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July 30, 1997

IN REPLY REFER TO:

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Mr. William F. Caton
Acting Secretary
Federal Communications Commission
1919 M Street, NW, Room 222
Washington, DC 20554

RE: *Ex Parte* Presentation -- Modeling Customer Location in Cost Models
CC Docket Nos. 96-45 and 97-160

Dear Mr. Caton:

On June 27, 1997, Mr. D. Mark Kennet of the Competitive Pricing Division of the Common Carrier Bureau gave a presentation attended by members of industry and Commission staff. Mr. Kennet discussed a potential approach to modeling customer location that may be incorporated into a cost model to estimate the forward-looking economic costs that non-rural local exchange carriers would incur to provide universal service in rural, insular, and high cost areas.

The attached documentation describes the approach to modeling customer location presented by Mr. Kennet, and includes graphs that were displayed at the presentation. The documentation was made available to parties who directly contacted Mr. Kennet. The following parties were in attendance:

Glen Brown -- U S WEST
Rich Clark (by phone) -- AT&T
Larry Cole -- GTE
Chris Frentrup -- MCI
Warren Hannah -- Sprint
Ron Lindsay -- PNR Associates
Scott Randolph -- GTE
Brian Staihr -- Sprint
Jim Stegman -- Indetec
Dennis Weller (by phone) -- GTE

Anthony Bush -- FCC
Bryan Clopton -- FCC
Pat DeGraba -- FCC
Emily Hoffnar -- FCC
Chuck Keller -- FCC
Bob Loube -- FCC
Tejal Mehta -- FCC
Bill Sharkey -- FCC
Vaikunth Gupta -- FCC Contractor

Two copies of this letter and the attached documentation are being submitted to the Secretary of the FCC in accordance with section 1.1206(a)(1), (2), and (3) of the Commission's rules.

Sincerely,

Natalie Wales

Natalie Wales
Attorney-Advisor
Universal Service Branch

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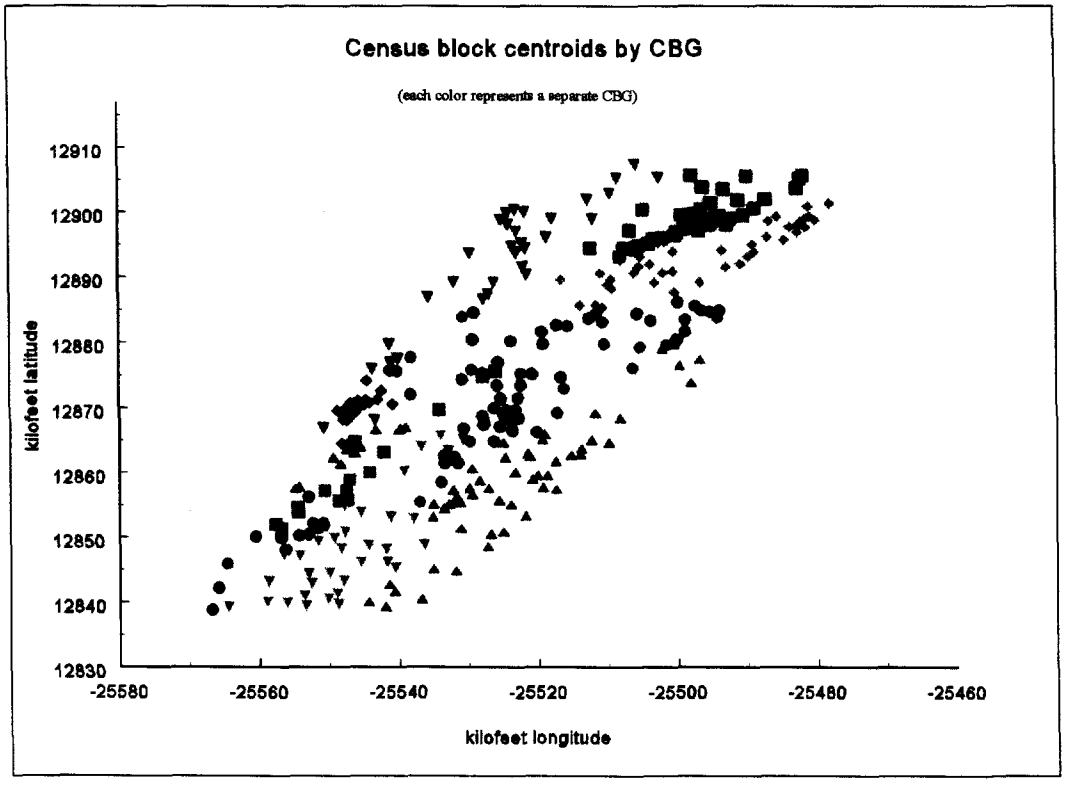
AN APPROACH TO MODELLING CUSTOMER LOCATION

D. Mark Kennet
Federal Communications Commission

In this short paper, I attempt to explain an approach to the problem of modelling customer location for forward-looking economic cost models expected to be employed in universal service fund (USF) calculations as well as unbundled network element (UNE) proceedings. This approach has been incorporated into a software product I call CENBLOCK, and is best explained using an example.

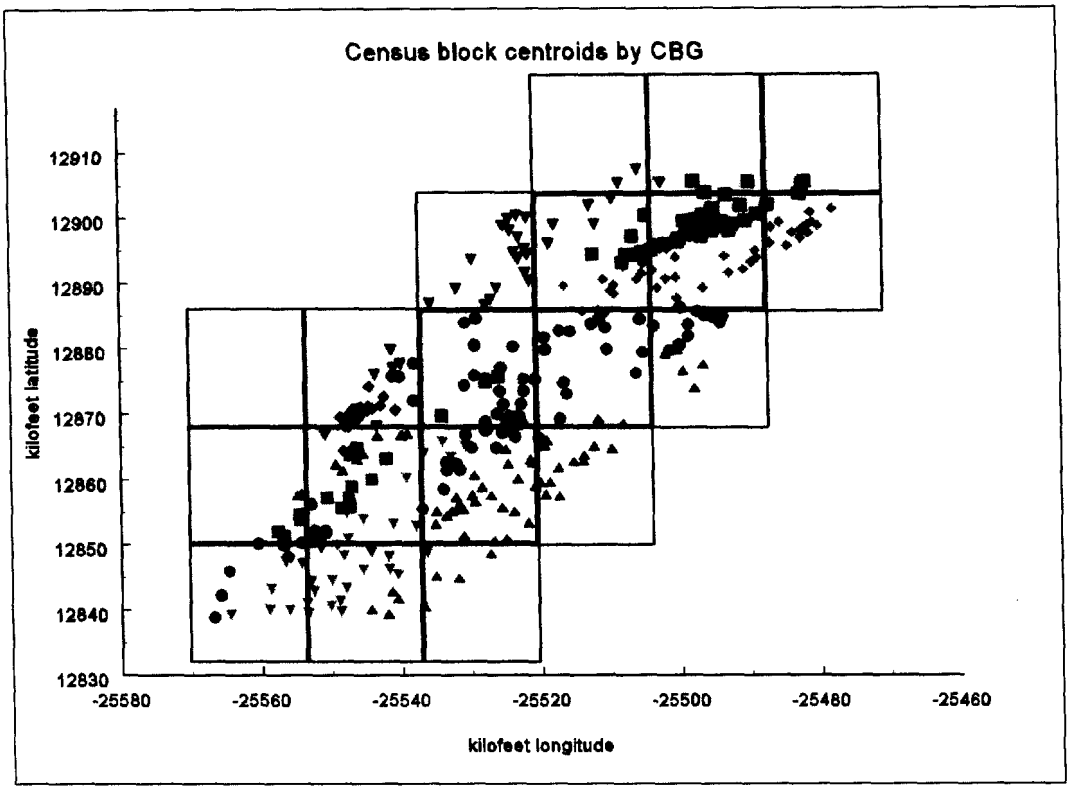
The drawings below illustrate a dataset consisting of the Census blocks within a particular telco's service territory. In the first drawing, I have plotted the raw data. Each point on the map represents the centroid of a block.



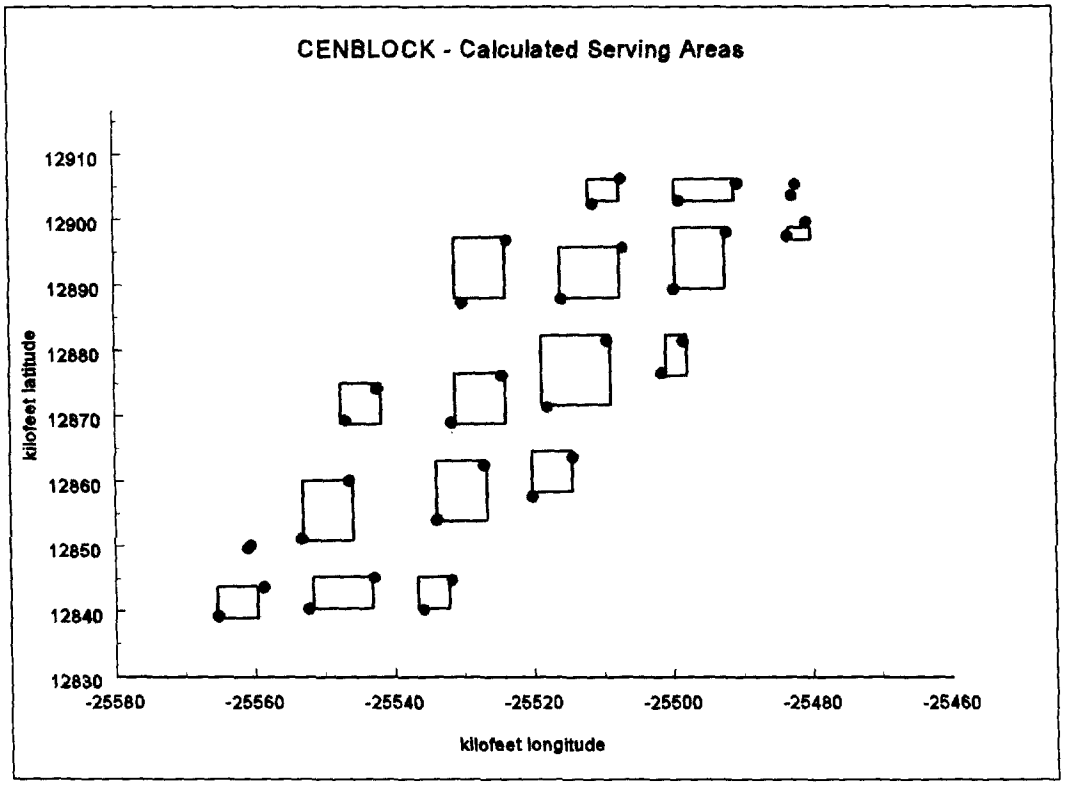
In modelling the feeder and distribution plant for a telco, if all we had available were the above data, we would need to assume some aggregation rule for the Census blocks. If each of the squares (small, medium, large) was a serving area, with its own serving area interface and distribution plant, the model would clearly overstate the amount of serving area interface electronics. On the other hand, aggregating to the level of the Census block group (CBG) level will misrepresent what is evident in this rural dataset (taken from a rural section of Tennessee): some CBGs have population located outside the reach of any currently existing interface devices, even if the area of the CBG meets an engineering specification. I would argue that in the context of engineering telco plant, length and width of distribution areas are more important than the area, for exactly this reason. The other point worth noting is that there is significant clustering of population, even in this rural section.

The CENBLOCK software provides a means to systematize that clustering for modelling purposes, aggregating together the blocks so that more meaningful approximations to real-world serving areas can be used while preserving information about length and width of the clusters.

The simplest clustering arrangement would be if we assumed that all serving areas were squares. The picture below depicts a CENBLOCK arrangement of 18 kf by 18 kf squares, with a maximum population of 2000 customers per serving area (the latter constraint in this dataset is nonbinding). If any of the grid blocks were to exceed that population count (which is a user input), CENBLOCK repeatedly cuts the block in half until either the maximum population criterion is met or it is determined that only one Census block remains in the grid (and no further divisions are possible).



Note that in this drawing, the total number of serving areas is equal to the number of populated squares, in line with what would likely be observed in the actual feeder/distribution plant, but the shape of the distribution areas does not adequately address clustering within the grid block. To address the latter issue, I make the following initial proposal for an algorithm to model the distribution area boundaries. First, find the centroid of all included CBs in a grid block. Now calculate the average X-value for CBs to the left of that centroid, and that for CBs to the right. Repeat the exercise for Y-values. There are now four corners, representing an "average" both horizontally and vertically for the locations of customers in the stylized serving area. For this example, modelled serving areas are as follows:



One may argue that these stylized distribution areas also do not quite capture population clustering or distances quite adequately. To address this problem, I am working on two possibilities. One approach is to create grid strips within each grid block, with the width equal to twice the average drop length, and determine where customers lie within the grid strips. Another approach is to use the general approach of averages described above, but to use root-mean-square (RMS) averages rather than arithmetic means. The RMS averages will give extra weight to CBs located farther from the distribution area centroid, possibly adding extra realism to the approximation.