57. In connection with the state proceedings resulting from the Triennial Review Order, MiCRA and other consultants constructed a model of the entry decision – the "Impairment Analysis Tool" -- faced by a CLEC contemplating the provision of mass market local exchange service using its own switches. Based in part on a model constructed by Dr. David Gabel for the National Regulatory Research Institute, MiCRA and other MCI consultants extended that model to consider a wider range of input data and a wider range of services that could be provided by the CLEC. The model calculated the investments required in each wire center for the CLEC to establish collocation and transport arrangements, as well as customer-specific investments and ongoing maintenance and recurring charges applicable to the provision of a range of services to residential, small business, and large business customers. Revenues and costs from all services are examined in order to account for any economies of scope from serving all markets and customers. For example, we are able to determine whether entry into the residential market is profitable for a carrier with a large enough base of business customers to justify a collocation.

58. In addition to the costs and revenues associated with the provision of basic residential local exchange service, the revised model permitted consideration of the costs and revenues associated with small business services, with ADSL services, and with the provision of services to enterprise customers. The model also was extended to permit consideration of different spending levels among

residential telephone customers, using wire-center specific data obtained from TNS Telecoms.

A. Analysis of Cost Categories

59. The broad categories of cost to be considered in assessing the potential for CLEC switch deployment to serve the mass market are loops, switches, the connection between the loop and the switch, collocation of the CLEC's facilities in the ILEC's wire center, the cost of digitization, concentration and aggregation, transport to the CLEC's switch, and the cost of cutting over the loops.

60. The cost of loops to the CLEC is the rate established by the state commissions in each of three or more UNE rate zones. Thus, for each wire center the UNE rate applicable to the rate zone to which the wire center is assigned is the cost to the CLEC of providing the loop portion of local exchange service. In addition, the cost of interconnection between the ILEC's facilities and the CLEC's collocation space, or to Enhanced Extended Loop ("EEL") facilities must be considered.

61. A CLEC evaluating the possibility of deploying facilities to provide UNE-L service must consider the cost of the switch. Switches are readily available from the various switch manufacturers as well as in secondary markets. Unlike many of the other costs faced by the CLEC, the cost of the switch is predictable and consistent (for any given level of demand) for all geographic markets that the CLEC might contemplate entering. And, although much of the price of a switch constitutes a fixed cost (since it is necessary to purchase an entire switch

processor and switch matrix to serve even one customer), it is not a sunk cost. (As discussed below, however, the cost of installing and configuring the switch may be a sunk cost.) For these reasons, the purchase of the switch itself does not in and of itself constitute an insuperable entry barrier.

62. Although local exchange switches are readily available and can be rapidly deployed, the CLEC must evaluate, on a market-by-market basis, whether the potential customer base is sufficiently large that the costs that are sunk in installing and configuring a switch may reasonably be expected to be recovered. Parts of modern switches (*e.g.,* line units and line cards) are designed to be scalable to customer demand; thus, the corresponding portion of the cost of switches is variable with respect to the number of customers served. Nevertheless, there may still be significant sunk costs incurred before the first customer can be served. These costs include engineering costs; the costs of purchasing, transporting, and installing the switch; the costs of acquiring space to house the switch and to supply it with power, climate control, and necessary testing equipment.

63. In addition to the costs of the loop and the switch, the CLEC must incur substantial costs to connect the leased loop to its switch – costs that the ILEC does not have to incur. These costs will vary for every wire center. These costs include the cost of establishing the collocation space and equipping that space with the necessary electronics to terminate purchased UNE loops, and the cost of establishing transport facilities to carry customer traffic from each collocated

ILEC wire center to the CLEC's switch location. In both instances, the costs include non-recurring charges by the ILEC for establishing collocation and transport arrangements, as well as costs incurred by the CLEC for engineering and purchasing loop termination and transport equipment. These costs too are both sunk and fixed costs. Moreover, they are costs that are not incurred by the ILECs. In what follows, I describe the costs in more detail.

64. Voice telephone service has traditionally been provided by connecting a customer's premises to the ILEC's central office with a twisted pair of copper wires (i.e., the local loop). The local loop terminates in the central office on a Main Distribution Frame ("MDF"). The local loops terminate on one side of the frame, the "customer facing side." On the other side of the frame – the "network facing side," short wires (referred to as "jumper wires") connect to ports on the ILEC's switch. This configuration allows for easy and flexible connections between loops and the local switch. The connection between the local loop and the ILEC switch consists of a single jumper wire, running from 15 to 100 feet in length. The cost of providing this jumper wire is very small, probably on the order of 2¢ a month.

65. This simple, inexpensive connection to the ILEC's switch is possible because the local network architecture was specifically designed and engineered to permit efficient and economical loop access to a monopoly local carrier. The placement of ILEC central office, and the configuration of the wires that connect these offices to the homes and businesses they serve, was based in part on engineering

considerations. The ILECs' networks were designed to limit the length of most copper loops to 15,000 to 18,000 feet, to avoid having to add equipment to enhance the quality of the voice signal. Outside of rural areas, this allowed the ILECs to deploy switches that were sufficiently large to take advantage of scale economies.

66. To provide comparable service, the CLEC offering UNE-L service must substitute for this jumper wire a much more complex physical connection between the MDF and its own switch. This is so because the CLEC switch will never be located as the ILEC switch is, 15-100 feet from the ILEC main distribution frame. It would be economically impossible for a CLEC to install a switch of its own at or near each ILEC central office, because those CLEC switches would serve too few customers to be cost-effective. Neither is it possible to collocate Class 5 switches in the existing ILEC offices, both because of space limitations and because existing rules do not permit it. Hence, unlike the ILEC, the CLEC cannot use an inexpensive 100-foot copper jumper to connect the local loop to its own switch. Rather, a CLEC must locate its switches in central locations and transport the traffic from the loop to that centralized location.

67. Transport involves a great deal more than simply connecting a very long jumper wire to connect the loop to the CLEC switch, for two reasons. First, for technical reasons, the signal would be unlikely to survive this form of transport to the distant CLEC switch. Second, even if this technical limitation were ignored, it

would be very costly and inefficient to run so many wire pairs from the various central offices the entire distance to the CLEC's centralized switch.

68. Instead of a connecting a simple jumper cable, the network operations necessary for CLECs to connect UNE loops to CLEC switches involve four stages. First, the CLEC must rent space in the ILEC's central office to "collocate" its own network equipment. Second, the CLEC must purchase and install electronic equipment in the collocation space that converts the analog loop signal into a digital signal, and at the same time aggregates and concentrates multiple loops into more efficient copper or fiber transmission facilities. Third, the CLEC must purchase or construct transport facilities to carry the traffic to its switch location. Fourth, when all of these connections are established, the ILEC and CLEC must coordinate a "cut over" of the loop from the ILEC's main distribution frame to the "POTS bay" at the CLEC's collocation space. I will describe each of these processes and discuss the type and nature of the costs involved in each step. The Commission previously has recognized that an analysis of each of these costs is important to determine whether entry is economic.[21]

69. The first thing a CLEC must do to provide UNE-L telephone service is to obtain collocation space at the ILEC central office at which the customer's loop terminates. Collocation is basically the rental of a small portion of central office space. There are three forms of collocation—(1) physical, caged collocation, (2) physical, cageless collocation, and (3) virtual collocation. Physical collocations

[21] *TRO* ¶¶ 481, 484, n. 1497, ¶520.

are space assigned within an ILEC central office in which a CLEC can deploy its own hardware and equipment. This space is generally caged (*e.g*., enclosed by meshed wire), to provide security. In physical, cageless collocation, a CLEC is generally assigned space in the ILEC's common equipment room where the CLEC can deploy its own equipment, but this space is not enclosed. In virtual collocations, CLECs purchase equipment; however, the ILEC takes ownership of the equipment (and responsibility for maintenance) and installs the hardware in the ILEC's equipment lineup. The type of collocation selected by a CLEC is often driven by the availability (or lack thereof) of space in a given central office. Establishing the collocation involves a number of activities that will vary depending on the type of collocation established.

70. In general, these activities include: (1) obtaining the necessary space in the ILEC's central office; (2) engineering the collocation; (3) arranging with the ILEC to provide the collocation (for physical caged collocations) as well as fire protection, heating, ventilation and air conditioning ("HVAC") and power, or, in, the case of a virtual collocation, to install the necessary equipment in ILEC-controlled space; and (4) establishing and pre-wiring the "POTS bay," which enables loops from the ILEC MDF to be connected to the CLEC's equipment at the collocation. While the cost of each element of establishing or continuing in a collocation arrangement is usually well defined by a tariff, Statement of Generally Available Terms and Conditions ("SGAT"), or interconnection agreement, determining the cost of collocation for a particular entry plan may be difficult and

subject to substantial uncertainty. For instance, for a "cageless" collocation, some of the ILEC make-ready work is unnecessary. CLECs need to obtain direct current ("DC") power and emergency power from the ILEC to operate collocated equipment, and the nature of these arrangements can vary substantially. The specific equipment needed to provide this functionality includes the battery distribution fuse bay ("BDFB") and the DC power cabling that is extended from the BDFB to the collocation arrangement. The BDFB is a large fuse bay or junction point where a large feed of DC power from the ILEC's power plant is broken down into smaller power units. The DC power cabling, consisting of copper cables in protective sheaths, is necessary to complete a power circuit from the BDFB to the collocation arrangement. In some cases, the CLEC may install its own BDFB in the collocation arrangement. The impairment analysis tool calculates the cost of collocation by considering the number and type of lines that must be connected from the ILEC's main distribution frame and DLC systems to the CLEC's collocation space, and calculates, based on the ILEC's UNE tariffs, interconnection agreements, or SGATs, as appropriate, the cost not only of establishing and equipping the collocation space, but also the cost of connecting individual customer lines from the ILEC to the CLEC. Some of these costs are incurred as monthly recurring costs, and are incorporated into the cost analysis directly as a monthly cost per line. Other costs are incurred either as non-recurring charges imposed by the ILEC, or are incurred by the CLEC as capital investment. In some cases, these costs are treated as a one-time expense that is amortized over a user-adjustable period of time. In other cases, particularly in the case of capital investments, the asset is depreciated over an appropriate economic depreciation life, and the capital carrying cost of the asset is included as a part of the monthly cost per line.

71. A substantial portion of collocation costs is fixed, i.e., there is a large cost associated with providing service to the first UNE-L customer served. Moreover, most of the up-front costs are sunk, which means they cannot be recovered if the CLEC exits the market. As discussed in the *Triennial Review Order*, the existence of substantial sunk costs creates a significant entry barrier, which has profound effects on UNE-L competition.

72. As a consequence of the CLEC's need to place its switch at a substantial distance from the ILEC's wire center, in order for the CLEC to be able to carry the traffic from its collocation space all of the way to its switch, it must install in its collocation space equipment that digitizes and encodes the analog signals delivered over the customers' loops to that collocation space. The equipment used to perform this function is sometimes referred to as DS-0 (that is, voice grade) equipment infrastructure. This equipment includes DLC equipment, high capacity digital cross-connection frames (DSX or DACS), power distribution and remote test equipment.

73. The DLC equipment is the equipment that receives the analog communications from the loop via the POTS bay and both digitizes and concentrates the communication for transmission to the CLEC's switch. Digitization of the analog

signals from the loop is necessary in order to interface the signal efficiently with the fiber optic transmission facilities that are used in interoffice transmission paths. Concentration of the signal permits the CLEC to more efficiently use interoffice transmission capacity. The DLC also interoperates with the CLEC switch to provide and receive signaling necessary for call supervision, including the provision of dial tone and ringing current, digit reception and related functions.

74. The CLEC must also install other equipment at the collocation to provide UNE-L service. A digital cross connection frame (or DSX-3) is needed to connect the DLC and the transport facility. In addition, a CLEC needs to install equipment that enables it to monitor its collocation equipment remotely, thereby permitting the CLEC to maintain its equipment and to diagnose and subsequently repair any service disruptions that may occur.

75. As in the case of the collocation costs, there are substantial fixed costs associated with these functions. The largest costs are for the DLC equipment, which even at its smallest size costs many thousands of dollars. And even if a CLEC can utilize the smaller DLC equipment efficiently, it will not be able to operate at the lowest possible cost unless it can achieve sufficient volume to capture the scale economies inherent in DLC technology.

76. The engineering and installation cost for these functions are sunk once they are committed to a particular central office. The purchase prices of the DLC and

other equipment are not sunk with respect to the provision of service at a particular location, because they could be moved elsewhere. Nevertheless, if the CLEC were to exit the market entirely, it might have a hard time recovering substantial portions of the equipment cost if UNE-L-based service failed to succeed across much of the CLEC industry.

77. Once the CLEC customers' signals have been prepared for transport to the CLEC switch, the CLEC must arrange for transmission facilities to deliver traffic from the collocation to its switch. In most cases, a CLEC will not be able to use its own network facilities to connect the collocation to its switch because the traffic volumes present at a given collocation are typically too low to afford the economies of scale necessary to justify CLEC construction of transport facilities solely for this purpose. Rather, the CLEC will use the ILECs' transport facilities to connect its collocation either directly to its switch or to a "hub" location at which traffic from several sub-tending collocations in the area are aggregated and subsequently transported to the CLEC's switching location. Given appropriate traffic volumes, this hub location may be connected to the CLEC's switching office via the CLEC's own optical fiber transport facility. In either case, whether purchased from the incumbent or self-provisioned by the CLEC, a CLEC must procure transport facilities between its collocations and switching locations to backhaul customer loops to its switch.

78. There are some sunk costs associated with providing transport for UNE-L based local service. If the CLEC leases transport from the ILEC, there will be sunk

costs associated with any nonrecurring charges, term commitment plans, and any costs associated with "grooming" circuits to handle increased and/or changed traffic demand. If the CLEC has transport facilities already in place, then its costs were sunk before it decided to provide UNE-L based local service.

79. The CLEC will face significant scale effects on transport leased from the ILECs. Most transport tariffs provide substantial volume discounts, and unless the CLEC has enough traffic to utilize a DS-3 or higher circuit, it will pay a high per unit cost for using DS 1 circuits. Also, because transport circuits are provided in "lumpy" amounts (for example a DS 1 circuit can carry 24 voice grade circuits, but the next larger size circuit, a DS 3, carries 672 voice grade circuits), a CLEC will be less likely to use transport facilities efficiently, the smaller its total demand for transport.

80. Once the necessary network infrastructure is in place, the CLEC is in a position to connect individual customer loops to its collocation (and ultimately to its switch). To accomplish this, the CLEC must arrange for what is typically referred to as a hot cut. The hot cut process involves multiple activities that require coordination among both CLEC and ILEC personnel and includes, among other things (1) physically moving the CLEC customers' loops from the ILEC MDF to the POTS bay at the CLEC collocation and (2) coordinating the porting of the customer's telephone number to the CLEC's switch so that calls dialed to the customer's number can be properly completed. Once the hot cut has been successfully completed, a CLEC can then provide service to its end-user using its own switch.

81. The cost of the hot cut required to serve a particular customer amounts to an investment the CLEC makes to acquire the stream of revenue it expects from that customer. As such, the investment loses its value entirely if the customer switches to another provider. The CLEC must therefore recover this cost within the period over which it can expect to retain the customer. Thus, the average period over which a CLEC can expect to retain a customer is the appropriate amortization period for customer acquisition costs, including hot cut costs. The average customer life, or retention period, is therefore a crucial element of the cost that a CLEC must evaluate in deciding whether to deploy facilities for UNE-L service or not. This average customer life is conceptually related to the concept of "churn" experienced by telecommunications even in a monopoly environment, as customers enter and leave the provider's serving area, and move from place to place within the serving area. Estimates of churn can be significant in some conventional cost studies, but churn in a monopoly environment is relatively stable and subject to fairly reliable approximations. Very much to the contrary, average customer life in a competitive environment depends on the nature of competition. In this case, the competitive environment to be considered is the environment after UNE-L based entry. While we have good reason to believe that the character of competition will be significantly different after UNE-L based entry – because a UNE-L competitor will have incurred greater sunk costs and face much lower marginal costs than a UNE-P based competitor – the precise character of that competition, and its implications for average customer life, must remain subject to a great deal of uncertainty. This uncertainty is relevant, not

only to the present modeling exercise, but to the CLEC's evaluation of risk associated with potential deployment of facilities to support UNE-L based service.

82. From the foregoing, it should be apparent that many of the costs faced by CLECs contemplating the provision of service to the local mass market using its own switches vary substantially from wire center to wire center. Because of the large component of fixed and sunk costs incurred by the CLEC in each wire center, the number of lines served by the wire center, and thus the number of customers that the CLEC may expect to acquire, will substantially affect the ability of the CLEC to recover its investment. The rates applicable for loops and transport differ according to the rate zone in which each wire center is located. Because transport rates generally are distance-sensitive, the length of haul from each wire center to the CLEC's switch or point of interconnection with the ILEC's network also will affect costs on a wire center-specific basis. As will be discussed in more detail below with regard to potential revenue, the particular demographic mix of customers also may affect the ability of the CLEC to recover its costs: Wire centers that contain a relatively high proportion of "upscale" residential and/or small business customers may have a higher penetration of second lines and vertical services, thus improving the CLEC's prospects. Higher-spending customers also may be more price-sensitive, however, and therefore may be more prone to switch from one carrier to another, thus increasing churn and increasing the CLEC's cost.

B. Post-Entry Revenue Projections

83. To determine whether to serve a market using UNE-L, the CLEC must consider not only its costs, it must also consider the likely revenues from the services it offers, including all categories of potential revenues.[22] Economic theory predicts that a CLEC will enter and compete against the ILEC only if the CLEC can expect to earn sufficient profits post-entry to enable it to earn an adequate return on the cost of the capital that it must commit to enter the market, recognizing the risk associated with the investment. Given the CLEC costs discussed above, and given the retail rates the competitor will be able to charge, the competitor may or may not be able to recover the costs it would have to incur to enter the market in the first place, in addition to the incremental cost of providing service.

84. In other words, before it enters a market, a competitor would need to understand its costs, estimate the revenue it would expect to receive, and determine whether entry would be profitable. Its revenue projections would be based on the rates it could charge, accounting for the effect of entry on competition, and the number of customers it expects to purchase its services. The rates that can be charged are highly dependent upon the rates the other market participants would charge for substitutable services. The CLEC's price must be competitive with the ILEC's if the CLEC is to be successful. A CLEC considering potential deployment cannot rationally assume it will be able to charge $40 for phone service if the incumbent LEC is likely to respond to entry by offering a similar service for $35.

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[22] *TRO* ¶¶ 484-85.

85. The ILEC's existing rates represent the highest conceivable rates that a CLEC might hope to charge after entry, and for reasons discussed below, it is not really plausible that those rates could be maintained after UNE-L competition becomes established.

86. Because a new entrant must generally offer rates that are no higher than those currently charged by the incumbent, existing retail rates are an optimistic starting point for any analysis of anticipated CLEC revenue. But, analysis of existing rates is only the starting point. Firms contemplating entry into new markets rationally base their entry analysis on the prices they expect will prevail after they enter, and not on current prices. This proposition is widely accepted in industrial organization economics, and the Commission previously has expressed its view that it is an important factor in an impairment analysis.[23] Consideration of post-entry prices in calculating potential revenue is particularly important in the case at hand because the entrant (or entrants) will be adding new capacity to a market (new switches and new transport); unless other firms are willing to watch their facilities operate well below capacity, prices will have to fall, following the well understood rules governing supply and demand. Because there is no reason to believe that other firms in the market will act unilaterally to reduce output to fully

[23] *Triennial Review Order* ¶ 88 ("an entrant that knows that an incumbent LEC has incurred substantial sunk costs may be disinclined to enter a market because the incumbent LEC is likely to drop its prices, possibly to levels below average cost, in response to entry). See also *id.* ¶¶ 75 n. 250, 83; 157 ("telecommunications prices are not static, and will change over time in response to increased competition").

offset the increase in capacity by the new entrants, prices certainly will fall unless the firms in the market collude to constrain capacity.

87. There are two reasons related to marginal costs of the ILEC and CLECs that strongly suggest price reductions as UNE-L competitors become established and replace UNE-P competitors. First, the costs of providing UNE-P service largely take the form of monthly charges for the required UNEs. These costs are not fixed or sunk costs, but vary with the number of customers served. These variable or marginal costs create a floor, below which a UNE-P competitor will never allow price to fall. If the UNE-P competitor cannot recover its marginal costs, which comprise the bulk of its costs, it will not offer service. On the other hand, a UNE-L competitor faces a substantially different cost structure. For a UNE-L competitor, a large portion of costs is sunk, and the marginal costs, those that vary with the number of customers served, comprise a smaller fraction of total costs. Thus, once the initial costs of entry have been "sunk" into the business, a UNE-L competitor will be willing to reduce price down to its lower marginal cost in order to acquire or retain customers. The urgency of covering the sunk cost of entry, which can only be accomplished by having customers that contribute something, even a small amount, above marginal cost, creates a competitive environment that is much more likely to involve substantial price reductions, than is the environment of UNE-P competition. So, assuming that UNE-L competition is economically and operationally feasible, CLECs face lower marginal costs and are under pressure to recover sunk costs by increasing volume.

88. When UNE-L competition becomes established, the ILEC also has a stronger incentive to win, or retain, a customer instead of having that customer served by a competitor. This is the case because the ILEC receives revenues related to a customer in two forms: If the customer chooses the ILEC at the retail level, the ILEC receives the retail price the customer pays for service. If the customer chooses a CLEC at the retail level, the ILEC still receives revenue for this customer, in the form of wholesale UNE revenue from the CLEC chosen by the end user customer. But the ILEC receives more UNE revenue from a UNE-P customer than from a UNE-L customer, as the UNE-P customer pays the ILEC for both switching and loops. In other words, the ILEC is worse off when a customer leaves it for a UNE-L CLEC than for a UNE-P CLEC and has a greater incentive to win the customer back. As a result, the ILEC is likely to cut prices further in the face of UNE-L competition than UNE-P competition.

89. Finally, as the market matures, CLECs' offerings should come to be regarded as closer and closer substitutes to the traditional ILEC's offerings. In the early days of competition consumers' lack of familiarity with CLECs' services provides a source of product differentiation that leads to a less rigorous form of competition. As the different providers' offerings come to be regarded as perfectly good substitutes for each other, price takes on greater importance as the locus of competition, and entrants must anticipate corresponding reductions in market price. Potential entrants will also have to consider whether other firms will also enter the market at the same time that they do. More entry, at least when there are

few firms in the market, generally will result in more aggressive price competition and lower market prices, which further reduces the post-entry profit margins of the entrants (as well as of the incumbent).

90. A CLEC must consider what the prices are likely to be for particular types of customers in particular geographic markets. The revenue a CLEC is likely to earn is strongly affected by the ability of the incumbent to cut prices selectively in response to entry. The more the incumbent can fine tune its prices and target only those customers (by geographic area or other marketplace characteristic) where entry has occurred or is threatened, the lower the cash flows an entrant can expect. When the incumbent has greater ability to price discriminate, it has a greater incentive to cut prices in response to initial, small-scale entry. The reason is that the incumbent does need not to lose profits by "unnecessarily" cutting prices to customers who have no competitive alternatives.

91. As with the costs faced by the prospective UNE-L based CLEC, the potential revenue available to the CLEC varies substantially from wire center to wire center. Wire centers that serve a relatively high proportion of small business customers have larger potential revenues than wire centers that are predominately residential in character. Wire centers with a more "upscale" demographic characteristic have larger potential revenues, due to greater second line penetration and greater penetration of additional services, such as vertical features, voice mail, and broadband services, than wire centers located in poorer neighborhoods. Wire centers with lower penetration of digital loop carrier

systems may present a greater opportunity for CLEC sales of DSL services. All of these factors would be considered by a rational firm seeking to enter the market for mass market local exchange service, and should be a part of any analysis of potential deployment.

C. Structure of the Model

92. A CD containing the model is provided as Exhibit 2 to this declaration.[24] The analysis tool is organized as a set of four worksheets that provide inputs to its calculations, a number of worksheets that calculate various cost components, and two (or three) worksheets that summarize its calculations. Inputs are contained on the worksheets entitled "Inputs," "Tariff Tables – NC," and "WC Inputs." The "WC Inputs" worksheet contains detailed information on each wire center in the ILEC's operating area, including the number of lines in each of several service categories, and the distance from the wire center to a CLEC switch assumed to be located near the largest ILEC switch in each LATA.[25] The "Tariff Tables –NC" worksheet contains detailed information on the rates charged by the ILEC for all aspects of collocation and interconnection arrangements. Finally, the "Inputs" worksheet contains a large number of user-adjustable assumptions that are used in the analysis tool to calculate costs. These include the assumed market share captured by a single CLEC for each of several services, estimates of CLEC

[24] The model is being filled for the State of Tennessee with the proprietary data having been removed. In order to run the model, actual data would have to be provided by the ILEC.

[25] Information on the number of lines, which was obtained under proprietary agreements in the state proceedings, is zeroed out in the model that accompanies this declaration.

internal costs for activities such as accepting hot cuts and customer acquisition and retention, and estimates of the purchase price of various items of equipment required by the CLEC in providing UNE-L based local exchange service, including DLC equipment, switches, DSL-related equipment, and digital cross-connect equipment.

93. Several worksheets perform calculations relating to the costs of establishing and operating a collocation space in each wire center. This includes all recurring and non-recurring costs incurred in establishing the collocation space, the costs of interconnection between the ILEC's loop facilities and the collocation space, and the capital costs incurred by the CLEC in equipping the collocation space. The analysis tool develops costs in each worksheet for virtual collocation, cageless collocation, and caged collocation.

94. In addition, the worksheets calculate the cost of concentration and cross-connection equipment located in the ILEC wire center where EEL transport is used by the CLEC. These worksheets are:

1) "Collocation" – which calculates the collocation costs associated with voice grade residential and small business services;
2) "ADSL Collocation" – which calculates the combined collocation costs associated with voice grade services as well as ADSL services for residential and small business customers; and

3) "DS1-DS3 Combined Collocation" and "DS1-DS3 Only Collocation" which calculate the collocation costs associated with the provision of DS-1 and DS-3 services in combination with voice grade and ADSL services, and collocation costs associated with the provision of DS-1 and DS-3 services only, respectively

95. Another set of worksheets performs calculations relating to the costs of acquiring transport facilities in order to carry traffic from each ILEC wire center to the CLEC's switch or hub. A number of possible scenarios are considered, including DS-1 and DS-3 unbundled dedicated transport, DS-1 and DS-3 special access transport, and EEL transport. For each form of transport, the non-recurring and recurring charges imposed by the ILEC for cross-connection, multiplexing and transport fixed and per-mile components are calculated, and non-recurring charges amortized as appropriate to produce a monthly per-line cost for each scenario. These worksheets are:

1) "Transport" – which calculates the transport costs associated with voice grade services for residential and small business customers;
2) "ADSL Transport" – which calculates the transport costs associated with voice grade services as well as ADSL services for residential and small business customers; and
3) "DS1-DS3 Transport" – which calculates the cost of transport associated with DS-1 and DS-3 services.

96. A final set of worksheets is used to summarize the outputs of the collocation and transport worksheets and to select a least-cost alternative. These worksheets are:

1) "Minicost" – which summarizes collocation and transport costs pertaining to voice grade services for residential and small business customers;
2) "Minicost ADSL" – which summarizes the collocation and transport costs pertaining to voice grade services combined with ADSL services for residential and small business customers; and
3) "ADSL Increment" – which determines the additional costs incurred as a result of a decision to offer ADSL services and restates those results as a per-DSL line cost

97. Finally, the results of the calculation worksheets are summarized in the worksheet "Summary Calcs." This worksheet brings together the results of the various collocation, transport, and hot cut worksheets and, for each type of customer calculates the monthly cost per line and the total monthly cost. The results are presented for each transport type. The analytical tool determines whether the least-cost alternative is to configure transport facilities as DS1 or DS3 facilities, and selects the least-cost alternative among the various collocation types. These costs are compared to the monthly per-line revenues for each service type, and a total net revenue per line per month and a total net revenue per month is calculated for each service type for each wire center. As a final step, the "best

case" is presented for the CLEC, choosing among the various transport and collocation options.

98. While ADSL costs and revenues are calculated for each wire center, the ADSL service is included in the net revenue and "best case" results only where the net revenue for ADSL is positive. In some wire centers, where very few ADSL customers are available to the CLEC, the cost of the transport facilities needed to support the service cannot be justified given the available revenues. In such cases, it assumed that the CLEC would decide not to offer ADSL services to customers in that wire center.

99. A final summary worksheet – "Sims" – compiles information computed in the "Summary Calcs" worksheet and permits analysis of the variation in profitability among wire centers given variations within a range of inputs to the impairment analysis tool. As I have previously explained, considerable uncertainty must attend any analysis of the dynamic competitive situation that will be faced by a CLEC attempting to provide local service using its own switching facilities. Accordingly, the impairment analysis tool is designed to present a range of possible outcomes. Any two wire centers can be entered into the worksheet for comparative analysis. Six of the most important inputs to the analysis tool are shown on the worksheet and, for each, a range of possible variation is provided. A button on this electronic worksheet – "Generate Random Scenarios" – activates a macro procedure that populates the analytical tool input with random numbers within the specified range, calculates the result for 250 random scenarios, and

presents the results graphically as a histogram showing the net revenue for each of the two wire centers. This permits a view of the range of possible outcomes in each wire center, with the most likely outcomes represented by the net revenue categories with the highest frequency.

100. The results of the impairment analysis tool were presented in a number of state proceedings following the TRO's mandate that state conduct a granular analysis of CLEC impairment with regard to availability of unbundled local switching, including all BellSouth states and certain states in the Verizon region. These results illustrate that CLEC profitability is highly variable among wire centers, and that CLEC profitability is highly sensitive to the input assumptions chosen. Many wire centers, particularly small wire centers, wire centers with low concentrations of business customers, and wire centers located in rural areas, are not profitable for CLEC entry under any reasonable set of input assumptions. Other wire centers are only profitable under a relatively narrow set of input assumptions, but otherwise produce negative net revenue. This has very important implications for the prospect of entry by switch-based CLECs.

101. To illustrate these implications, I will utilize the actual results of the model in one state, Pennsylvania. Exhibit 3 to this declaration presents the model results for the Verizon wire centers in Pennsylvania, where Verizon sought a ruling of non-impairment based on the trigger test. I reported these results in testimony

presented in the Pennsylvania impairment proceeding.[26] The results show a very wide range of potential profitability of a switch-based CLEC across the 148 wire centers in the top three density zones in Pennsylvania. Using values for the inputs that likely overestimate potential profitability, the model shows that only 7 wire centers would yield positive profitability, and only with a very small margin of $2.29 per line per month in the most attractive wire center market, which is the Poplar wire center in Philadelphia. In all of the remaining 141 wire centers where Verizon sought a ruling of non-impairment, the model demonstrates that the potential CLEC entrant would lose money, on average by almost $6.00 per month, per customer served.

102. I did not present evidence in the Pennsylvania case on the impact of uncertainty in the range of inputs on potential CLEC entrant, because Verizon did not raise the potential competition issue in that case. I used the model only to draw inferences about market definition. In other states, however, MCI's experts ran the model with the stochastic process described above to generate information on the range of possible outcomes facing the potential entrant. In Tennessee Dr. Mark Bryant provided model results for two wire centers in Tennessee. Both are within the Nashville local exchange, and both are in UNE rate zone 1 (the highest density, lowest cost rate zone). The results show that the NSVLTNST wire center, which is a very large wire center serving more than 35,000 lines, is profitable for CLEC

[26] Direct Testimony of Michael D. Pelcovits, on behalf of MCI WorldCom Network Services, Inc. before the Pennsylvania Public Utility Commission, Docket No. I-00030099, Attachment MDP-4, filed January 9, 2004, presented at Hearing on January 27, 2004.