGITAL TELEPORT
Belton city	AMERICAN CABLEVI
Berkeley city	AT&T, DIGITAL TELEPORT, INTERMEDIA, MFS

CAPs Network Presence in SWBT's Serving Area by City

Breckenridge Hills village	INTERMEDIA
Brentwood city	DIGITAL TELEPORT, MFS
Bridgeton city	AT&T, DIGITAL TELEPORT, INTERMEDIA, MFS
Brookline village	TCI
Champ village	AT&T, DIGITAL TELEPORT
Charlack city	DIGITAL TELEPORT
Chesterfield city	DIGITAL TELEPORT, INTERMEDIA, MFS, TCG
Clayton city	DIGITAL TELEPORT, INTERMEDIA, MFS, TCG
Concord CDP	DIGITAL TELEPORT
Cool Valley city	DIGITAL TELEPORT, MFS
Country Club Hills city	AT&T
Crestwood city	DIGITAL TELEPORT
Creve Coeur city	DIGITAL TELEPORT, INTERMEDIA, MFS, TCG
Dardenne Prairie town	DIGITAL TELEPORT
Dellwood city	AT&T
Des Peres city	DIGITAL TELEPORT
Edmundson village	DIGITAL TELEPORT
Eureka city	DIGITAL TELEPORT
Fenton city	AT&T, DIGITAL TELEPORT
Ferguson city	AT&T, DIGITAL TELEPORT, INTERMEDIA
Flordell Hills city	AT&T, INTERMEDIA
Florissant city	AT&T, DIGITAL TELEPORT
Foristell city	DIGITAL TELEPORT
Frontenac city	DIGITAL TELEPORT
Gladstone city	AMERICAN CABLEVI
Glasgow Village CDP	DIGITAL TELEPORT
Grandview city	AMERICAN CABLEVI
Hanley Hills village	MFS
Hazelwood city	AT&T, DIGITAL TELEPORT, INTERMEDIA, MFS
Independence city	AMERICAN CABLEVI
Jennings city	AT&T, DIGITAL TELEPORT, INTERMEDIA
Kansas City city	AMERICAN CABLEVI
Kinloch city	MFS
Kirkwood city	DIGITAL TELEPORT
Ladue city	DIGITAL TELEPORT, INTERMEDIA, MFS, TCG
Lake St. Louis city	DIGITAL TELEPORT
Lee's Summit city	AMERICAN CABLEVI
Lemay CDP	DIGITAL TELEPORT, WORLDCOM
Liberty city	AMERICAN CABLEVI
Manchester city	AT&T
Maryland Heights city	AT&T, DIGITAL TELEPORT, INTERMDIA, MFS, TCG
Mehlville CDP	DIGITAL TELEPORT, WORLDCOM
Normandy city	DIGITAL TELEPORT, MFS
North Kansas City city	AMERICAN CABLEVI
Northwoods city	DIGITAL TELEPORT
Norwood Court town	DIGITAL TELEPORT
O'Fallon city	DIGITAL TELEPORT

Oakland city	DIGITAL TELEPORT
Oaks village	AMERICAN CABLEVI
Oakview village	AMERICAN CABLEVI
Oakville CDP	WORLDCOM
Oakwood Park village	AMERICAN CABLEVI
Oakwood village	AMERICAN CABLEVI
Olivette city	DIGITAL TELEPORT, INTERMEDIA, MFS, TCG
Overland city	DIGITAL TELEPORT, INTERMEDIA, MFS, TCG
Pagedale city	MFS
Parkville city	AMERICAN CABLEVI
Peerless Park village	AT&T, DIGITAL TELEPORT
Pine Lawn city	DIGITAL TELEPORT, INTERMEDIA
Platte Woods city	AMERICAN CABLEVI
Pleasant Valley city	AMERICAN CABLEVI
Raytown city	AMERICAN CABLEVI
Richmond Heights city	DIGITAL TELEPORT, MFS, TCG
Sappington CDP	DIGITAL TELEPORT
Shrewsbury city	DIGITAL TELEPORT
Smithville city	AMERICAN CABLEVI
Spanish Lake CDP	DIGITAL TELEPORT
Springfield city	TCI
St. Ann city	DIGITAL TELEPORT, MFS
St. Charles city	DIGITAL TELEPORT
St. George city	DIGITAL TELEPORT
St. John city	DIGITAL TELEPORT
St. Louis city	AT&T, DIGITAL TELEPORT, INTERMEDIA, MCI, MFS, TCG, WORLDCO
St. Peters city	DIGITAL TELEPORT
Sunset Hills city	DIGITAL TELEPORT
Sycamore Hills village	DIGITAL TELEPORT
Town and Country city	AT&T, DIGITAL TELEPORT
Twin Oaks village	AT&T
University City city	DIGITAL TELEPORT, INTERMEDIA, MFS, TCG
Valley Park city	AT&T
Vinita Park city	MFS
Vinita Terrace village	MFS
Webster Groves city	DIGITAL TELEPORT
Weldon Spring town	DIGITAL TELEPORT
Wellston city	MFS
Wentzville city	DIGITAL TELEPORT
Westwood village	INTERMEDIA
Woodson Terrace city	DIGITAL TELEPORT, MFS
OKLAHOMA	
Alex	CHICKASHA IN
Ardmore	CHICKASHA IN
Bixby	SPRINT
Blanchard	CHICKASHA IN

CAPs Network Presence in SWBT's Serving Area by City

Broken Arrow	BROOKS
Catoosa	AT&T, BROOKS, WILTEL
Davis	CHICKASHA IN
Del City	AT&T, CHICASHA IN, DOBSON, SPRINT, WILTEL/MCI
Duncan	CHICKASHA IN
Gene Autry	CHICKASHA IN
Goldsby	CHICKASHA IN
Jenks	SPRINT
Lawton	CHICKASHA IN
Marlow	CHICKASHA IN
Midwest City	AT&T, DOBSON, SPRINT, WILTEL/MCI
Moore	CHICKASHA IN
New Tulsa	BROOKS
Newcastle	CHICKASHA IN
Nichols Hills	Brooks Fiber, OKC
Nicoma Park	AT&T, DOBSON, WILTEL/MCI
Noble	CHICKASHA IN
Norman	CHICKASHA IN
Oakhurst	AT&T, BROOKS, SPRINT, WILTEL
Oklahoma City	AT&T, Brooks Fiber, OKC, CHICKASHA IN, DOBSON, SPRINT, WILTEL/
Owasso	BROOKS
Paoli	CHICKASHA IN
Pauls Valley	CHICKASHA IN
Purcell	CHICKASHA IN
Putnam town	AT&T, BROOKS, CHICKASHA IN, SPRINT, WILTEL
Sapulpa	AT&T, BROOKS, SPRINT, WILTEL
Spencer	AT&T, SPRINT, WILTEL/MCI
Springer	CHICKASHA IN
Stratford	CHICKASHA IN
Sulphur	CHICKASHA IN
Tulsa	AT&T, BROOKS, SPRINT, WILTEL
Turley	BROOKS
Velma	CHICKASHA IN
Warr Acres	Brooks Fiber, OKC
Wayne	CHICKASHA IN
Wynnewood	CHICKASHA IN
Yukon	SPRINT
TEXAS	

CAPs Network Presence in SWBT's Serving Area by City

Abilene city	ACTION TELECOM, AT&T, IXC, SPRINT, ACSI, XIT TELECOM
Addison city	MCI, MFS, TCG
Alamo Heights city	TIME WARNER
Aldine CDP	E.TEXAS, HL&P, MFS, PHONOSCOPE, TCG, TIME WARNER
Anderson Mill CDP	TIME WARNER
Arlington city	MCI, METRO ACCESS
Austin city	MCI, METRO ACCESS, TIME WARNER
Balcones Heights city	TIME WARNER
Barrett CDP	AT&T
Bellaire city	AT&T, HL&P, MFS, PHONOSCOPE, TIME WARNER
Bellmead city	TIME WARNER
Belton city	TIME WARNER
Beverly Hills city	TIME WARNER
Bronte town	AT&T
Bruceville-Eddy city	AT&T, ENMR, IXC, MCI, NTS, POKA LAMBRO, SPRINT, TIME WARNER
Brushy Creek CDP	TIME WARNER
Bunker Hill Village city	PHONOSCOPE, TCG, TIME WARNER
Carrollton city	MFS, TCG
Castle Hills city	TIME WARNER
Cedar Park city	TIME WARNER
China Grove town	TIME WARNER
Converse city	TIME WARNER
Coppell city	TCG
Corpus Christi city	ACSI
Dallas city	AT&T, MCI, METRO ACCESS, MFS, TCG
Dalworthington Gardens city	METRO ACCESS
Deer Park city	HL&P
El Paso city	ACSI, TIME WARNER
Euless city	TCG
Farmers Branch city	MCI, MFS, TCG
Forest Hill city	METRO ACCESS
Fort Bliss CDP	TIME WARNER
Fort Worth city	ACSI, MCI, METRO ACCESS, TCG
Freeport city	AT&T, E. TEXAS, ELECTRA, HL&P, MFS, PHONOSCOPE, SPRINT, TCG, TIME WARNER
Grand Prairie city	MCI, METRO ACCESS
Grapevine city	TCG
Haltom City city	METRO ACCESS
Hedwig Village city	PHONOSCOPE, TIME WARNER
Hewitt city	TIME WARNER
Highland Park town	MFS
Hill Country Village city	TIME WARNER
Hilshire Village city	PHONOSCOPE
Hollywood Park town	TIME WARNER
Houston city	AT&T, E. TEXAS, ELECTRA, HL&P, HOUSTON TEL CO, MCI,

CAPs Network Presence in SWBT's Serving Area by City

Houston city (continued)	MFS, PHONOSCOPE, SPRINT, TCG, TIME WARNER
Hunters Creek Village city	PHONOSCOPE, TIME WARNER
Hurst city	TCG
Irving city	MCI, METRO ACCESS, TCG
Jersey Village city	HL&P, MFS, SPRINT, TIME WARNER
Jollyville CDP	TIME WARNER
Katy city	ELECTRA
Kennedale city	METRO ACCESS
Kirby city	TIME WARNER
La Porte city	HL&P
Lacy-Lakeview city	TIME WARNER
Laredo city	TIME WARNER
League City city	HL&P
Leon Valley city	TIME WARNER
Live Oak city	TIME WARNER
Los Fresnos city	TIME WARNER
Lubbock city	ENMR, NTS, W.TX MICROWAVE
McGregor city	TIME WARNER
Meadows city	HL&P
Mesquite city	MCI
Midland city	AT&T, IXC, POKA LAMBRO, SPRINT
Mission Bend CDP	AT&T, TIME WARNER
Missouri City city	TIME WARNER
Morgan's Point city	HL&P
Northcrest town	TIME WARNER
Odessa city	IXC, SPRINT
Olmos Park city	TIME WARNER
Pasadena city	HL&P
Piney Point Village city	PHONOSCOPE
Plano city	AT&T, MCI, MFS, TCG
Potosi CDP	AT&T
Richardson city	AT&T, MCI, MFS, TCG
Richland Hills city	METRO ACCESS, TCG
Roanoke city	TCG
Robert Lee city	AT&T
Robinson city	TIME WARNER
Rollingwood city	TIME WARNER
Round Rock city	MCI, TIME WARNER
San Antonio city	METRO ACCESS, TIME WARNER
San Leanna village	TIME WARNER
Shavano Park city	TIME WARNER
Sheldon CDP	AT&T
South Houston city	HL&P
Southlake city	TCG
Southside Place city	TIME WARNER

CAPs Network Presence in SWBT's Serving Area by City

Spring CDP	TIME WARNER
Spring Valley city	ELECTRA, PHONOSCOPE, TIME WARNER
Stafford town	HL&P, TIME WARNER
Sterling City city	AT&T
Sunset Valley city	TIME WARNER
Tanglewood Forest CDP	TIME WARNER
Temple city	TIME WARNER
Terrell Hills city	TIME WARNER
Timberwood Park CDP	TIME WARNER
Tomball city	HL&P
Trophy Club town	TCG
Tye town	IXC, SPRINT
Universal City city	TIME WARNER
University Park city	MFS, TCG
Waco city	TIME WARNER
Waller city	SPRINT
Webster city	HL&P
West Lake Hills city	TIME WARNER
West University Place city	TIME WARNER
Westlake town	TCG
Windcrest city	TIME WARNER
Woodway city	TIME WARNER

Engineering Evaluation of Cost Proxy Models for Determining Universal Service Support: Hatfield Model 2.2, Release 2

Price Technical Services, Inc. and

Austin Communications Education Services, Inc.

Principal Investigator:

Robert F. Austin, Ph.D.

February 5, 1997

Executive Summary

The United States Telephone Association retained Price Technical Services to provide an engineering evaluation of cost proxy models submitted in the Federal Communication Commission's Universal Service proceeding, CC Docket 96-45. This report contains our engineering evaluation of the Hatfield Model Version 2.2, Release 2, sponsored by AT&T and MCI.

In view of its importance to the Hatfield Model, we begin our critique with an evaluation of the concept of structure sharing. We then review four aspects of the model: model structure, engineering assumptions, materials assumptions, and data inputs. In our discussion of the model structure, we consider the logic that underlies the model and defines its function. In the section on engineering, we consider the assumptions and methodologies of the engineering paradigm that supports the model. In the section on materials, we evaluate the materials recommended or specified in the model and consider possible conflicts between the materials specified and the model's assumptions. Finally, in the section addressing data inputs, we consider the default values of the model, as well as the user defined inputs to the model. We consider the implications of the input and default values specified by the model's designers for the outputs that the model produces.

We identify significant shortcomings in the model. Cumulatively, these shortcomings constitute strong evidence of an unacceptable bias in design that would preclude use of the model in any real world design or cost analysis. Perhaps the most significant issue in this regard is the failure of the model to incorporate contemporary design principles in the feeder network. These shortcomings also indicate a weak design embedded within the software, a weakness that probably could not be overcome by simply recompiling the code or transferring the underlying design to another software application package.

Contents

EXECUTIVE SUMMARY 2

INTRODUCTION 5

STRUCTURE SHARING 7
- Introduction 7
- Incorporating Structure Sharing in a Model 9
- Practical Considerations 11
- Sample Calculation 13
- Summary 14

MODEL 16
- Introduction 16
- Missing Inputs 16
- Construction Equipment 17
- Cost 18
- Logic 19

ENGINEERING 21
- Cable 21
- Carrier 22
- Conduit 23
- Design 24
- Drops 27
- Interoffice/Inter-Exchange 28
- Land 28
- Loop 28
- Manhole 31
- Plausibility 32
- Pole 32
- Serving Area Interface 33
- Switch 33
- Terrain 34

MATERIALS 34
- Cables 34
- Poles 35

USER INPUTS 36
- Cable 36
- Conduit 36
- Construction Costs 37
- Discounts 37

Labor Rates 38
Land 38
Line Cards 38
Manholes 39
Pay Stations 39
Regenerator 39
Resurfacing 39
Scale 39
Splicing 40

CONCLUSION 41

APPENDIX A. EXCERPT FROM THE JOINT BOARD RECOMMENDATIONS TO THE FCC (PARAGRAPH 277) 42

APPENDIX B. CREDENTIALS OF PRINCIPAL INVESTIGATOR 43

Engineering Evaluation of Cost proxy Models for Determining Universal Service Support: Hatfield Model 2.2, Release 2

Price Technical Services, Inc. and
Austin Communications Education Services, Inc.

Principal Investigator:
Robert F. Austin, Ph.D.

February 5, 1997

Introduction

The United States Telephone Association ("USTA") retained Price Technical Services to provide an engineering evaluation of cost proxy models submitted in the Federal Communication Commission's ("FCC") Universal Service proceeding, CC Docket 96-45. These models are the Hatfield Model Version 2.2, Release 2 ("Hatfield Model"), sponsored by AT&T and MCI, and the Benchmark Cost Proxy Model ("BCPM"), sponsored by Sprint, US West and Pacific Bell. Working with Austin Communications Education Services, Price Technical Services has prepared and submits herewith this report of our engineering evaluation of the Hatfield Model

Hatfield Associates initially prepared what became the Hatfield Model under contract to AT&T. Independent of this effort MCI and various partners had authorized the preparation of a cost proxy model known as the Benchmark Cost Model ("BCM"). Subsequent to Hatfield Associate's initial design work, the firm incorporated a revised version of the BCM, known as BCM-PLUS, in the Hatfield Model. The most recent release of the Hatfield Model is Version 2.2, Release 2. To facilitate public discussion, Hatfield Associates published this version of the model, and the associated documentation, on CD-ROM on September 10, 1996.

In view of its importance to the Hatfield Model, we begin our critique with an evaluation of the concept of structure sharing. We then review four aspects of the model: model structure, engineering assumptions, materials assumptions, and data inputs. In our discussion of the model structure, we consider the logic that underlies the model and defines its function. In the section on engineering, we consider the assumptions and methodologies of the engineering paradigm that supports the model. We also evaluate the model to determine the extent of its compliance with the Joint Board's recommendations concerning supported services. (See Appendix A.)

In the section on materials, we evaluate the materials recommended or specified in the model and consider possible conflicts between the materials specified and the model's assumptions. Finally, in the section addressing data inputs, we consider the default values of the model, as well as the user defined inputs to the model. We consider the implications of the input and default values specified by the model's designers for the outputs that the model produces.

Structure Sharing

Introduction

The Federal-State Joint Board on Universal Service, CC Docket 96-45 ("Joint Board") published its *Recommended Decision* on November 8, 1996. In that document, the Joint Board specified that the "technology assumed in the model should be the least-cost, most efficient and reasonable technology for providing the supported services that is currently available for purchase."[1] Furthermore, the Joint Board specified that: "All underlying data should be verifiable, engineering assumptions reasonable, and outputs plausible." [See Appendix A for the complete list of recommendations.]

While these specifications arguably may be in conflict in some instances, they certainly constitute an endorsement for sharing network construction costs among several companies where feasible. Both models address the subject of structure sharing explicitly in several tables and implicitly in their structure. In brief, the concept assumes that several companies could use some or all support structures in a telephone network simultaneously. For example, in theory several companies could attach aerial cables to a pole.

The number of companies that may attach facilities to a pole depends primarily on the height of the pole, the class of the pole, and the number of pre-existing attachments. The height of the pole is a factor because federal, state, and local laws and ordinances, as well as safety concerns, mandate certain minimum clearances over roadways and railroad tracks below the cable span. These and other parameters, such as the weight of the cable, dictate the minimum height at which users may attach cables to poles.

The same and other regulations prescribe the spacing of cables on a pole. In combination, these constraints determine the maximum theoretical number of cables that users

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[1] Federal-State Joint Board on Universal Service, CC Docket 96-45, *Recommended Decision*, November 8, 1996, ("Joint Board Decision"), paragraph 277

may attach. Similarly, the class of the pole, which corresponds to the diameter of the pole (six feet above ground after pole placement), determines the total load that the pole may bear and the support guying required. Pre-existing attachments, by definition, occupy space to the exclusion of newcomers.

It seems reasonable to state that high relative rates of structure sharing would best serve the interests of the Hatfield Model's sponsors. In support of this statement, we note first that a high assumed rate of structure sharing will result in a calculated reduction of the average forward-looking costs of construction, hence a reduced cost for unbundled network elements. This would result in lower network "assembly" or "element leasing" costs (as opposed to construction costs) for the sponsors. In other words, the higher the rate of sharing that the model assumes, the lower the *pro rata* cost of new network construction that the model will calculate.

Second, a higher rate of proposed structure sharing infers the existence and current availability of a larger amount of structures for immediate use in network build-out by entrants to the market. If Entrant Local Exchange Companies ("ELEC") should decide to reject the pricing of unbundled network elements, they could demand access to this hypothetical structure capacity. If the Incumbent Local Exchange Companies ("ILEC") do not make capacity available, the ELECs could claim that the ILECs were intentionally and anti-competitively withholding this hypothetical capacity.

(Interestingly, in their supplementary Hatfield Model filing, the sponsors stated that: "Present structure owners could use their control of these scarce resources to restrict entry by potential competitors."[2] If the resources are indeed scarce, where is one to find the surplus capacity that the ELECs allege is available?)

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[2] "AT&T and MCI Submission on the Hatfield Proxy Model," (*Ex Parte* Presentation - Proxy Cost Model Questions, CC Docket 96-45), January 7, 1997, page 20.

Third, the structure sharing rates presented in the model imply that the ILECs have been prodigiously inefficient and profligate in their spending by failing to share structures at the rates recommended by the Hatfield Model sponsors. While this may be a comforting, albeit self-serving, assumption, it also, in most respects, is an unreasonable assumption. During the first 80 years of the life of the telephone industry, there were no CATV companies to share structures. Therefore, the telephone companies did not build structures to share with them.

During the same 80 years, there were no dielectric, fiber optic cable transmission facilities that could safely share a duct or feeder route trenches with power cables. The ILECs shared poles where it was possible, given concerns about induction coordination, by attaching telephone cables to power poles, by organizing joint construction in appropriate areas, and by installing larger poles, under certain circumstances, and leasing capacity to the power companies.

Incorporating Structure Sharing in a Model

The Joint Board's specifications regarding universal service costs are clear and unequivocal. Only forward-looking costs may be considered. The scenario they specify dictates that, for modeling purposes, there are no existing telephone network structures or facilities. The scenario also specifies that models should assume that the locations of the existing wire centers persist. (Although with the benefit of 100 years of hindsight some observers may judge these wire center locations to be less than optimal, their selection for modeling is a neutral assumption: all models will work from the same given location to build new networks. In any event, their locations reflect the distribution of population reasonably well.)

One option for a cost model would be to consider the use of existing facilities placed by other industries. For the most part, the nation's CATV and power networks are in-place

and in-service. (The Joint Board quite correctly does not suggest that a model of telephone network construction costs should assume "green fields" for every utility or be predicated on the complete reconstruction or new construction of these other utilities' networks.) If these utilities sized their structures to permit leasing of excess capacity to another company or companies, there might be capacity available for use by a new telephone company. The Hatfield Model does not appear to incorporate such ELEC costs (that is, leasing facilities from utilities other than ILECs), a shortcoming that we recommend for correction in future model releases.

In their supplementary Hatfield Model filing, the sponsors stated that: "It is more than reasonable to assume that, *on a forward-looking basis*, ... ILECs will be able to recover an increasing portion of their structure costs through joint ownership or rental arrangements."[3] This appears to be an unreasonable assumption, given that the electric companies and CATV companies already have their networks built.

If, on the other hand, the ILECs were to place all new structures for their new, forward-looking network, we must assume they would size them in compliance with the FCC's constraints on the model, including the "least cost" constraint that precludes construction of surplus structure capacity. A design engineer might assume that under some circumstances the true "least cost" might be a shared new construction cost and that the telephone company should build and lease excess new, forward-looking structure capacity to reduce aggregate costs. In this case, the telephone company will face a marketing problem: the networks of the other utilities already exist. There are no other companies with whom to share these structures, except, perhaps, a hypothetical ELEC. (We must exclude the cases of new sub-divisions because the guidelines given to the model developers preclude considerations of future growth in demand.)

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[3] "AT&T and MCI Submission on the Hatfield Proxy Model," (*Ex Parte* Presentation - Proxy Cost Model Questions, CC Docket 96-45), January 7, 1997, page 20.