92. GTE recommends against calculating inputs from the total survey data collected by the Hatfield engineering team. To add the excluded data points would not allay all of GTE's concerns. GTE witness Murphy stated that since the sample data might not be valid, the averages calculated from the data might be incorrect. GTE does not propose the adoption of alternative input values that could be used in the Hatfield Model. Exh. CC-54 at 27-28.

93. The Commission agrees with GTE that the method used by AT&T to collect data from vendors was flawed. A questionnaire was sent to vendors asking the cost of installing cables in different soil, bedrock, and density conditions. See, *e.g.*, Exh. CC-54, Attachment A, Bates GHATF000262-GHATF00265 and GHATF000277-GHATF000305; Exh. CC-10. The AT&T questionnaire did not define the terms used in the questionnaire. Therefore, one contractor's estimates could be higher than another due, for example, to a different perception of what constitutes rocky soil. Also, the contractors who responded to the questionnaire could have differing views as to which line or household density bands constitute rural, suburban, or urban conditions. This varying perception of soil conditions and density could account for some of the variation in the data supplied by the vendors.

94. AT&T/MCI argue that it was appropriate to discard data from vendors whose prices were high. Mr. Fassett testified that, in a competitive bid situation, the contract is awarded to the low bid submission. Exh. 8 at 6, 8. Competitive bid contracts are typically awarded to the low bid submission in which the engineering tasks are well specified. Since the installation conditions in the AT&T questionnaire were not defined, we conclude that it was inappropriate to discard such data. The Hatfield team did not know if the high bids were due to prices that were not sustainable in a competitive marketplace, the hypothesis offered by AT&T witness Fassett, or because the high prices reflected the contractor's perception of installation conditions which differed from the views of other contractors.

95. Even if the terms had been defined in the questionnaire, the collection of data should have been done in a manner consistent with the way in which the information was to be used in the Hatfield Model. That is, the definition of rocky soil provided to the contractors should have been consistent with the way in which the term is used in the Hatfield Model. We note that while the Hatfield Input Portfolio discusses the modeling of soft and hard rock, these terms do not appear in the questionnaire sent to some of the contractors. Exh. CC-54, Attachment A, Bates GHATF000262-GHATF00265; Exh. 40, Hatfield Model Release 3.1 Inputs Portfolio, Section 2.7, and Hatfield Model.

96. We find that the outside plant data collected from the vendors by the Hatfield engineering team do not provide sufficient validation for the opinion of these experts.

97. It is unfortunate that GTE did not propose alternative input values for the Hatfield Model. The FCC has stated that an incumbent local exchange carrier, such as GTE, is obligated to prove the nature and magnitude of the costs it seeks to recover:

> We note that incumbent LECs have greater access to the cost information necessary to calculate the incremental cost of the unbundled elements of the network. Given this asymmetric access to cost data, we find that incumbent LECs must prove to the state commission the nature and magnitude of any forward-looking cost that it seeks to recover in the prices of interconnection and unbundled network elements.

FCC Interconnection Order at ¶680.

98. In summary, the Commission disagrees with the method used by the Hatfield team to collect data from outside plant contractors. However, no reasonable alternative Hatfield Model input values were provided. Consequently, lacking an alternative, the Commission will utilize the model's default values. Our determination of the loop cost has taken into account the likelihood that the Hatfield Model understates cable placement costs.

B. Pole Costs

99. The Hatfield Model assumes that a 40 foot, class 4, pole can be installed for $417.00. This value reflects the material and labor costs, as well as periodic down-guys and anchors. Exh. 40, RAM-3, at 16.

100. GTE witness Murphy criticizes the Hatfield model input for poles. Here, too, Mr. Murphy stated that the default value used in the model does not comport with the data collected from the outside plant vendors. He also faults the Hatfield engineering team for selecting a labor price from a different vendor than the one that supplied the material price. Furthermore, he expresses a concern that the Hatfield Model's input excludes the cost of down-guys and poles. Exh. CC-54 at 16-22.

101. AT&T/MCI witness Fassett responds that the Hatfield Model's material price for poles is reasonable when compared and contrasted with data provided by GTE and U S WEST. Mr. Fassett also responded to Mr. Murphy's claim that the Hatfield Model does not account for the cost of guys and anchors, suggesting that these costs are included in the loaded labor rate. Exh. 8 at 11-14.

102. GTE identifies the cost of guys and anchors, but does not suggest the likelihood that this equipment is required on every pole. Exh. CC-54 at 19.[15]

103. We are concerned that the cost of guys and anchors may have been excluded from the Hatfield model. Furthermore, we find that it was inappropriate of the Hatfield engineering team to obtain the cost of labor from one bid and the cost of materials from another.

104. GTE suggests, without providing any citation in support of the value, that the appropriate input value is $737.00. We are equally reluctant to use this undocumented value, insofar as it appears inconsistent with some of the evidence contained in the record.[16] For example, according to U S WEST, the average cost of the poles it installs is $336.00. This value, which is based upon the average cost for poles ranging in size from 22 to 50 feet, includes both material and installation costs. Exh. 114, MSR-2, at 11. Consequently, lacking an alternative, the Commission will utilize the Hatfield Model's $417.00 default value.

C. Rock Hardness; Road Cable; Horizontal Connecting Cables; Algorithm Errors

105. As part of the calculation of the cost of installing cable facilities, the Hatfield Model incorporates an additional cost for installation based upon depth of bedrock, hardness of bedrock, and surface soil texture. Exh. 23 at 9. Sprint criticizes the method used by the Hatfield Model to account for difficult terrain. Sprint notes that the value the Hatfield sponsors used to correct for difficult terrain resulted in a lower cost estimate than that suggested by some of the contractors contacted by the Hatfield engineering team. Sprint Brief at 49; Tr. 487-88.

106. Sprint points out that the State Members of the FCC's Joint Board on Universal Service concluded that the BCPM method used for difficult terrain was more reasonable than the Hatfield method. Exh. 23 at 9. Neither Sprint nor any other party explained how the BCPM difficult terrain cost estimation process could be incorporated in the Hatfield Model. Sprint Brief at 49.

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[15] In BCPM, for example, guys and anchors are assumed to be placed on every sixth pole. Folder Misc. Table Inputs.

[16] The $737.00 value is consistent with the input value for the BCPM. Tr. 644. However, there is no documentation to support the reasonableness of the BCPM input. See discussion, *supra*, at paragraph 83.

107. Sprint also points out a number of other problems with the method used by the Hatfield Model to estimate placement costs. Sprint Brief at 49-50; Exh. 57 at 8-9. U S WEST also identifies some Hatfield Model errors which caused the cost of the loop to be understated. Exh. 47, MAC-3, at 9.

108. In a response to Commission Bench Request 04-001, GTE and U S WEST point out that some of the algorithmic errors contained in the first version of the Hatfield Model version 3.1 have been corrected. GTE and U S WEST note that at least two errors existed in the revised version of Hatfield 3.1. These errors cause the model to omit certain sub-feeder cables and maintenance expenses. AT&T/MCI concurs that at least the former of the programming errors has not been corrected. AT&T/MCI Submission December 17, 1997; GTE and U S WEST Response to Bench Request, March 12, 1998.

109. U S WEST identifies how these two errors could be corrected. We have implemented the proposed changes in the version of the Model that we use to estimate the cost of the loop. U S WEST Response to Bench Request, March 12, 1998.

110. GTE's March 12, 1998 Bench Request Response identifies an additional algorithmic error related to horizontal connecting cable. We have not implemented the proposed modification because we find the presentation unconvincing, and the claimed cost impact, an approximately 30% increase in loop costs, implausible.

D. Drops

111. A primary difference between the drop cost estimates of GTE and the Hatfield Model is attributable to the different assumptions regarding when a drop is installed. The Hatfield Model assumes that drop wire is installed by "a crew installing aerial drop wires throughout a neighborhood or CBG in coordination with the installation of NIDs, terminals, and distribution cables." Exh. 40, RAM-3 at 10.

112. GTE argues that it is more appropriate to measure the cost of installing an individual drop. GTE states that this is the more appropriate activity to study since GTE is "require[d] to install drops wherever requested to do so by a CLEC." GTE Brief at 61.

113. GTE adds that the Hatfield Model "impermissibly requires GTE to absorb the cost difference between a complete reinstallation of drops, terminals, and cable throughout a CBG and the cost of installing equipment on a more limited basis."

114. We find GTE's methodology to be inconsistent with the objective of measuring total element long-run incremental cost. The study methodology assumes that a new network is being constructed, subject to the constraint that the current location of wire centers does not change. Whereas the cost of satisfying the total demand for service is being modeled, it is inappropriate to measure the cost of installing only one drop wire.

115. For the drop wire, GTE has effectively submitted a marginal, not a TELRIC, cost study. GTE has estimated the cost of installing one additional drop wire. GTE has implicitly presumed that each time a loop is ordered, a craftsperson must install a new drop. Simultaneously, it assumes that all existing customers have a drop. Exh. 92. These two assumptions are inconsistent. If every time a loop is ordered, a new drop must be installed, then it is appropriate to suppose, as does the Hatfield Model, that line crews would be deployed to install drops to all houses simultaneously. Individual loops would be installed if some customers already had connections to the network. But if the latter conjecture is made, it is inappropriate to assume, as does GTE, that all UNE loop orders would require a new drop. Instead, some of the UNE loops would be able to use the drop facilities that are already in place.

116. Due to this inconsistency in the study, we have reduced by $28.00 GTE's estimate of its drop investment. This is equivalent to a $0.69 reduction in the monthly cost of the loop.

117. There are two inputs that account for most of the cost of the drop wire: the length of the facility and the per-foot placement costs.

118. For most density zones, the Hatfield Model assumes that 70%-75% of drops will be buried, and that 25%-30% will be aerial. Exh. 40, RAM 3, at 11. Hatfield assumptions for the length of the facility range from 50 to 150 feet. Hatfield presupposes a buried drop placement cost of $0.75 per foot for the six lowest density zones. For the remaining three density zones, the Model assumes a per-foot cost which ranges from $1.13 to $5.00. Exh. 40, RAM-3, at 9. Aerial drop costs range from a total installed cost of $11.67 in urban areas to $53.33 in rural areas. *Id.* at 10.

119. In order to validate the reasonableness of these inputs, the Hatfield engineering team collected data from various construction companies. One of the respondents provided data specific to Washington State, while others provided cost information that was applicable to multiple states, including Washington. The Washington specific data suggests that the placement costs for buried drops are in the range of $2.00 to $5.00 per foot. The Hatfield team did not use this value because they did not deem it to be reasonable. Tr. 316-321.

120. BCPM uses a drop cost per foot for material and installation of $0.77. Exh. 83, Attachment 1, at 38. The BCPM value of $0.77 per foot is equivalent to using a cost per foot for buried cable of $0.897 in the Hatfield Model. These two values are equivalent, because the BCPM value is used for aerial and buried drops. The Hatfield Model cost of placing aerial cable is approximately $0.39 per foot.

121. The Hatfield Model includes a material cost of $0.14 per foot. Exh. 40, RAM-3, at 13. The $0.75 Hatfield installation cost, plus the $0.14 material cost for the drop wire, raises the total cost per buried drop foot in the Hatfield Model to $0.89. Therefore, the Hatfield and Benchmark Cost Proxy Model use similar input values for the cost of labor and material associated with installing buried drops.

122. Neither GTE nor U S WEST challenged the BCPM drop input value of $0.77 per foot.

123. Based upon the information in the record, we have not changed the cost-per-foot input value in the Hatfield Model.

124. GTE contends that the drop lengths are understated in the Hatfield Model. GTE states that the input values to the Hatfield Model are understated, relative to the data collected by the Hatfield engineering team. Furthermore, the Company points out that in its own study, it "assumes the length of the drop to be 100 feet for high density, 150 feet for medium density, and 250 feet for low density areas."[17] GTE Brief at 62.

125. GTE does not contend that its own inputs are based upon a study of actual drop lengths in Washington State. *Id.* Instead, they have a different set of assumptions: GTE uses the same lengths in its various service territories throughout the nation. Tr. 1108-1109.

126. The BCPM documentation does not explicitly state the drop lengths used in the model. Exh. 83, Attachment 1. Rather, the drop cost is determined endogenously, based upon the length to the center of a lot. The drop is terminated on a network interface device. AT&T/MCI assert that it is unreasonable to assume that the NID is in the center of the lot, as "most houses tend to be toward the front of the lot with a larger back yard than front yard; thus, BCPM overstates the drop length that, on average, would be necessary." Exh. 6 at 29. Sprint counters that generally in urban and suburban areas, houses are serviced not from the front, but from the back lot line. Sprint Brief at 50.

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[17] The installation times used in the GTE drop study are a function of these loop lengths. Exh. 65, WATELRIC.WK4, folder Drop_Inv, line 42. The installation times do not appear to be reasonable, especially for rural installations. We have not made any adjustment to these values in this proceeding; it should not be inferred that we believe these inputs are necessarily correct.

127. AT&T/MCI did not identify the cost impact of the BCPM assumption. AT&T/MCI Brief at 50.

128. WITA asserts that the proxy models underestimate drop lengths in rural areas. WITA Brief at 20. WITA does not identify the magnitude or the source of the error.

129. U S WEST points out that, in 1995 and 1996, their actual drop investments in Washington State averaged $209.00 per line. This value exceeds the $80.00 maximum drop cost estimated by the Hatfield Model. U S WEST adds that "RLCAP's assumption of approximately $150.00 for drop investment, while very conservative, is a far more realistic investment." U S WEST Brief at 47-48.

130. The loop lengths used in the Hatfield Model are, in general, shorter than the values used in RLCAP. Exh. C-115, RLCAP, folder drop, cells G26, G38, and N30.

131. U S WEST argues that the average investment for a new drop in 1995 and 1996 was $209.00. U S WEST proposes that in order for similar investment values to be produced by the Hatfield Model, all drop lengths be increased by 50 feet. U S WEST also proposes a few other changes to the method used to calculate the drop investment. Exh. 47, MAC-2, Table 3 and Document 3.2. While we find this information of some use, U S WEST did not show that the costs are associated with a TELRIC environment. We are concerned that the U S WEST costs are associated with satisfying incremental, rather than total demand.

132. Commission Staff concludes that the drop costs in the Hatfield Model "appear reasonable." Exh. 104 at 21-22. Staff did not perform any studies to determine the average loop length of GTE's drop lengths. Instead, the reasonableness of the values was based upon the Staff witness' familiarity with conditions in Washington State. Tr. 1670.

133. Unfortunately, no party has provided the results from a study in which they have identified the actual drop lengths. Rather, each party has relied upon a different set of assumptions. In future proceedings, we strongly encourage the parties to substitute the results from a study for their value judgements.

134. For each of the density zones with less than 2,550 lines per square mile, we increase the Hatfield drop lengths by 25 feet. We make this adjustment based upon the data found in the GTE and U S WEST studies, as well as the information collected by the Hatfield engineering team on Washington State loop lengths. We do not adjust the lengths in the other studies because no alternative lengths are proposed. The lack of adjustment to these studies should not be interpreted as an acceptance of the values.

135. We find the Hatfield Model's methodology for estimating the time associated with installing a loop to be more reasonable than the approach adopted by GTE.[18]

136. The drop wire is part of the loop. The cost estimation of the drop wire should use the same set of assumptions as are made in estimating distribution and feeder costs. For those facilities, the models assume that capacity is being installed to meet total demand. Methodological consistency requires that the same level of demand be used when estimating the cost of the drop. The cost of the drop is a function of the length of the loop. We will require that in future proceedings, parties present evidence on the actual lengths of loops in Washington State, rather than relying on regional or national data.

E. Load Coils

1. Recurring Costs

137. The length of the loop that connects a customer premises to an ILEC central office affects the type of service that can be provided to the customer. On long loops, load coils have historically been added to copper wires in order to improve the quality of voice communications. Tr. 360. Advanced digital services cannot be provided over loops that contain load coils.

138. The FCC has adopted a requirement that rural customers should have access to the same quality of service as subscribers in urban areas. *In the Matter of Federal-State Joint Board on Universal Service*, CC Docket 96-45, Report and Order, (May 8, 1997), ¶21 (FCC Universal Service Order).

139. Sprint contends that the BCPM complies with this requirement, because it is engineered to allow for the provision of advanced service capability on all loops, urban and rural. Sprint Brief at 55.

140. The Hatfield Model assumes that customers who are more than 18,000 feet from a digital line carrier will be served with load coils. Such customers are generally found in rural areas. A network built following this assumption would not have the capability of complying with the FCC's requirement for urban/rural service parity.

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[18] Furthermore, we conclude that the GTE asserted driving time associated with an installation is unreasonable. Exh. C-69, Bates 000104.

141. The FCC has rejected the use of long loops with load coils to serve rural customers, because "they impede the provision of advanced services." Universal Service Order at ¶250.

142. Load coils have been excluded from the GTE loop model and the BCPM. Tr. 360-364; GTE Brief at 67; Sprint Brief at 55-56.

143. Load coils are not compatible with digital services, therefore, U S WEST contends that the cost of removing the load coils should be reflected in a cost study. U S WEST Brief at 52. AT&T/MCI responds that load coils are typically removed for the provision of broadband services, which reflects the ILEC's failure to maintain a modern network. Consequently, this cost should not be reflected in the cost of providing an unbundled, voice grade loop. Tr. 363; AT&T/MCI Brief at 53-54.

144. We find AT&T/MCI's position on load coils to be inconsistent. The Hatfield Model has been characterized as a tool which estimates the cost of service using forward-looking technology. Since load coils are part of the sponsor's vision of a forward-looking network, the cost of removing the load coils are not, as suggested by AT&T/MCI, the result of "an ILEC's failure to properly update its network." AT&T/MCI Brief at 54.

145. We concur with the FCC that on a forward-looking basis, load coils will not be installed by local exchange companies. Universal Service Order at ¶250. We also agree with Sprint that removing the load coil algorithms from the Hatfield Model "would require fundamental reengineering of the model." Sprint Brief at 56.[19] Whereas we are unable to remove the load coils, we will take into account in our calculation of loop costs that their inclusion in the Hatfield Model results in an understatement of forward-looking loop costs.

2. Nonrecurring Costs

146. With regard to removing load coils currently installed in the network, AT&T/MCI argue that this cost would rarely be incurred. They further contend that U S WEST's nonrecurring cost study for deloading is flawed, because it presumes that the cost would be recovered from one customer when there are often up to twenty-five lines deloaded simultaneously. AT&T/MCI Brief at 54.

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[19] AT&T/MCI note that future versions of the Hatfield Model will exclude load coils. AT&T Brief at 53.

147. We find that where deloading occurs, the costs should be assigned to those lines for which removal of the load coils has been requested. AT&T/MCI argue that deloading is undertaken to meet the more stringent technical requirements of broadband customers. The customers who have requested the activity, rather than ordinary voice customers, should pay for the cost of removing the load coils.

148. U S WEST's cost study assumes that when load coils are removed from installed facilities, one loop will pay the cost of removing the load coils from 25 pairs. AT&T Brief at 53. AT&T does not challenge the cost associated with the unloading, but states that it is improper to recover the cost from one loop. In Phase II of this proceeding, we will require the parties to submit a rate proposal where the cost is recovered from all cable pairs in the 25-pair binder group that have requested the activity. For example, if the cost of unloading is $100.00 for the 25 pairs, and four pairs require the unloading, the cost might be recovered from all four pairs in such a manner that the total charges equal $100.00.

149. In its recurring cost loop study, U S WEST identifies the engineering and labor costs of installing load coils on a 600 pair underground and 300 pair buried cable. The per-pair labor cost associated with these larger installations is approximately one-fourth the reported cost for removal of load coils and bridge taps in the Company's UNE NRC study. RLCAP folder PRICER, cells Q245, R245, Q189, and R189, versus LIS-LINK Unloading, December 1996, at 31 of 32. We recognize that there are some economies of scale associated with installing or removing load coils, but the magnitude of the difference suggested by the Company's studies is unreasonable.

150. U S WEST assumes there is 160 minutes of work time at each of the three splice locations. We find this time estimate to be unreasonable. Especially troublesome are the times for site set-up and site tear-down. While the proposed values may be appropriate for underground cable, they are clearly too high for buried and aerial installations. We find that 120 minutes for each of the three splice locations visited, or a total of 360 minutes, is a more reasonable assumption.

151. U S WEST assumes that when deloading occurs, three hours of outside plant engineering is required. We find this assumption to be unreasonable. The engineer must identify the location of the load coils but this process should not require three hours of work. Therefore, we will require U S WEST to refile this study using an input time of sixty minutes.

152. The cost study also includes a mark-up for common costs. Whereas we have concluded that the recovery of common costs is a Phase II issue, we will require that this cost be removed from the study.

153. The U S WEST study assumes that the removal of bridge taps would occur at three locations. We find this assumption to be unreasonable. With single-party service, the bridge tap removal would occur at only one location. We therefore will require U S WEST to file a revised cost study for the removal of bridge taps that reflects the assumption of one site set-up, tear-down, and splice operation. The study should also reflect the aforementioned adjustments for splice technician work time and outside plant engineering.

154. Whereas the electronic version of the U S WEST cost study does not contain linked cells, we will require U S WEST to modify its load coil unloading and bridge tap cost studies consistent with our findings as fully described in this section of the Order. The revised studies must be filed no later than 21 days after the date of this Order.

155. Load coils are not a forward-looking technology and therefore they should be excluded from a loop model that is estimating forward-looking recurring costs. On the other hand, in the near-term, there will be occasions where a CLEC will request that load coils or a bridge tap be removed from existing facilities. Load coils or a bridge tap are removed to satisfy the requirements of a particular end-user. We believe that it is appropriate to recover these customer specific costs from the cost-causer.

F. Integrated/Universal Digital Carrier

156. Prospectively, digital line carrier is used on long loops between the carrier serving area interface and the central office. With no unbundling, these loops enter the switch on an integrated (still concentrated) basis and are separated into individual loop information in the switch. According to U S WEST and Sprint, when a CLEC leases loops without leasing switching, it is necessary to split individual lines from concentrated lines prior to entering the switch. Otherwise, the unbundled loops will use switching capacity and, therefore, cause additional switching costs. Sprint Brief at 56-57; U S WEST Brief at 52-53.

157. The parties disagree about the cost of splitting out the unbundled loops prior to entering the switch. AT&T/MCI contends that on an efficiently designed network, little additional equipment is required for grooming. Therefore, they argue that this cost should be excluded from the cost of the unbundled loop. AT&T Brief at 55.

158. Sprint and GTE claim that additional costs are incurred with grooming. Sprint Brief at 57; Exh. 53 at 32.

159. During the hearings, U S WEST stated that it had reconsidered the assumptions in its link study to reflect the impact of new technologies. U S WEST Brief at 53. Using the prescribed depreciation lives, U S WEST estimated that the cost of using grooming was $2.85 per line. Tr. 1910.

160. U S WEST has stated that it is economic to use digital line carrier on fiber only, rather than on copper cables, when the feeder distance is greater than 12,000 feet. Whereas a sizeable portion of the loops will not be served using digital line carrier, its monthly cost of $2.85 for grooming appears to be on the high side.[20] We note that in New Mexico, U S WEST testified that the cost of grooming was approximately $1.81. *In The Matter of The Interconnection Contract Between AT&T Communications of The Mountain States, Inc., And U S WEST Communications, Inc., Pursuant to 47 U.S.C. Section 252*, New Mexico State Corporation Commission, Docket No. 96-411-TC (March 27, 1997), ¶¶124 and 125.

161. If a CLEC were to order a bundled loop and port from an ILEC, the cost of grooming would be avoided. Exh. 162, URI-2, at 7.

162. Neither the ILECs nor the CLECs present technical documents which support their claims about the current capabilities of digital line carrier systems or the costs associated with that equipment. The record evidence suggests that technological change is reducing the cost of grooming, but we remain unconvinced that the Hatfield Model fully accounts for this cost.

163. On this issue, the FCC has ruled that the costs associated with grooming should be recovered from the requesting carrier: "We find that it is technically feasible to unbundle IDLC-delivered loops . . . [t]he costs associated with these mechanisms will be recovered from requesting carriers." FCC Interconnection Order at ¶384.

164. We concur with the findings of the FCC. Therefore, based upon the evidence of record, we will include an unbundling cost of $2.85 in the U S WEST link study. We will not add any costs for grooming to the Hatfield Study. Since we will use both models to determine the cost of the loop, both positions will be reflected in our final cost determination.

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[20] We are unable to locate the work papers associated with the $2.85 value. Exh. 162, URI-4.

G. Fill Rates

165. The fill rate is the actual usage of the network relative to its total capacity. Fill is used to calculate per unit costs.

166. The FCC has stated that the calculation of the total element long-run incremental unit costs should be based upon reasonably accurate fill factors. According to the FCC, "the per-unit costs associated with a particular element must be derived by dividing the total cost associated with the element by a reasonable projection of the actual total usage of the element." FCC Interconnection Order at ¶682.

167. U S WEST contends that its current fill rate is the best predictor of its projected fill rates. U S WEST's loop model uses a feeder fill rate of 58%. This is the lowest utilization level observed in the several states served by U S WEST. According to the Company, 67.6% is the highest actual fill factor in any state it serves. Exh. 114 at 16.

168. Previously, we have found that the objective fill rate should be used in U S WEST cost studies. The objective fill is the level of utilization at the point at which additional equipment is installed to meet the level of demand. The objective fill is almost always greater than the actual fill. U S WEST states that it is uneconomical to operate facilities at objective fill, because each new service order would require expensive additional equipment. Exh. 114 at 15-16.

169. Commission Staff and Public Counsel urge the use of objective fill rates. Staff points out that, in prior decisions, most notably the 1995 U S WEST rate case, we found that objective fill should be used in cost studies. Commission Staff Brief at 30; Public Counsel Brief at 88. In that decision, we stated: "Using objective fill will assign a reasonable portion of unused capacity to individual services. The remaining unused capacity is most appropriately treated as a shared cost. This issue ultimately has no effect on whether U S WEST recovers the cost of this unused capacity, since shared costs also are recovered in rates." Fifteenth Supplemental Order, Docket No. UT-950200 (April 11, 1996), at 88.

170. U S WEST contends that, if objective fill is used in a cost study and if prices are to be strictly based upon costs, then use of objective fill in a cost study will result in an inability to recover costs. The Company believes that the Hatfield Model's default values are "fairly reasonable." U S WEST Brief at 49.

171. It is not appropriate to use the objective fill rate in TELRIC studies. As the FCC stated when they introduced the notion of basing unbundled network element prices on TELRIC, "the per-unit costs associated with a particular element must be derived by dividing the total cost associated with the element by a reasonable projection of the actual total usage of the element." FCC Interconnection Order at ¶682. Whereas the objective fill is greater than the actual and projected fill rate, the use of an objective fill is contrary to the concept of deriving TELRIC.

172. More fundamentally, there is an important difference between the use of a cost study for the setting of rates in a rate case and in a TELRIC proceeding. As we stated in Docket No. UT-950200, U S WEST will be able to recover its total costs regardless whether objective or projected fill rates are used in the cost study. The cost studies that were at issue in the 1995 rate case were being used to help establish rates that would permit U S WEST the opportunity to recover its cost-of-service. In this proceeding, we are not considering all of the rates of the Company. If the shared cost of unused capacity is not part of the element cost estimate, recovery of the shared cost must be considered during Phase II of this proceeding. We believe that it is more expeditious to assign each element the same share of unused capacity, rather than leaving this as an open matter to be addressed in Phase II.

173. We have not used the objective fill rate in any of the cost models. For the Hatfield and Benchmark Cost Proxy Models, we have used their default utilization rates.

174. For the distribution portion of its network, in its RLCAP model, U S WEST uses "[t]he actual number of lines in service" to calculate unit costs. Exh. 114 at 16. For suburban households, this involves assuming that the distribution plant is engineered with three lines per household. Even though the current level of demand is less than three pairs, U S WEST contends this is the correct level of provisioning, because of the growth in demand for multiple lines in a household, as well as to ensure reliable service in case of the failure of cable pairs. Exh. 114 at 18.

175. Paradoxically, on the demand side, U S WEST assumes that the number of working lines per household would decline relative to the current value. While saying that there is a growing demand for second, third, and fourth lines, the Company's model assumes that each household would have only one telephone per line. Exh. 152 at 26-27. This value is less than the current ratio of lines per household. According to the testimony of U S WEST witness Reynolds, in Washington State on average 3%-4% of the residential customers have an additional

line. Exh. 117 at 29.[21] In response to a data request , U S WEST indicated that in 1998, the percentage of residential households with second lines would be significantly higher. Public Counsel Brief at 13; Response to PC 02-0028, provided in response to BCH 01-0002. The U S WEST assumptions also result in a much lower fill than that which is recommended by the Hatfield Model defaults, values that U S WEST finds to be reasonable. See, for example, U S WEST Brief at 49; Exh. 114, Appendix 6, at 22 (BCM2); BCPM inputs, folder Percent Table Inputs, Table Density Fill Table (U S WEST has sponsored the development of both BCM2 and BCPM).

176. The U S WEST loop model, RLCAP, has an effective distribution utilization level of approximately 33%. AT&T/MCI witness Zepp modified the U S WEST loop model to reflect a 50% fill factor, a rate not unlike that used in the HM and BCPM proxy models. He did this by increasing the level of demand to 1.5 lines per household. This adjustment reduced the loop cost by 27%. Exh. 117 at 29-30.[22]

177. U S WEST claims that the adjustment made by Mr. Zepp is inappropriate, arguing that if an analyst wanted to explore the impact of a higher utilization rate, the number of pairs per household should be held constant, effectively at one, and instead a smaller size distribution cable should be modeled. This reduction in the number of pairs per household from three to two reduces the cost per loop by less than 5%. Exh. 117 at 27-31.

178. Mr. Zepp's method for obtaining a 50%fill factor has a larger impact on the cost per loop than U S WEST's recommended method. The different impact, 27% versus 5%, is due to the way in which unit costs are derived. The unit cost of production is the total cost divided by total demand. The installation of a loop is a labor intensive process. Under the U S WEST methodology, the reduction in the number of pairs per household results in a small change in the material cost, but not a large change in the total cost of installing loops. Neither is there any change in the level of demand. On the other hand, with Mr. Zepp's method, there is no change in the total cost, that is the numerator, but there is a large increase in the denominator, the level of demand.

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[21] BCPM input folder Misc. Table Inputs, row 70, reports that the ratio of residence loops to households is 1.0967.

[22] Public Counsel urges the Commission to use the 1.5 lines per household if it does not use objective fill rates in the cost studies. Public Counsel Brief at 16.

179. We find AT&T/MCI's study approach more reasonable. U S WEST has argued that there is an increased demand for second, third, and even fourth lines. Exh. 117 at 39. In order to meet this growth in demand, the Company is now deploying three lines per household. The study approach taken by U S WEST conflicts with their testimony on the forward-looking design of the network. Whereas demand for multiple lines is increasing, AT&T/MCI's costing approach is the appropriate method for analyzing the demand for multiple lines.

180. Accordingly, we adjust U S WEST's RLCAP model to increase the percentage of additional lines. We do not adopt AT&T/MCI's use of 1.5 lines per household, because this value is well above the current level of demand. Instead, we adopt a value of 1.25 lines per household. This level of use is in line with the proprietary forecast provided by U S WEST. Exh. 127.

181. We also adjust the RLCAP feeder utilization to 65%. This value does not reflect best-system practices, but it is higher than the level currently experienced by U S WEST in Washington State. Furthermore, the value is reasonable in light of the historical practice of installing 1.5 feeder pairs per household and is consistent with the default values used in the Hatfield Model. Tr. at 1905.

182. Public Counsel criticizes the GTE loop model for its treatment of spare capacity. Public Counsel Brief at 14-15. The GTE loop model applies a 55% fill factor to both feeder and distribution plant. Exh. 31 at 16. The 55% fill factor is based upon the Company's study of the current level of utilization in 14 states in which it operates. The GTE study apparently does not reflect the growth in demand that it anticipates over the next few years. Tr. 2285; Exh. 65; GTE Brief at 64.

183. GTE witness Tucek testified that the California Public Utilities Commission (CPUC) has recently ordered a change in the fill factors utilized for feeder and distribution in GTE's cost studies. The CPUC ordered the use of a 65% fill factor. Exh. 65 at 25. We adopt the use of a 60% fill factor for the running of the GTE model in this proceeding.[23] We have selected a lower value because, while 65% is reasonable for the feeder portion of the network, we believe the composite loop fill factor should be lower to reflect utilization in the distribution portion of the network.

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[23] Due to the closed nature of the GTE model, it is not possible to determine if the resultant sizing of cables makes economic sense. In future proceedings before this Commission, GTE must employ a cost model that is both transparent and open. A transparent model offers the opportunity to observe how calculations are being made, even if the analyst would not change the algorithms. By open, we mean the model would be readily and easily susceptible to modification of the program algorithms.

184. GTE has not provided an integrated loop model. The loop model was written in 'C' and is difficult for a party to modify the program. Exh. 31 at 14. GTE did provide a LOTUS-version of its cost models, WATELRIC (Exh. 65), but the spreadsheet only summarizes the calculations done in other programs. The spreadsheet only provides limited opportunities for evaluating the cost impact of different input assumptions. For example, while the spreadsheet has a location for changing the assumed loop fill of 55%, a change in this input has no impact on the calculated costs. GTE also provided a spreadsheet, LTM_WA.WK4, that replicates the logic and modeling assumptions contained in its Loop Technology Model. This spreadsheet only replicates a portion of the model and therefore provides only limited opportunities to conduct sensitivity analyses. Furthermore, the spreadsheet does not appear to provide any insight into how GTE calculated the cost of a four versus a two wire loop. Exh. CC-64.

185. The LTM_WA.WK4 spreadsheet only replicates a portion of the GTE loop model. We will use the worksheet for the limited purpose of testing the impact of increasing the utilization level to 60%. The spreadsheet suggests that the level of investment would decline 8.7%. We accept that the level of costs would decline proportionately.

186. Public Counsel also claims that GTE's method for calculating the cost impact of spare capacity is in error. Public Counsel notes that the method is flawed because the adjustment for spares is applied to the incorrect size of cable. Public Counsel Brief at 15.

187. We concur with Public Counsel. GTE's loop study is flawed because, as recently stated by the New Mexico State Corporation Commission, it "develops a unit cost based on a size cable that is inconsistent with the assumed level of utilization." *In the Matter of the Interconnection Contract Between AT&T Communications of the Mountain States, Inc. and GTE Southwest, Inc. Pursuant to 47 U.S.C. §252,* Docket No. 97-35-TC (September 19, 1997), ¶154.

188. Unfortunately, because the GTE loop model is a compiled 'C' program, we are unable to correct this error. Our loop cost has taken into account that this flaw results in an overstatement of the cost of the loop.

H. Four-Wire Loop

189. The parties also disagree about the additional cost associated with providing a four wire loop. An ordinary loop requires the use of only two wires, or one pair of cables.

190. U S WEST has assumed that the investment for a two-pair cable is twice that for a four-pair cable. Exh. C-115, Local Interconnection Service - Link - 4-Wire, 1996 Recurring Cost Study, November 1996, Section 7, at 1b.

191. This assumption is inconsistent with U S WEST's argument that the incremental cost of providing an additional pair of wires to a subscriber is approximately five percent of the cost of a loop. Exh. 117 at 27-31. The incremental cost of a second pair of cables is low because a significant portion of the cost of the loop is associated with labor costs that are independent of the size of the cable.

192. Neither the Hatfield nor the Benchmark Cost Proxy Models report the difference in the cost of providing a two-wire versus a four-wire loop.

193. GTE's study indicates that the cost of a four-wire loop is approximately 50% higher than a two-wire loop. Exh. CC-64 at 55.

194. For the reasons discussed, *supra*, at paragraph 184, it is not possible to determine how GTE calculated these values.

195. Based upon the evidence of record, we find that the cost of a four-wire loop is 25% greater than a two-wire loop. This value falls between the five percent value suggested by U S WEST and the 50% difference reported by GTE.

I. Cable Size/Lengths and Fiber/Copper Breakpoints

196. One of the inputs to the loop models is the distance at which fiber or copper cable is used in the network. The Hatfield Model assumes that on a forward-looking basis, the crossover point should be at 9,000 feet from the central office. U S WEST, GTE, and Commission Staff contend that the appropriate crossover point is approximately 12,000 feet from the central office. U S WEST Brief at 50; GTE Brief at 66; Commission Staff Brief at 31; AT&T/MCI Brief at 53.

197. In the Hatfield Model, the selection between these two technologies is based upon the total length of feeder cable from the wire center to the serving-area interface. The BCPM default set the maximum loop lengths for copper at 12,000 feet for both feeder and distribution cable.

198. We accept 12,000 feet as the crossover point as proposed by U S WEST, GTE, and Commission Staff. Implementing this determination within the BCPM is difficult, since the crossover point is calculated based upon the total distance to the customer, rather than the distance to the serving-area interface. Therefore, we have changed the input value in the BCPM so that the maximum loop length for copper is 15,000 feet.

J. Special Access (Above DS-0) Loops

199. The Hatfield Model includes special access DS-1 and DS-3 lines by assuming them to be the equivalent number of DS-0 lines in terms of capacity. In other words, the Hatfield Model treats a special access DS-1 line as 24 separate voice-grade loops; similarly, it treats a special access DS-3 line as 672 voice-grade loops.

200. U S WEST maintains that the Hatfield treatment of special access DS-1 and DS-3 lines is improper, because these non-switched digital lines are not the functional equivalent of, and not the same TELRIC element as, a narrow band unbundled loop. Moreover, U S WEST observes that the economies of scale that Hatfield assumes in access line placement causes the cost of unbundled loops to unjustifiably decrease. Exh. 46 at 9. According to U S WEST witness Fitzsimmons, there are 202,488 DS-1 and DS-3 channel equivalents in Washington State. *Id.* Including those increases the line count in the state by seven percent. He proposes including the DS-1 and DS-3 lines only on a physical line, not a channel equivalent basis. Doing so would increase the per-line monthly cost by $0.66 per month. *Id.* at 11; U S WEST Brief at 51; TRACER Brief at 26.

201. TRACER argues that, if the adjustment is made to the line counts, there would need to be an offsetting adjustment to the investment in drops and NIDs. TRACER Brief at 27-28, quoting from Tr. 628-30. TRACER suggests that if the second adjustment is made, there may be a corresponding offset. TRACER Brief at 28.

202. Neither TRACER nor AT&T/MCI provided any data that suggests that the adjustment for drops and NIDs would offset the adjustment for line counts. We do not find TRACER's suggestion compelling because the drop and NID constitute a minority of the investment in the loop.

203. GTE also disagrees with the Hatfield Model's treatment of special access DS-1 and DS-3 lines. GTE did not identify the cost impact of treating these special access lines simply as a physical line. GTE Brief at 66-67.

204. We have adjusted the Hatfield Model loop cost for U S WEST upward by $0.66. Whereas GTE did not propose any adjustment for this item, we will not make a similar change to its loop cost estimate. Nevertheless, we recognize the potential that such data may impact the loop cost.

205. The unit cost of a facility is determined by dividing the total cost by the level of demand. The Hatfield Model treats each voice channel equivalent as a unit of demand. This assumption is incorrect and leads to an understatement in the unit cost of providing a loop. As the telecommunications industry increasingly relies on digitally derived circuits, it is essential that a model developer distinguish between the number of physically derived circuits and the number of equivalent voice channels that are in-service.

K. Capital Factors; Cost of Capital; and Depreciation

206. The investments identified by the different models are converted to a monthly cash-flow requirement through the application of annual charge factors. Depreciation and the cost of capital are two components of the annual charge factors.

207. The ILECs argue that the Commission should establish cost-of-capital factors which reflect the risk associated with an increasingly competitive market. Exh. 113 at 27.

208. GTE uses a weighted cost-of-capital input of 11.25% for "illustrative purposes." GTE Brief at 36. U S WEST uses a cost of capital of 11.4%. U S WEST Brief at 55. Sprint advocates the adoption of the rate authorized by the FCC -- 11.25%. Sprint Brief at 59.

209. Commission Staff, TRACER, TCG/Nextlink, AT&T/MCI, and Public Counsel believe that the most recent Commission authorized return and capital structure should be used in the cost models. Commission Staff Brief at 25, 32-33; TRACER Brief at 28; TCG/Nextlink Brief at 23; AT&T/MCI Brief at 56; Public Counsel Brief at 17.

210. In the Interconnection cases, we maintained our policy that the cost of money used in a cost study should be the same as the authorized return. We also noted that, as with other inputs into a model, this input should be reviewed periodically. We singled out the cost of debt as being the component that should be reviewed in a forward-looking cost study: "The Commission recognizes that the authorized return is based upon embedded costs, particularly with respect to debt rates." Fourth Supplemental Order, Docket No. UT-941464 (October 31, 1995) at 90.

211. In the 1995 U S WEST rate case, we determined that the authorized rate-of-return should be used in forward-looking cost studies: "[A]ny theoretical advantage of using 'pure' forward-looking values would be more than offset by the practical problems of turning every cost-based rate filing into a cost of money case." We reaffirm that determination in the instant Order. Fifteenth Supplemental Order, Docket No. UT-950200 (April 11, 1996) at 88.

212. Under the pricing standards set forth in Section 252(d)(1) of the Act, the rates charged for interconnection and unbundled network elements must be "based on the cost (determined without reference to a rate-of-return or other rate-based proceeding) of providing interconnection or network elements . . . nondiscriminatory . . . and may include a reasonable profit." The FCC recognized that the appropriate depreciation rate to be included in a TELRIC analysis is a forward-looking, economic depreciation rate. Economic depreciation is defined by the FCC as the "periodic reduction in the book value of an asset that makes the book value equal to its economic or market value." FCC Interconnection Order at ¶703, footnote 1711.

213. The ILECs contend that, due to increased rivalry in the local exchange market, the length of time within which they can recover their investment is reduced relative to the pre-Act era. U S WEST, GTE, and Sprint advocate the adoption of depreciation lives that are shorter than that which would occur under the triennial represcription process. Exh. 79 at 4; U S WEST Brief at 54; Sprint Brief at 60-61.

214. Commission Staff advocates using the most recently approved depreciation lives and salvage established by the Commission. Exh. 104 at 13. AT&T/ MCI and Public Counsel also endorse basing the TELRIC costs on the existing approved depreciation rates. AT&T/MCI Brief at 56.

215. In the 1995 U S WEST rate case, we "concluded that the authorized depreciation rates are proper for cost study use and that they sufficiently reflect U S WEST's costs that they may be used in an accurate cost study and for rate making purposes." Fifteenth Supplemental Order, Docket No. UT-950200 (April 11, 1996) at 88.

216. U S WEST asks that if we are to rely on regulatory depreciation lives, the prescribed rates approved by the Commission on August 18, 1997, in Docket No. UT-951425, be used in this proceeding. U S WEST Brief at 54.

217. In depreciation proceedings in Docket Nos. UT-940926 (GTE) and UT-951425 (U S WEST), we considered the degree to which depreciation rates should be modified to reflect regulatory and market changes. For both GTE and U S WEST, we have used the average service lives and future net salvage values that were reported in those recent proceedings. The rates adopted in those proceedings reflect our understanding of the capital lives of the assets. We therefore conclude that the service lives are appropriate for a forward-looking economic cost model and adopt them for estimating the cost of unbundled network elements.

L. Customer Locations

218. The proxy models use census block group data to identify the location of households within the serving wire center. Business location information is obtained from a variety of commercial data sources.

219. Concern was expressed during the hearings that the models do not accurately identify customer locations. Some parties also expressed concern that the models attach customers to the incorrect wire center. GTE Brief at 47-48; WITA Brief at 10-11.

220. In response to a Commission bench request, the model sponsors provided a comparison of the loop length estimates generated by the proxy models with the distances identified in special studies undertaken by U S WEST and GTE. The special studies identified the loop lengths for each wire center, as well as the number of lines.

221. The comparison showed that the difference between the models and special loop length estimates was large. For example, for GTE's wire centers, the ratio of Hatfield Model loop lengths to GTE special study loop lengths ranged from a low of 16% to a high of 884%. AT&T's December 17, 1997 Response (AT&T's Response), Attachment 4; Sprint's November 21, 1997 Response (Sprint's Response).

222. For both the Hatfield Model and the Benchmark Cost Proxy Model, the magnitude of variation between wire center special study lengths and default proxy lengths is unacceptable. The special study data is a sensible method for validating the reasonableness of the customer location data in the models. Both models clearly fail this test.

223. In the case of the Hatfield Model, the model's estimated loop lengths for GTE and U S WEST, when considered in their entirety, is less than the loop lengths reported by the Companies. Conversely, the BCPM reported loop lengths exceed on average the distances reported by the Companies. AT&T's December 17, 1997 Response to Bench Requests; BCPM folder Misc. Table Inputs, version of model provided in response to bench request.

224. In response to a Commission bench request, the proxy model developers modified their models so they could use the wire center and loop length data provided by U S WEST and GTE. This involved two steps. For each wire center, a loop length factor was computed by dividing the models' average loop length for that wire center by the Companies' average loop length. On a wire center by wire center basis, all distance-related loop investments were divided by this factor. AT&T's Response, p. 2; Sprint's November 21, 1997 Response to Bench Request.

225. GTE and U S WEST also provided data on wire center counts. This information was used by the Hatfield Model developers to adjust the wire center loop counts in their models. AT&T's Response, p. 2. It does not appear that Sprint made a similar adjustment in the BCPM. Sprint's Response.

226. We have used the revised versions of the proxy models to determine the cost of the loop. In light of the large differences in loop lengths discussed, *supra*, at paragraph 221, we believe the reasonableness of the costs are greatly improved by these modifications.

227. In future proceedings, we will require proxy model sponsors to address the relationship between the study's average loop length estimates and the ILEC's actual average loop length, as well as the similarity in wire center line counts. We note that the FCC has recently expressed great interest in this data in a recent notice: *State Forward-Looking Cost Studies for Federal Universal Service Support*, CC Docket Nos. 96-45 and 97-160, DA 98-217, February 27, 1998.

M. Expense Factors

228. The Hatfield Model estimates some expenses based upon expense-to-investment ratios derived from the ILEC's ARMIS reports. For example, if historically there is five cents of maintenance expense for every dollar invested in buried cable, the Model assumes that prospectively the same ratio would hold in the future. When certain expenses are deemed more sensitive to the number of customers, expense factors take the form of ARMIS expense divided by ARMIS reported number of lines. Exh. 29, Hatfield Model Release 3.1: Model Description, February 28, 1997, at 55.

229. GTE criticizes the use of such ratios as being too simplistic and failing to take into account that factors other than investment or the number of lines may be causing the expenses to be incurred. GTE Brief at 70-71.

230. While GTE criticizes the use of expense-to-investment ratios and suggests that there may be a better alternative, the Company did not propose any substitute formula that could be used when re-running the model.

231. GTE also disagrees with the assumption made in the Hatfield Model that forward-looking operations expenses can be approximated by applying a factor of 50% to its current booked expense.

232. Network operations include the expenses associated with the provisions of power, network administration, testing, plant operations administration, and engineering. Exh. 47, MAC-2, Tab 6.

233. The Hatfield Model relies upon ARMIS data, a publicly available source for expense data. AT&T contends that, in order to make these historical figures forward-looking, the Model should reduce the current ARMIS-reported network operations expense by 50%. The adjustment is designed to reflect the opportunity to realize reductions in this expense as labor is substituted for capital. For example, the Hatfield Model assumes that by deploying a digital cross-connect system, labor expenses would be reduced. Exh. 40, RAM-2, at 74-75; Tr. 390.

234. AT&T also notes that the assumption of a 50% savings is consistent with the default expense values used in the BCPM. Overall, the BCPM sponsors use a 40% reduction in operating expenses, relative to the ARMIS values. AT&T Brief at 57.

235. Whereas the Hatfield sponsors assume the network operations expense to be $1.79 per line, the BCPM uses a lower value, $1.33 (Account 6530). Exh. 46, WLF-2, Table 5; BCPM, folder Expense Inputs. The BCPM value is based upon a national survey of local exchange companies. The survey instrument asked the local exchange companies what were their forecasted forward-looking expenses. Tr. 1212. Neither U S WEST nor GTE challenged the reasonableness of the BCPM's operations expense input value.

236. U S WEST argues that the Hatfield Model's 50% expense reduction should not be adopted, because it does not reflect data analysis of the Company's Washington operations. U S WEST Brief at 56.

237. GTE concurs with U S WEST. GTE points out that they have been unable to validate the forecasted 50% expense reduction. GTE Brief at 71-72.

238. Commission Staff supports the adoption of the 50% discount for network operations. They contend that the recent experience of local exchange companies does not accurately reflect long-run economic cost conditions. Commission Staff Brief at 34; Tr. 1625.

239. We conclude that, based upon the evidence of record in this proceeding, the Hatfield operations' expenses should not be set at 50% of the current level. While we accept that there will be some efficiency gains, we believe a 30% assumption to be more reasonable. This reduction is consistent with the BCPM survey results and U S WEST's assertion that these costs will be declining over time. U S WEST Brief at 56. We view the BCPM survey results as supportive, but they cannot be determinative of this issue. As the survey responses are not publicly available, we have given less weight to these results than we would had they been in the public domain.

240. The lack of data to support the BCPM or Hatfield Model proposed network operations expense input values highlights the need for parties to provide studies that can be independently validated. As with many other contested issues in this case, parties have made conflicting claims regarding cost levels that would be incurred by efficient telecommunications service providers. Such conflicts are best resolved by subjecting the claimed values to some form of validation or, where data cannot be compared to the recent experience of efficient firms, careful analysis of the study methodology and assumptions. We will require sponsors of future cost studies to provide a well-documented study to support their positions.

241. U S WEST's operating expense factors include maintenance, administration, marketing expense, product management, and sales expense. The network operations' factor includes the expenses associated with providing power, network administration, testing, plant operations, administration, and engineering. U S WEST stated that its operating expense factors have been adjusted to reflect anticipated cost savings. U S WEST Brief at 56; Tr. 2036-2047.

242. U S WEST's maintenance factors are determined by dividing the prospective account expense by the current value of the investment. Tr. 2042. GTE's maintenance factors, on the other hand, appear to be based upon the ratio of current expenses to embedded investment. Exh. 31 at 14-15. To the extent that GTE's models are based upon this historical ratio, we find that future studies should reflect the methodology used by U S WEST. This would require GTE to adjust its expenses to reflect anticipated productivity gains and to divide the current expenses by current or future investment levels, not the embedded value.

243. We are unable to adjust GTE's expense factors in this case because the necessary data is not part of this record. In future cases, we will require parties to provide studies that reflect both forward-looking technology and the costs associated with such facilities. We are concerned that both the GTE model's and the Hatfield model's use of embedded expense-to-investment ratios may not provide a reasonable prediction of future expense levels.

N. Joint, Shared, and Common Costs

244. Joint, shared, and common costs are expenses that are not attributable to a particular service, nor to a family of products.