should be based upon PNR's estimate of households.[70]

In the real world, outside plant engineers design distribution plant based on housing units, not households. This allows them to design a network that can provide timely service to all customers in a serving area, and allows the carrier to satisfy its carrier-of-last-resort obligations. A cost model designed to capture the forward-looking, long run cost of a telephone network should adhere to the same principle.

In the Universal Service Order, the FCC laid out ten criteria for a forward-looking cost model. The FCC's cost model Criterion 1 states, in part, "[t]he loop design incorporated into a forward-looking economic cost study or model should not impede the provision of advanced services." [71] Building a network that serves only households, as suggested in the FNPRM, would impede the provision of both supported and advanced services. The first time any service is requested at a new or recently occupied housing unit not served by the plant built only to "households," will require that expensive and disruptive construction projects will have to be initiated. The time that it would take to build new plant to these units would result in violations of the stringent requirements that most state commissions place on service delivery intervals.

The proposed use of households clearly conflicts with the requirement that costs be based upon the least-cost, most efficient forward-looking network design. The least-cost, most efficient loop design is one that builds distribution plant to serve the ultimate demand in an area, i.e., housing units. Building a forward-looking network requires an engineer to plan not only for future demand, but also for periodic shifts in demand. For

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[70] FNPRM at ¶ 43.

[71] Universal Service Order at ¶ 250.

example, a family with multiple phone lines that moves from one neighborhood to another will not typically be served by the same distribution plant. Therefore, there must be sufficient capacity available in the plant that serves the family's new neighborhood to accommodate their multiple lines. A network that can only serve current demand will be unable to do that, and thus is entirely divorced from forward-looking thinking.

Compensating non-rural carriers only for the costs of serving the customers who currently have telephones is also at odds with the Act's mandate that "the Commission shall base policies for the preservation and *advancement* of universal service."[72] The incremental cost of adding margins for increased demand at the outset is miniscule compared to the cost of adding pairs every time a new service is requested. Placement of loop facilities involves large fixed costs and diminishing marginal unit costs.

A simple example illustrates the cost savings associated with efficient network planning. Assume that two telecommunications providers, FutureSense Communications and Today's Networks, plan to provide local service in a new area. For simplicity's sake, assume a two-year period with no inflation. Each firm expects to serve 75 lines in Year-0. The cable sizes available are 100 and 200 pair cables, at a cost (including placement) of \$4.05 and \$4.96 per foot, respectively.[73] Each firm must

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[72] 47 U.S.C. § 254(b) (emphasis added).

[73] Average cost for installing aerial distribution cable of size $_y$, in normal terrain in density zone 3 using proposed inputs:

Total cost $_y$ = Placement cost + cable cost $_y$

Average cost $_y$ = Total cost $_y$ / y.

Ignoring engineering costs, this equates to, for a 200 pair cable:

TC200 = 1.98 + 2.98 = 4.96

AC200 = 4.96 / 200 = .0248

determine its investment in cable. FutureSense Communications, realizing that demand in the new area will fluctuate and possibly increase, uses the long run planning horizon, which, in this example, is only two years. It determines that, in the long run, profits will be maximized by investing in a 200 pair cable in Year-0. Today's Networks, on the other hand, decides to install only enough cable to serve to its currently known customer base. The cost of this option is the lowest in Year-0. Since costs (and resultant universal service support) are determined in Year-0, Today's Networks is deemed more efficient than FutureSense Communications because it invested less in cable. In Year-1, however, demand increases and both companies must serve 150 lines. Today's Networks must now place additional cable to meet the growing demand. By ignoring the increased placement costs associated with cutting and replacing concrete and other placement tasks that did not exist with the initial placement in Year-0, Today's Networks must incur an additional investment of $4.05 for an additional 100 pair cable in Year-1. FutureSense Communications, however, needs no additional investment, and is ready to serve its new customers quickly and efficiently upon request.

Table 2 below represents the cable costs for these two companies that result from the placement decisions they made and the horizons they adopted in their network planning schemes.

For a 100 pair cable:

TC100 = 1.98 + 2.07 = 4.05

AC100 = 4.05 / 100 = .0405

Table 2
Cable Cost Comparison

	Year-0 (75 Lines)	Year-1 (150 Lines)	Total
FutureSense Communications			
Capital Investment	$4.96	$ --	$4.96
Investment per Line	$0.0661	$ --	$0.0331
Today's Networks			
Capital Investment	$4.05	$4.05	$8.10
Investment per Line	$0.0540	$0.0540	$0.0540

As seen in Table 2, Today's Networks invested less per line in Year-0 than FutureSense Communications. However, in order to meet demand in Year-1, it was forced to incur costs when FutureSense was not. Clearly, FutureSense Communications' long run planning horizon and decision to build its network to serve more than current demand was the long run, least cost option.

The costs associated with provisioning outside plant to unoccupied housing units should be included in the total cost calculation for universal service purposes.[74] These are real costs that are incurred to provide local exchange service, and the most fundamental of costing principles require that they not be ignored. Regardless of the occupancy of a housing unit, a carrier still must incur the cost of providing outside plant to that location.

The inclusion of unoccupied units as a model input has the added advantage of making the cost results more consistent with the intent of FCC cost model Criterion 6.[75]

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[74] FNPRM at ¶ 46.

[75] Universal Service Order at ¶ 250.

That is, modeling an entire network allows for a better reflection of economies of scale than modeling only a partial network. Excluding unoccupied units would lead to an unnecessary understatement of the true economies of scale inherent in an ILEC's network.

At first glance, it appears that a methodology is needed to estimate the number of unoccupied units. However, the most reliable option is the use of housing units in lieu of a measure of households plus unoccupied units. Because the incidence of unserved areas is *de minimis* in comparison with the normal and efficient churn in the housing stock,[76] the use of housing units as an input is warranted. With housing units as a base, it would be possible to consider alternative minor adjustments to alleviate any concerns about the potential of carriers receiving a windfall from unserved areas. GTE will apply any increase that it receives in explicit support to reduce implicit support in other rates. Thus, there is no danger of a windfall from a supposedly over-sized fund. The only danger is to the future of universal service and competition if the fund is under-sized.

C. Clustering Has Not Been Documented Or Validated.

The Commission has inexplicably not requested comment on a number of significant inputs to the Model's clustering module, even though these same inputs were not subject to comment in the "platform" stage of this proceeding.

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[76] Census Bureau Statistics show that 13.7 million housing units are vacant (11.7% of all households). *See United States Dept. of Commerce News*, CB 98-58 (April 21, 1998). Of these, 10.4 million (or 76%) were classified as year-round use. A significant number of housing units are vacant pending rental turnover or real estate transfers.

One of the most important of these "missing" inputs is the clustering algorithm. Although there are numerous reliable algorithms available in the public domain, the FCC chose to develop a new set of clustering routines. Had these routines been well documented and validated against a calibration data set, their use might not be problematic. Unfortunately, the Commission has not done that. GTE's concern is not with clustering, which is a potentially viable modeling technique, but with the fact that the routines used in the Model have neither been rigorously tested nor sufficiently documented.

GTE's testing of the Model has confirmed that this lack of quality control is not an abstract issue. The current version of the Model does not run correctly when using the agglomerative and nearest neighbor clustering techniques.[77] In territories where a comparison was possible, GTE confirmed the importance of the clustering techniques with differences in calculated support of up to 42%. GTE suggests that the FCC adopt one of the standard algorithms presently available in the public domain.

There are two related problems with the "line limit" imposed on clusters. First, the limit is not implemented correctly. Even a cursory look at the output files of the Model reveals that the line limit constraint is violated in many instances. In every GTE service area analyzed, there were numerous clusters that exceeded the line limit imposed by the FCC.[78] In the three states GTE analyzed, the Model placed inadequate

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[77] Runs with both algorithms failed during the clustering process for GTE Oregon. On the other hand, results for Contel Missouri could be obtained using the nearest neighbor algorithm, but failed with the agglomerative method.

[78] GTE examined cluster data for its service areas in Florida, Michigan and Oregon. In these states, 178 clusters -- 4% of the total -- exceeded the 1,800 line limit.

SAI capacity in over 70% of the clusters, resulting in an underestimation of SAI investment of over 40%.[79] Maximum SAI line capacity is one-half the number of pairs, established at a 1 pair in/1 pair out scenario, which is a minimum ratio. For example, an SAI with a 1,200 pair capacity established at the 1:1 ratio would be capable of accommodating a maximum of 600 pairs. When adjusted for fill rates, the maximum number of pairs is 600 * 0.80 or 480 pairs.

Second, the Model documentation states that the line limit is related to the maximum capacity of an SAI. The Model's input file shows SAI sizes ranging from 1 to 7,200 lines. If the 7,200-line size reflects the maximum size SAI to be considered, then the line limit should be 2,800 lines. In many instances, the Model does not place adequate capacity to serve clusters. The capacity of the SAI should, at a minimum, serve all lines in the cluster and have enough spare capacity to satisfy the fill factor constraints.

The violations and inconsistencies found with this input variable point to serious flaws in both the input, the Platform and, of course, the Model's results. The underutilization of SAIs in the Model significantly underestimates (up to 45%) the SAI investment required to provide service. Thus, GTE urges the Commission to investigate this issue and remedy any problems.

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[79] Inadquate SAI capacity results in 45% underestimation of SAI investment for each of GTE's serving area in Florida and Oregon.

V. THE PROPOSED INPUT VARIABLES AND VALUES ARE, WITH FEW EXCEPTIONS, UNRELIABLE AND UNREASONABLE

A. Outside Plant.

1. Cable Costs.

a) Use of all available 24-gauge cable sizes (¶ 65).[80]

GTE agrees that the Model should use 26-gauge *and* 24-gauge copper cable in all available cable sizes in order for its network to stay within transmission guidelines when modeling 18 kilofoot loops. While 26-gauge cable is adequate from a transmission perspective for 12 kilofoot loops (the appropriate maximum copper loop length), 18 kilofoot loops, at a minimum, require a combination of 26 and 24-gauge cable. GTE also believes that, even for 12 kilofoot loops, a significant amount of 24-gauge cable will continue to be deployed in the network for cost-saving reasons related to the larger diameter of the 24-gauge cable, such as increased splicing efficiency and lower maintenance costs.

b) Feeder and distribution cable costs (¶ 66).

GTE agrees that it is unnecessary and inappropriate to have different costs for feeder and distribution cable material. The same material and labor elements are used whether the cable is placed in the feeder or distribution portion of the network. Although quantities of material (e.g., pair size) and labor (e.g., labor hours) related to cable size may differ between feeder and distribution, the unit costs for each remain the same.

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[80] The parenthetical paragraph reference here and in the headings that follow are to paragraphs in the FNPRM.

c) Separate values for aerial/buried/underground cable (¶ 68).

GTE agrees that cable costs differ, both in material and labor, depending on the type of construction. From a material perspective, the cable may have different protective sheathing depending on construction applications. For example, buried cable would normally require more, and perhaps different, protective sheathing and a gel-type filler to protect it from water and underground hazards, such as sharp rocks. More importantly from a cost perspective, the labor costs associated with the type of placement are different. Significant unit cost differences exist among the construction types and must be accounted for in the in-place cable costs.

d) Derivation of cable costs, related factors and adjustments (¶¶ 72, 80-82, 86, 91, 93, 95, 111, 114).

As GTE has indicated throughout these Comments, the use of the NRRI Study to develop inputs for cable costs is not acceptable. Company-specific values are the best choice, especially if a regression study is proposed. But, there is no need to develop national input values for 24-gauge cable based on a regression analysis, or derive the costs for 26-gauge cable from costs for 24-gauge cable as proposed by the Commission, because the actual costs of both 26-gauge and 24-gauge cable (and associated labor) are available for every state. In addition, the "smoothing" effect of curves used to estimate costs causes inaccuracies, and a single cost for all states will not capture the material and labor cost differences encountered across the nation. Furthermore, GTE believes the suggested method to derive 26-gauge cable costs from like-sized 24-gauge cable costs systematically reduces the amount of labor associated with placing the cable into service, as discussed above in Section III.B.3(a), at pp. 23-26.

It is methodologically inappropriate to apply a factor to the in-place cost of one cable gauge to calculate the in-place cost of a different gauge cable. The factor should only be applied to the material portion of the in-place cable cost.

The proposed engineering and splicing adjustments to cable costs are understated, significantly in some cases, as compared to GTE's actual engineering and splicing expenditures. This disparity raises doubt about the FCC's use of the same, constant engineering loading across all cable types, and to buried and underground structure. GTE data show significant variations and similarities in the engineering and splicing loadings between copper and fiber, and by placement type. In particular, splicing costs for all copper placements appear to be significantly understated.

Because the methodology used by the FCC to develop the splicing factor is based on the RUS data, it is, like the superior buying power adjustment, flawed. Analysis of the source contract data also shows that some splicing costs are invalid. For instance, some data show splicing costs without corresponding cable costs, while other data show no or very little splicing associated with a large amount of cable.

The application of the engineering and splicing factors presents another problem. The basic cable cost algorithm multiplies the cable cost (discounted by the superior buying power adjustment) by the sum of the engineering and splicing loadings. The superior buying power adjustment, in effect, lowers the cost of the engineering and splicing loadings. For example, the engineering and splicing loading sum of 14.7% for RUS aerial fiber cables results in a loading of $0.735 on a $5.00 cable. The same cable, after being discounted 33.8% by the superior buying power adjustment, results in a combined engineering and splicing loading of $5 times (1-0.338) times 0.147, or

$0.487. In copper applications, the loading amount is reduced even further when discounted for the calculation of 26-gauge cable, as explained previously.

For these reasons, GTE recommends that the engineering and splicing loadings be based upon costs more reflective of the non-rural LECs, preferably using company-specific data.

2. Structure Costs.

a) Pole costs (¶¶ 107-110).

The FCC proposes to calculate pole investment based on the cost of a 40-foot, Class 4 pole using the equation in the NRRI Study, and to express the cost of a pole on a per-foot basis by dividing the cost per pole by the estimated distance between poles. In addition to its criticisms of the NRRI Study, GTE objects to both of these proposals.

The proposed use of a single pole size overlooks the fact, acknowledged in the NRRI Study, that telephone companies place a variety of pole sizes, and that the taller a pole is, the more likely it is to be shared. While a cost model cannot reflect conditions related to ground clearance and other issues that might require a specific size pole placed a cost model should recognize the impact of sharing on the required height of poles. If a cost model does not and, instead, assumes a single pole size and applies the sharing input to every pole (as does the Model), the amount of pole investment assigned to the incumbent LEC will always be understated. This is illustrated by the following example based on the RUS data used in the NRRI Study. Using only those records for which both material and labor costs were reported, the average material and placement costs for a 30-foot, Class 5 pole and a 40-foot, Class 4 pole are as follows:

	Material	Labor	Total
30-foot, Class 5	$121.88	$131.88	$253.76
40-foot, Class 4	$213.94	$142.71	$356.65

(Note that these averages have not been adjusted for the date of the placement, and are presented only for illustrative purposes.)

Under the 40-foot pole, all-shared assumption, the investment assigned to the incumbent is always $178.33 per pole (one-half of $356.65). Suppose, however, that only 30% of all poles are shared, and that 50% of the investment in the shared poles is assigned to the incumbent. When the required mix of poles is accounted for, the average investment assigned to incumbent is $231.13 per pole (0.7 x $253.76 +0.5 x .3 x $356.65). The impact of the single-size, all-shared assumption on the average per-pole investment assigned to the incumbent is shown in the two graphs contained in Attachment 4, for each of the two proposed sharing inputs. For this reason, the Model should rely on two sizes of poles: a 30-foot, Class 5 pole when sharing does not occur; and a 40-foot, Class 4 pole when sharing does occur.

The FCC's proposal to convert pole investment to a per-foot basis by dividing the cost per pole by the distance between poles also understates the amount of investment assigned to the incumbent LEC. The proper way to model expected pole investment for a given length of facility is to multiply the cost per pole times the expected number of poles: # of Poles = 1+ Round (Facility Length / Average Spacing). GTE recommends that the Model be modified to calculate the required number of poles using the above formula, and that pole investment be determined by multiplying the cost per pole by the required number of poles.

b) Anchors and guys (¶ 108).

The FCC proposes to add the cost of anchors and guys to the input for an installed pole. Given that the pole costs used in the NRRI Study exclude anchors and guys, GTE agrees that the Model must account for them separately. Rather than simply adding them to the cost of a pole, GTE recommends that the Model have a separate input for both the cost of an anchor and guy, and for their spacing. Even if company-specific *price* inputs are not used, the Model should use company-specific operating characteristics, such as the spacing of anchors and guys. Finally, because anchors and guys are not always shared, even when pole space is shared, the Model's sharing inputs should not be applied to the anchor and guy investment.[81]

c) Derivation/extrapolation of underground and buried structure costs (¶¶ 111-113).

The FCC has proposed separate inputs for buried cable and structure by arbitrarily separating buried cable costs from any associated loading, such as engineering costs. The FCC did not discuss how the NRRI Study's single statistical equation for both cable and structure could be validly separated into two independent equations -- one each for cable and structure – to estimate two different costs. The resulting equations are questionable because the FCC's buried structure costs would not vary with cable sizes or the presence of water.

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[81] The development of the FCC's proposed anchor and down guy inputs is shown in Table 2-14 of the NRRI Study. With respect to the actual values, GTE notes that the rural, suburban, and urban probabilities shown for each component used in their development are unsupported and appear to be solely a construct of the NRRI Study's authors.

GTE is not able to separate actual costs of buried structure from total costs of buried plant; therefore, a comparison of its costs to the proposed costs was not possible. However, GTE is able to compare its actual engineering costs to the material and placement costs for the entire buried plant account (242310). Results indicate that an engineering percentage should be greater than the 10% suggested by the FCC. Likewise, a comparison of GTE's engineering costs to material and placing costs for underground structure revealed a percentage higher than the suggested 10%.

The extrapolation of costs from the two lowest density zones (density zones 1 and 2) to all other density zones is problematic. To begin with, the costs for density zones 1 and 2, which are used to estimate costs for all other density zones, are underestimated. The variables used to generate cost estimates in Normal, Soft Rock, and Hard Rock conditions in density zones 1 and 2 do not account for difficult soil texture or the presence of water, both of which would cause higher costs. Since the costs for other density zones are estimated using a ratio to these underestimated costs, they are also underestimated.

GTE also believes that certain construction costs inherent in non-rural construction simply do not exist in rural areas, or exist in amounts too small to extrapolate accurately to non-rural areas. For example, concrete replacement is a major construction adder in non-rural areas, but may not exist at all in many rural areas.

3. Fill Factors.

As a preliminary matter, GTE notes that with respect to the modeling of the local distribution network, generalized fill factors are not proper inputs for a cost model that seeks to estimate the long run costs of building a network. While different fills, or utilization levels, for distribution plant are used in real-world networks, it does not follow that generalized fill factors as cost model inputs are required or even desired. The use of generalized fill factors as cost model inputs disregards how actual distribution plant is designed, and that different levels of utilization are observed in different parts of the local network.

Utilization levels in distribution plant are based on three factors: (1) the number of customer locations to be served (and their dispersion); (2) the available discrete sizes of cable; and, (3) the number of lines to be provisioned per location. The resulting fills will be lower in less dense areas, due to the impact of the first two items.

The number of implicit lines per location proposed in the FNPRM decreases as the density increases. This result, however, is the opposite of what occurs in reality. There are usually (if not always) more business customers in higher density zones, which means that the number of lines that must be provisioned per location should increase as density increases. To correct this anomaly, the Model should be modified to accept the number of pairs per location to determine the required amount of distribution plant, instead of using fill factor inputs. The resulting fill factors should be reported by the Model as a means of validating the reasonableness of its results. Nevertheless, GTE comments below on the input fills proposed by the FCC for use in the Model.

a) Fill factors in low density zones (¶ 97).

GTE agrees that, in theory and practice, fill factors should be lower in low density zones. Furthermore, GTE contends that company-specific information should be used to determine appropriate fill factor inputs. The input fill should be a function of density, size, growth rates, and occupancy rates, and be based on the actual plant utilization data of non-rural LECs. These data, adjusted upward to reverse the impact of discrete cable size selection, should be used as inputs to the Model, not the proposed fill factors.

There is an error in the way the Model calculates density zones that prevents the correct application of zone-specific inputs. After the Model has assigned customer locations to clusters, it constructs a "convex hull" around all locations in the cluster. The Model then calculates density as the lines in the cluster divided by the area within the convex hull. The calculated densities will be higher than those observed in the real world because the denominator excludes all land area that is not contained within a convex hull. This will bias the Model toward the use of inputs for higher density zones. It is impossible to evaluate zone-specific inputs based upon real world experience because they do not correspond to any measures of density actually observed.

b) Current demand vs. ultimate demand (¶¶ 100-102).

GTE does not agree that the Model's input values for distribution fill factors should only reflect current demand, rather than the industry practice of building to meet ultimate demand. If distribution plant is not built to serve ultimate demand, there will be delays in service and increased placement costs due to the need to reinforce distribution plant in established neighborhoods on a regular basis. Telephone companies do not design distribution plant with the expectation that it will require reinforcement because that is rarely the least-cost method of placing plant. Moreover, in a competitive environment, facilities-based competitors would build plant to serve ultimate demand because no prospective customer can be expected to choose a carrier that must disturb the customer's lawn and landscaping in order to provide service.

Additionally, the FCC has misconstrued the meaning of building distribution plant "to serve ultimate demand." It does not mean, as in the case of feeder, to build plant based on forecasts of expected future growth. Rather, it means to build facilities sufficient to accommodate all demand in a given area. For example, in a residential development, distribution plant will be placed for all lots before streets are in place, regardless of how many homes are occupied, or even built, because that is the cost-effective way to provision telephone service. For these reasons, the cost of building distribution plant to satisfy ultimate demand should be supported by universal service support mechanisms.

GTE agrees with the Commission's proposed 100% input value for fiber fill as it relates to 100% redundancy only if it provides fibers for redundant optical transmit and receive, and does not equate to 100% fiber utilization.

4. Structure Sharing.

GTE believes that its actual structure sharing experience best represents future sharing opportunities and thus its forward-looking costs. GTE's structure sharing experience is fairly consistent across all the states in which GTE operates, making it possible for this input to reflect company-specific sharing averages. GTE therefore recommends that each LEC be allowed to provide company-specific inputs for each state (if there is variability between states) or a national average.

GTE's experience with structure sharing shows that the only significant sharing is with aerial structure. GTE shares *very* little underground structure, averaging only 0.035% across all 28 states in which it operates. Buried structure sharing is almost nonexistent and is only recorded in a few jurisdictions. A host of reasons may explain this, including the timing of plant installation, scheduling of work crews, location preferences, safety concerns, concern for the integrity of each party's network, and code requirements for separation of facilities. The limited instances of sharing of buried and underground facilities between power and telecommunications may be based on special circumstances, such as confined rights-of-way, e.g., new road cuts (borings or crossings) or road widenings. But, even in these situations, a trench or underground facility is seldomly shared. The FCC's proposed aerial sharing inputs come closer to GTE's actual experience, but still assign too few costs to the carrier. In addition, the Model's reliance on a single-size pole and the assumption that every pole is shared underestimate the costs assigned to the ILEC. This issue was discussed in greater detail above in Section V.A.2(a), at pp. 50-51.

The FCC has wrongly concluded that because the Model designs a network as if it were completely rebuilt at one point in time, the sharing inputs should also reflect this assumption. With respect to sharing, the Model assumes that all existing buried plant will be dug up, immediately reburied, and that GTE and other carriers had the foresight to build conduit systems and pole lines that could accommodate the proposed greatly expanded sharing opportunities as the plant is reburied. They have not. Moreover, expanded sharing opportunities do not exist except when there is new residential or commercial construction. If a hypothetical new entrant were going to rebuild the entire network, it would not experience levels of sharing that exceed GTE's actual experience because there would not be a universal coincidence of demand. That is, no other company would need to place plant at the same location and at the same point in time as the new entrant. The most likely candidates for sharing are cable television ("CATV") and electric companies, but their networks are already in place. Thus, the amount of sharing that exists today is based on logical arrangements that make sense for all utilities, given timing and construction constraints.

The Model's use of speculative future, unproven sharing percentages would disadvantage the providers of universal service and undermine their ability to fulfill carrier of last resort obligations. GTE's unique company-specific structure sharing percentages reflect GTE's density and service area characteristics, and should not be averaged with or overridden by the FCC's proposed industry-wide inputs.

5. Plant Mix.

a) Distribution plant mix (¶ 119).

Company-specific plant mix data should be used in the Model because only this information can capture the relevant variables that would influence forward-looking plant mix decisions, such as relevant terrain considerations and zoning requirements. While it can be argued that a forward-looking plant mix would differ from the historic mix, this would only lead to amounts of expensive underground or buried plant that exceed current levels (and less aerial plant) because of stricter zoning requirements, particularly in more dense areas.

b) Feeder plant mix (¶ 121).

GTE disagrees with the FCC's tentative conclusion that there is no reason to distinguish between plant mix ratios for copper and fiber feeder. Even though the trend is for more "out of sight" construction for all types of cable plant, the existing plant mix indicates that additional efforts have already been made to limit aerial exposure of fiber cable, resulting in differing copper and fiber feeder plant mixes. Because GTE expects that trend to continue, a distinction between copper and fiber plant mix is necessary.

c) Plant mix and terrain (¶¶ 123-125).

The proposed methodology for adjusting the nationwide plant mix inputs to reflect varying terrain conditions should be discarded because it is vague and has little or no impact on the accuracy of the Model. The methodology appears be little more than the application of arbitrary scaling factors to the underground and aerial mix vectors, and does not address the relationship among density zones. This failure to use density zones for plant mix is a significant modeling flaw.

The current density zone structure for plant mix inputs makes it difficult to determine the appropriate values with any degree of accuracy. Since the density zones do not correspond to the way plant mix data are collected, it is difficult to populate them accurately from existing data. Further, the correct process for populating the density zones would require sampling. The samples would have to be drawn from a statewide cross-section of areas of comparable density and size. Such a sample, aside from definitional problems, would result in key characteristics (topography, zoning, climate) being pooled together. The cross-section, by its nature, would average out and reduce the impact of all factors except density.

Regardless of the form of the input structure, it would be inappropriate to use a single set of plant mix factors for all geographic areas and companies. Area and company-specific plant mix factors should be used. The actual plant mix for any area should be the most efficient mix of buried, aerial and underground plant, given the area's constraints. Typical constraints include local zoning conditions, growth, frequency and types of adverse weather, and service quality requirements. The historical plant mix selection was based not only on initial cost, but also on recurring investments and annual expenses.

Although the historical plant mix represents a cost efficient solution to the plant mix problem and is the appropriate starting point for determining plant mix values, it is not necessarily the most appropriate forward-looking plant mix. Conservatively, the appropriate mix should be a two-to-five-year projection of future plant mix, with the historic mix as a starting point. The projection should be based on the changes that have taken place over the last five years. Data from the 43-08 ARMIS report for two time periods, five years apart, can provide the information needed to project what the embedded mix will be in the future. This projection gives an overall control target. By repeatedly running the Model and adjusting the mix inputs, a set of plant mixes can be developed resulting in an overall mix, close to the forward-looking target.

GTE does not agree that the Model should optimize plant mix based on the cost of cable and structure. Plant mix decisions are made based on a number of factors, the cost of cable and structure being only two. Zoning requirements also affect plant mix decisions. GTE does not concur with the FCC that zoning requirements are not a factor because they are in place for aesthetics, not engineering or economic reasons. Because an efficient network's plant mix must reflect zoning requirements, zoning cannot be arbitrarily eliminated in the interest of reducing reported costs. Zoning requirements, like water table depth and depth to the bedrock, are a feature of a carrier's operating environment that cannot be assumed away. The introduction of a plant mix optimization routine based only on cable and structure costs would divorce the Model results from reality.

6. SAI, DLC, and HDSL Inputs.

a) SAI costs (¶¶ 140-141).

The costs of all sizes of SAIs should not be extrapolated from the cost of a 7,200 pair indoor SAI. First, GTE sees no need to extrapolate SAI costs when the cost of individual SAI sizes and associated labor is readily available. Second, GTE disagrees with the premise that SAI costs are subject to a linear relationship across all sizes. GTE's SAI estimates exhibit a high degree of linearity only for SAIs between 900-5,400 pairs.[82] Below 900 pairs, the material costs of the splice cases and SAI cabinets, and the SAI placement and splice setup costs skew the costs away from a linear relationship. In addition, costs for splice sizes below 300 pairs also depart from a linear relationship.[83] GTE therefore recommends that the Commission either develop a mathematical relationship that takes these nonlinear factors into account, or develop its SAI costs based on data submitted by the input workshop participants.

b) DLC costs (¶ 145-146).

GTE disagrees that the costs of DLCs or any other item should be adjusted to reflect cost decreases that have occurred since the company-specific data on the items were submitted. All items have and will experience price changes over time. Some individual items, such as poles, have experienced large cost increases over the past

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[82] Universal Service Cost Model Docket, GTE *Ex Parte*, March 2, 1999, Exhibit 1, at p. 1.

[83] *Id.*, Exhibit 3, at p. 1.

few years, but no mention is made of adjusting the cost of poles upward. Likewise, labor costs will continue to increase, but are not mentioned as an adjustment item. As inputs to the Model are updated over time, the current cost of technology would be reflected in the revised data. There is no need to adjust any data that are based upon current (or market) costs.

GTE agrees that the DLC data submitted by the LECs are the most reliable data on DLC costs available to the Commission, and should be used as inputs to the Model. Further, it is appropriate to add shipping and handling costs, and sales tax based upon company-specific data in developing total DLC material costs. The cost data for DLCs submitted by GTE included shipping, material handling costs and sales tax.

c) HDSL costs (¶ 60).

In response to the Commission's request for comments on copper-based T-1/High Bit Rate Digital Subscriber Line ("HDSL") technology and its applications in a forward-looking environment, GTE agrees that the Model should not use the T-1 option.

HDSL alleviates interference problems associated with conventional copper T-1 carrier. Further, HDSL can and is used to provide 1.544 Megabit per second ("Mbps") data rates over embedded copper plant, but its use is not an appropriate forward-looking technology.

Predominant uses of HDSL are to provision "short fuse" 1.544 Mbps service requests and extend the life of the embedded copper network. HDSL-based DLC is used to extend the capacity of embedded copper plant to customers that would more likely be served via fiber-based Next Generation Digital Loop Carrier ("NGDLC") under forward-looking design parameters.

B. Switching And Interoffice Transport.

1. Use of RUS Data (¶¶ 155 and 162).

The NRRI Study source data (RUS data) should not be used to determine switching input values because the data are outdated, non-representative, and inconsistent with regard to switch size (small vs. large). The NRRI Study data set is too limited in scope and not representative of non-rural costs because of the small size of the companies that submitted the data. It is unlikely that the mix of switches used by small, rural companies is representative of the switch sizes and vendors used in larger non-rural carrier switching networks.

Instead, the FCC should gather current switch cost data from the non-rural companies to develop the fixed and per-line cost of switches. A standard detailed report on costs submitted by non-rural companies can be used to create the source data set. The switch investment data should include investments for both total new switch installs and for adding new equipment to existing switches. Switch investments can then be developed by state, company, manufacturer, host/remote configurations and line size. The data should be manufacturer-specific and gathered in a consistent manner so that it can be compared with the data collected by NRRI for the large LECs. If there is a need to adjust material price or investment data, the C.A. Turner Index should be used.

Absent such a survey, GTE recommends that the FCC's inputs reflect the installed switch investment data furnished by BellSouth, Sprint and GTE for several reasons.[84] First, the data are based on actual switch purchases and therefore include all the relevant installed costs associated with a switch. There is no need to estimate installation-related charges. Second, both host and remote switches included in the data would presumably include the actual host/remote, umbilical investments in the total installed investments, and avoid the need to rely on an estimate of investments associated with umbilicals. Lastly, the documents provided by BellSouth, Sprint and GTE contain a broad range of central office switch sizes. These data may be useful to measure the investment data the FCC has already acquired for use in the Model.

2. Adjustments to Switch Cost Data (¶¶ 157-159, 178).

As discussed below, the RUS switch cost data must be adjusted to include costs for MDF, power, host-remote connectivity and LEC engineering in order to make them consistent with actual investment data.

GTE has concerns about the proposed adjustment for MDF per-line investment. It appears, based on other "per-line" calculations, that the FCC proposes to multiply the MDF per-line investment adjustment by only the number of working lines. This approach is incorrect. MDF investment is required to terminate *every* outside plant cable pair that goes to the central office building. Therefore, the MDF per-line investment should be multiplied by the number of pairs terminated, not the working lines in the central office. If the central office investment figures contain appropriate investments in MDF and power, then the Model inputs of MDF/protector investment per line and power input values should be set at zero.

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[84] Universal Service Cost Model Docket, BellSouth *Ex Parte*, January 29, 1999; Sprint *Ex Parte*, February 5, 1999; GTE *Ex Parte*, February 22, 1999.

the allocation of embedded cost or the vagaries of the cost model. Finally, this alternative measure could readily be constructed using currently available data. Once this measure has been developed for each study area, a comparison to the nationwide mean could proceed for the purpose of determining support necessary to maintain reasonable comparability.

GTE has argued above that universal service support should be determined on a deaveraged basis. For the purpose of assessing the federal funding that is needed to maintain reasonable comparability, GTE has suggested that the UNE zones established by the states, which will generally be aggregations of homogeneous wire centers, are reasonable geographic areas. The relative levels of the UNE rates in each zone could be used for this disaggregation. Until the appropriate UNE zones have been set by the state, the study area can be used in the interim The result would be a set of geographic zones in which the total revenue, across all zones, would be the same as the study area revenue, while the relative level of the average revenue per line for high cost support determination between any two zones would be the same as the ratio of the UNE rates in those zones.

This approach would allow the Commission to develop a consistent, reasonable surrogate measure of cost at the zone level for purposes of the universal service calculations proposed in the Seventh Report and Order.[105]

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[105] In the Matter of Federal-State Joint Board on Universal Service, In the Matter of Access Charge Reform, CC Docket 96-45, *Seventh Report & Order* and *Thirteenth Order on Reconsideration*; CC Docket No. 96-262, *Fourth Report & Order*, CC Docket Nos. 96-45, 96-262, *Further Notice of Proposed Rulemaking*, FCC 99-119 (rel. May 28, 1999), at ¶¶ 102-109.

B. Portability of an Explicit Fund.

For each study area, wire centers with above-average costs based on the forward-looking cost model outputs would receive support based on the relative weighting to all other wire centers with above-average costs in the same study area. This would allow the resulting explicit support to be targeted to individual wire centers and made portable to the eligible telecommunications carrier that wins the end-user customer.

C. Proposed Modification to Procedures for Distinguishing Rural and Non-Rural Companies.

GTE offers the following comments on various issues related to the rural and non-rural designations.

1. Annual Filing Requirements for Carriers Serving Less Than 100,000 Access Lines.

GTE agrees that, in the future, a carrier serving less that 100,000 access lines should not be required to file the annual rural certification unless its status has changed since its last filing. On a prospective basis, carriers must continue to review annually their study area status to ensure qualification. A status change may occur due to access line growth or potential demographic changes identified in the most recent listing of metropolitan areas published by the Office of Management and Budget ("OMB"). The Commission would eliminate administrative costs for itself and for carriers by requiring that changes be communicated only on an annual basis. The Universal Service Administrative Company ("USAC") should post these changes to the current database maintained for all local exchange carriers and publish the results.

2. Definition Of "Local Exchange Carrier Operating Entity."

GTE has interpreted the meaning of the phrase "local exchange carrier operating entity" to mean a study area and has previously filed for rural certification based on this interpretation. Should the Commission clarify or change this definition to mean something other than a study area, carriers should be required to re-file rural exemptions for universal service support commencing on January 1, 2000. A change in the meaning of "local exchange carrier operating entity" could alter the current study area reporting for companies under 100,000 lines, as well as for companies exceeding this threshold. A definitional clarification in the meaning of "communities of more than 50,000" also could potentially alter the rural status of companies exceeding 100,000 lines qualifying as rural under Section 153(37)(D) of the Act.

The phrase "local exchange carrier operating entity" in Section 153(37) of the Act is a new term not previously used in regulatory proceedings. As mentioned previously, GTE interpreted the phrase "local exchange carrier operating entity" to mean a study area. The study area is the appropriate service area for "rural exemption filings" due, in part, to FCC guidelines prescribed in Part 54.207(b), which specify that a rural telephone company's service area is a study area.[106]

In addition, Section 153(37) of the Act identifies the criteria for determining rural status. Two of the four criteria included in this section use the term "study area" to describe applicability:

> (A) provides common carrier service to any local exchange carrier study area that does not include either...

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[106] 47 C.F.R. § 54.207(b), Service Areas at p.8.

(i) any incorporated place of 10,000 inhabitants or more, or any part thereof, based on the most recently available population statistics from the Bureau of the census; or

(ii) any territory, incorporated or unincorporated, included in an urbanized area, as defined by the Bureau of the Census as of August 10, 1993;

(C) provides telephone exchange service to any local exchange carrier study area with fewer than 100,000 access lines.[107]

If a holding company definition were used to define rural status, the Act would have been amended to strike the term "study area" in the above-cited paragraphs.

3. Section 153(37)(D) of the Act Needs Clarification, But Not Section 153(37)(A).

GTE concurs with the Commission that Section 153(37)(A) of the Act can be applied consistently without additional information. This provision states explicitly that a "study area" can not include either an incorporated place of 10,000 inhabitants or any "urbanized" area, as defined by the Bureau of Census as of August 10, 1993. This meaning is self-explanatory and administratively easy to implement. However, Section 153(47)(D) -- study areas with less than 15% of their lines in communities greater than 50,000 -- is more difficult to determine and needs clarification by the Commission.

4. The Definition of Rural Telephone Company In Sections 251(f)(1) and Section 214(e)(2) Has Been Interpreted Consistently.

It has been GTE's experience that state commissions have defined the term "rural telephone company" consistently in exercising their authority under Sections

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[107] 47 U.S.C. § 153(37) ("rural telephone company" is defined as local exchange carrier that: serves study area that does not include any incorporated place of 10,000 inhabitants or more or any urbanized area; serves fewer than 50,000 access lines; serves study area with fewer than 100,000 access lines; or has less than 15 percent of its access lines in communities of more than 50,000 on date enactment of Telecommunications Act of 1996.)

251(f)(1) and 214(e)(2) of the Act. When determining whether or not a company is rural for interconnection purposes, the definition was not at issue. The issue was whether interconnection was unduly burdensome and technically feasible. Most state commissions did not consider any GTE study areas rural for interconnection purposes. However, as this Commission acknowledges, numerous GTE study areas are rural for interstate high cost funding.[108] More confusion arose because many states did not make a distinction between rural and non-rural for state universal service purposes. In other words, a state where GTE has only one study area may be rural for interstate universal service purposes, but may be considered non-rural for state purposes. For example, GTE Midwest -- Nebraska is considered rural for interstate high cost funding and non-rural for state universal service funding. Despite this difference in classification, the distinction did not create a problem when determining each jurisdiction's need for funding.

5. Linking "communities of more than 50,000" with Metropolitan Statistical Areas ("MSAs").

GTE believes that a community is linked to a MSA. Consistent methodology and source of demographic data are imperative to properly determine whether a study area qualifies under Section 153(37)(D) of the Act. There are various ways to interpret the term community and absent a specific Commission methodology, carriers have more than likely interpreted and applied various criteria when filing for "rural exemptions."

OMB defines a metropolitan area (urban) as consisting of at least one central city of an approximate size (usually at least 50,000), its surrounding "suburban" territory

[108] Universal Service Cost Model Docket, Self-Certification as Rural Telephone