computers to other subscribers on the public switched network.[601] In order to accomplish this, a telephone network must connect customer premises equipment to a switching facility, ensure that adequate capacity exists in that switching facility to process calls, and interconnect the switching facility with other switching facilities to route calls to their destination. A wire center is the location of the switching facility and the wire center boundaries define the area in which all customers are connected to a given wire center. The infrastructure to interconnect the wire centers is known as the "interoffice" network, and the carriage of traffic between wire centers is known as "transport."

287. In the *Universal Service Order*, the Commission stated that "[a]ny network function or element, such as . . . switching, transport or signaling, necessary to provide supported services must have an associated cost."[602] In the *1997 Further Notice*, the Commission sought comment on issues that affect the input values relating to the forward-looking economic cost of switching and interoffice transport.[603] The *Switching and Transport Public Notice* established several guidelines relating to switching, the design of the interoffice network, and interoffice cost attributable to providing supported services.[604] In the *Platform Order*, the Commission concluded that the federal mechanism should incorporate, with certain modifications, the HAI 5.0a switching and interoffice facilities module.[605]

288. Both HAI and BCPM sponsors have provided default input values for estimating the forward-looking economic cost of switching and interoffice network.[606] On December 1, 1998, the Bureau held a public workshop designed to elicit comment on the

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[601] The functions performed by the switch for local service include: line termination; line monitoring; usage call processing, routing, and completion; interconnection to other carriers; billing and maintenance; and vertical services and features. We note that not all of these functions are supported by universal service.

[602] *Universal Service Order*, 12 FCC Rcd at 8913, para. 250 (criterion two).

[603] *1997 Further Notice*, 12 FCC Rcd at 18560-66, paras. 121-38.

[604] *Switching and Transport Public Notice* at 2-6. The Bureau guidelines established that: (1) the models permit individual switches to be identified as host, remote, or stand-alone; (2) switching investment costs should be separately estimated for host, remote, and stand-alone switches; (3) models should include switch capacity constraints; (4) all of the line-side port costs and a percentage of usage costs should be assigned to the cost of providing the supported service; and (5) models should accommodate an interoffice network that is capable of connecting switches designated as hosts and remotes in a way that is compatible with capabilities of equipment and technology that are available today and current engineering practices. *Id.*

[605] *Platform Order*, 13 FCC Rcd at 21354, para. 75.

[606] *See* Letter from Richard N. Clarke, AT&T, to Magalie Roman Salas, FCC, dated February 3, 1998 (HAI Feb. 3 submission) App. B; BCPM April 30, 1998 submission, Switch Model Inputs.

switching inputs values to be used in the federal mechanism.[607]

289. In the *Inputs Further Notice*, we tentatively adopted input values associated with switching and interoffice facilities, including values associated with the installation and purchase of new switches.[608] In addition, we tentatively adopted the Local Exchange Routing Guide (LERG) database to identify host-remote switch relationships.[609]

B. Switch Costs

1. Background

290. In the *Inputs Further Notice*, we tentatively concluded that we should use publicly available data on the cost of purchasing and installing switches that was compiled by the Commission, in conjunction with the work of Gabel and Kennedy,[610] and the Bureau of Economic Analysis (BEA) of the U.S. Department of Commerce.[611] This information was gathered from depreciation reports filed by LECs at the Commission. In order to better estimate the costs of small switches, we tentatively concluded in the *Inputs Further Notice* to augment the depreciation data with data compiled by the Commission, in conjunction with Gabel and Kennedy and the U.S. Department of Agriculture Rural Utility Service (RUS).[612] This information was gathered from reports made to RUS by LECs.

291. In order to make the RUS data comparable with the depreciation data, we proposed a series of adjustments to the RUS data. The cost figures reported in the depreciation information reflect the costs of purchasing and installing new switches. While the RUS cost data also contain information on purchasing and installing new switches, they do not include: (1) the cost associated with purchasing and installing the main distribution frame (MDF); (2) the cost associated with purchasing and installing power equipment; (3) the cost

[607] *See Workshop Public Notice*. The December 1, 1998 workshop addressed issues relating to switching and expenses.

[608] *See Inputs Further Notice* at paras. 147-91, App. A.

[609] *Inputs Further Notice* at paras. 174-78.

[610] *See* NRRI Study, *supra* note 214.

[611] *Inputs Further Notice* at para. 152.

[612] *Inputs Further Notice* at para. 162.

of connecting each remote switch to its respective host switch; and (4) LEC engineering costs.[613] In order to make the depreciation and RUS information comparable, we proposed in the *Inputs Further Notice* to add estimates of these four components to the switch costs reported in the RUS information.[614]

292. In order to account for the cost of MDF omitted from the RUS information, we tentatively concluded that $12 per line was a reasonable cost for purchasing and installing MDF equipment.[615] In order to account for the cost of power equipment omitted from the RUS information, we tentatively concluded that the cost of purchasing and installing switches with 0-999 lines should be increased by $12,000, the cost of purchasing and installing switches with 1,000-4,999 lines should be increased $40,000, and the cost of purchasing and installing switches with 5,000-25,000 lines should be increased by $74,500.[616] We tentatively concluded that $27,598 should be added to the cost of each RUS remote switch in order to account for cost of connecting the remote switch to the host switch, a cost omitted from the RUS information.[617] We further proposed in the *Inputs Further Notice* that, in order to account for the LEC engineering costs omitted in the RUS information, we should add, after making the above adjustments for power, MDF, and remote connection costs, eight percent to the total cost of each RUS switch.

293. In order to determine the reasonable forward-looking cost of switches, based on the selected data set, we tentatively concluded in the *Inputs Further Notice* that we should employ regression analysis.[618] We tentatively concluded that the cost of a switch should be estimated as a linear function of the number of lines connected to the switch and the type of switch installed (i.e., host or remote).[619]

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[613] Letter from W. Scott Randolph, GTE, to Magalie Roman Salas, FCC dated December 18, 1998 (GTE Dec. 18 *ex parte*) at 5 and 6; NRRI Study at 97 and 102; Letter from Pete Sywenki, Sprint, to Magalie Roman Salas, FCC, dated December 22, 1998 (Sprint Dec. 22 *ex parte*) at 13-21; Letter from Richard Clarke, AT&T, to Magalie Roman Salas, FCC, dated January 7, 1999 (AT&T Jan. 7 *ex parte*) at 1.

[614] *Inputs Further Notice* at paras. 157-161.

[615] *Inputs Further Notice* at para. 158.

[616] *Inputs Further Notice* at para. 159.

[617] *Inputs Further Notice* at para. 160.

[618] *Inputs Further Notice* at para. 163.

[619] *Inputs Further Notice* at para. 164. In order to estimate the forward-looking cost of purchasing and installing a switch, switch costs also are estimated as a function of the date of installation. By including information on installation dates, the model produces forward-looking estimates that account for historical pricing trends.

294. In order to capture changes in the cost of purchasing and installing switching equipment over time, we tentatively concluded in the *Inputs Further Notice* that we should modify the data to adjust for the effects of inflation, and explicitly incorporate variables in the regression analysis that capture cost changes unique to the purchase and installation of digital switches.[620]

295. In the *Inputs Further Notice*, we tentatively concluded that in order to capture the costs associated with the purchase and installation of new switches, and to exclude the costs associated with upgrading switches, we should exclude switch cost data that contained costs reported more than three years after installation. We tentatively concluded that this restriction eliminates switch cost data that contain a significant amount of upgrade costs and, therefore, do not solely represent the purchase and installation costs of new switches.[621]

2. Discussion

296. Switch Cost Estimates. We adopt the fixed cost (in 1999 dollars) of a remote switch as $161,800 and the fixed cost (in 1999 dollars) of both host and stand-alone switches as $486,700. We adopt the additional cost per line (in 1999 dollars) for remote, host, and stand-alone switches as $87.[622]

297. For the reasons set forth below, we affirm our tentative conclusion to use the publicly available data from LEC depreciation filings, and to supplement the depreciation data with data from LEC reports to the RUS. We also affirm our tentative conclusion that we should not rely on the BCPM and HAI default values, because these values are largely based on non-public information or opinions of their experts, without data that enable us adequately to substantiate those opinions.

298. Switch Cost Data. The depreciation data contains for each switch reported: the model designation of the switch; the year the switch was first installed; and the lines of capacity and book-value cost of purchasing and installing each switch at the time the depreciation report was filed with the Commission.[623] The RUS data contains, for each switch

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[620] *Inputs Further Notice* at para. 166.

[621] *Inputs Further Notice* at para. 170.

[622] *See* Appendix C for regression results, and an explanation of how cost estimates are derived from these results.

[623] Until 1996, large incumbent LECs were required to file depreciation rate reports with the Commission pursuant to 47 C.F.R. § 43.43. Prior to filing these reports, companies generally would submit depreciation rate studies that included data for each digital switch in operation. *See* Appendix C for a further description of the data set.

reported: the switch type (i.e., host or remote); the number of equipped lines; cost at installation; and year of installation.[624]

299. The sample that we use to estimate switch costs includes 1,085 observations. The sample contains 946 observations selected from the depreciation data, which provide information on the costs of purchasing and installing switches gathered from 20 states. All observations in the depreciation data set are for switches with 1,000 lines or more. In order to better estimate the cost of small switches, we augmented the depreciation data set by adding data from RUS. The RUS sample contains 139 observations which provide information from across the nation on the costs of small switches purchased and installed by rural carriers. Over 80 percent of the observations of switch costs in the RUS data set measure the costs for switches with 1,000 lines of capacity or less. The combined sample represents purchases of both host and remote switches, with information on 490 host switches and 595 remote switches, and covers switches installed between 1989 and 1996. This set of data represents the most complete public information available to the Commission on the costs of purchasing and installing new switches.

300. The depreciation data set proposed in the *Inputs Further Notice* excluded 26 observations that had been deemed to be outliers by the Bureau of Economic Analysis. Bell Atlantic criticizes the Commission for excluding these outliers.[625] The excluded observations were not available in electronic form prior to the release of the *Inputs Further Notice*. Subsequently, the Bureau obtained these outlying observations from the Bureau of Economic Analysis and reinserted them into the data set used to derive the input values we adopt herein. In addition, several commenters recommend that the depreciation data set also should include switches with fewer than 1,000 lines of capacity. This information, however, is not available in electronic format and, therefore, would be unduly burdensome to include.[626]

301. In response to the *1997 Data Request*, the Commission received a second set of information pertaining to 1,486 switches. Upon analysis, however, we have identified one or more problems with most of the data submitted: missing switch costs; zero or negative installation costs; zero or blank line counts; unidentifiable switches; or missing or inconsistent Common Language Local Identification (CLLI) codes. After excluding these corrupted observations, 302 observations remained. The remaining observations represented switches purchased by only four companies. We affirm our tentative conclusion that the data set we

[624] Many small telephone companies receive financial assistance from RUS, which requires these companies to report the payments made for new switches. *See* Appendix C for a further description of the RUS data.

[625] Bell Atlantic *Inputs Further Notice* comments at 10 and 11.

[626] The Bureau of Economic Analysis, in creating the electronic data set from depreciation filings, did not include observations for switches with fewer than 1,000 lines.

use is superior to the data set obtained from the data request, both in terms of the number of usable observations and the number of companies represented in the data set.

302. Following the December 1, 1998, workshop, three companies voluntarily submitted further data regarding the cost of purchasing and installing switches: BellSouth provided data on switch investments for its entire operating region; Sprint provided similar data for its operations in Nevada, Missouri, and Kansas; and GTE provided switch investment information for California.[627] When consolidated, this information forms a data set of approximately 300 observations representing the costs of new switches.[628] As AT&T has noted, however, the information submitted contains some inconsistencies.[629] Considering these inconsistencies, the limited number of companies represented, and the size of this voluntarily submitted data set, we conclude that the data set we use is preferable.

303. BellSouth suggests that we merge either the information received in response to the *1997 Data Request,* the information from the voluntary submissions, or both, with the data set we use.[630] We reject this suggestion because there are significant inconsistencies between the different data sets. For example, in its voluntary submission, GTE provides the amount of total investment for each of its California switches at the time these switches were installed, but reports associated line counts only for October 1998. This information is not consistent with the data set used by the Commission, which contains aggregate investment and line counts measured at the same point in time. Second, our analysis of the information provided in both the voluntary submissions and the data request reveals, based on simple linear regression, inconsistencies between these two data sets and the data set employed by the Commission.[631] Our analysis reveals that both alternative data sets contain information that is

[627] BellSouth January 29, 1999 *ex parte*; Sprint February 5, 1999 *ex parte*; and GTE February 22, 1999 *ex parte*.

[628] Some of the switch cost values provided in the voluntary submissions include the costs associated with upgrading switching equipment. The voluntary information does not, however, contain information that would allow us to identify the upgrade components associated with these additional costs. For example, post-installation investments are not identified as investments in additional line capacity, additional software, and so forth. After removing the information where new switch costs and the costs associated with post installation upgrades are inextricably linked, using the process outlined in Appendix C, fewer than 300 observations remain.

[629] AT&T points out that the data submitted by Sprint contains records that are either missing or inconsistent with other records, records that are old or do not reflect equipment used exclusively to provide end office switching, and records that contain ambiguous information. *See* AT&T Mar. 10, 1999 *ex parte*.

[630] BellSouth *Inputs Further Notice* comments at B-14 and B-15.

[631] A year-by-year analysis of the deprecation data and the RUS data reveals that the fixed cost of a host switch is significantly more than the fixed cost of a remote switch. Our analysis examining the deprecation data reveals that the difference is statistically significant and positive in four of the seven years covered by the

inconsistent with the comments in this proceeding.[632]

304. Adjustments to the Data. As discussed above, in the *Inputs Further Notice*, we proposed certain adjustments to the RUS data to account for the cost of MDF and power equipment, which were omitted from the RUS information.[633] Specifically, we proposed increasing the cost of purchasing and installing switches by $12 per line for MDF and $12,000, $40,000, or $74,500, depending upon switch size, for power costs. Commenters who address this issue agree that the RUS data must be modified to account for the costs of MDF and power to make the RUS data consistent with the depreciation data, which include these costs.[634] Some commenters who address these adjustments claim that we should use different values for MDF and power costs, but provide little or no information we can use to verify their suggested values.[635] Sprint, for example, claims our power costs are too low and provides a breakdown of power costs, but does not supply any data to support their higher proposed values for power costs.[636] AT&T and MCI claim our proposed power costs should be reduced because they are substantially higher than those proposed by their experts.[637]

Commission data set. In 1995, there are only nine observations including only one host switch, and therefore, there is insufficient data to draw any conclusion for 1995. In the other two remaining years, 1993 and 1994, the difference has a large positive magnitude but is not statistically significant (the "t-statistics" for these years are 0.68 and 0.99). In contrast, the fixed cost of host switches in the data from the *1997 Data Request* do not differ statistically from the fixed costs of remote switches, nor is there a large difference in the magnitudes of the estimated costs. Similarly, year-by-year analysis of the voluntary data provided by the carriers does not reveal any systematic difference between host fixed costs and remote fixed costs.

[632] As noted in the previous footnote, the fixed cost of host switches exceeds the fixed cost of remote switches in the data set we have chosen. This is consistent with comments from this proceeding. *See* BellSouth *Inputs Further Notice* comments at B-15; Sprint *Inputs Further Notice* comments at 46; and Letter from Richard Clarke, AT&T, to Magalie Roman Salas, FCC, dated January 7, 1999 (AT&T Jan. 7 *ex parte*) at 1.

[633] *See supra* para. 291.

[634] *See, e.g.*, AT&T/MCI *Inputs Further Notice* comments at 38; Sprint *Inputs Further Notice* comments at 44; *but cf.* GTE *Inputs Further Notice* comments at 65. GTE appears to be confused about our use of the power adjustment to make the RUS data comparable to the depreciation data and incorrectly assumes we only use the depreciation data for switches with more than 25,000 lines.

[635] SBC claims that our proposed $12 per line for MDF is too low and argues a more reasonable estimate is $30 per line. SBC *Inputs Further Notice* comments at 13. Sprint, AT&T and MCI, on the other hand, agree that $12 cost per line for MDF is reasonable. AT&T/MCI *Inputs Further Notice* comments at 38; Sprint *Inputs Further Notice* comments at 44.

[636] Sprint *Inputs Further Notice* comments at 44, attachment 7. GTE also claims its power investment is higher than our proposed values, but offers no data to support this claim. GTE *Inputs Further Notice* comments at 66.

[637] AT&T/MCI *Inputs Further Notice* comments at 38.

305. We find that we need not attempt to resolve disagreement over the reasonableness of our proposed values, in the absence of any additional information, because we adopt an alternative methodology for estimating MDF and power costs. We find that we should adjust the RUS data for MDF and power equipment costs in a way that is more consistent with the way in which these costs are estimated in the depreciation data set. In the depreciation data, MDF and power equipment costs are estimated as a percentage of the total cost of the switch, as are all other components of the switch. Based on the estimates of Technology Futures, Inc., we find that these costs were eight percent of total cost.[638] Because we are adjusting the RUS data so that they are comparable with the depreciation data, we find it is appropriate to use a comparable method to estimate the portion of total costs attributable to MDF and power equipment. Accordingly, in order to account for the cost of MDF and power equipment omitted from the RUS information, we conclude that the cost of switches reported in the RUS data should be increased by eight percent.

306. In the *Inputs Further Notice*, we tentatively concluded, based on an estimate provided by Gabel and Kennedy, that $27,598 should be added to the cost of each remote switch reported in the RUS data.[639] SBC recommends that remote termination costs should be added to remote switch costs on a per-line basis, but provides no estimates of the per-line cost of remote termination.[640] Sprint provides remote termination estimates of $22,636 for termination of remote switches with less than 641 lines and $46,332 for termination of remote switches with between 641 and 6,391 lines.[641] Using Sprint's methodology, the average cost of terminating a RUS remote switch on a RUS host switch is $29,840.[642] Sprint's estimate is consistent in magnitude with Gabel and Kennedy's estimate. Therefore, because Sprint's tiered estimates captures differences between remote termination costs associated with remote switch size, we adopt Sprint's estimates.

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[638] Lawrence K. Vanston, Ray L. Hodges, Adrian J. Poitras, Technology Futures, Inc., *Transforming the Local Exchange Network: Analyses and Forecast of Technology Change* 149 (2d ed. 1997) (TFI Study). The terminology used in the TFI study differs somewhat. What TFI calls "shell" is "the common equipment, such as cabling and power equipment, that is not modular and lasts the life of the switch entity." TFI Study at 136. This includes MDF and power investment.

[639] *Inputs Further Notice* at para. 160 (citing NRRI Study at 102-104).

[640] SBC *Inputs Further Notice* comments at 13.

[641] *See* Sprint *Inputs Further Notice* comments at 45. Sprint also provided an estimate of the cost of terminating remote switches with over 6,390 lines. We note, however, that there are no remote switches in the RUS data with over 6,390 lines.

[642] Sprint estimates the average cost of terminating its own remotes on its own host switches as $61,700. Its tiered cost estimates indicate, however, that for remotes in the RUS data set, which do not include any remote switches with over 6,390 lines, the average cost is $29,840. *See* Sprint *Inputs Further Notice* comments at 45.

307. Based upon Gabel and Kennedy recommendations, derived from data analysis undertaken by RUS, we conclude that the cost of switches reported in the RUS data should be increased by eight percent in order to account for the cost of LEC engineering.[643] We conclude, however, that this adjustment should not be added to the cost of power and MDF, because these estimates already include the costs of LEC engineering.

308. Methodology. Consistent with our tentative conclusions in the *Inputs Further Notice,* we employ regression analysis. In this Order, we also adopt our tentative conclusion to use a linear function based on examination of the data and statistical evidence.

309. Sprint recommends using a non-linear function, such as the log-log function, to take into account the declining marginal cost of a switch as the number of lines connected to it increases.[644] We affirm our tentative conclusion that the linear function we adopt provides a better fit with the data than the log-log function. A discussion of the effect of time and type of switch on switch cost is presented below.

310. Based upon an analysis of the data and the record, we conclude that the fixed cost (i.e., the base getting started cost of a switch, excluding costs associated with connecting lines to the switch) of host switches and remote switches differ, but that the per-line variable cost (i.e., the costs associated with connecting additional lines to the switch) of host and remote switches are approximately the same. This is consistent with statistical evidence[645] and

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[643] *Id.*

[644] Sprint Dec. 22 *ex parte* at 12. Sprint criticized the Commission's preliminary switch regression presented in the December 1998 workshop based on the "R-squared" statistical goodness of fit criterion. After adjusting for data transformations associated with moving to a log-log specification, however, the R-squared of a log-log regression (0.56) suggested by Sprint is lower than the R-squared in the linear regression (0.73). Specifically, we note that the R-squared measure resulting from a regression employing a log-log functional form is not directly comparable to the R-squared measure from a linear regression. In order for the two measures to be comparable, the R-squared measure computed from the log-log regression must be computed using observed and predicted cost measures, not the logs of these measures. We also note that the log-log regression we employed is of the form:

$$Ln(Cost) = a_1 + a_2*Ln(Lines) + a_3*Host + a_4*Ln(Time) + a_5*Ln(Lines)*Ln(Time) + a_6*Host*Ln(Time) + e$$

where Ln(x) denotes the natural log of x. Because Sprint did not make these necessary adjustments, we believe that its criticism of the use of a linear function is misplaced. For a discussion of the "R-squared" statistical goodness of fit criterion and a discussion of log-log specifications, see William H. Greene, *Econometric Analysis*, 192-193 and 251 (1990).

[645] *See* General Wald Test for omitted variables in Ramu Ramanathan, *Introductory Econometrics with Applications* 170 (1989).

the comments of Sprint, BellSouth, and the HAI sponsors.[646]

311. Accounting for Changes in Cost Over Time. We recognize that the cost of purchasing and installing switching equipment changes over time. Such changes result, for example, from improvements in the methods used to produce switching equipment, changes in both capital and labor costs, and changes in the functional requirements that switches must meet for basic dial tone service. In order to capture changes in the cost of purchasing and installing switching equipment over time, we affirm our tentative conclusion in the *Inputs Further Notice* to modify the data to adjust for the effects of inflation, and explicitly incorporate variables in the regression analysis that capture cost changes unique to the purchase and installation of digital switches.

312. To the extent that the general level of prices in the economy changes over time, the purchasing power of a dollar, in terms of the volume of goods and services it can purchase, will change. In order to account for such economy-wide inflationary effects, we multiply the cost of purchasing and installing each switch in the data set by the gross-domestic-product chain-type price index[647] for 1997 and then divide by the gross-domestic-product chain-type price index for the year in which the switch was installed, thereby

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[646] *See* Sprint *Inputs Further Notice* comments at 46. *See also* Letter from Richard Clarke, AT&T, to Magalie Roman Salas, FCC, dated January 7, 1999 (AT&T Jan. 7 *ex parte*) at 1.

> The primary difference between a host switch and remote switch is in the extent and complexity of the 'getting started equipment,' associated with each type of switch (e.g., switch central processor functions, SS7 non-scaleable equipment, maintenance and testing, call recording for billing purposes, etc.). Because most of these functions for lines terminating a remote switch are performed at that switch's host, very little of this type of 'getting started' equipment is required at the remote. In contrast, the scaleable equipment used to terminate lines and trunks and to perform basic call processing is essentially the same at the host and remote. In fact, the line units used by Lucent 5E Remote Switching Modules are identical to those used by 5E host or stand-alone switches. Similarly, the line cards used in Nortel DMS 100 host or stand-alone switches are the same as those used in DMS 100 remotes, or in DMS 10 host or remote switches.

Id. BellSouth notes in its *Inputs Further Notice* comments that "BellSouth finds that the per line costs are slightly different because hosts' lines also bear the costs of some umbilical trunking and control that is not provided at the remotes. Still it is a reasonable simplification to allow host and remote per line costs to be the same." BellSouth *Inputs Further Notice* comments at B-15.

[647] The gross-domestic-product chain-type price index, which tracks economy-wide inflation, is published monthly by the Bureau of Economic Analysis of the U.S. Department of Commerce in the *Survey of Current Business*.

converting all costs to 1997 values.[648]

313. In order to account for cost changes unique to switching equipment, we enter time terms directly into the regression equation.[649] US West agrees that the costs of the equipment, such as switches and multiplexers, used to provide telecommunications services are declining, and that the per-unit cost of providing more services on average is declining.[650] Bell Atlantic and GTE, however, contend that the cost of switches is not currently declining and therefore pricing declines should not be expected to continue into the future.[651] As evidence, they cite their own fixed-cost contracts. As AT&T notes, however, "[i]f Bell Atlantic in fact agreed to switching contracts that 'effectively froze prices on switching equipment,' those prices would reflect its idiosyncratic business judgement . . ."[652] GTE expresses concern that, under certain specifications of time, the regression equation produces investments for remote switch "getting started" costs that are negative and that such specifications overstate the decline in switch costs.[653] As noted in the *Inputs Further Notice*, the HAI sponsors also caution that the large percentage price declines in switch prices seen in recent years may not continue.[654] We affirm our tentative conclusion that the reciprocal form of time in the regression equation satisfies these concerns by yielding projections of switch purchase and installation costs that are positive yet declining over time.[655]

314. Ameritech and GTE advocate the use of the Turner Price Index to convert the embedded cost information contained in the depreciation data to costs measured in current

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[648] Switch costs are adjusted after estimation for both realized and expected inflation between 1997 and 1999. *See* Appendix C for an explanation of these adjustments.

[649] Time was added to the regression in reciprocal form as an independent variable to measure fixed cost changes unique to remote switches. Then, a time term was added in conjunction with the host identifier variable to measure the fixed cost changes unique to host switches. A time term was also added in conjunction with the line variable, in order to measure cost changes unique to line additions on switches.

[650] US West *Inputs Further Notice* comments at 64-65.

[651] *See* Bell Atlantic *Inputs Further Notice* comments at 20, 21; GTE *Inputs Further Notice Reply* comments at 32.

[652] AT&T/MCI *Inputs Further Notice Reply* comments at 35, n.54.

[653] GTE Dec. 18 *ex parte* at 4.

[654] *See Inputs Further Notice* at para. 168. *See also* AT&T Jan. 7 *ex parte* at 4.

[655] Although the log specification of time proposed in the December 1, 1998, workshop yields similar results, it produces investments for host switch "getting started" costs that become negative in 2000 and consequently overstates pricing declines.

dollars.[656] We note, however, that this index and the data underlying it are not on the public record. We prefer to rely on public data when available. Moreover, we affirm our tentative conclusion that it is not necessary to rely on this index to convert switch costs to current dollars. Rather, as described in the preceding paragraph, we will account for cost changes over time explicitly in the estimation process, rather than adopting a surrogate such as the Turner Price Index.

315. Treatment of Switch Upgrades. The book-value costs recorded in the depreciation data include both the cost of purchasing and installing new equipment and the cost associated with installing and purchasing subsequent upgrades to the equipment over time. Upgrades costs will be a larger fraction of reported book-value costs in instances where the book-value costs of purchasing and installing switching equipment are reported well after the initial installation date of the switch. We affirm our tentative conclusion that, in order to estimate the costs associated with the purchase and installation of new switches, and to exclude the costs associated with upgrading switches, we should remove from the data set those switches installed more than three years prior to the reporting of their associated book-value costs.[657] We believe that this restriction will eliminate switches whose book values contain a significant amount of upgrade costs, and recognizes that, when ordering new switches, carriers typically order equipment designed to meet short-run demand.

316. Bell Atlantic criticizes the Commission for excluding a large percentage of the observations from the initial depreciation data set.[658] As noted in the preceding paragraph, however, the observations that have been excluded do not accurately represent the price of a new switch.

317. We reject the suggestions of Ameritech, Bell Atlantic, BellSouth, GTE, and Sprint that the costs associated with purchasing and installing switching equipment upgrades should be included in our cost estimates.[659] The model platform we adopted is intended to use the most cost-effective, forward-looking technology available at a particular period in

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[656] *See* Ameritech Dec. 16, 1998 comments at 5; GTE Dec. 18, 1998 *ex parte* at 4. The Turner Price Index is an index designed to measure the changing cost of telecommunications plant published semi-annually by AUS consultants.

[657] *Inputs Further Notice* at para. 170.

[658] Bell Atlantic *Inputs Further Notice* comments at 12.

[659] Ameritech Dec. 16, 1998 comments at 4-5; GTE Dec. 18, 1998 *ex parte* at 4-5; Sprint Dec. 22, 1998 *ex parte* at 5-7; GTE *Inputs Further Notice* comments at 68; Bell Atlantic *Inputs Further Notice* comments, Affidavit of Harold Ware and Christian Michael Dippon at 9-13; Bell Atlantic *Inputs Further Notice* comments at 8-13; BellSouth *Inputs Further Notice* comments at B-15 and B-16; Sprint *Inputs Further Notice* comments at 47 and 48.

time. The installation costs of switches estimated above reflect the most cost-effective forward-looking technology for meeting industry performance requirements. Switches, augmented by upgrades, may provide carriers the ability to provide supported services, but do so at greater costs. Therefore, such augmented switches do not constitute cost-effective forward-looking technology. In addition, as industry performance requirements change over time, so will the costs of purchasing and installing new switches. The historical cost data employed in this analysis reflect such changes over time, as do the time-trended cost estimates.

318. Additional Variables. Several parties contend that additional independent variables should be included in our regression equation. Some of the recommended variables include minutes of use, calls, digital line connections, vertical features, and regional, state, and vendor-specific identifiers.[660] For the purposes of this analysis, our model specification is limited to include information that is in both the RUS and depreciation data sets. Neither data set includes information on minutes of use, calls, digital line connections, vertical features, or differences between host and stand-alone switches. State and regional identifiers are not included in the regression because we only have depreciation data on switches from 20 states. Thus, we could not accurately estimate region-wide or state-wide differences in the cost of switching. Our model specification also does not include vendor-specific variables, because the model platform does not distinguish between different vendors' switches.[661]

319. Switch Cost Estimates. A number of commenters criticize the switch cost estimates contained in the *Inputs Further Notice* and suggest that they should be dismissed or substantially revised. For example, Sprint suggests that we dismiss the results because the data are collinear and the model is mis-specified.[662] Bell Atlantic and BellSouth suggest that the Commission underestimates the cost of switches, while AT&T and MCI suggest that the Commission overestimates the cost of switches.[663] The Commission's estimates, however, are based upon the most complete, publicly-available information on the costs of purchasing and installing new switches and therefore represent the Commission's best estimates of the cost of

[660] GTE Dec. 18, 1998 *ex parte* at 5; Sprint Dec. 22, 1998 *ex parte* at 13; Ameritech Dec. 16, 1998 comments at 6; Bell Atlantic *Inputs Further Notice* comments, Affidavit of Harold Ware and Christian Michael Dippon at 17 and 18.

[661] Moreover, even if the model platform were changed, we do not believe that it would be appropriate to use vendor-specific input values for switch costs. The model is intended to estimate the least-cost, most-efficient technology being deployed, not the technology available from a particular vendor.

[662] In Appendix C, we discuss the issues of multicollinearity and mis-specification identified by Sprint in its comments.

[663] AT&T/MCI *Inputs Further Notice* comments at 36; Bell Atlantic *Inputs Further Notice* comments at 10-11; Sprint *Inputs Further Notice* comments at 46; BellSouth *Inputs Further Notice* comments at B-15.

host and remote switches. In the preceding paragraphs and in Appendix C, we have addressed the specific objections that have been raised by parties with regard to the methodology, data set, or other aspects of the approach we adopt to derive switch cost estimates, and for the reasons given there, we reject those objections. We conclude that the remaining evidence provided as grounds for dismissing or substantially revising these estimates is largely anecdotal or unconfirmed and undocumented and does not lead us to believe that our estimates should be altered. We conclude, therefore, that the switch cost estimates we adopt are the best estimates of forward-looking cost.

C. Use of the Local Exchange Routing Guide (LERG)

320. In the *Inputs Further Notice*, we tentatively concluded that the Local Exchange Routing Guide (LERG) database should be used to determine host-remote switch relationships in the federal high-cost universal service support mechanism.[664] We now affirm that conclusion. In the *1997 Further Notice*, the Commission requested "engineering and cost data to demonstrate the most cost-effective deployment of switches in general and host-remote switching arrangements in particular."[665] In the *Switching and Transport Public Notice*, the Bureau concluded that the model should permit individual switches to be identified as host, remote, or stand-alone switches.[666] The Bureau noted that, although stand-alone switches are a standard component of networks in many areas, current deployment patterns suggest that host-remote arrangements are more cost-effective than stand-alone switches in certain cases.[667] No party has placed on the record in this proceeding an algorithm that will determine whether a wire center should house a stand-alone, host, or remote switch.[668] We therefore affirm our conclusion to use the LERG to determine host-remote switch relationships.

321. In the *Platform Order*, we concluded that the federal mechanism should incorporate, with certain modifications, the HAI 5.0a switching and interoffice facilities

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[664] *Inputs Further Notice* at para. 174. The LERG is a database of switching information maintained by Telecordia Technologies (formerly Bellcore) that includes the existing host-remote relationships. The HAI proponents have placed on the record the portion of the LERG that identifies the host-remote relationships. Letter from Chris Frentrup, MCI Worldcom, to Magalie Roman Salas, FCC, dated September 14, 1998 (MCI Sept. 14 *ex parte*).

[665] *1997 Further Notice*, 12 FCC Rcd at 18560-61, para. 122.

[666] *Switching and Transport Public Notice* at 2. Switches can be designated as host, remote, or stand-alone switches. Both a host and a stand-alone switch can provide a full complement of switching services without relying on another switch. A remote switch relies on a host switch to supply a complete array of switching functions and to interconnect with other switches.

[667] *Switching and Transport Public Notice* at 2-3.

[668] *Platform Order*, 13 FCC Rcd at 21355, para. 76.

module.[669] In its default mode, HAI assumes a blended configuration of switch technologies, incorporating both hosts and remotes, to develop switching cost curves.[670] HAI also allows the user the option of designating, in an input table, specific wire center locations that house host, remote, and stand-alone switches. When the host-remote option is selected, switching curves that correspond to host, remote, and stand-alone switches are used to determine the appropriate switching investment. The LERG database could be used as a source to identify the host-remote switch relationships. In the *Platform Order*, we stated that "[i]n the inputs stage of this proceeding we will weigh the benefits and costs of using the LERG database to determine switch type and will consider alternative approaches by which the selected model can incorporate the efficiencies gained through the deployment of host-remote configurations."[671]

322. The majority of commenters throughout this proceeding have supported the use of the LERG database as a means of determining the deployment of host and remote switches.[672] These commenters contend that the use of the LERG to determine host-remote relationships will incorporate the accumulated knowledge and efficiencies of many LECs and engineering experts in deploying the existing switch configurations.[673] Sprint contends that there are many intangible variables that can not be easily replicated in determining host-remote relationships.[674] Commenters also contend that an algorithm that realistically predicts this deployment pattern is not feasible using publicly available data and would be unnecessarily "massive and complex."[675] AT&T and MCI argue, however, that use of the LERG to identify host-remote relationships may reflect the use of embedded technology,

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[669] *Platform Order*, 13 FCC Rcd at 21354-55, para. 75.

[670] HAI Feb. 3, 1998 submission, Model Description at 58.

[671] *Platform Order*, 13 FCC Rcd at 21355, para. 76.

[672] *See, e.g.*, BellSouth *Inputs Further Notice* reply comments at 17; Sprint *Inputs Further Notice* comments at 48. *See also* Aliant *Switching and Transport Public Notice* comments at 2; Bell Atlantic *Switching and Transport Public Notice* reply comments at 2.

[673] Bell Atlantic *Switching and Transport Public Notice* reply comments, Attachment 1 at 2; BellSouth et al. *Switching and Transport Public Notice* reply comments, Attachment 1 at 2-3.

[674] Sprint *Inputs Further Notice* comments at 48.

[675] *See, e.g.*, AT&T/MCI *Switching and Transport Public Notice* comments at 6; BellSouth et al. *Switching and Transport Public Notice* reply comments, Attachment 1 at 2.

pricing, and engineering practices.[676]

323. We conclude that the LERG database is the best source set forth in this proceeding to determine host-remote switch relationships in the federal high-cost universal service support mechanism. As noted above, no algorithm has been placed on the record to determine whether a wire center should house a stand-alone, host, or remote switch. In addition, many commenters contend that development of such an algorithm independently would be difficult using publicly available data.[677] While GTE suggests that the best source of host-remote relationships would be a file generated by each company, we note that no such information has been submitted in this proceeding.[678] In addition, GTE's proposal would impose administrative burdens on carriers. We conclude that the use of the LERG to identify the host-remote switch relationships is superior to HAI's averaging methodology which may not, for example, accurately reflect the fact that remote switches are more likely to be located in rural rather than urban areas. We therefore conclude that use of the LERG is the most feasible alternative currently available to incorporate the efficiencies of host-remote relationships in the federal high-cost universal service support mechanism.

D. Other Switching and Interoffice Transport Inputs

324. General. In the *Inputs Further Notice*, we proposed several minor modifications to the switching inputs to reflect the fact that the studies on which the Commission relied to develop switch costs include all investments necessary to make a switch operational.[679] These investments include telephone company engineering and installation, the main distribution frame (MDF), the protector frame (often included in the MDF), and power costs.[680] To avoid double counting these investments, both as part of the switch and as separate input values, the commenters agree that the MDF/Protector investment per line and

[676] AT&T/MCI *Inputs Further Notice* comments at 44-45. Although AT&T and MCI oppose the use of the LERG, they have taken steps to ensure that the LERG database is compatible with use in the switching module of the synthesis model. *See* MCI Sept. 14 *ex parte*; Letter from Richard N. Clarke, AT&T, to Magalie Roman Salas, FCC, dated September 16, 1998 (AT&T Sept. 16 *ex parte*).

[677] *See, e.g.*, Ameritech *Switching and Transport Public Notice* comments at 3; AT&T/MCI *Switching and Transport Public Notice* comments at 6; BellSouth et al. *Switching and Transport Public Notice* comments Attachment 1 at 1-2; GTE *Switching and Transport Public Notice* at 11-12.

[678] GTE *Inputs Further Notice* comments at 69.

[679] *Inputs Further Notice* at para. 178.

[680] AT&T Jan. 7 *ex parte*; Sprint Dec. 22 *ex parte* at 9.

power input values should be set at zero.[681] In addition, commenters agree that the Switch Installation Multiplier should be set at 1.0.[682] We agree that including these investments both as part of the switch cost and as separate investments would lead to double counting of these costs. We therefore adopt these values.

325. Analog Line Offset. In the *Inputs Further Notice*, we tentatively concluded that the "Analog Line Circuit Offset for Digital Lines" input should be set at zero.[683] We now affirm that conclusion. AT&T and MCI contend that the switch investment in the model should be adjusted downward to reflect the cost savings associated with terminating digital, rather than analog, lines.[684] AT&T and MCI assert that this cost savings is due primarily to the elimination of a MDF and protector frame termination. AT&T and MCI further contend that the model produces, on average, 40 percent digital lines, while the data used to determine switch costs reflect the use of only approximately 18 percent digital lines.[685] In contrast, GTE contends that the model may calculate more analog lines than carriers have historically placed due to the use of an 18,000 feet maximum copper loop length.[686]

326. AT&T and MCI suggest that the analog line offset input should reflect a $12 MDF and $18 switch port termination savings per line in switch investment for terminating digital lines in the model.[687] Several commenters disagree and recommend setting the analog line offset to zero.[688] Sprint contends that the analog line offset is inherent in the switching curve in the model, thus making this input unnecessary and, therefore, justified only if the switch cost curve is based on 100 percent of analog line cost.[689] Sprint argues that an

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[681] AT&T *Inputs Further Notice* comments at 40; GTE Dec. 18 *ex parte* at 5-6; Sprint *Inputs Further Notice* comments at 49.

[682] *See, e.g.*, AT&T *Inputs Further Notice* comments at 40; GTE Dec. 18 *ex parte* at 6; Sprint *Inputs Further Notice* comments at 49.

[683] *Inputs Further Notice* at para. 179.

[684] AT&T/MCI *Inputs Further Notice* comments at 41-42. AT&T/MCI contend that the cost of terminating digital lines is significantly less expensive than terminating analog lines.

[685] AT&T/MCI *Inputs Further Notice* comments at 41.

[686] GTE *Inputs Further Notice* comments at 66.

[687] AT&T/MCI *Inputs Further Notice* comments at 42.

[688] BellSouth *Inputs Further Notice* comments at 16; GTE *Inputs Further Notice* comments at 66-67; Sprint *Inputs Further Notice* comments at 49.

[689] Sprint *Inputs Further Notice* comments at 49.

unknown mixture of analog and digital lines are taken into consideration in developing the switch curve.[690]

327. The record contains no basis on which to quantify savings beyond those taken into consideration in developing the switch cost. We also note that the depreciation data used to determine the switch costs reflect the use of digital lines. The switch investment value will therefore reflect savings associated with digital lines. AT&T and MCI's proposed analog line offset per line is based on assumptions that are neither supported by the record nor easily verified. For example, it is not possible to determine from the depreciation data the percentage of lines that are served by digital connections. It is therefore not possible to verify AT&T and MCI's estimate of the digital line usage in the "historical" data. In the absence of more explicit support of AT&T and MCI's position, we conclude that the Analog Line Circuit Offset for Digital Lines should be set at zero.

328. Switch Capacity Constraints. In the *Inputs Further Notice*, we proposed to adopt the HAI default switch capacity constraint inputs as proposed in the HAI 5.0a model documentation.[691] We now adopt that proposal. The forward-looking cost mechanism contains switch capacity constraints based on the maximum line and traffic capabilities of the switch. In their most recent filings on this issue, AT&T and MCI recommend increasing the switch line and traffic capacity constraints above the HAI input default values for those inputs.[692] AT&T and MCI contend that the default input values no longer reflect the use of the most current technology.[693] For example, AT&T and MCI recommend that the maximum equipped line size per switch should be increased from 80,000 to 100,000 lines.[694]

329. We conclude that the original HAI switch capacity constraint default values are reasonable for use in the federal mechanism. We note that Sprint, the only commenter to respond to this issue, supports this conclusion.[695] We also note that the HAI model documentation indicates that the 80,000 line assumption was based on a conservative estimate "recognizing that planners will not typically assume the full capacity of the switch can be

[690] Sprint Dec. 22 *ex parte* at 12.

[691] HAI Feb. 3, 1998 submission, App. B at 38-39.

[692] AT&T Jan. 7 *ex parte*. The HAI proponents included the updated switch capacity constraints in a table attached to the Jan. 7 *ex parte*.

[693] AT&T Jan. 7 *ex parte*.

[694] AT&T Jan. 7 *ex parte*.

[695] Sprint *Inputs Further Notice* comments at 49.

used."[696] AT&T and MCI therefore originally supported the 80,000 line limitation as the maximum equipped line size value with the knowledge that the full capacity of the switch may be higher.[697]

330. Switch Port Administrative Fill. In the *Inputs Further Notice*, we proposed a switch port administrative fill factor of 94 percent.[698] We now adopt that proposed value. The HAI model documentation defines the switch port administrative fill as "the percent of lines in a switch that are assigned to subscribers compared to the total equipped lines in a switch."[699] HAI assigns a switch port administrative fill factor of 98 percent in its default input values.[700] The BCPM default value for the switch percent line fill is 88 percent.[701]

331. Bell Atlantic contends that switches have significant unassigned capacity due to the fact that equipment is installed at intervals to handle growth.[702] Sprint recommends an average fill factor of 80 percent.[703] US West contends that its actual average fill factor is 78 percent.[704] AT&T and MCI contend that the switching module currently applies the fill factor input against the entire switch when it should be applied only to the line port portion of the switch.[705] AT&T and MCI therefore contend that, either the formula should be modified, or the input needs to be adjusted upward so that the overall switching investment increase

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[696] *See* HAI Dec. 11 submission, Model Inputs at 80.

[697] In addition, we note that a decision to adopt the revised HAI values for maximum equipped lines per switch would have only a minimal impact on the overall forward-looking cost estimation because fewer than 2 percent of wire centers have more than 80,000 lines. A review of the data indicates that, of the 12,506 wire centers served by non-rural LECs, only 189 (1.5 percent) have more than 80,000 lines and 57 (0.5 percent) have more than 100,000 lines. *See* HAI Feb. 3, 1998 model submission.

[698] *Inputs Further Notice* at para. 184.

[699] HAI Dec. 11, 1997 submission, Inputs Portfolio at 80.

[700] HAI Dec. 11, 1997 submission, Inputs Portfolio at 80.

[701] BCPM April 30, 1998 submission, Switch Model Inputs at 20-21. BCPM defines Switch Percent Line Fill as the ratio between the number of working lines on the switch and the total number of lines for which the switch is engineered.

[702] Bell Atlantic *Inputs Further Notice* comments at 8-9.

[703] Sprint *Inputs Further Notice* comments at 50.

[704] *See* Letter from Pete Sywenki, Sprint, to Magalie Roman Salas, FCC, dated Jan. 8, 1999 (attachment includes US West switch data) (Sprint Jan. 8 *ex parte*).

[705] AT&T/MCI *Inputs Further Notice* comments at 43.

attributable to line fill will be the same as if the formula were corrected.[706]

332. We note that the switch port administrative fill factor of 94 percent has been adopted in several state universal service proceedings and is supported by the Georgetown Consulting Group, a consultant of BellSouth.[707] We also note that this value falls within the range established by the HAI and BCPM default input values. The BCPM model documentation established a switch line fill default value of 88 percent that included "allowances for growth over an engineering time horizon of several years."[708] Sprint has provided no substantiated evidence to support its revised value of 80 percent. US West's average fill factor of 78 percent is based on data that include switches with unreasonably low fill factors.[709] Regarding AT&T and MCI's contention that the switching module currently applies the fill factor input against the entire switch rather than the line port portion of the switch, we note that this occurs only when the host-remote option is not utilized in the switch module. As noted above, we are using the host-remote option and therefore no adjustment to the switch fill factor is required. We therefore adopt a switch port administrative fill factor of 94 percent.

333. Trunking. In the *Inputs Further Notice*, we tentatively concluded that the switch module should be modified to disable the computation that reduces the end office investment by the difference in the interoffice trunks and the 6:1 line to trunk ratio. In addition, we tentatively adopted the proposed input value of $100.00 for the trunk port investment.[710] We now affirm these tentative conclusions and adopt this approach.

334. The HAI switching and interoffice module developed switching cost curves using the Northern Business Information (NBI) publication, "U.S. Central Office Equipment

[706] AT&T/MCI *Inputs Further Notice* comments at 43.

[707] BellSouth *Inputs Public Notice* reply comments at Exhibit 2-13; Commonwealth of Kentucky, *An Inquiry Into Universal Service and Funding Fees*, Administrative Case No. 360, App. F at 13; Louisiana Public Service Commission, *State Forward-Looking Cost Studies for Federal Universal Service Support* (May 19, 1998) (Louisiana Cost Study).

[708] BCPM April 30, 1998 submission, Switch Model Inputs at 20-21.

[709] For example, switches with installed lines of 65,001, 48,818, 11,520, 12,288, 74,039, 12,800, and 36,897 were listed as having, 1,1, 2, 10, 10, 21, and 26 working lines, respectively, or collectively, an average fill factor of .027 percent. *See* Sprint Jan. 8 *ex parte*. Our analysis of the US West data indicated that, after eliminating the observations with unreasonably low fill factors, the majority of US West switches had fill factors ranging from 88 percent to 98 percent.

[710] *Inputs Further Notice* at para. 187.

Market: 1995 Database."[711] These investment figures were then reduced per line to remove trunk port investment based on NBI's implicit line to trunk ratio of 6:1.[712] The actual number of trunks per wire center is calculated in the transport calculation, and port investment for these trunks is then added back into the switching investments.

335. Sprint notes that, under the HAI trunk investment approach, raising the per-trunk investment leads to a decrease in the switch investment per line, "despite a reasonable and expected increase" in the investment per line.[713] GTE also notes that the selection of the trunk port input value creates a dilemma in that it is used to reduce the end office investment, as noted above, and to develop a tandem switch investment.[714] GTE and Sprint recommend that the switch module be modified by disabling the computation that reduces the end office investment by the difference in the computed interoffice trunks and the 6:1 line to trunk ratio.[715] MCI agrees that the trunk port calculation should be deactivated in the switching module.[716]

336. In the *Inputs Further Notice*, we agreed with commenters that the trunk port input creates inconsistencies in reducing the end office investment.[717] Consistent with the suggestions made by GTE and MCI, we conclude that the switch module should be modified to disable the computation that reduces the end office investment by the difference in the computed interoffice trunks and the 6:1 line to trunk ratio. Sprint, the only commenter to address this issue in response to the *Inputs Further Notice*, agrees with our conclusion.[718]

337. Because the trunk port input value is also used to determine the tandem switch investment, we must determine the trunk port investment.[719] In the *Inputs Further Notice*, we

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[711] HAI Dec. 11, 1997 submission, Model Description at 52.

[712] HAI Dec. 11, 1997 submission, Model Description at 53.

[713] Sprint Dec. 22 *ex parte* at 10.

[714] GTE Dec. 18 *ex parte* at 6.

[715] GTE Dec. 18 *ex parte* at 6; Sprint *Inputs Further Notice* comments at 50.

[716] Letter from Chris Frentrup, MCI Worldcom, to Magalie Roman Salas, FCC, dated Feb. 9, 1999 (MCI Worldcom Feb. 9 *ex parte*) at 24.

[717] *Inputs Further Notice* at para. 190.

[718] Sprint *Inputs Further Notice* comments at 50.

[719] HAI defines this input as the "per trunk equivalent investment in switch trunk port at each end of a trunk." HAI Dec. 11, 1997 submission, Appendix B (HM 5.0 Inputs, Assumptions, and Default Values) at 46.

proposed an input value for trunk port investment per end of $100.00.[720] SBC and Sprint contend that this value should be higher -- ranging from $150.00 to $200.00.[721] BellSouth has filed information on the record that supports our proposed trunk port investment value.[722] BellSouth notes that the four states that have issued orders addressing the cost of the trunk port for universal service[723] have chosen estimates of the cost of the trunk port that range from $62.73 to $110.77.[724] We conclude that the record supports the adoption of a trunk port investment per end of $100.00, as supported by the HAI default values. As noted above, this value is consistent with the findings of several states and BellSouth. In addition, we note that SBC and Sprint provide no data to support their higher proposed trunk port investment value. We therefore adopt the HAI suggested input value of $100.00 for the trunk port investment, per end.

VII. EXPENSES

A. Introduction

338. In this section, we consider the inputs to the model related to expenses and general support facilities (GSF) investment. Consistent with the *Universal Service Order's* seventh criterion, we select input values that result in a reasonable allocation of joint and common costs for non-network-related costs, such as GSF, plant non-specific expenses, corporate operations expenses, and customer services expenses. The Commission's methodology for estimating these types of expenses is designed to "ensure that the forward-looking economic cost [calculated by the model] does not include an unreasonable share of the joint and common costs for non-supported services."[725] Consistent with the *Universal Service Order's* first and third criteria, we also select input values for plant-specific operations expenses that reflect the cost of maintaining a forward-looking network.[726]

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[720] *Inputs Further Notice* at para. 191.

[721] SBC *Inputs Further Notice* comments at 14; Sprint *Inputs Further Notice* comments at 50.

[722] Letter from William W. Jordan, BellSouth, to Magalie Roman Salas, FCC, dated August 7, 1998, Attachment to Question 1 at 5, 9, 13, 17 (dated July 15, 1998) (BellSouth Aug. 7 *ex parte*).

[723] BellSouth Aug. 7 *ex parte*, Attachment to Question 1 at 5, 9, 13, 17. The four states are Kentucky, Louisiana, North Carolina, and South Carolina.

[724] BellSouth Aug. 7 *ex parte*, Attachment to Question 1 at 5, 9, 13, 17.

[725] *Universal Service Order*, 12 FCC Rcd at 8915, para. 250, criterion 7; *see also* 47 U.S.C. § 254 (k).

[726] *See Universal Service Order*, 12 FCC Rcd at 8913, para. 250, criteria 1, 3; *see also infra* para. 351.