Market Potential Model and Its Application to a Regional Planning Problem

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This study considered the following aspects of a regional planning problem in Baltimore: is there a potential in the region under existing policies for the large retail cores envisaged in the metrotown center concept, and if so, how many, where and when? Answers to these questions were sought through the development of an estimating tool (market potential model) that permits a flexible evaluative procedure to consider alternative patterns of future retail growth in the Baltimore region. The scale, location and timing of a large number of retail cores were identified, indicating a key component of the metrotown center concept to be consistent with the urban growth processes.

•A GROWING CONCERN over appropriate concepts and policies of urban spatial organization is noticeable today in many Western countries. The traditional image of an urban community with its tightly knit, articulated form and structure has been seriously eroded by the effect of ever-increasing mobility and communications and by the widely distributed benefits of rising productivity. The consequent desire for a new desirable image of a metropolitan community and the mounting problems of metropolitanization have stimulated a wave of interest in recent years in the development of appropriate concepts and criteria for urban spatial organization. This movement has led in turn to the formulation of metropolitan plans that envisage various goal-forms that will presumably enrich the economic, social, and aesthetic life of the urbanite.

The resultant plans evidence varying traces of utopian ideas as well as pragmatic requirements of effective metropolitan planning and public communication. Generally, they lean towards ideal forms for the future metropolis. Thus, Washington's Year 2000 Plan proposes a starlike configuration with corridors of dense development around a dominant center (1). The Greater London Plan calls for free-standing towns at the outer edge of a permanent greenbelt.

In the Baltimore region, systematic analyses of the present growth patterns and the forces behind them have been made to diagnose the potential for change and the leverage for goal-directed spatial organization. These extensive exploratory studies by the Regional Planning Council indicate that the activity and interaction patterns noticed today in large metropolitan areas suggest a scale for urban organization larger than the traditional concepts of neighborhood and community. As a result of these analyses (2, 3), the Regional Planning Council developed the concept of metrotowns. (One of the interesting points about the results of the analyses is that the development of these towns can reduce travel as much as 20 percent.) The metrotown concept envisages a regional system of suburban towns deployed radially and in a series of rings around the City of Baltimore (Fig. 1). Each metrotown is viewed as a relatively self-sufficient, physically cohesive community, with a population of 100,000 to 200,000, broad and varied choices of housing densities, considerable employment opportunities, a full-scale retail and service hub, and attractive recreational and cultural facilities

Paper sponsored by Committee on Land Use Evaluation.

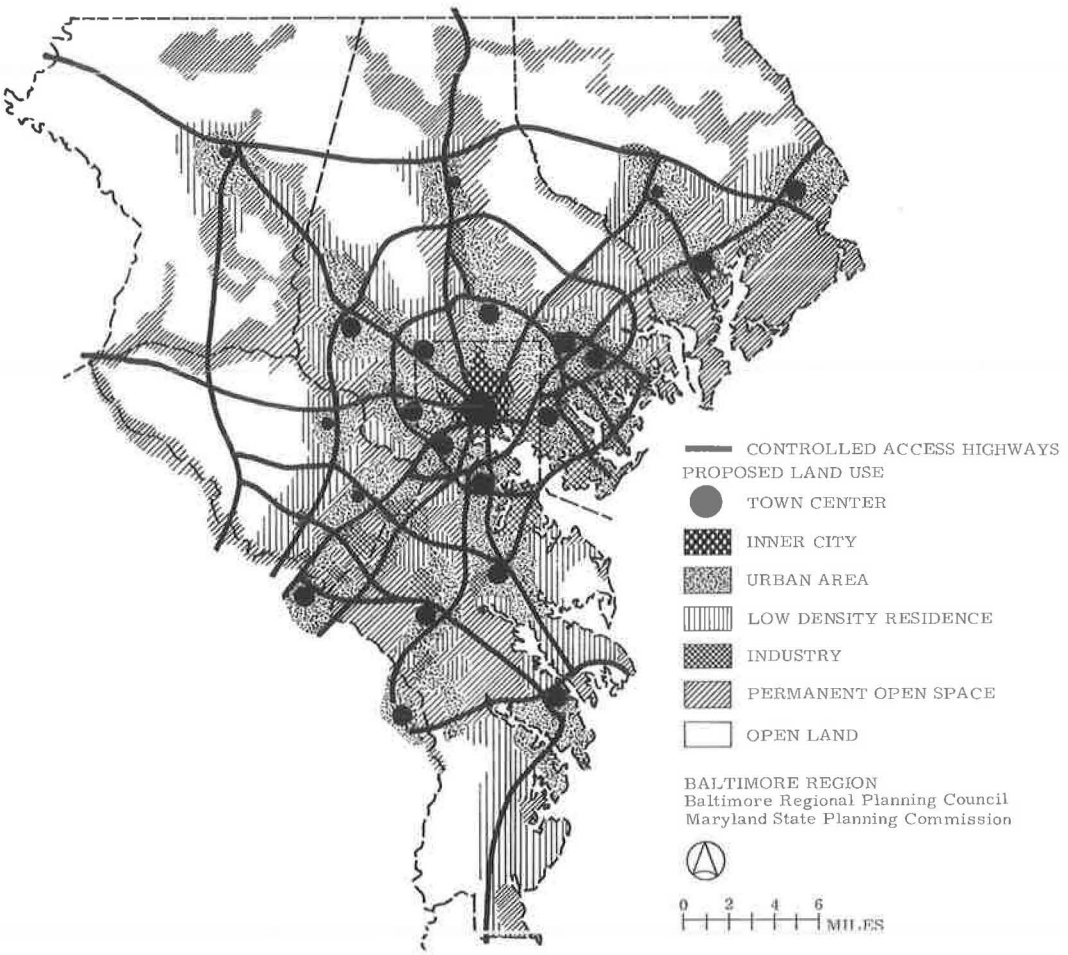


Figure 1. Metrotown concept, Baltimore area.

(Fig. 2). Major open spaces or "greenbelts" will separate the metrotowns and a regional transportation network will link all metrotowns and the "metrocenter" of Baltimore City.

It will be noticed that the metrotown concept is, to some extent, a reformulation of the ideals and spatial structure expressed in the British New Towns Hypothesis, in accordance with the realities of contemporary patterns of living, work, and circulation in the United States. The bias against sprawl, the notion of a desirable size, the emphasis on compact town centers to heighten the sense of urbanity (4), the belief that orderliness depends on boundedness—the greenbelt—and the provision of convenient accessibility from residential areas to high levels of diverse service and employment are commonalities. But there are significant differences. The metrotown concept is intended not to curb but to channel the growth of Baltimore into a desirable urban form. In addition, differences in scale of the towns, and above all in the machinery of plan implementation, must be obvious. Further, the metrotown centers are not viewed as free-standing service or employment centers but as nodes in an interrelated metropolitan spatial system.

Any formalized spatial concept such as the "metrotown" concept is not only a statement of a desired future urban form but also an hypothesis of a viable spatial structure. The validity of the hypothesis rests largely on the consistency of the spatial structure it implies with the nature and operation of urban growth processes and the realities of

Figure 2. Site plan of a metrotown center.

institutional arrangements in the region. Therefore, the metrotown concept is viewed as an hypothesis of metropolitan spatial organization whose relationship with the factors and forces of development in Baltimore must be evaluated. Such an approach, though by no means easy in the current state of the art, will lead to a more precise and realistic formulation of the scale, composition and scheduling of metrotowns and their centers.

STUDY OBJECTIVES

The objective of the current research effort of the Regional Planning Council is to forge a set of decision-making tools to guide the scale, location, and composition of viable metrotown centers. The necessary research effort, in a concept that envisages a score of metrotowns in the region, dictates the analysis of these new towns as an integrated spatial system. Perhaps it is this explicit analysis of metrotown centers as nodes in an interrelated metropolitan spatial system that may distinguish the metrotown study from the analyses associated with individual new towns—Columbia,

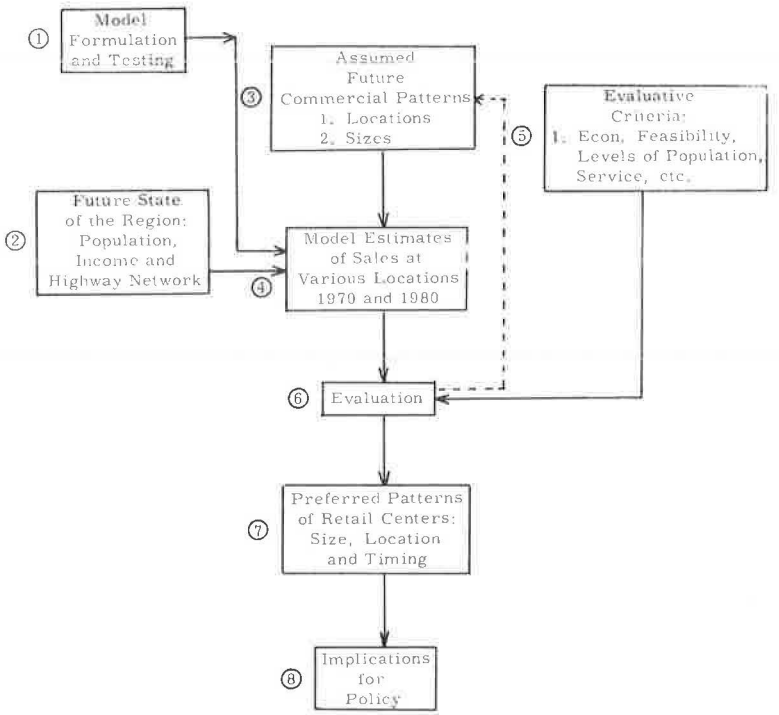


Figure 3. Metrotown centers: market potential analysis flow chart.

Reston, or Irvine Ranch—proposed in the United States today. Analyses try to go beyond the common focus on balance within towns to balance between towns. Consequently, a beginning has been made towards systems analysis techniques that relate function, location and interactions in an urban landscape.

The study reported in this paper is one of a series of related studies (5, 6) that investigate the scale, composition, and location of metrotown centers. The initial formulation of the metrotown concept postulates a gradient of dwelling densities outward from each center, with greenbelt separators for demarcation of towns. The validity of this classical planning premise is also currently examined in view of the increasing diversity of people's residential locational preferences (5). Webber (6) prophesies that recreation may well replace in the future the work place as a major determinant of residential location. Then the greenbelt may be a better location for high-rise apartments than the town center, or even for the town center itself. Again, how realistic is a greenbelt as a "container" in the current context of interaction in an automobile era?

The present study addresses itself to one facet—the retail core—of the complex functional organization envisaged in the town centers. It investigates the possibility that the large commercial hubs implied in the metrotown center concept may be realized. In operational terms, assuming the continuation of current policies and growth trends in the Baltimore region, what is the potential for large regional commercial centers? How many centers? What sizes? Where? When?

STUDY DESIGN

A prerequisite for tackling the foregoing questions is a realistic description of the functioning of the commercial centers today. If such a description—a model—is developed, it could be used to estimate the potential of commercial centers at a future point in time. Such estimates of performance can then be evaluated against stated

criteria of planning relevance to guide decision-making on the scale, location and scheduling of large future commercial centers in the region.

The overall study process is shown in Figure 3. First, a market potential model that views each retail center as an integral part of an interrelated spatial system of commercial nodes in the region was developed and tested. Second, data were assembled about the future state of the region. Such data included future population distribution and highway networks assuming existing trends and policies, as well as assumed alternate commercial patterns. Next, the model was used as an estimator of sales at various centers under the different alternate assumptions. Finally, the results of the model application were reviewed in the light of evaluative criteria such as the economic feasibility of centers—existing and future—and levels of retail service. The results of this evaluation yielded a preferred pattern of large retail centers, each described by location, size and timing, and some implications for regional commercial policy-making.

A MARKET POTENTIAL MODEL

Model Formulation

Retail activities are consumer oriented. A reasonable premise of the model would be that the size and the number of retail establishments in an area is a function of the number of consumers, or more appropriately their aggregate purchasing power. Stated differently, within a metropolitan region, which can be considered for the present purpose as an economic and spatial entity, the total sales generated at all the shopping centers must equal the total available consumer expenditures for retail goods. (The following formulation assumes that purchases by residents in establishments outside the region are balanced by the sales made to visitors in the region.) However, the sales at any given retail center will be a function of the consumer expenditures in the surrounding area.

It is in the definition of the surrounding area that the present formulation differs from most approaches to this problem. Since customers bear the burden of costs of movement--economic, temporal, or psychic—to the retail center, the actual locations of the retail centers are influenced by the intricate patterns of the consumer movements for retail goods. Generally, there is a desire to minimize these costs of movement on the part of the consumer (7), hence, the desire of the retailer to choose sites of high accessibility so as to reduce these costs of friction. This overall tendency has persuaded market analysts to assume that a consumer, confronted with a choice among several alternative shopping centers, will inexorably choose the nearest center. This heuristic assumption permits the delineation of trade area—primary and secondary—boundaries, with the inclosed consumer expenditures allocated through other sub-assumptions to the individual shopping centers. Such a procedure is no more accurate than the highly questionable assumption of closed market areas around retail centers. Empirical studies have demonstrated that there is, instead, a continuum of market orientation of consumers to shopping centers (8). From a behavioral point of view it has also been asserted that shoppers engage in an information-seeking process, which, over a period of time, tends to attract them to different centers in some constant proportion (9). Further, the traditional definition of the surrounding region as a closed market area is operationally inflexible for the evaluation of alternate spatial patterns of retail activity attempted in this study.

The present formulation, consequently, asserts that the location or sales potential of a retail center is not to be viewed as a function of the purchasing power of an arbitrary spatial slice of the region. More realistically, it describes a situation of overlapping competition between shopping centers and develops a mathematical framework for measuring it.

Essentially, the model states that the sales potential of a retail center is directly related to its size. This follows from the observation that a large center offers a wider range and depth of goods and attracts consumers from a wider area than a smaller center would in the same location. Further, the sales potential of a center is directly related to its proximity to the number and prosperity of the consumers.

The larger and closer the consumer shopping dollars available, the greater the sales potential. Finally, the model states that the sales potential of a center is related to how disposed it is to competing shopping facilities. The farther away other shopping facilities are spatially, the greater the sales potential of a center.

These relationships are expressed in a mathematical form, using the familiar gravity model framework shown in Eq. 1:

$$S_{ij} = C_i \frac{\frac{F_j}{d_{ij}^{\alpha}}}{\frac{F_1}{d_{i1}^{\alpha}} + \frac{F_2}{d_{i2}^{\alpha}} \cdots \frac{F_n}{d_{in}^{\alpha}}} = C_i \frac{\frac{F_j}{d_{ij}^{\alpha}}}{\sum_{k=1}^{n} \frac{F_k}{d_{ik}^{\alpha}}} \qquad (1)$$

where

S_{ij} = consumer retail expenditures of population in zone i, spent at zone j,

C_i = total consumer retail expenditures of population in zone i,

F_j = size of retail activity in zone j,

d_{ij} = distance (in driving time) between zones i and j, and

x = exponent applied to distance variable .

The gravity model was first applied by Reilley to separate the market areas of two cities competing for customers in a hinterland.

Eq. 1 which can be meaningfully applied if the region is divided into a large number of zones, states the retail center in zone j (F_j) attracts consumer dollars (S_{ij}):

1. In direct proportion to the consumer expenditures,
2. In direct proportion to its size F_j,
3. In inverse proportion to distance to the consumers (d_{ij}^{x}), and
4. In inverse proportion to competition $\left(\sum_{k=1}^{n} \frac{F_k}{d_{ik}^{\alpha}} \right)$.

Eq. 1 can be modified to state the consumer expenditures available in all zones of the region that would probably be spent in zone j (retail centers F_j):

$$S_j = \sum_{i=1}^{n} C_i \frac{\frac{F_j}{d_{ij}^{\alpha}}}{\sum_{k=1}^{n} \frac{F_k}{d_{ik}^{\alpha}}} \qquad (2)$$

where S_j is total sales in retail center F_j.

Eq. 2 sums up the sales from every zone at zone j. It implies that there is no trade area boundary but a shopping interaction between all zones, though this may fall off sharply with distance.

This model, though new to market potential studies, has been extensively used in traffic studies in many urban areas in the United States. These studies have used operational definitions for the variables meaningful for traffic analysis and found it a good predictor of shopping travel patterns.

Model Verification

The relevance of the model to the real world was verified by applying it to the current shopping patterns in terms of dollar sales and shopping trips in the Baltimore

TABLE 1

VARIABLES WITH OPERATIONAL DEFINITIONS USED IN THE STUDY

Variable	Definition
S_j	Annual sales of shopping goods made in zone j (in dollars).
C_i	Total consumer annual expenditures on shopping goods available from zone i. Operational: The product in dollars of the population in zone i and the per capita shopping expenditures.
F_j	Size of shopping goods activity in a zone. Operational: Square feet of floor space devoted to shopping goods in zone j.
d_{ij}	Distance between the shopping center j and the consumers in a zone i. Operational: Driving time in minutes between the centroids of the zones.
α	Exponent applied to distance factor, d. Operational: In practice, a friction factor, F, is used so that $F = \frac{1}{d_{ij}^{\alpha}}$; exponent α is variable with d_{ij}. The set of F factors used were obtained from the BMATS shopping goods trip gravity model.

region. The model concerned itself with only the shopping goods centers that offer the higher order retail goods, since they constitute the type of retail activity of importance to the metrotown concept. Table 1 summarizes the operational definition of the variables used in the model.

Estimation and Evaluation.—With all the variables measured, standard computer programs developed for traffic studies were used to generate sales in dollars that were attracted to all zones that had shopping goods floor space. Figure 4 compares the annual sales generated by the model and the actual annual sales confidentially obtained for six large shopping centers. The fit appears good except for observation 5, which was not fully open during the comparison period, hence the apparent overestimate.

The sales comparisons, though encouraging, were possible for only six centers. To provide a more pervasive check on the model, an estimation of shopping goods trips was made. This was felt to be a valid check of the model, as previous studies have clearly shown a direct relationship between retail sales and trip generation (11, Figs. 4, 7). The number of shopping goods trips that actually left every residential zone was obtained from origin-destination (O-D) survey data. These trips correspond to the consumer expenditures that went from every zone to different shopping goods centers in the previous estimation. Using the shopping goods floor space as an attractor, these trips were allocated to the various shopping centers.

From the O-D survey it was also possible to obtain the number of shopping goods trips actually attracted to each center. Figure 5 provides a comparison between actual (O-D) shopping person trips and model person trips. The model appears to conform well ($r^2 = 0.91$), particularly when it is remembered that the survey data are based on a 10 percent sample and subject to considerable sampling error in the lower ranges.

The sales comparison at the central business district (CBD) was inconclusive, owing to the unaccountability of purchases made by workers and visitors. However, the shopping trip comparison was extremely gratifying (only about 5 percent difference); (actual) O-D shopping trips to CBD = 17,466, model shopping trips to CBD = 16,425.

Summing up, the comparison of the actual and estimated patterns of current shopping sales and trips in the Baltimore region demonstrates that the model performs reasonably well. The noticeable variations appear to be a measure of the inevitable abstraction in any model formulation as well as data problems. The market potential model was, consequently, accepted for application.

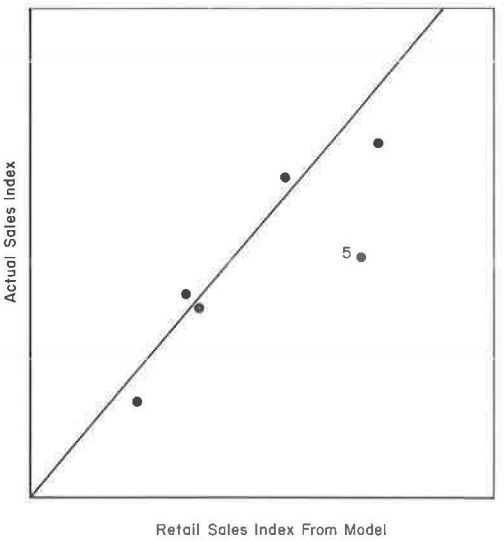


Figure 4. Retail sales at selected shopping centers.

Model Application—Data Requirements

The market potential model formulated and tested in this study is essentially a tool for estimating the market potential of each retail center in a metropolitan region. To be used as an estimating tool, the model requires a description of the urban area in terms of (a) the shopping goods demand described spatially, (b) the supply of competing shopping goods facilities, and (c) the spatial links between the retailers and the consumers. All these components of the retail spatial structure have to be specified before the model can be used for estimating sales of each center in the urban area for a required point in time, e.g., 1970 or 1980.

Demand for Shopping Goods.—The demand for shopping goods is represented by the consumer purchasing power in the region. To compute the demand for shopping goods for a future year, projec-

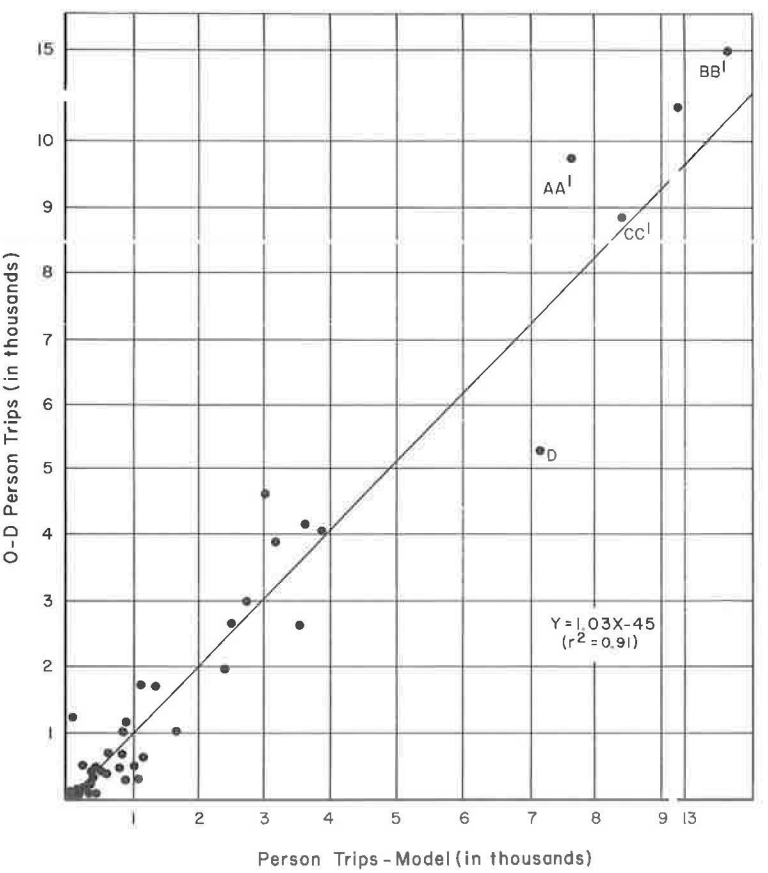


Figure 5. Trips generated by retail center.

tions of population and per capita expenditures are prerequisites. This study used the zonal population projections developed in a recent study by the Baltimore Regional Planning Council (12). These projections resulted from the application of mathematical models that made two basic assumptions: (a) existing trends in the residential site selection process would continue, and (b) existing policies—zoning, public works, etc.—in the region would continue. No policies relating to the metrotown program entered into these projections. Thus, the distribution of consumers in 1970 and 1980 assumed as inputs to the market potential model would reflect the probable effect of existing policies.

The per capita shopping goods expenditures for 1970 and 1980 were developed through the application of an econometric model (13): For 1960, $C_{ij} = 2.3 Y_i^{0.573}$; for 1970, $C_{ij} = 2.30 (Y_i + 109)^{0.573}$ and for 1980, $C_{ij} = 2.30 (Y_i + 238)^{0.573}$, where C_{ij} = capita shopping goods expenditures and Y_i = estimated mean income.

The projections of per capita expenditures by zone used the income projections developed in the previously cited study by the Baltimore Regional Planning Council. Thus, both the population and income projections used in the study imply the continuation of existing policies.

Existing Facilities. —The supply of existing facilities refers to the shopping goods retailing units described by size and location in the region in any year for which the model is to be applied. To apply the model for a future point in time, e.g., 1970 or 1980, the size and location of the shopping goods facilities had first to be assumed for that year. The model could then allocate the total consumer expenditures for shopping goods to the various assumed and existing shopping centers. Therefore, use of the model is a trial and error process, and the model framework is not a locational but an evaluative scheme. Generally, models of intraurban location determine locations of shopping facilities, given the distribution of retail demand and the distributive effects of the transportation system (14). The market potential model used in this study, however, accepts locations of shopping facilities as inputs and then estimates their sales levels. Since alternative location-size patterns can be assumed, this model offers a technique for estimating the consequences of alternative patterns of growth of shopping goods facilities.

In practice, alternate assumptions of the sizes and locations of shopping facilities, in addition to the existing facilities, were made. The market potential or sales level of each of the centers in the region in each of the alternatives was then obtained from the model.

Spatial Description of System. —A key variable of the model is the consumer-retailer interaction space. The operational definition used for the variable was the driving time between the consumer's and the retailer's zones. An application of the model to 1970 or 1980 requires, consequently, the zone-to-zone travel times on the 1970 and 1980 highway networks. This data input leads to assumptions concerning the highway networks in 1970 and 1980.

Here again, the assumption built into the model is that current policies will continue. The Baltimore Regional Planning Council prepared a map showing the future highway networks that represented a composite of existing policies. Inside the BMATS area, the recommendations of the recent Wilbur Smith study were incorporated. In the rest of the region outside the BMATS area, the highway proposals of the Maryland Needs Study were assumed.

Model Output

Given a description of the three components of the retail spatial structure—demand, supply, and buyer-seller interaction space--the model output provides the following measures for each alternative: (a) the probable sales levels at each center—existing and future; (b) the average trip length for shopping goods for the system as a whole; and (c) the consumer dollars from each residential zone that are spent at each shopping center.

CRITERIA FOR EVALUATION OF RETAIL POTENTIAL

The major output of the market potential model then is a series of estimates of probable sales at shopping centers, assuming existing trends and policies and under various alternative schemes of growth. They are projections of consequences—in terms of market potential at shopping centers—of stated assumptions and policies and do not by themselves suggest any optimal or preferred patterns. To guide decision-making on preferred (location-size-time) patterns of growth of shopping goods facilities, criteria against which these estimates can be evaluated had to be formulated. These criteria would reflect the regional planning objectives in terms of the metrotown program.

To use the various alternatives and the corresponding sales estimates to identify the locational opportunities for large shopping centers, two broad sets of criteria were formulated. The first would assess any alternative at the individual location level. These would be the broad criteria guiding the investment decisions of individual developers. How does a developer gage his locational opportunities? What is the minimum return considered necessary before investment decisions are made?

The evaluation problem in this study is broader in scope, however, than that of an individual developer interested in a specific location. It involves the consideration of the rigidities in the existing commercial pattern. For instance, what would be the impact of location of a new large shopping center on the performance (or sales level) of a nearby existing shopping center? Therefore, the second set of criteria enlarged the scope of evaluation from an assessment of individual centers to an evaluation of an interrelated system of centers in the whole region. In other words, how do the new (assumed) shopping centers evaluated by the first set of criteria and the existing set of regional centers "add up" as a regional pattern? Do the regional patterns assumed provide comparable levels of service in different part of the region to the consumers? Further, are the regional patterns of centers evaluated in relation to all these questions a reasonable simulation of the market processes? These are ticklish questions and the judgment criteria related to them are by no means easy to establish. But they are very relevant questions and the criteria developed in the study appear, in our opinion, to be the most reasonable in this regard.

All criteria used in this study are explicitly set down in the following, and the rationale for their use is developed in some detail.

Size of Centers

It was stated earlier that this study investigates the potential for large shopping centers to form the cores of metrotown centers. This raises the question of an operational definition of a large center. The definition adopted in this study was in terms of a minimum size for a shopping center to be considered as a metrotown core.

The specification of a minimum size must, of course, be related to the observable trends in retailing. There seems to be a number of factors contributing to the increase in the scale of a shopping center. For one thing, as the population and income per capita increase in a region, the distribution plant in the retailing sector gets more fully utilized and possible economies of scale increase. As the retail establishments increase in size, they also tend to cluster together and offer a wider range of goods and associated services to induce the consumers away from other clusters. Further, as these clusters of establishments develop and increase the size of their market, the probability of new specialty goods stores coming in with special bundles of goods increases (15). As a result, though there are limits for the increase in size of the individual establishments, the clusters of establishments—shopping centers—have been growing in size. However, the increasing searching costs of the consumers in large centers as well as the competition of other clusters may pose restrictions on the indefinite increase in scale of a shopping center. The time costs imposed on a consumer looking for a shopping good increases rapidly with increase in the size of the shopping center. Conceivably, these costs could increase in a very large center to a point where consumers may prefer actually smaller centers.

The shopping goods floor space in a center would, of course, vary in relation to the number of consumers in the part of the region where it would be dominant. Consequently, two minimum sizes related to location in the region were postulated for consideration of shopping centers as metrotown center potential. In other words, in the inner beltway area, which is likely to be more densely settled by 1970 or 1980, the minimum size of centers to be considered was assumed to be 450,000 to 500,000 sq ft of shopping floor space. In the outer beltway with a probably thinner development, a lower minimum of 250,000 to 300,000 sq ft of shopping goods floor space was postulated. Exceptions to these rules would be the older recognized communities such as Aberdeen or Westminster.

Economic Feasibility

A locational decision is made by a shopping center developer when a minimum expected return is assessed at a particular location relative to returns available at alternate locations. So the centers tried in this study must be evaluated as to their relative economic potential at the level of an individual center (termed here as locational level). The evaluation of the individual centers in an alternative at a location level by the minimum sales criterion, as described in the following, points up viable locations.

A further level of evaluation arises; i.e., do the sales levels, size ranges, etc., of a subregional set of centers in an alternative simulate the market conditions? If so, that alternative will be judged as one realistic pattern of probable regional commercial growth. Thus, the alternative has to be evaluated in relation to viability of centers both at the locational and at the subregional level. The criteria for economic evaluation at both these levels used in this study are briefly outlined.

Locational Level.—There appears to be a minimum expected return on a shopping center considered necessary by developers before locational decisions are made. This minimum return is defined here in terms of annual sales per square foot. The use of this measure assumes returns for investment to be the same for different production functions of different retail establishments. Thus, the payoffs between sales levels and costs, such as rent levels, are ignored (though they may be uncovered in the subsequent site analysis). Further, the assumption is made that merchandising and advertising differentials will not be significant and location vis-a-vis consumers is most relevant.

The sales per square foot varies by the type of store in a regional shopping center. Thus, the department stores sell on an average $59/sq ft, the variety stores $27, jewelry shops $55, and shoe stores $40 to $45 (16). So the sales per square foot for a shopping center as a whole are a function of the tenant mix. In the Baltimore region the sales per square foot for all shopping goods stores in a regional center in 1963 ranged from $45 to $53/sq ft. (This information is drawn from confidential information obtained from the Sales Tax Department for a set of six regional shopping centers for 1963.) The shopping goods establishments aggregated over the entire Baltimore region averaged $44/sq ft.

This study assumed that new shopping goods aggregations are viable when the sales per square foot obtained from the model run were at least $50 to $55. This minimum value is in line with the foregoing data and the best thinking among some leading practitioners in the field of marketing.

The sales per square foot obtained at any location at one point in time is related to the size of center tried. Thus, when an assumed shopping center was selling less than $50/sq ft, a reduction of its size in the next trial indicated the same location as workable at a lower size. Thus, this criterion helps in determining the scale at which a shopping center is viable. This criterion also aids in assessing the impact of a large new center on an existing center. Since the sales level at an existing center can be obtained, it is easy to measure the drop in its performance when competition is offered in the form of an assumed center nearby. Judgments can then be made about the size and location of a new shopping center that can be added close by without the existing center dropping its sales below minimum levels.

Subregional Level.—The use of the criterion at the locational level will only indicate which centers are viable in 1970 and 1980 at sizes chosen. It will not show whether

the set of future centers tried in any subregion are a reasonable approximation of the probable commercial development as a result of market processes. Such an evaluation is not easy to make, but some indications may be obtained by considering the set of centers tried in a subregion in any alternative simultaneously. The procedure is difficult to outline without the illustrations that will be introduced later in the paper. Only the rationale for such a technique is set forth briefly here.

If the sales per square foot for the major existing centers and the future centers tried in a subregion are plotted for all alternatives, some interesting observations can be made. In some earlier alternatives, the centers varied very sharply among themselves in sales per square foot. In some later alternatives, the centers varied considerably in size but had a narrower range of difference in sales per square foot. It is easy to see that the earlier alternatives are poorer descriptions of the probable future pattern of centers. If some centers did poorly (e.g., $30), they will not appear. In the same alternative, if some centers did very well (e.g., over $75/sq ft), they would either increase in size or generate their own competition. In other words, alternatives which assumed such a size-location distribution of centers are not describing the market processes. The later alternatives more truly indicate the typical market situation when centers will vary in size (depending on location vis-a-vis consumers) but will have no such sharp differences in relative performance.

Level of Retail Service

It was indicated earlier that evaluation was necessary at levels higher than individual centers—existing or assumed. Individual centers may be evaluated at the locational level as workable at specific sizes. But do a group of such centers at a subregional level serve the consumers efficiently? This criterion of efficiency of a set of assumed centers that form an alternative was measured in two ways:

1. The sales per square foot of shopping centers aggregated by transportation districts—The underlying assumption is that, if a group of shopping centers in a transportation district (T.D.) has high sales per square foot (e.g., more than $75), the consumers in such districts are poorly served. The potential for shopping goods floor space exists, and the few shopping goods stores in those transportation districts generate high sales per square foot. The consumers have to go to larger shopping centers in other sections of the region for their shopping. In reality, however, high sales per square foot in such areas would result in either the centers increasing in size or in the development of new stores nearby to serve the consumers. So the implication for our analysis is that if some alternative patterns indicate high sales per square foot for a number of transportation districts in a subregion, those alternatives are poor descriptions of the probable future pattern in that subregion. So in those subregions in subsequent alternatives, more shopping goods floor space will have to be assumed and the evaluation procedures repeated. So this criterion is useful as a corrective in the iterative strategy of setting up alternatives to approximate the probable future patterns of shopping goods growth. The details of application of this criterion are discussed with specific examples later in the paper.

2. Average shopping trip lengths—this is a gross measure of the system efficiency of an alternative. In an alternative, where the assumed centers are tried at locations eccentric to population distribution, the average length of the shopping goods trip will increase. As indicated later, the average trip length increased 15 percent (1.5 min) over present-day levels in one alternative. If the total number of shopping trips is considered, this would involve a very considerable increase in time spent on shopping trips in the region. So an alternative pattern assumed was evaluated as efficient in terms of how close its average trip length was to present-day level. Generally, a 5 to 7 percent variation from the current average trip length for the region was allowed.

It must be obvious that the shopping service level to population is measured on a gross system level by the average trip length measure and on a subregional level by the sales per square foot by transportation district.

APPLICATION OF CRITERIA AND EVALUATION OF RETAIL POTENTIAL

The first step in the estimation of retail potential is the development of alternative patterns of possible future retail development.

Development of Alternatives and Estimation

The development of alternative patterns was basically a trial and error process. Initially, it involved allocating the estimated total regional demand for additional shopping goods by 1970 and 1980 to specific locations in a few exploratory alternatives. The probable sales levels at all centers estimated by the model for such alternatives were then evaluated against the stated criteria to provide guidelines for the formulation of more realistic alternatives.

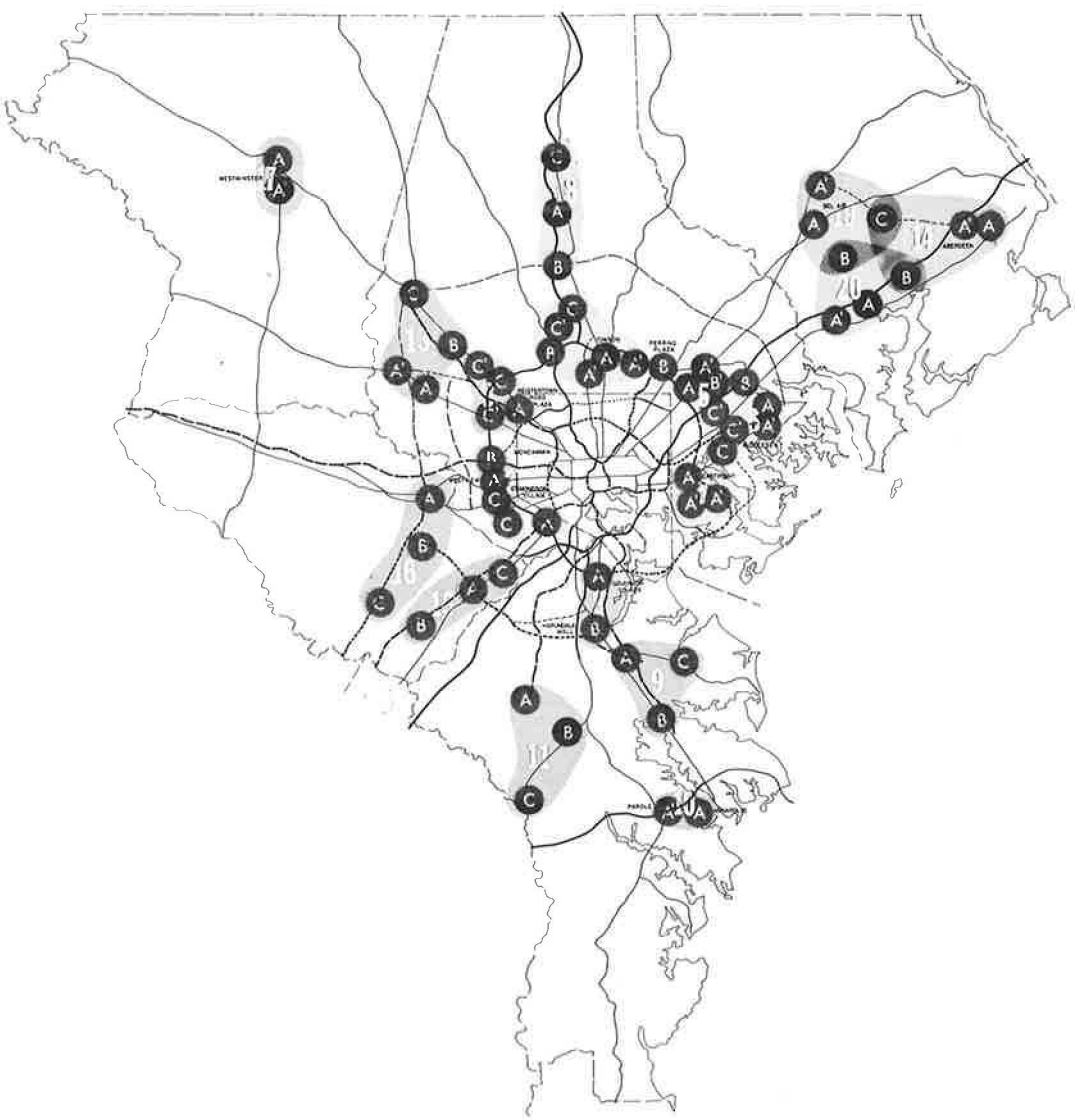


Figure 6. Universe of potential location for metrotown centers.

A prerequisite to the formulation of alternatives is an estimation of future regional demand for shopping goods in the region. The projected growth of consumer expenditures on shopping goods in the region for 1962-70 and 1970-80 was treated as potential demand and expressed in floor space for the respective time periods (on the assumption of an average return of $55/sq ft). Based on an analysis of current trends, 78 percent of the regional floor space demand was assumed as nucleated center potential.

To allocate this estimated regional demand in the form of alternatives, a universe of potential locations was specified by the Regional Planning Council (Fig. 6). (Available land, existing commercial nucleation, general location fixes of previous metrotown studies, and disposition to areas of population growth were some of the factors guiding the choice of these locations.) Each of these locations was treated as a potential candidate for metrotown centers and tested in this study for retail potential.

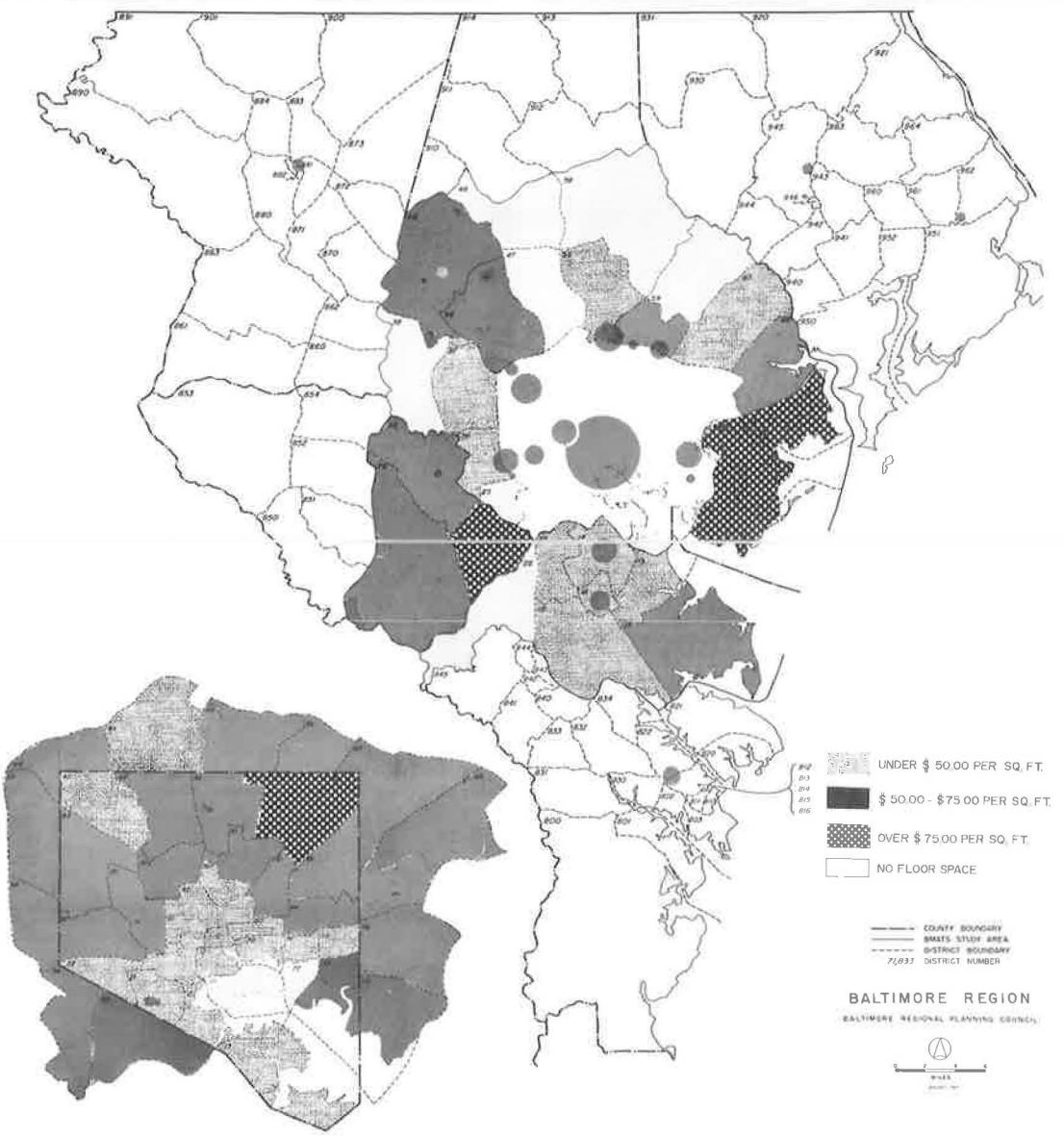


Figure 7. Performance of existing shopping districts, 1963.

Initially, two hypotheses—concentration and dispersion—of retail development were assumed. In the first alternative, all the growth by 1970 was assumed to take place in the inner beltway (identified as 1970 Alt. 1). The second assumption was that most of the growth is likely to skip the more densely settled inner beltway and locate in the less-developed outer beltway area (1970 Alt. 4).

The 1970 consumer shopping expenditures were distributed with the model to all shopping centers—existing and future—in each of these two alternatives. The sales per square foot of shopping centers by transportation districts were computed and mapped for both alternatives. Figures 7, 8, and 9 indicate this measure of retail service for 1963, 1970 Alt. 1, and 1970 Alt. 4, respectively.

In 1963, the areas with sales levels of more than $75/sq ft—areas of poor retail service—are minimal. The few such pockets are mainly peripheral low-density areas.

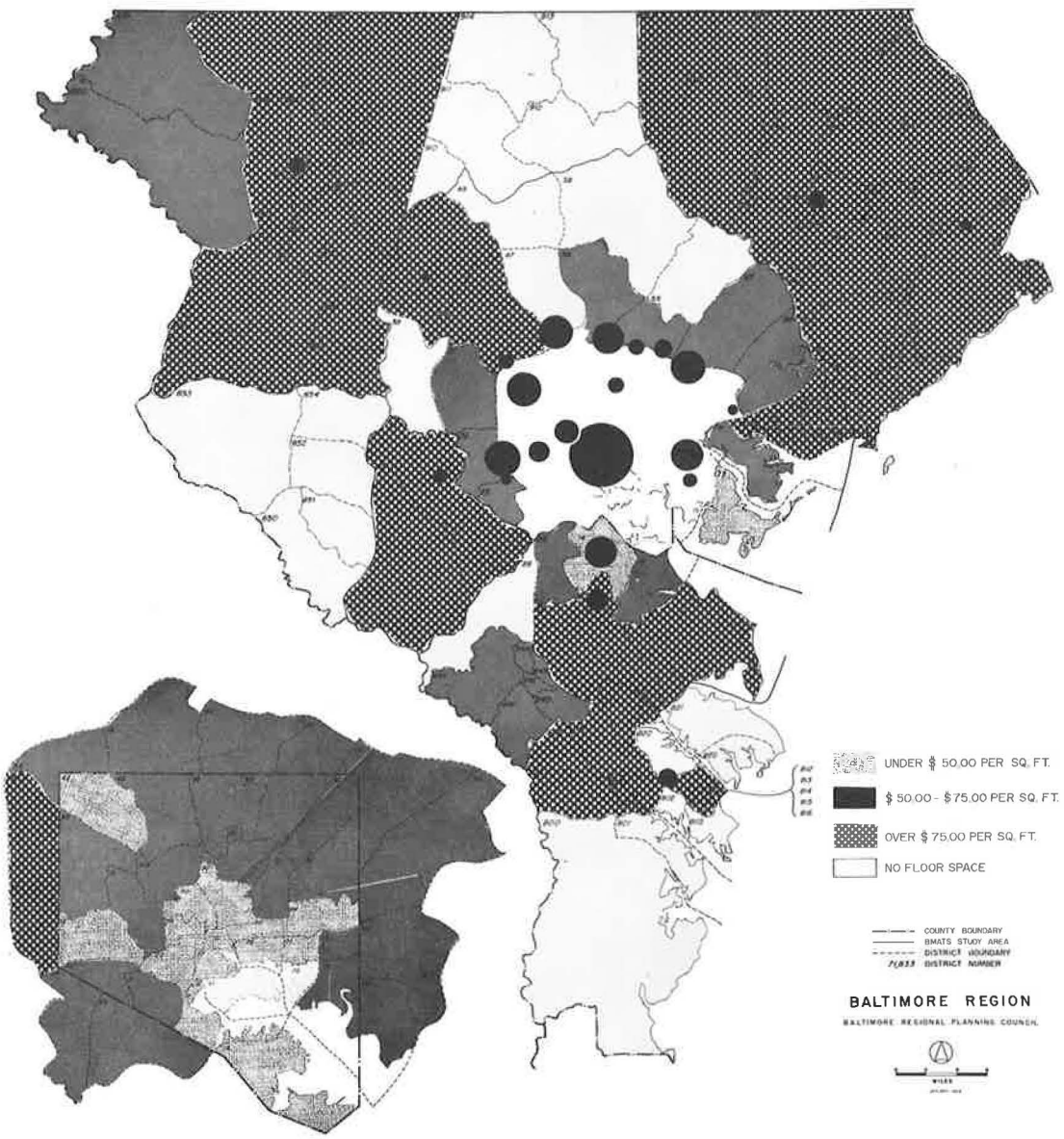


Figure 8. Potential of shopping districts, 1970 Alt. 1.

The main thing to realize is that, except for these few pockets, the system of shopping goods centers today provides a good retail service throughout the region. In contrast, Figure 8 indicates that the concentration alternative provides a low level of retail service for large sections at peripheral regions. It is also indicated in the next section that the sales performance of the various centers varied from $30 to $150—an unlikely occurrence in the market process. Conversely, in Figure 9 the level of retail service in the outer areas of the region is good, but large areas of the densely populated inner parts of the region are poorly served. In addition, the average trip lengths for these alternates were 11.8 and 11.4 min—a 10 percent increase over current levels.

The major conclusion from this preliminary evaluation was that both these pure alternatives are poor descriptions of likely future development. Composite alternatives that combine features of both these alternatives were consequently set up for further

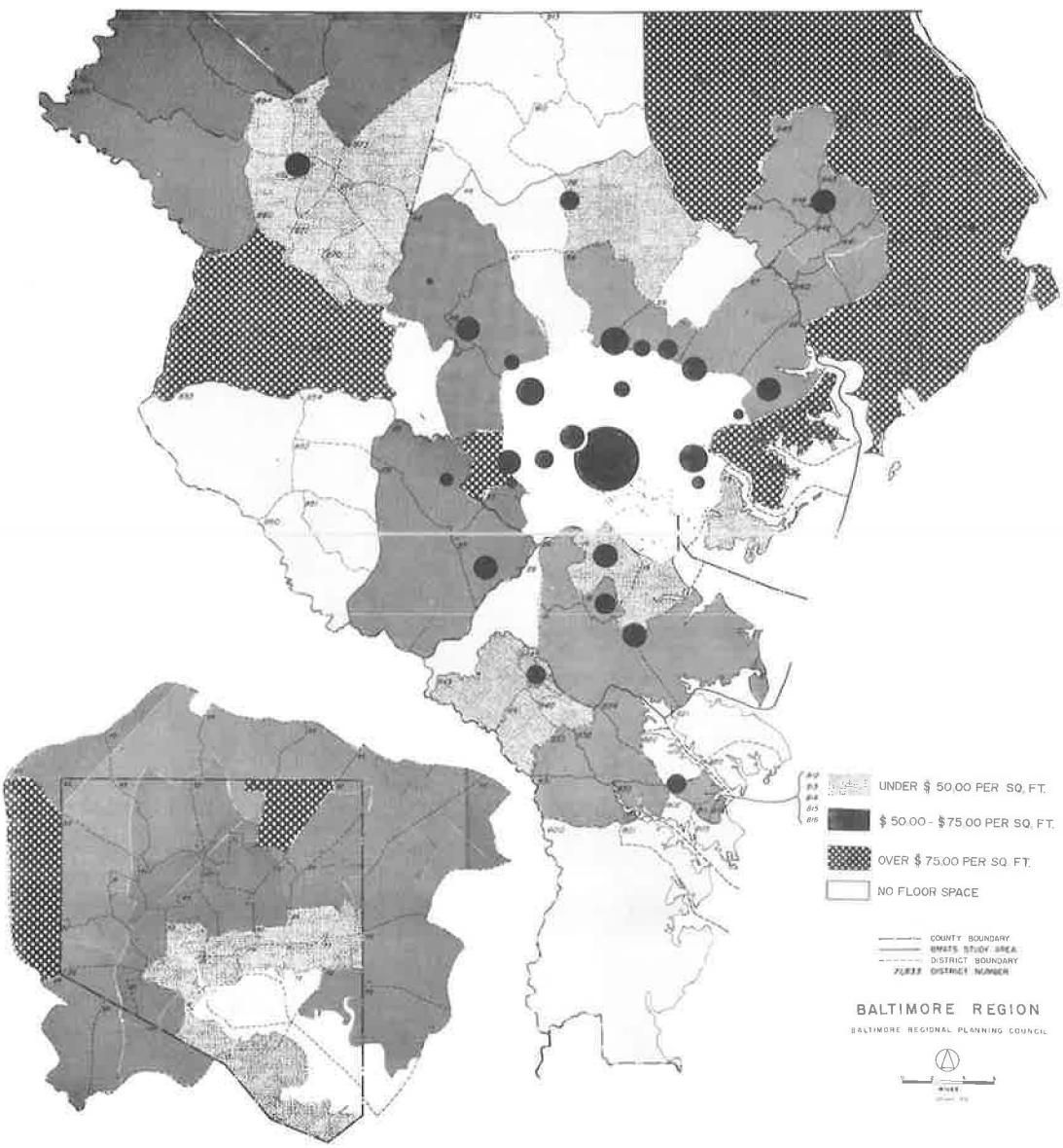


Figure 9. Potential of shopping districts, 1970 Alt. 4.

evaluation. Figure 10 indicates the level of retail service for one such composite alternative. As indicated in this figure, the resulting retail service level is a considerable improvement over the results obtained with the two exploratory runs. The average trip length also dropped to 11.0 min.

Evaluation of Alternatives

Throughout this study, 25 alternatives (14 for 1970 and 11 for 1980) were set up and evaluated. This evaluation is a complex process involving several dimensions of interpretation: the relation of size to performance in several alternatives for the same center, the sensitivity of a center to competition nearby, the interrelation of all

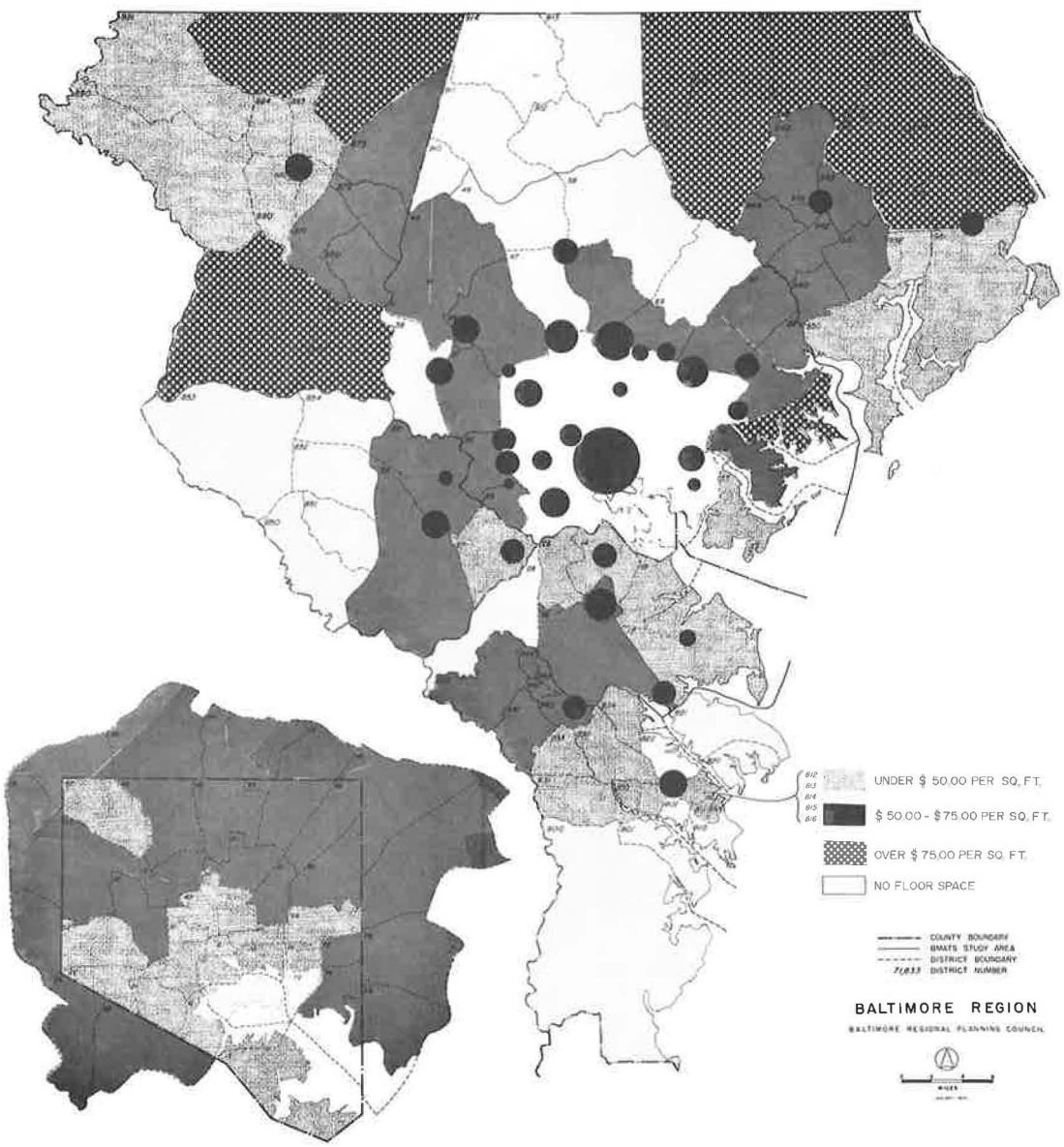
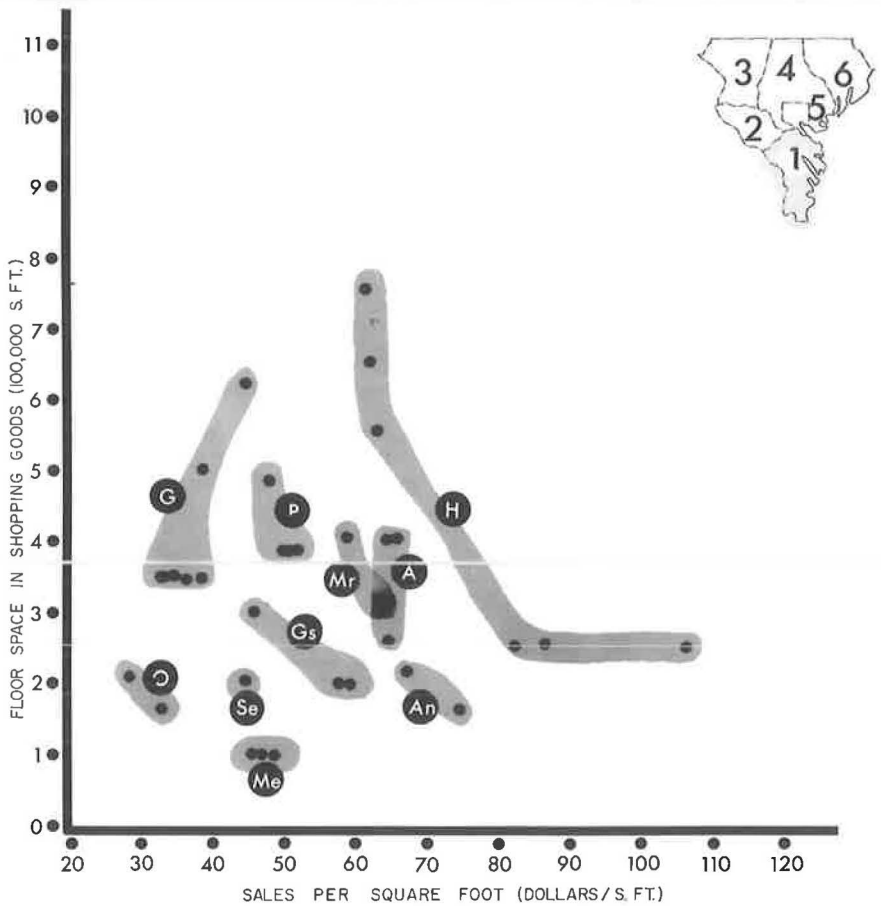


Figure 10. Potential of shopping districts, 1980 Alt. 8.

centers in a subregion, and the assessment of subregional levels of retail service by alternative. Space limitations do not permit a detailed description (17) of all the evaluations performed; however, the following selected examples will indicate the procedures used and the typical findings.

The basic framework of the evaluation was the subregion. It involves the recognition of six overlapping subregional markets. This framework permits the retail centers in each subregion to be viewed as serving one market, which is overlapped by service of some centers in the adjoining subregion. It must be pointed out that the recognition of the subregions is a device of evaluation only and does not affect the sales estimation procedures which still assume a market continuum implicit in the use of the model.



SUBREGION 1

H	HARUNDALE MALL
G	GOVERNOR PLAZA
Mr	MT. RD.-RITCHIE
Mc	MT. RD.-EXTENDED
Sc	SEVERNA PARK
An	ANNAPOLIS
P	PAROLE
Gs	GAMBRILS
O	ODENTON
C	CROFTON

SUBREGION 2

W	WESTVIEW
S	SEC. BLVD.
A	ARBUTUS
E	ELKRIDGE
Io	I-95/O. BELT
Im	I-95/MD-32
C	COLUMBIA
Rt	RT. 40/RT. 29
Ed	EDMONDSON

SUBREGION 3

Rp	R. R. PLAZA
Rd	RANDALLSTOWN
Sd	SOLDIERS DELIGHT
R	REISTERSTOWN
Om	OWINGS MILLS
Wt	WESTMINSTER TOWN
Wn	WESTMINSTER NORTH

SUBREGION 4

J	JONES FALLS
Sh	SHAWAN
He	HEREFORD
T	TOWSON
Sy	STEWART-YORK

SUBREGION 5

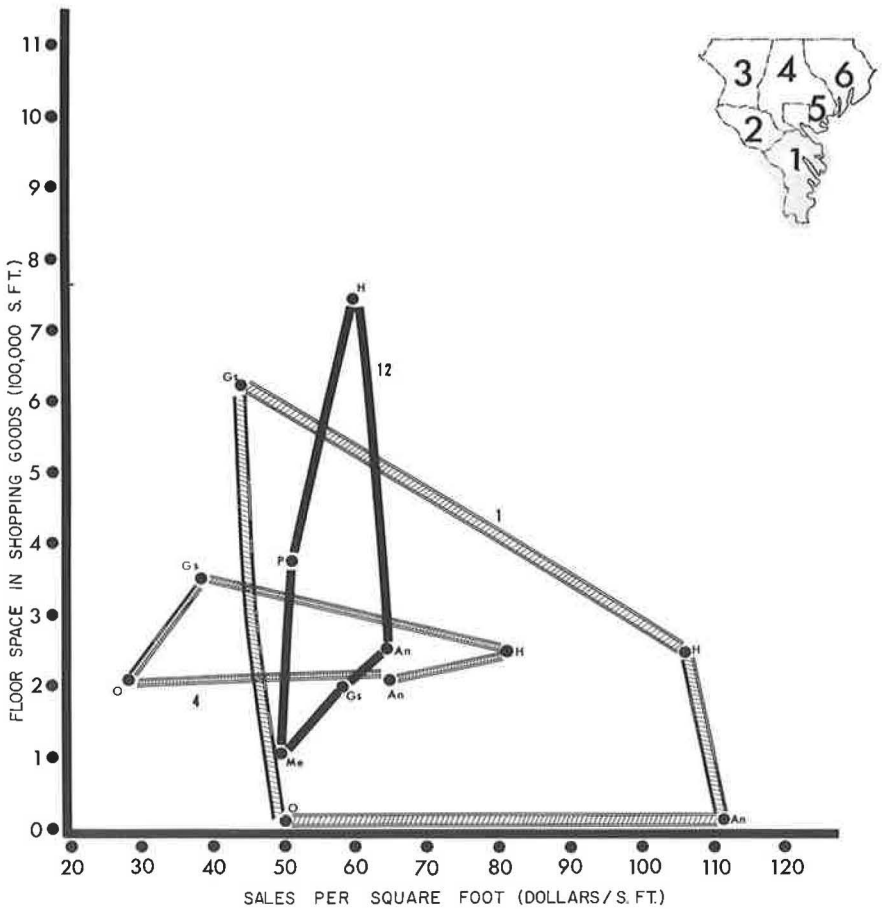
Wi	WHITEMARSH-1
Wm	WHITEMARSH-3
Wd	WINDLASS
Mx	MIDDLESEX
Ep	EASTPOINT
Pp	PERRING PLAZA

SUBREGION 6

Ba	BELAIR
Jp	JOPPA
Ab	ABERDEEN TOWN
Ab'	ABERDEEN WEST

Figure 11. Comparative success of centers, subregion 1, 1970.

For each of the six subregions, four graphs—two each for 1970 and 1980--were prepared. For each point of time, the two graphs were (a) comparative success of centers in the subregion (Fig. 11), and (b) comparative system performance in the subregion (Fig. 12). Both these graphs are plots of sales per square foot vs size of centers for selected alternatives. Figure 11 involves connecting the points in all alternatives for each center. This shows clearly the relation between size and corresponding performance—a measure of depth of market and effect of nearby competition. Figure 12 involves connecting the plots of all the centers for each alternative and gives a visual measure of the performance range of different centers within the subregion. The very wide range of sales per square foot among centers in subregion 1 for alternatives 1 and



SUBREGION 1		SUBREGION 2		SUBREGION 3		SUBREGION 4		SUBREGION 5		SUBREGION 6	
H	HARUNDALE MALL	W	WESTVIEW	Rp	R. R. PLAZA	J	JONES FALLS	Wi	WHITEMARSH-1	Ba	BELAIR
G	GOVERNOR PLAZA	S	SEC. BLVD.	Rd	RANDALLSTOWN	Sh	SHAWAN	Wm	WHITEMARSH-3	Jp	JOPPA
Mr	MT. RD.-RITCHIE	A	ARBUTUS	Sd	SOLDIERS DELIGHT	He	HEREFORD	Wd	WINDLASS	Ab	ABERDEEN TOWN
Me	MT. RD.-EXTENDED	E	ELKRIDGE	R	REISTERSTOWN	T	TOWSON	Mx	MIDDLESEX	Ab'	ABERDEEN WEST
Sc	SEVERNA PARK	Io	I-95/O. BELT	Om	OWINGS MILLS	Sy	STEWART-YORK	Ep	EASTPOINT		
An	ANNAPOLIS	Im	I-95/MD-32	Wt	WESTMINSTER TOWN			Pp	PERRING PLAZA		
P	PAROLE	C	COLUMBIA	Wn	WESTMINSTER NORTH						
Gs	GAMBRILS	Rt	RT. 40/RT. 29								
O	ODENTON	Ed	EDMONDSON								
C	CROFTON										

Figure 12. Comparative system performance, subregion 1, 1970.

4 is striking. If a center such as Odenton could generate only very low sales, it would either not be built or it would go out of business. If a center such as Harundale generated more than $80/sq ft, either its size would be increased or competition close by would be generated. The market process is more truly indicated by alternative 12, where all the centers have sales ranging from $43 to $65/sq ft.

It is of interest to recall that alternatives 1 and 4 were the exploratory alternatives providing poor levels of retail service and high values of average trip length. Alternate 12, on the other hand, provided better retail service and lower trip length.

Evaluation of a similar nature involving the system efficiencies and the probable potential of individual locations was carried out for all locations in all subregions. Out of this evaluation emerged two preferred systems of centers. In terms of the

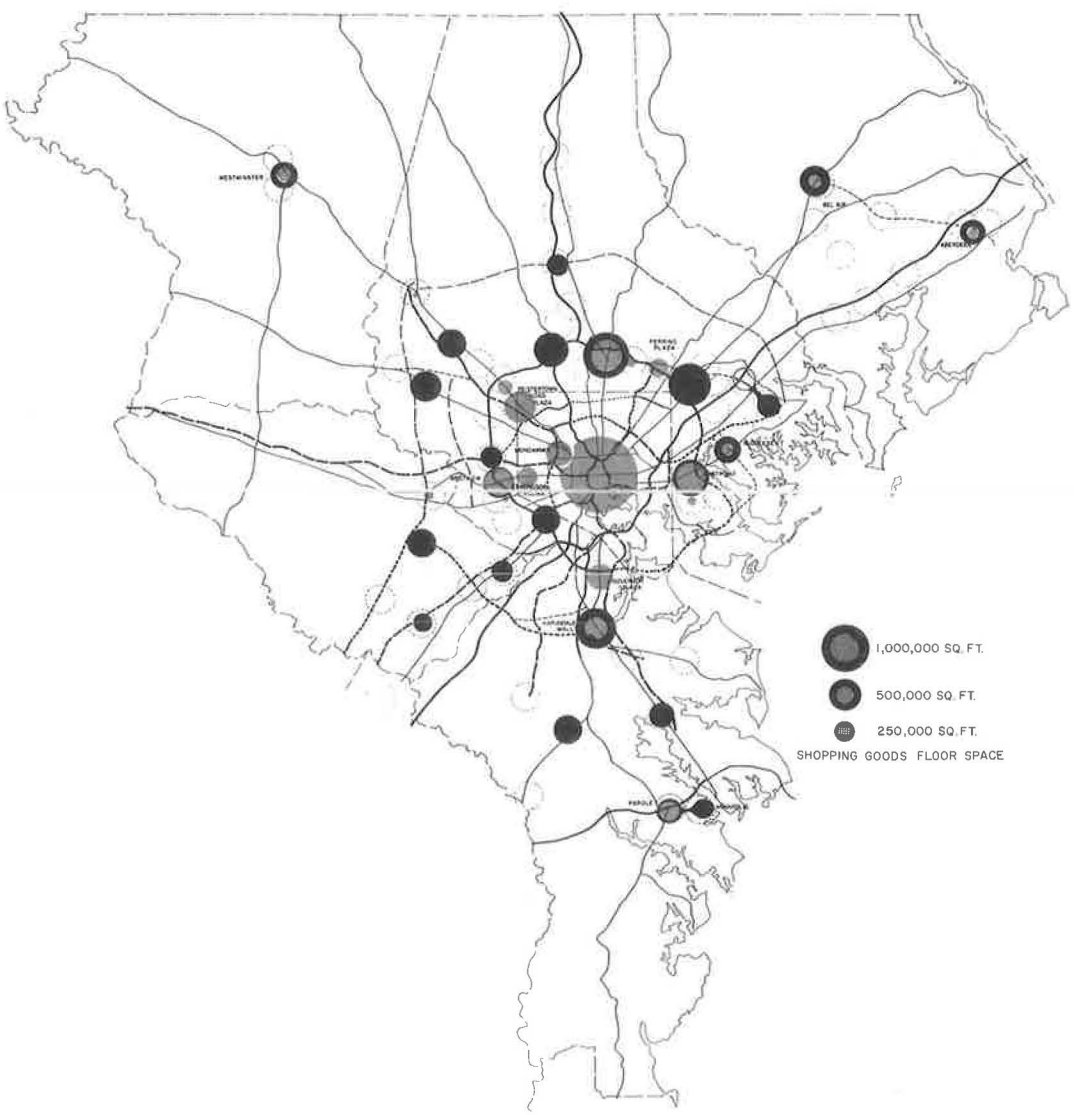


Figure 13. Preferred system of centers, 1980—pattern A.

TABLE 2

PROJECTED GROWTH OF SHOPPING GOODS FLOOR SPACE

Location	1962-1970		1970-1980		Total Growth (%)	
	Million Sq Ft	%	Million Sq Ft	%	1962-70	1970-80
Inner belt	1.90	50	1.04	26	66	34
Outer belt	1.36	36	2.44	60	38	62
Satellite comm.	0.54	14	0.56	14	50	50

criteria used, clear preference of one pattern over the other could not be established. Figure 13 represents one of these systems.

Retail Growth Patterns and Implications

The nature of regional commercial growth pattern indicated by the preferred system of centers can be described in two forms.

1. Table 2 provides a statistical summary of commercial growth. The inner belt area is the ring around the inner beltway where most of the present suburban nucleated

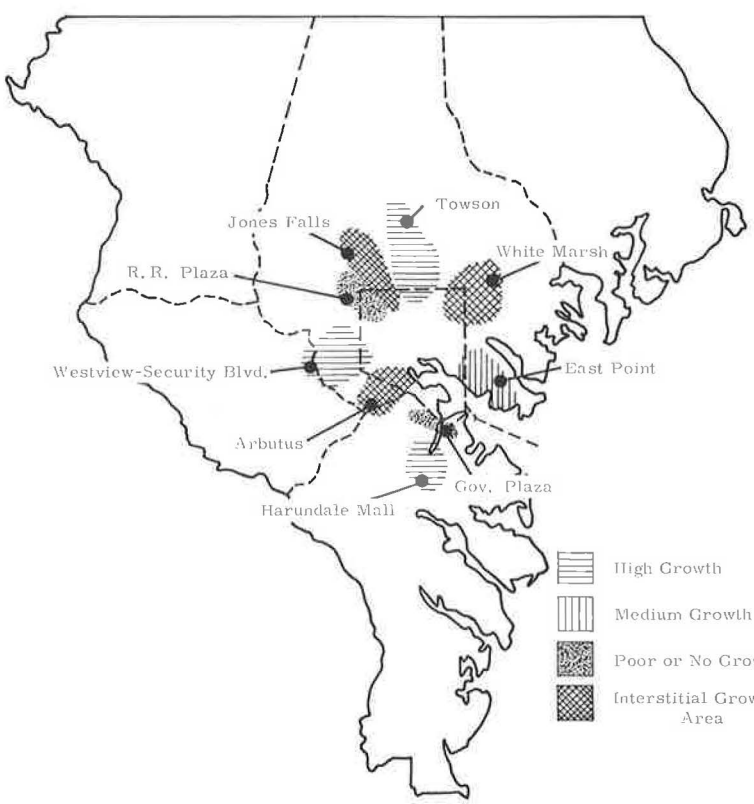


Figure 14. Broad scheme of commercial development, Inner Belt, 1962-80.

shopping centers are located. The outer belt corresponds to the area around the proposed outer beltway and beyond. The satellite communities refer to old established peripheral communities such as Westminster, Belair and Annapolis. It is interesting to note the shifting of the axis of major growth from the inner belt to the outer belt between 1970 and 1980. Up to 1970, the inner belt accounts for half of the total growth, whereas the outer belt is expected to get 60 percent of the next decade's growth. The satellite communities tend to have a constant rate of growth throughout the time period studied, indicating their relative isolation from the wave of metropolitan expansion during this period. Put another way, the inner belt is expected to experience two-thirds of its growth before 1970, whereas the outer belt area will get two-thirds of its growth during the following decade.

2. The patterns of probable retail growth in the belt area have very important sub-regional variations. Figure 14 sketches the growth variations in different segments of the inner beltway area by 1970.

Three of the existing large commercial nucleations—Towson, Harundale Mall, and Westview—have considerable potential growth. One other existing center—East Point—has more moderate growth potential. In addition, three interstitial centers—Whitemarsh I, Arbutus, and Jones Falls area—hold out great possibilities of growth. Two existing centers--Governor Plaza and Reisterstown Road Plaza—in this area appear to suffer from poor location or slow growth in their markets.

CONCLUSION

It may be recalled that this study was prompted by the desire to test out a key component—large commercial cores—of the multi-use centers envisaged in the metrotown concept. Accordingly, all the locations identified by the Regional Planning Council as potential candidates for metrotown centers were evaluated as to their retail potential. This evaluation, assuming the continuation of existing trends and policies, identified the potential for large-scale retail activity at a number of these locations. In other words, under existing policies, market forces seem to point to retail centers of the scale envisaged in the metrotown concept. (By 1970, nine commercial centers could be cores of metrotown centers, and six more could approach this potential by 1980.) This implies that a key component of the metrotown center appears to be consistent with the operation of urban growth processes.

The market potential model, though developed in response to a specific planning problem, has a more general application. In this study, the continuation of existing land and highway policies was assumed and the evaluation criteria were relevant to the needs of a "new town" retail core. The model can be equally well applied with different assumptions of metropolitan policies and various evaluative criteria related to other forms of commercial organization. The estimating procedures are fully computerized and compatible with data being produced by the metropolitan studies under way in many American cities.

ACKNOWLEDGMENTS

The study reported in this paper was undertaken by Alan M. Voorhees and associates, Inc., for the Regional Planning Council, Baltimore, Md., as one of a series of related studies carried out by the Council over the last few years on the investigation of regional development forms. This study was made possible by the generous help and constant encouragement of the staff of the Regional Planning Council. The authors take this opportunity to acknowledge gratefully this debt, particularly to W. Wilson Horst, S. Thyagarajan and John Backer.

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