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Pete Sywenki
Director, Federal Regulatory Relations

Law & External Affairs
1850 M Street, NW, Suite 1100
Washington, DC 20036
Voice 202 828 7452
Fax 202 296 3469
pete.n.sywenki@mail.sprint.com

EX PARTE-ERRATA

December 22, 1998

Ms. Magalie Roman Salas
Secretary - Federal Communications Commission
1919 M Street, N.W. Room 222
Washington, D.C. 20554

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FEDERAL COMMUNICATIONS COMMISSION
OFFICE OF THE SECRETARY

RE: CC Docket Nos. 96-45 and 97-160
FCC CCB Cost Model Input Workshops—Switch Cost Inputs

Dear Ms. Salas,

On December 17 and 18, 1998, I filed ex parte notices of information provided to the Commission's Common Carrier Bureau staff in regard to the above referenced proceedings, specifically, regarding proposed switch cost inputs to the Commission's synthesis cost proxy model. This errata notice is being provided in order to replace these prior submissions. Both of the prior submissions contained tables that included a column labeled "Total USF Cost per Line". Since the results depicted in this column include information beyond switching costs (i.e. loop, operator services, etc.) and because we only evaluated the switching components in our analyses, this submission removes the total cost column from the results tables. The total cost results were produced by running the cost model in default mode and without proper review and analysis, we do not endorse the non-switching components contained in the total cost results. In order to avoid assumptions by other parties that we endorse the total cost results that were depicted in the prior submissions and to eliminate any chance for misinterpretation, this submission removes the ancillary total cost column. We regret any inconvenience this may have caused.

We request that this information be made a part of the record in this matter. The original and three copies of this notice are being submitted to the Secretary of the FCC in accordance with Section 1.1206(b)(1) for this purpose. If there are any questions, please call.

Sincerely,

Pete N. Sywenki

Pete Sywenki

No. of Copies rec'd 0+3
List ABCDE

Attachments

cc: C. Brown
B. Loube
K. King
J. Eisner
J. Zolnierek

Switch Investment Inputs for the HCPM/HAI Platform

Prepared by the BCPM Sponsors
BellSouth, INDETEC International, Sprint, and U S WEST

December 22, 1998

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Development of HAI Switch Investment Inputs

The purpose of this analysis is to identify the major switch input values for the HAI model that will provide a realistic estimate of forward-looking switch investments for universal service. This study is commissioned by the BCPM sponsor companies (BellSouth, Sprint, U S WEST, and INDETEC International). We describe several possible sources for the switch investment functions and analyze two alternatives: the recent FCC switch investment study, and a proposal to use switch contract data and engineering records provided by several non-rural LECs. Finally, we present a set of recommended HAI platform switch inputs to integrate with the recommended switch functions. Our proposed switch investment functions shall be developed from current booked switch investments. Only with this new data will the investments include all of the functionality needed to support the forward-looking service capabilities expected of non-rural LECs. Attachment 1 summarizes the effects of the recommended changes upon the model outputs.

In this analysis we have analyzed as many of the HAI switch platform inputs as possible, given time constraints. We believe that we have identified and made recommendations upon all of the critical values; however, we shall continue to examine the switch platform and will make additional recommendations as needed. In addition, the BCPM sponsors are analyzing the transport and signaling portions of the platform and expect to comment on those inputs at a later date.

Our testing uncovered a serious flaw in the HAI switch investment model. The model is not applying the Switch Port Administrative Fill Factor to standalone switches.

Background

On October 28, 1998, the FCC issued a *Fifth Report and Order* on Universal Service,[1] which selected the cost model platform to be used by the FCC to determine support levels for high cost serving areas of non-rural LECs. In this Report and Order, the FCC selected the HAI Model 5.0a switching and interoffice module as the model platform to be used for those sections of the network. The second stage of this proceeding to identify the forward-looking costs of providing the supported services is to select the inputs to be used with this model platform. On December 1, 1998, the FCC Common Carrier Bureau held a workshop in which it presented a set of switch inputs developed by the Bureau itself. The FCC inputs will be evaluated as part of this analysis.

The selected HAI switch cost platform has several characteristics that must be considered when selecting switch investment functions. The model provides a relatively simple means of computing central office switch investments. There is no means to differentiate switches by vendor. There is no input to define company-specific vendor price levels, so the switch functions input must incorporate switch prices at some average net price level. There is no means to provide switch investment characteristics specific to individual wire center conditions and company practices, so the selected inputs must be valid for a range of situations. The reasonableness of the HAI platform results can be improved by changes to several critical inputs, which we will identify here.

[1] FCC Report and Order, "In the Matter of Federal-State Joint Board on Universal Service, Forward Looking Mechanism for High-Cost Support for Non-Rural LECs," DA 98-279, CC Docket Nos. 96-45 and 97-160, October 28, 1998.

Alternative Investment Sources

Several input data sources for the critical switch investment equations were considered:

SCIS/SCM

SCIS and SCM would provide the most precise sources of switch investment available. Such engineering-based models provide the most reliable means that we know of to separately compute the investments for analog and digital line terminations. Modelers would know with assurance that all investments needed to provide universal service, and only those investments, would be included. The FCC, in its Fifth Report and Order, however, cited reliance upon SCIS and SCM inputs as a key reason for rejecting the BCPM platform.[2] In addition, the Federal-State Joint Board, in its November 25 *Second Recommended Decision*, emphasized that it is opposed to using proprietary information as data sources to the model platform.[3] In light of this opposition to proprietary sources of model input, we will not recommend these superior sources of switch investment data for the universal service platform at this time.

FCC Study

This study was performed by the FCC staff and was presented in a public workshop on December 1, 1998. The study is apparently an outgrowth of an April, 1998 study published by David Gabel and Scott Kennedy for the National Regulatory Research Institute (NRRI). Gabel and Kennedy used a data set of large LEC switch

[2] Fifth Report and Order at 78.

[3] Federal-State Joint Board, "In the Matter of Federal-State Joint Board on Universal Service, Second Recommended Decision," FCC 98J-7, CC Docket No. 96-45, November 25, 1998 at 29. The issue is also raised in the "Joint Statement of Chairman Julia L. Johnson and Commissioner David Baker" and "Separate Statement of Public Counsel Martha Hogerty" attached to the decision.

costs extracted from LEC depreciation studies supplied to the FCC.[4] A separate NRRI small LEC switch curve was constructed from a set of Rural Utilities Service (RUS) data. The FCC study merged the two data sources to create a single set of switch curves. Both studies provide simple linear total switch investment functions for host and remote switches. The data does not provide differentiation of analog and digital lines, and does not separate vertical services and features from the basic switch investments.

The NRRI data used in the FCC regression analysis excluded upgrade costs for new software and processors after initial placement. As such, the resulting switching costs are understated and do not reflect forward-looking Digital Switching technology or a realistic environment under which they are purchased and provisioned.

The BCPM Sponsors have concerns about the methodology employed in the FCC staff study. Given the sketchy documentation provided in the December 1, 1998 staff workshop, we are unable to analyze in detail the quality of the model's estimation. The study has several apparent methodology problems, however, which are discussed in detail in the "Analysis of the FCC Model Methodology" section below.

LEC Accounting Records

During the December 1, 1998 FCC workshop, it was suggested that LEC data from actual booked switch costs would be considered as a possible alternative to the NRRI data set. The data could be derived from a survey of LEC accounting records covering the book costs for switch installations over recent years. The FCC performed such a survey in 1997 in its Universal Service Data Request to the RBOCS plus

[4] David Gabel and Scott Kennedy, "Estimating the Cost of Switching and Cables Based on Publicly Available Data," National Regulatory Research Institute, April, 1998.

Sprint, GTE, Anchorage Telephone, and Puerto Rico Telephone company.[5] The LECs would provide the data only under confidential cover, so we would have to negotiate arrangements for obtaining the confidential data. The following report format was developed and agreed to by the LECs at a United States Telephone Association (USTA) conference on December 10, 1998:

USTA Conference Report Format

Sprint --
COE/CPR Master Detail Listing
Sub-Accounts 1210X -- Digital Switching Equipment
Thru 12/31/97

State	CLLI Code	Orig Year	Switch Type	Host (H) Remote (R) Stand alone (S)	Installed Cost	Equipped Lines	Working Lines

Attachment 2 describes a process by which a forward-looking switch investment function can be derived from these data.

Switch Investment Considerations

Over the last decade, to a large extent, digital switch software and processor upgrades have been driven by substantial changes in the way calls are routed and handled through Digital Switching machines. These changes were mandatory, either from a regulatory or industry perspective, to continue to meet the minimum routing standards of the North American Number plan. To illustrate this point, following is a brief summary of major upgrade drivers for the last seven years which have

[5] FCC Order, "In the Matter of Federal-State Joint Board on Universal Service," DA 97-1433, CC Docket No. 96-45, July 9, 1997.

subsequently driven switch additions/upgrades necessary to the minimum industry dialing requirements expected of a forward-looking DMS-100 switching platform.

Switch Upgrade Drivers

Year	Mandate	Switching Cost Impacts
1992	800 Portability &: Line Information Database (LIDB). FCC required post dial delay requirements which in turn drove substantial switch upgrades.	Required SS7 connectivity at access tandem level to meet post dial delay mandates from Docket 86-10. Both projects drove major switch upgrades to provide trunk signaling and basic SS7 query capabilities.
1993	Feature Group B CIC code expansion	Impacted tandem switches. Required upgrade to BCS34; this in turn required additional software.
1995	Interchangeable NPAs implemented due to NANPA code exhausts	Required upgrades to all switches. Tandem offices with Operator service capabilities particularly impacted where table limitations occurred.
1995	Feature Group D CIC code expansion	Impacted all Equal Access capable switches. Drove switches to BCS36 baseline. XPM upgrades to switch peripherals required with software upgrade.
1995	888 Code expansion	Impacted all switches, software upgrades required to handle new SAC queries
1995	GR-303 Generic Next Generation Digital Loop Carrier interface, consistent with forward-looking loop investment requirement specs.	Required new ESMA peripheral hardware and Software RTU per ESMA
1996	International Direct Digit Dialing expansion to 15 digits	IDDD Required all switches to be at NA004 and associated software upgrades.
1997	Carrier Identification Parameter (CIP) required to identify second carrier codes handled by primary carrier.	Required upgrade to obtain CIP software, LOC0002.
1997	Intralata Equal Access Implementation	Required upgrade to NA006 and insertion of Two-PIC software, EQA00015.
1997	Local Number Portability implementation order from the 1996 Telecommunications act required LNP implementation by 12-31-98 in the top 100 MSAs.	Required software upgrade to NA008 plus purchase and installation of LNP specific packages, AIN002, AIN0026, AIN0006, AIN0007, AIN0009, and LNP0100.
1998	Flexible ANI implementation mandate required to facilitate a two digit ANI code identifying payphone owners for carrier compensation purposes.	Required software upgrade to NTS00025.

Similar upgrades were required with other vendors' switching equipment. Absent these real, tangible, requirements, a DMS-100 Digital Switch purchased today could not meet the minimum dialing standards expected on a forward-looking basis. As an example, absent the Interchangeable NPA (INPA) software, switches could not complete calls terminating to local NXXs which use 0 or 1 in the second digit of the NXX code. If the investment function for switching does not capture the cost of these network upgrades, then the proxy model will be building a network that cannot complete a large number of local calls.

Published Reports

Data on per-line switch prices can also be obtained from commercially available research reports such as the "NBI Study". An old, out of print (1995) edition of this study formed the basis for the HAI "blended" switch cost function. An obstacle to the use of this study is its purchase price, currently $3,000. We are unable to tell, without viewing the report, whether it provides switch costs in a sufficient level of detail to identify hosts, remotes, and standalone switches separately. It is also unclear whether the switch investments in this report include vertical services and forward-looking digital line terminations. An updated version of the NBI study ("U.S. Central Office Equipment Market, 1997") is available from Dataquest, San Jose, California.

Conclusion

We believe that the most valid means of constructing switch curves would be to use actual booked switch costs and contract terms from a LEC survey. This would allow construction of a verifiable switch curve that is based on real-world, and not theoretical or imaginary, purchasing conditions. The real costs of switch upgrades for required service capabilities and functions would be recognized. It should also allow for exclusion of vertical service investments. With the assistance of FCC staff, a joint data template has been developed. Non-rural companies can use the template to provide alternative data from actual switch purchases. This should serve to alleviate concerns that the NRRI data being considered for use in the HCPM model contains incomplete, inaccurately developed data.

Methodology

The joint sponsors wish to provide the FCC with meaningful data, which accurately reflects conditions under which state of the art digital switching equipment can be purchased. Given the limited time available to perform this analysis, the FCC investment functions were used for testing the HAI model. The following provides a comparison of HAI generated 'base case' investment costs versus the FCC switch curve plus the suggested HAI adjustments. Finally, we will provide a comparison of these results to illustrative LEC switching costs.

We began by running the HAI Model for United Telephone of Florida as a base case. United of Florida has 91 wire centers ranging from 400 to 55,000 switched lines. The median line size is 11557. There are 31 standalone, 22 host, and 38 remote switches in the serving area, along with four tandems. The base case run was done using the newly provided LERG input process for standalone, host, and remote switch identification, and the default HAI switch inputs (switch curve). The base run produced these results:

Base Case

Switch and MDF Investment per Line	Local Tandem Investment per Line	USF Switch, Transport, Signaling Cost per Line
87.50	**2.49**	**2.25**

Since the default HAI host/remote/standalone cost functions were based on the HAI default "blended" switch curve, we started by inputting a better-supported set of switch cost functions. The HAI default switch cost defies the openness criterion for the model platform since its source data is unsupported.[6] For the second case, we used the recommended switch equations from the FCC study. This study was based upon RBOC depreciation data and RUS data complied by the FCC and Bureau of Economic Analysis. The HAI Model uses a separate per-line input for the Main Distributing Frame (MDF) of $12 per analog line. This amount is added to analog lines only, based on line counts from the loop module. Since the switch data underlying this curve includes the Main Distributing Frame (MDF), **the MDF/Protector Investment per Line (input 4.1.6) should be set to zero when using the FCC data**. The FCC numbers produce slightly different results from those of the HAI switch curve:

Case "FCC" – HAI Defaults with FCC Switch Curve

Switch and MDF Investment per Line	Local Tandem Investment per Line	USF Switch, Transport, Signaling Cost per Line
96.59	**2.49**	**2.37**

Next, we turned our attention to the trunk investment per trunk, which we believe is a critical input because of an anomaly in the HAI model's logic flow. The HAI model attempts to remove trunking investment from each switch's investment after computing the total from the switch curve. It does this by dividing the per-trunk input ($100 as a default) by a hard-coded line/trunk ratio of 6, and then removing the

[6] In November, 1998, the BCPM Sponsors attempted to purchase a copy of the 1995 NBI Central Office Equipment Market study used for part of the HAI switch curve. We were informed by Dataquest, the owner of NBI, that the study is out of print and no longer available. BellSouth requested the study in an October, 1998, data request to AT&T in the Georgia Universal Access Fund docket (No. 5825-U). AT&T declined to provide the document.

resulting $16.67 from each line's switch investment. The line to trunk ratios and per-trunk investments inherent in the switch curves are unknown. Secondly, line to trunk ratios vary significantly from switch to switch, and are typically in the range of 10 to 14. This means that the model will virtually never produce a switch investment level that matches the input investment. The same $100 is used elsewhere to compute interoffice direct and tandem trunking investments per line. This approach yields curious results. Raising the per-trunk investment actually decreases the switch investment per line:

Case "FCC 1" – HAI Defaults with FCC Switch Curve, $200 Trunk

Switch and MDF Investment per Line	Local Tandem Investment per Line	USF Switch, Transport, Signaling Cost per Line
82.47	**3.71**	**2.16**

As you can see, raising the trunk investment from $100 to $200[7] decreases the switch and transport cost from $2.37 to $2.16 per month, despite a reasonable and expected increase in the local tandem investment per line from $2.49 to $3.71.

Since the HAI model produces contradictory results from the trunk investment per line input, **we recommend setting the Trunk Port Investment, per end (input 4.5.4) to zero**. This recommendation is justified in light of several other factors. The basic switch curve data (for example, the FCC study) already includes the appropriate amount of trunking investment. The FCC has taken the position that a level of detail that requires separate identification of trunk investment was not needed for universal service; this was part of the FCC's basis for choosing the HAI model

[7] A conservative change: experience indicates that trunk investments are from $300 to $500 each.

over the BPCM.[8] Also, given the required level of detail, a separate trunk investment input is not necessary for computing tandem switching costs (the other application of this input). We can simply increase the tandem switch investment input to reflect an appropriate average number of trunks per tandem. HAI results with the zero trunk input are as follows:

Case "FCC 2" – HAI Defaults with FCC Switch Curve, $0 Trunk

Switch and MDF Investment per Line	Local Tandem Investment per Line	USF Switch, Transport, Signaling Cost per Line
110.70	**1.26**	**2.58**

Note that the HAI model produces higher results with a *zero* trunk investment than with the $100 default input. The total USF monthly cost rises from $18.45 to $18.85. Is this the correct result? To find out, we created a worksheet that uses the FCC large LEC switch equations to compute the switch investments by wire center for United of Florida. The FCC equations produced an average investment of $102.44 per line, not including installation. When the HAI switch installation factor is applied to the $102.44, we get $112.69 per line, very similar to the HAI result of $110.70.

As a final step in analyzing the FCC data, we ran the HAI model with the complete set of FCC preliminary inputs for switching as provided in the FCC spreadsheet. The "Analog Line Circuit Offset for Digital Lines" is subtracted from each digital line to account for the investment difference between analog and digital

[8] Fifth Report and Order at 77, The BCPM provides this level of detail *with accuracy* through its switch partitioning process.

lines. For input to be usable, the switch curves would have to be based on 100% analog lines. Both the HAI and FCC switch curves have some unknown mixture of analog and digital lines. In any event, the analog line offset is inherent in the curve, making application of this input unnecessary. **We recommend setting the Analog Line Circuit Offset for Digital Lines (input 4.1.7) to zero,** as specified in the FCC "HIGH" input set. Our only other deviations from the FCC "high" data set were to set the MDF/Protector investment and Trunk investments to zero, as mentioned previously.

These changes produce the following results:

Case "FCC 3" – FCC Preliminary Input Data Set

Switch and MDF Investment per Line	Local Tandem Investment per Line	USF Switch, Transport, Signaling Cost per Line
120.10	**1.26**	**2.96**

Analysis of the FCC Model Methodology

The Gabel and preliminary FCC switch curves have methodological problems that prevent them from giving a completely accurate level of switch investment.

Functional Form

The Gabel and FCC switch functions are linear, while the Mercurio and Siwek function presented a log-log function that shows declining marginal cost as line size increases. It seems likely that marginal costs do decline with line size, due to issues such as breakage. Therefore the FCC model (or any linear function) is likely to overstate costs for large wire centers and understate costs for small wire centers.

Model Specification

A simple examination of the supplied scatter charts shows that switch cost correlation with lines is not strong enough to produce a good model using lines as the only independent variable. The model proponents and the FCC correctly anticipated this when all agreed to use a set of three capacity constraints for switches: lines, calls and holding time (CCS usage). The BCPM sponsors also reached this conclusion when specifying the BCPM switch regression model, and created a structure that allowed for use of multiple independent variables within BCPM.

The Gabel and FCC models use dichotomous host-remote specifications. Remote lines terminating on the hosts need to be included as a variable because hosts and remotes are not functionally separable. If changing the quantity of service provided by one network element (remotes) changes the cost of some other network element (host call processing capacity), then these elements cannot be separated in a cost analysis. The reason is that the costs of these elements are always conditional upon one another. Ignoring this conditionality in estimating the costs of such elements independently can only give inconsistent and nonsensical results. Clearly, increasing the subscriber lines on a remote switch also increases the switching resources required at the host switch. Any analysis of switch costs cannot separate remotes from their tending host switches.[9]

Estimation

The R^2 values of the Gabel and FCC switch functions demonstrate that lines alone are a weak predictor of total switch investment. The Gabel recommended large LEC and small LEC functions have R^2 values of only 68.3% and 78.6%, respectively. Gabel and Kennedy themselves acknowledge that it is necessary to

[9] For a complete discussion of aggregation and separability see Blackorby, Charles, Daniel Primont, and R. Robert Russell, Duality, Separability, and Functional Structure: Theory and Economic Applications, New York, Holland, 1978.

introduce a variable for switch vendor in order to get a statistically significant large LEC model.[10] The FCC time series model also shows a weak R^2 of 83%. We are not given statistics on the "Preliminary FCC Estimate" linear function.

BCPM Sponsors' Recommended Data Set

In this section we present an HAI data set that incorporates the conclusions reached above, as well as an illustrative switch investment function that was created using LEC accounting data, as proposed. Attachment 2 describes in detail the process used to create the switch investment functions below. The focus of the switch investment study was to ensure that all relevant switch investments, including upgrades needed to support the basic service set, are included. Inclusion of the complete switch investment, and not just the limited service capability provided at initial installation, is the key distinction between our study and the FCC preliminary study. Starting with the FCC "high" input set, modified as above, we made the following further adjustments:

Switch Investments

The illustrative switch function is derived from actual data from Sprint of Nevada and represents the characteristics of Sprint of Nevada switches. As more data is received from other states and LECs, a more comprehensive statistical function will replace this model. In addition, it may be more accurate to segment

[10] Gabel and Kennedy at 119.

switch investment functions by the four ranges of switch sizes allowed in the HAI/HCPM.

Switch Investment Functions		
	Fixed	**Per Line**
Standalone	$2,533,487.49	$100.00
Host	$3,365,397.13	$100.00
Remote	$100,900.85	$100.00

Telco Engineering and Labor Investment

The recommended switch investment data includes costs for Telco engineering and installation activities. **We therefore recommend setting the Switch Installation Multiplier (input 4.1.8) to zero.**

Power Investment

Power investment is included in the recommended switch data. **The five Power Investment inputs (4.2.3) should be set to zero** when the recommended data is used.

New Purchase vs. Growth Price Levels

A vital consideration in constructing the switch curve is the vendor price level to be represented. In practice, switch vendors offer switches to LECs at price levels lower than the stated list price. The per-line price level for initial placement of a switch is usually much lower than the price offered for additional equipment needed for growth lines on an existing switch. In many cases, this switch replacement price is drastically lower than the growth price because of special promotions such as analog switch replacement programs. The situation is analogous to that of a variety of products, such as razor blades or china, where the initial purchase of the product includes a limited selection of piece parts (blades or dishes). The price for the starter set is low (often below cost), as an incentive to commit to the product. Later purchases of additions or refills come at a much higher price level because the manufacturer now has a "captive" customer for the product.

The California PUC addressed this issue in its 1998 rulemaking on the appropriate TELRIC cost study methods for setting Unbundled Network Element (UNE) prices[11]. Ironically, the CPUC notes that the same "NBI Study"[12] relied upon by the HAI model refutes AT&T claims that only new switch prices are relevant. The following quote from the 1994 NBI study was included in an analysis of the Hatfield Model submitted by Drs. Tim Tardiff and Gregory Duncan of NERA to the CPUC:[13]

> "The add-on market provides significant revenue potential for switch suppliers, particularly as the margins on new switches remain below the margins for the add-on market. A digital line shipped and in place will generate hundreds of dollars in add-on and hardware revenue during the life of the switch. Suppliers can afford to lose a few dollars on the initial (new) line sale in exchange for the increased revenue in the after-market, where prices are less likely to be set by competitive bidding." (1994 NBI Study, p. 71, *quoted in* Tardiff & Duncan, pp. 41-42.)

Use of new-switch price levels for an entire network would be wrong because it assumes a circumstance that is impossible. Switch vendors could not possibly produce enough product to instantly replace the entire network. If all switching equipment were replaced in a very short period of time, switch prices would rise

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[11] "Before the Public Utilities Commission of the State of California, Interim Decision Adopting Cost Methodology, Evaluating the Hatfield Computer Model, and Deciding other Issues Related to Cost Studies of Pacific Bell's System," Decision 98-02-106, February 19, 1998.

[12] Northern Business Information: "U.S. Central Office Equipment Market – 1995," McGraw-Hill, New York, 1996.

[13] Tardiff and Duncan, "Economic Evaluation of the Hatfield Model, Version 2.2, Release 2," March 17, 1977. Citation from CPUC decision 98-02-106 at p.40.

dramatically.[14] Another market reality governing discounts is that if LECS actually attempted to replace entire networks at the most generous discount level, those deep discounts would likely be reduced. Vendors offer a deep discount (at low margins) for the initial placement of lines knowing that the purchase of line additions must come from the same vendor. Without the opportunity for higher margin line additions, the vendors would necessarily have to reduce the size of the initial discount.

In summary, inputs to the cost proxy models must reflect the technology price levels that a LEC will experience over the long-term development or evolution of the network. TELRIC methodology requires realistic price levels for currently available technology. Exclusive use of deep-discounted new switch price levels assumes a set of circumstances that could never exist in the real world.

Switch Port Administrative Fill

The BCPM Sponsors have adequate evidence to support a port fill factor of 80%. The Switch Port Administrative Fill (input 4.1.4) is described in the HAI Model Inputs Portfolio as "the percent of lines in a switch that are assigned to subscribers compared to the total equipped lines in a switch." Based on that definition this input is more appropriately called port "utilization," not "administrative fill." "Administrative fill" reflects the number of lines reserved for administrative purposes and not available for assignment to customers. The difference between total equipped lines and those assigned to subscribers ("working lines"), minus the administrative lines, is the unassigned capacity. Switches virtually always have significant unassigned capacity, due to the fact that equipment is installed at discrete intervals to handle 1 to 3 years' growth.

Since the HAI platform computes switch investment based on working lines, it is critical to use an actual utilization number, as specified, for fill. To do otherwise

[14] This is similar to a general proposition presented by Armen A. Alchian, "Costs and Outputs," in Readings in Microeconomics, ed. W. Breit and H. Hochman (1968), p. 165.

would significantly understate costs by creating the unrealistic assumption that working lines plus administrative fill equals engineered lines. To use administrative fill would also invalidate the modeling process because the switch investment functions under consideration use equipped lines, not working lines, as the independent variable. U S WEST and BellSouth are experiencing company-wide average fills (or utilization) in the range of 76% for analog and digital lines. Sprint has an average fill of about 80% in the set of Nevada switches that make up the investment functions presented in this paper. The recommended 80%, therefore, is a conservative number by real world standards.

Additional Input Changes

The final recommended changes involve tandem switching investment. The HAI default Tandem Equipment Common Investment of $1,000,000 has no apparent support. Also, as noted above, setting the trunk investment to zero understates the local tandem investment per line. We therefore propose to use a supportable value for **the Tandem Equipment Common Investment, and include a reasonable number of trunks therein**. Based on a current SCIS DMS-200 run provided by a BCPM sponsor, common equipment (getting started) investment for a tandem switch is $1,014,379 (discounted a hypothetical 65%). Assuming 10,000 trunks on each tandem at $203.88 discounted, the total investment per tandem is $3,053,200.

One additional input concerning tandem investment, the "Tandem Common Equipment Intercept Factor," needs to be changed. This input is described by the HAI Model Inputs Portfolio as:

> The multiplier of the common equipment investment input that gives the common equipment cost for the smallest tandem switch, allowing scaling of the tandem switching investment according to trunk requirements.

Upon examination of the HAI tandem switch investment formulas, we found that this input does nothing that resembles the above description. To describe what this input does we must explain how the HAI tandem switch formulas work. The model first computes the total tandem switch common investment based on a number of tandem switches apparently compiled from NECA input data. Next, the model, through a convoluted set of formulas, subtracts the amount of tandem switching investment that is **not** used for *local* tandem switching from the total tandem switch common investment. The tandem equipment common intercept factor at the default 0.50 adjusts this amount of non-local tandem switch investment *downward* for no apparent reason. **We recommend setting the Tandem Equipment Common Intercept Factor (input 4.6.6) to zero**. This will cause the local tandem investment to come out lower than with the default value.

Although we have not done so for these runs, we also suggest changing the HAI Maximum Trunk Occupancy to a value more representative of real-world experience and the way the input is employed in the model. U S WEST has data indicating that trunk fill should be set at about 18.3 CCS.

Case "BCPM Sponsors" – Recommended Input Data Set

We performed an HAI model run for Sprint-Nevada with the suggested input changes. The illustrative switch data formulas produced these results:[15]

Switch and MDF Investment per Line	Local Tandem Investment per Line	USF Switch, Transport, Signaling Cost per Line
159.57	**0.79**	**3.88**

[15] The differences in tandem switching between this case and case "FCC 3" are due to differences in network configuration and outside plant costs between Florida and Nevada.

HAI Model Flaw – Use of Switch Port Administrative Fill

In developing the recommended input set we discovered an anomaly that points to a serious flaw in the HAI switching algorithms. When using a 90% fill factor we observed an investment per line of $146.47. Changing the fill factor to 80% increased the investment only 5%, to $154.50. Upon examination of the two runs, we discovered that **the HAI model is not applying the line fill factor to standalone switches.** The host and remote investments change with the fill factors, but standalone switch investments do not change at all. The model that computes standalone switch investments is very long and complex, so we have not been able to determine that exact portion of the formula that is at fault. This flaw has a major impact upon investment, however, and must be corrected before the model can be used to calculate universal service support.

Summary

We have tested the FCC preliminary input values in the HAI Switching and Transport platform. The FCC input values are based on publicly available data, and with two modifications, can produce more reasonable results than the default HAI Model switch curves. Our modifications, to the trunk investment and MDF/protector investment, bring the input set and the HAI model's application of trunk investment into alignment. The default HAI switch investment functions should not be used under any circumstances, as they are unsupported.

To create an accurate switching investment for universal service, a new switch investment model, using the data template provided, will need to be created. The Sprint Nevada study presented here provides sound methods for converting the LEC data into a switch investment function.

In summary the following inputs, at a minimum, should be changed:

- The model should be optioned to use host/remote assignments and populated with LERG data for these assignments.

- The HAI default switch equations for standalones, hosts, and remotes are unsupported and should be replaced by equations based on actual LEC purchase data adjusted to a forward-looking basis. The FCC study data can be used as an interim data source.
- For the permanent switch investment function, we recommend that the Commission create a new model using data obtained from the LECs in the format presented here. The Sprint Nevada analysis can be used as a template for the study.
- Switch price levels should be set to reflect real-world conditions, not some impossible hypothetical situation in which an entire network is purchased at once.
- Set the Trunk Port Investment, per end (input 4.5.4) to zero.
- Set the MDF/Protector Investment per Line (input 4.1.6) to zero.
- Set the Analog Line Circuit Offset for Digital Lines (input 4.1.7) to zero.
- Change the Tandem Equipment Common Investment to a $3,053,820 including trunks.
- Set the Tandem Equipment Common Intercept Factor (input 4.6.6) to zero.
- Set Switch Port Administrative Fill (input 4.1.4) to 80%.
- Set the Switch Installation Multiplier (input 4.1.8) to zero.
- Set the five Power Investment inputs (4.2.3) to zero.

The HAI model platform must be corrected to allow application of the switch line fill factor to standalone switches.

The key distinction between our proposed methodology and the FCC preliminary study is our inclusion of the complete switch investment, and not just the limited service capability provided at initial installation. The NRRI data used in the FCC regression analysis excluded upgrade costs for new software and processors after initial placement. The resulting switching costs are understated and do not reflect forward-looking Digital Switching technology or a realistic environment under which they are purchased and provisioned.

SUMMARY OF SCENARIO RUNS

Scenario	Switch + MDF per Line	Local Tandem Inv per Line	USF Switch, Transport, Signaling per Line	Scenario Information
BASE CASE	$ 87.50	$ 2.49	$ 2.25	All default HAI inputs using H/R assignment.
FCC	$ 96.59	$ 2.49	$ 2.37	Default HAI inputs, H/R assignment, $0 MDF, FCC switch equations.
FCC 1	$ 82.47	$ 3.71	$ 2.16	Default HAI inputs except for $200/trunk, H/R assignment, $0 MDF, FCC switch equations.
FCC 2	$ 110.70	$ 1.26	$ 2.58	Default HAI inputs except for $0/trunk, H/R assignment, $0 MDF, FCC switch equations.
FCC 3	**$ 120.10**	**$ 1.26**	**$ 2.96**	FCC recommended inputs except for $0/trunk, $0 MDF, $0 analog line offset.
BCPM Sponsors	**$ 159.57**	**$ 0.79**	**$ 3.88**	BCPM Sponsors' illustrative input set (80% fill). Sprint - NEVADA.

Note: All of the above scenarios understate switch investment because the HAI model does not apply the line fill factor to standalone switches.

Switching Investment Study

Introduction

A study has been designed with the purpose of providing actual LEC "switch provisioning" data from which to populate the switch function of the HCPM/HAI switching module. This study incorporates a similar methodology as the Gable/Kennedy approach although includes current LEC specific data from which to determine switch investment. Results from actual Sprint Nevada switch provisioning data will be reflected and compared to suggested HCPM/HAI default values.

The first section of this overview provides a format for input which is then translated to forward looking switching investment. The Input Format section defines the composition in which information will be provided. The second section reflects the Study Design which shows the activities necessary to translate input to forward looking investment.

Input Format

The Input Format was designed to provide actual telco data which could be used to determine forward looking switching investment. The following categories represent the variables needed to capture investment parameters necessary for input to the HCPM/HAI.

State-The state in which the switch resides.

CLLI Code-Common Language Location Identifier which identifies the location of the switch. This is a Bellcore trade marked item.

Orig Year- The year of switch investment. Each switch may have several years of investment representing initial provisioning as well as upgrades for technical regulatory or growth requirements.

Switch Type- The type and technology of the switch. The predominant vendors include Nortel's DMS and Lucent's 5ESS technologies.

Host,Remote, Stand Alone- The designation of type of switch provisioned.

Installed Cost-The investment of switch provisioning for each year.

Equipped Lines-Lines equipped for service.

Working Lines-Lines actually in service or ready for service.

Study Design

The switching cost study is segmented into seven activities as follows:

1. Determine actual switching investment currently in use. Plant records are utilized to provide actual investment for switching through March of 1998. Attachment 3 reflects those records for Sprint of Nevada. Sprint's sample study represents over 5,000 lines of material as referenced on Sprint's investment records. It should be noted that there is investment (on the books) from before 1980 within this study. These investments are for line equipment frames and the like which are still in good working condition. This investment accounts for less that one half of one percent of Sprint of Nevada's forward looking investment. Sprint's data, as with the template to be populated by participating ILECS, includes the vintage year that the asset was purchased, the switch (CLLI code) from which the asset is associated along with the original installed investment per year. The type of switch as well as the equipped and working line are also a part of the data set.

2. Apply the C.A. Turner Telephone Plant Index (TPI) appropriate for the specific geographic region, to the original purchase price of the investment based on the vintage year of the purchase (in the same manner that the TPI is used by Gabel/Kennedy). The goal of the TPI is to produce a product

which, when utilized together with each company's books and records, would generate a reproduction cost value. For example, if a LEC placed a certain switch in 1985, the TPI would reduce the original investment by 52% in order to represent 1997 reproduction investment.

3.Aggregate the adjusted investment by Stand Alone, Host and Remote categories as reflected on the Local Exchange Routing Guide ("LERG"). The LERG is a Central Office data base maintained by Bellcore. The LERG contains the type of switch in terms of equipment and host/remote relationships. A LEC will combine all remotes with their appropriate wire centers if the remote is not separately identified by the HCPM/HAI. This process would have the same effect as combining host and remote within the HCPM/HAI. Defining results as Host, Remote or Stand Alone categories allows for more refined investment distribution and better assigns cost to the cost causer.

4.Modify the TPI- adjusted book investment to represent forward looking switching investment provisioned to support Residential and Business Single Party Line (R1/B1) customers. These adjustments include:

- Removing all investment for advanced services such as Integrated Services Digital Network ("ISDN"), Automatic Call Distributor ("ACD"), Packet Switching, Advanced Intelligent Network ("AIN"), DataPath and Frame Relay services.

- Removing private use trunks such as PBX and Internet Service Provider ("ISP") trunking.

- Dividing the total fixed cost by the number of switch entities to result in an average fixed cost per switch category (Stand Alone , Host and Remote).

Attachment 3

	A	B	C	D	E	F	G	H	I
1	Sprint -- NEVADA								
2	COE/CPR Master Detail Listing								
3	Sub-Accounts 1210X -- Digital Switching Equipment								
4	Thru 4/28/98								
5									
6					Host			Thru 4/28/98	
7		CLLI	Orig	Switch	Remote	Installed	Equipped	Working	
8	State	CODE	Year	Type	Stand alone	Cost	Lines	Lines	Location
9	Nevada	LSVGNVXRDS0	63	DMS	Host	25,436.04			East 1 CO
10			64			948.40			East 1 CO
11			65			586.39			East 1 CO
12			66			1,286.84			East 1 CO
13			67			199.97			East 1 CO
14			69			11,630.94			East 1 CO
15			70			23,408.62			East 1 CO
16			71			39,888.27			
17			72			76,291.55			East 1 CO
18			74			110,227.46			East 1 CO
19			75			149,200.78			East 1 CO
20			77			35,659.96			East 1 CO
21			78			64,496.10			East 1 CO
22			79			1,837.41			East 1 CO
23			80			31,493.30			East 1 CO
24			81			25,641.43			East 1 CO
25			82			3,789,226.05			East 1 CO
26			83			55,537.03			East 1 CO
27			84			81,893.21			East 1 CO
28			85			213,500.62			East 1 CO
29			86			2,689,909.33			East 1 CO
30			87			926,765.99			East 1 CO
31			88			322,730.66			East 1 CO
32			89			145,028.63			East 1 CO
33			90			2,418,506.62			East 1 CO
34			91			469,333.71			East 1 CO
35			92			887,875.10			East 1 CO
36			93			42,766.85			East 1 CO
37			94			76,083.22			East 1 CO
38			95			1,611,181.19			East 1 CO

	A	B	C	D	E	F	G	H	I
1	Sprint -- NEVADA								
2	COE/CPR Master Detail Listing								
3	Sub-Accounts 1210X -- Digital Switching Equipment								
4	Thru 4/28/98								
5									
6					Host			Thru 4/28/98	
7		CLLI	Orig	Switch	Remote	Installed	Equipped	Working	
8	State	CODE	Year	Type	Stand alone	Cost	Lines	Lines	Location
39			96			816,239.34			East 1 CO
40			97			1,883,533.79			East 1 CO
41	**Nevada**	**LSVGNVXRDS0**	**TOTAL**	**DMS**	**Host**	**17,028,344.80**	**97,101.00**	**80,560.00**	East 1 CO
42									
43	Nevada	LSVGNVXIDS0	71	DMS	Host	327,294.00			East 2 CO
44			76			11,699.32			East 2 CO
45			78			20,443.81			East 2 CO
46			80			1,006,556.45			East 2 CO
47			81			239,656.43			East 2 CO
48			82			1,250,713.95			East 2 CO
49			83			96,846.62			East 2 CO
50			84			448,979.33			East 2 CO
51			85			1,028,729.30			East 2 CO
52			86			2,807,015.35			East 2 CO
53			87			462,862.48			East 2 CO
54			88			56,781.57			East 2 CO
55			89			18,197.13			East 2 CO
56			90			442,006.54			East 2 CO
57			91			615,947.33			East 2 CO
58			92			163,821.62			East 2 CO
59			93			614,187.47			East 2 CO
60			94			153,559.57			East 2 CO
61			95			326,198.15			East 2 CO
62			96			293,193.74			East 2 CO
63			97			1,351,099.24			East 2 CO
64	**Nevada**	**LSVGNVXIDS0**	**TOTAL**	**DMS**	**Host**	**11,735,789.40**	**46,171.00**	**40,872.00**	East 2 CO

	A	B	C	D	E	F	G	H	I
1	Sprint -- NEVADA								
2	COE/CPR Master Detail Listing								
3	Sub-Accounts 1210X -- Digital Switching Equipment								
4	Thru 4/28/98								
5									
6					Host			Thru 4/28/98	
7		CLLI	Orig	Switch	Remote	Installed	Equipped	Working	
8	State	CODE	Year	Type	Stand alone	Cost	Lines	Lines	Location
65									
66	Nevada	LSVGNVXMDS0	82	DMS	Host	69,953.66			East 7 CO
67			83			2,950,272.77			East 7 CO
68			84			76,379.23			East 7 CO
69			85			160,401.17			East 7 CO
70			86			568,993.25			East 7 CO
71			87			230,869.21			East 7 CO
72			88			146,698.29			East 7 CO
73			89			525,628.84			East 7 CO
74			90			263,680.14			East 7 CO
75			91			1,090,133.56			East 7 CO
76			92			308,454.61			East 7 CO
77			93			93,006.45			East 7 CO
78			94			944,725.85			East 7 CO
79			95			937,976.79			East 7 CO
80			96			228,966.86			East 7 CO
81			97			4,494,448.99			East 7 CO
82	Nevada	LSVGNVXMDS0	TOTAL	DMS	Host	13,090,589.67	38,649.00	29,738.00	East 7 CO

	A	B	C	D	E	F	G	H	I
1	Sprint -- NEVADA								
2	COE/CPR Master Detail Listing								
3	Sub-Accounts 1210X -- Digital Switching Equipment								
4	Thru 4/28/98								
5									
6					Host			Thru 4/28/98	
7		CLLI	Orig	Switch	Remote	Installed	Equipped	Working	
8	State	CODE	Year	Type	Stand alone	Cost	Lines	Lines	Location
83									
84	Nevada	NLVGNVXFDS1	58	DMS	Host	76,455.63			North 2 CO
85			68			33,537.99			North 2 CO
86			70			100,230.43			North 2 CO
87			73			23,328.71			North 2 CO
88			81			1,245.02			North 2 CO
89			82			189,180.89			North 2 CO
90			83			4,876,134.97			North 2 CO
91			84			114,304.60			North 2 CO
92			85			45,342.49			North 2 CO
93			86			166,011.88			North 2 CO
94			87			488,543.07			North 2 CO
95			88			133,221.15			North 2 CO
96			89			15,327.69			North 2 CO
97			90			33,127.34			North 2 CO
98			91			1,146,949.16			North 2 CO
99			92			112,974.13			North 2 CO
100			93			700,502.04			North 2 CO
101			94			1,014,960.28			North 2 CO
102			95			228,471.87			North 2 CO
103			96			723,284.43			North 2 CO
104			97			1,534,215.48			North 2 CO
105	Nevada	NLVGNVXFDS1	TOTAL	DMS	Host	11,757,349.25	43,817.00	32,514.00	North 2 CO

	A	B	C	D	E	F	G	H	I
1	Sprint -- NEVADA								
2	COE/CPR Master Detail Listing								
3	Sub-Accounts 1210X -- Digital Switching Equipment								
4	Thru 4/28/98								
5									
6					Host			Thru 4/28/98	
7		CLLI	Orig	Switch	Remote	Installed	Equipped	Working	
8	State	CODE	Year	Type	Stand alone	Cost	Lines	Lines	Location
106									
107	Nevada	NLVGNVXGDS0	72	DMS	Host	26,726.66			North 3 CO
108			81			152,634.95			North 3 CO
109			82			1,433,093.54			North 3 CO
110			83			235,672.02			North 3 CO
111			84			872,888.00			North 3 CO
112			85			229,680.31			North 3 CO
113			86			184,848.33			North 3 CO
114			87			530,214.39			North 3 CO
115			88			160,673.86			North 3 CO
116			89			8,091.10			North 3 CO
117			90			80,611.13			North 3 CO
118			91			337,138.15			North 3 CO
119			92			372,622.33			North 3 CO
120			94			643,752.23			North 3 CO
121			95			279,929.85			North 3 CO
122			97			2,167,299.19			North 3 CO
123	Nevada	NLVGNVXGDS0	TOTAL	DMS	Host	7,715,876.04	21,528.00	17,024.00	North 3 CO

	A	B	C	D	E	F	G	H	I
1	Sprint -- NEVADA								
2	COE/CPR Master Detail Listing								
3	Sub-Accounts 1210X -- Digital Switching Equipment								
4	Thru 4/28/98								
5									
6					Host			Thru 4/28/98	
7		CLLI	Orig	Switch	Remote	Installed	Equipped	Working	
8	State	CODE	Year	Type	Stand alone	Cost	Lines	Lines	Location
124									
125	Nevada	LSVGNVXUDS0	80	DMS	Host	1,155,890.29			North 5 CO
126			81			99,366.95			North 5 CO
127			82			848,583.26			North 5 CO
128			83			16,669.75			North 5 CO
129			84			19,974.02			North 5 CO
130			85			203,084.02			North 5 CO
131			86			158,657.80			North 5 CO
132			87			452,758.68			North 5 CO
133			88			372,291.85			North 5 CO
134			89			135,727.62			North 5 CO
135			90			105,164.85			North 5 CO
136			91			1,587,380.55			North 5 CO
137			92			155,455.24			North 5 CO
138			93			442,314.03			North 5 CO
139			94			886,995.76			North 5 CO
140			95			1,551,330.76			North 5 CO
141			96			963,089.01			North 5 CO
142			97			2,872,347.16			North 5 CO
143	Nevada	LSVGNVXUDS0	TOTAL	DMS	Host	12,027,081.60	58,025.00	46,387.00	North 5 CO

	A	B	C	D	E	F	G	H	I
1	Sprint -- NEVADA								
2	COE/CPR Master Detail Listing								
3	Sub-Accounts 1210X -- Digital Switching Equipment								
4	Thru 4/28/98								
5									
6					Host			Thru 4/28/98	
7		CLLI	Orig	Switch	Remote	Installed	Equipped	Working	
8	State	CODE	Year	Type	Stand alone	Cost	Lines	Lines	Location
144									
145	Nevada	LSVGNVXTDS0	69	DMS	Host	275,012.78			North 8 CO
146			75			5,328.28			North 8 CO
147			76			52,844.16			North 8 CO
148			77			42,843.52			North 8 CO
149			78			37,479.93			North 8 CO
150			79			13,536.13			North 8 CO
151			80			35,837.44			North 8 CO
152			81			1,647.58			North 8 CO
153			82			39,371.03			North 8 CO
154			83			2,142,157.69			North 8 CO
155			84			145,269.92			North 8 CO
156			85			2,522,293.94			North 8 CO
157			86			300,169.85			North 8 CO
158			87			367,549.00			North 8 CO
159			88			153,750.83			North 8 CO
160			89			10,785.41			North 8 CO
161			90			240,829.53			North 8 CO
162			91			275,329.42			North 8 CO
163			92			414,765.63			North 8 CO
164			93			1,088,891.94			North 8 CO
165			94			530,726.64			North 8 CO
166			95			308,715.82			North 8 CO
167			96			304,626.89			North 8 CO
168			97			2,851,583.43			North 8 CO
169	Nevada	LSVGNVXTDS0	TOTAL	DMS	Host	12,161,346.79	50,086.00	37,261.00	North 8 CO

	A	B	C	D	E	F	G	H	I
1	Sprint -- NEVADA								
2	COE/CPR Master Detail Listing								
3	Sub-Accounts 1210X -- Digital Switching Equipment								
4	Thru 4/28/98								
5									
6					Host			Thru 4/28/98	
7		CLLI	Orig	Switch	Remote	Installed	Equipped	Working	
8	State	CODE	Year	Type	Stand alone	Cost	Lines	Lines	Location
170									
171	Nevada	LSVGNVXLDS0	57	DMS	Host	14,000.00			South 6 CO
172			77			67,264.19			South 6 CO
173			80			592.64			South 6 CO
174			81			200,126.25			South 6 CO
175			82			4,244,635.72			South 6 CO
176			83			125,130.25			South 6 CO
177			84			182,513.25			South 6 CO
178			85			481,710.29			South 6 CO
179			86			213,423.36			South 6 CO
180			87			510,764.36			South 6 CO
181			88			317,539.62			South 6 CO
182			89			85,416.27			South 6 CO
183			90			152,862.55			South 6 CO
184			91			288,674.68			South 6 CO
185			92			431,610.52			South 6 CO
186			93			430,060.24			South 6 CO
187			94			1,653,521.38			South 6 CO
188			95			423,694.78			South 6 CO
189			96			602,838.91			South 6 CO
190			97			2,451,644.97			South 6 CO
191	Nevada	LSVGNVXLDS0	TOTAL	DMS	Host	12,878,024.23	39,176.00	31,400.00	South 6 CO

	A	B	C	D	E	F	G	H	I
1	Sprint -- NEVADA								
2	COE/CPR Master Detail Listing								
3	Sub-Accounts 1210X -- Digital Switching Equipment								
4	Thru 4/28/98								
5									
6					Host			Thru 4/28/98	
7		CLLI	Orig	Switch	Remote	Installed	Equipped	Working	
8	State	CODE	Year	Type	Stand alone	Cost	Lines	Lines	Location
192									
193	Nevada	LSVGNVXHDSO	80	DMS	Host	24,004.80			West 8 CO
194			81			4,402,980.52			West 8 CO
195			82			34,051.75			West 8 CO
196			83			38,292.22			West 8 CO
197			84			99,957.03			West 8 CO
198			85			50,242.28			West 8 CO
199			86			325,092.26			West 8 CO
200			87			658,233.76			West 8 CO
201			88			277,480.94			West 8 CO
202			89			32,127.96			West 8 CO
203			90			252,637.52			West 8 CO
204			91			1,846,751.34			West 8 CO
205			92			617,478.51			West 8 CO
206			93			434,059.90			West 8 CO
207			94			535,806.56			West 8 CO
208			95			455,365.41			West 8 CO
209			96			27,481.01			West 8 CO
210			97			2,612,837.77			West 8 CO
211	Nevada	LSVGNVXHDSO	TOTAL	DMS	Host	12,724,881.54	44,506.00	35,509.00	West 8 CO

	A	B	C	D	E	F	G	H	I
1	**Sprint -- NEVADA**								
2	**COE/CPR Master Detail Listing**								
3	**Sub-Accounts 1210X -- Digital Switching Equipment**								
4	**Thru 4/28/98**								
5									
6					**Host**			**Thru 4/28/98**	
7		**CLLI**	**Orig**	**Switch**	**Remote**	**Installed**	**Equipped**	**Working**	
8	**State**	**CODE**	**Year**	**Type**	**Stand alone**	**Cost**	**Lines**	**Lines**	**Location**
212									
213	**Nevada**	**LSVGNVXKDS0**	72	**DMS**	**Host**	59,785.46			West 6 CO
214			73			45,352.14			West 6 CO
215			75			7,372.23			West 6 CO
216			76			21,675.22			West 6 CO
217			77			24,902.53			West 6 CO
218			78			28,690.63			West 6 CO
219			79			14,799.96			West 6 CO
220			80			20,913.36			West 6 CO
221			81			27,070.27			West 6 CO
222			82			1,728,568.76			West 6 CO
223			83			344,482.33			West 6 CO
224			84			4,201,948.88			West 6 CO
225			85			866,659.45			West 6 CO
226			86			506,978.29			West 6 CO
227			87			717,580.40			West 6 CO
228			88			1,073,803.61			West 6 CO
229			89			1,627,275.70			West 6 CO
230			90			152,558.48			West 6 CO
231			91			2,013,712.08			West 6 CO
232			92			363,860.36			West 6 CO
233			93			830,016.07			West 6 CO
234			94			1,038,972.90			West 6 CO
235			95			1,290,990.49			West 6 CO
236			96			741,777.07			West 6 CO
237			97			5,085,071.56			West 6 CO
238	**Nevada**	**LSVGNVXKDS0**		**DMS**	**Host**	**22,834,818.23**	**119,151.00**	**98,895.00**	West 6 CO

	A	B	C	D	E	F	G	H	I
1	Sprint -- NEVADA								
2	COE/CPR Master Detail Listing								
3	Sub-Accounts 1210X -- Digital Switching Equipment								
4	Thru 4/28/98								
5									
6					Host			Thru 4/28/98	
7		CLLI	Orig	Switch	Remote	Installed	Equipped	Working	
8	State	CODE	Year	Type	Stand alone	Cost	Lines	Lines	Location
239									
240	Nevada	BLCYNVXFDS0	79		Host	161,898.34			Boulder City CO
241			81			5,895.12			Boulder City CO
242			82			21,921.59			Boulder City CO
243			83			15,868.55			Boulder City CO
244			84			17,383.58			Boulder City CO
245			85			1,803,188.54			Boulder City CO
246			86			109,726.89			Boulder City CO
247			87			237,225.12			Boulder City CO
248			88			96,305.90			Boulder City CO
249			89			8,190.57			Boulder City CO
250			90			40,200.04			Boulder City CO
251			91			290,454.33			Boulder City CO
252			92			231,821.64			Boulder City CO
253			93			98,206.56			Boulder City CO
254			94			40,838.78			Boulder City CO
255			95			751,666.63			Boulder City CO
256			96			21,963.41			Boulder City CO
257			97			1,634,981.00			Boulder City CO
258	Nevada	BLCYNVXFDS0	TOTAL		Host	5,587,736.59	12,017.00	10,524.00	Boulder City CO

	A	B	C	D	E	F	G	H	I
1	Sprint -- NEVADA								
2	COE/CPR Master Detail Listing								
3	Sub-Accounts 1210X -- Digital Switching Equipment								
4	Thru 4/28/98								
5									
6					Host			Thru 4/28/98	
7		CLLI	Orig	Switch	Remote	Installed	Equipped	Working	
8	State	CODE	Year	Type	Stand alone	Cost	Lines	Lines	Location
259									
260	Nevada	LSVGNVXVDS0	80	DMS	Host	985,655.11			South South CO
261			81			73,660.08			South South CO
262			82			14,247.57			South South CO
263			83			122,736.10			South South CO
264			84			53,659.84			South South CO
265			85			111,067.60			South South CO
266			86			139,031.35			South South CO
267			87			169,416.60			South South CO
268			88			329,094.40			South South CO
269			89			83,218.04			South South CO
270			90			324,092.78			South South CO
271			91			1,031,101.51			South South CO
272			92			566,808.46			South South CO
273			93			553,285.53			South South CO
274			94			1,055,324.00			South South CO
275			95			1,765,572.88			South South CO
276			96			1,129,890.68			South South CO
277			97			3,844,874.31			South South CO
278	Nevada	LSVGNVXVDS0	TOTAL	DMS	Host	12,352,736.84			South South CO

	A	B	C	D	E	F	G	H	I
1	Sprint -- NEVADA								
2	COE/CPR Master Detail Listing								
3	Sub-Accounts 1210X -- Digital Switching Equipment								
4	Thru 4/28/98								
5									
6					Host			Thru 4/28/98	
7		CLLI	Orig	Switch	Remote	Installed	Equipped	Working	
8	State	CODE	Year	Type	Stand alone	Cost	Lines	Lines	Location
279									
280	Nevada	HNSNNVXFDS0	80	DMS	Host	229425.49			Henderson CO
281			81			146042.93			Henderson CO
282			82			3364168.00			Henderson CO
283			83			93669.98			Henderson CO
284			84			96729.06			Henderson CO
285			85			145038.45			Henderson CO
286			86			174821.36			Henderson CO
287			87			151335.59			Henderson CO
288			88			307995.71			Henderson CO
289			89			31560.71			Henderson CO
290			90			177537.48			Henderson CO
291			91			340141.52			Henderson CO
292			92			395937.84			Henderson CO
293			93			227308.35			Henderson CO
294			94			86768.11			Henderson CO
295			95			1348475.17			Henderson CO
296			96			161201.30			Henderson CO
297			97			2474091.49			Henderson CO
298	Nevada	HNSNNVXFDS0	TOTAL	DMS	Host	9,952,248.54	40,211.00	33,236.00	Henderson CO

	A	B	C	D	E	F	G	H	I
1	Sprint -- NEVADA								
2	COE/CPR Master Detail Listing								
3	Sub-Accounts 1210X -- Digital Switching Equipment								
4	Thru 4/28/98								
5									
6					Host			Thru 4/28/98	
7		CLLI	Orig	Switch	Remote	Installed	Equipped	Working	
8	State	CODE	Year	Type	Stand alone	Cost	Lines	Lines	Location
299									
300	Nevada	SRCHNVXF297	82	OPM	Remote	9069.99			Searchlight
301			90			61278.05			Searchlight
302			91			144673.22			Searchlight
303			92			116597.83			Searchlight
304			94			18216.15			Searchlight
305	Nevada	SRCHNVXF297	TOTAL	OPM	Remote	349,835.24	998.00	797.00	Searchlight

	A	B	C	D	E	F	G	H	I
1	Sprint -- NEVADA								
2	COE/CPR Master Detail Listing								
3	Sub-Accounts 1210X -- Digital Switching Equipment								
4	Thru 4/28/98								
5									
6					Host			Thru 4/28/98	
7		CLLI	Orig	Switch	Remote	Installed	Equipped	Working	
8	State	CODE	Year	Type	Stand alone	Cost	Lines	Lines	Location
306									
307	Nevada	BDMDNVXS875	83	OPM	Remote	100455.10			Blue Diamond
308			91			129731.87			Blue Diamond
309	Nevada	BDMDNVXS875	TOTAL	OPM	Remote	230,186.97	454.00	432.00	Blue Diamond

	A	B	C	D	E	F	G	H	I
1	Sprint -- NEVADA								
2	COE/CPR Master Detail Listing								
3	Sub-Accounts 1210X -- Digital Switching Equipment								
4	Thru 4/28/98								
5									
6					Host			Thru 4/28/98	
7		CLLI	Orig	Switch	Remote	Installed	Equipped	Working	
8	State	CODE	Year	Type	Stand alone	Cost	Lines	Lines	Location
310									
311	Nevada	JEANNVXF874	78	OPM	Remote	1255.13			Jean
312			81			22506.77			Jean
313			82			22989.89			Jean
314			83			6971.35			Jean
315			92			11303.64			Jean
316			94			155494.75			Jean
317			95			3876.49			Jean
318	Nevada	JEANNVXF874	TOTAL	OPM	Remote	224,398.02	641.00	545.00	Jean

	A	B	C	D	E	F	G	H	I
1	**Sprint -- NEVADA**								
2	**COE/CPR Master Detail Listing**								
3	**Sub-Accounts 1210X -- Digital Switching Equipment**								
4	**Thru 4/28/98**								
5									
6					**Host**			**Thru 4/28/98**	
7		**CLLI**	**Orig**	**Switch**	**Remote**	**Installed**	**Equipped**	**Working**	
8	**State**	**CODE**	**Year**	**Type**	**Stand alone**	**Cost**	**Lines**	**Lines**	**Location**
319									
320	**Nevada**	**MTCHNVXF872**	81	**RLCM**	**Remote**	1397.06			Mt. Charleston
321			85			10029.15			Mt. Charleston
322			86			4263.03			Mt. Charleston
323			88			2137.66			Mt. Charleston
324			97			162356.43			Mt. Charleston
325	**Nevada**	**MTCHNVXF872**	TOTAL	**RLCM**	**Remote**	**180,183.33**	**638.00**	**568.00**	Mt. Charleston

	A	B	C	D	E	F	G	H	I
1	Sprint -- NEVADA								
2	COE/CPR Master Detail Listing								
3	Sub-Accounts 1210X -- Digital Switching Equipment								
4	Thru 4/28/98								
5									
6					Host			Thru 4/28/98	
7		CLLI	Orig	Switch	Remote	Installed	Equipped	Working	
8	State	CODE	Year	Type	Stand alone	Cost	Lines	Lines	Location
326									
327	Nevada	LSVGNVXWDS0	82	DMS	Host	584455.68			WestWest
328			83			163659.46			WestWest
329			84			3873.42			WestWest
330			85			1039565.02			WestWest
331			86			130855.43			WestWest
332			87			165276.98			WestWest
333			88			720360.60			WestWest
334			89			267433.34			WestWest
335			90			1060682.36			WestWest
336			91			3034272.61			WestWest
337			92			854005.63			WestWest
338			93			991741.22			WestWest
339			94			623337.83			WestWest
340			95			2758541.49			WestWest
341			96			580518.93			WestWest
342			97			8979946.16			WestWest
343	Nevada	LSVGNVXWDS0	TOTAL	DMS	Host	21,958,526.16	111,411.00	90,668.00	WestWest
344									
345									
346									
347									

	A	B	C	D	E	F	G	H	I
1	Sprint -- NEVADA								
2	COE/CPR Master Detail Listing								
3	Sub-Accounts 1210X -- Digital Switching Equipment								
4	Thru 4/28/98								
5									
6					Host			Thru 4/28/98	
7		CLLI	Orig	Switch	Remote	Installed	Equipped	Working	
8	State	CODE	Year	Type	Stand alone	Cost	Lines	Lines	Location
348	GRAND TOTAL ALL SWITCHES					184,789,953.24			
349									
350									