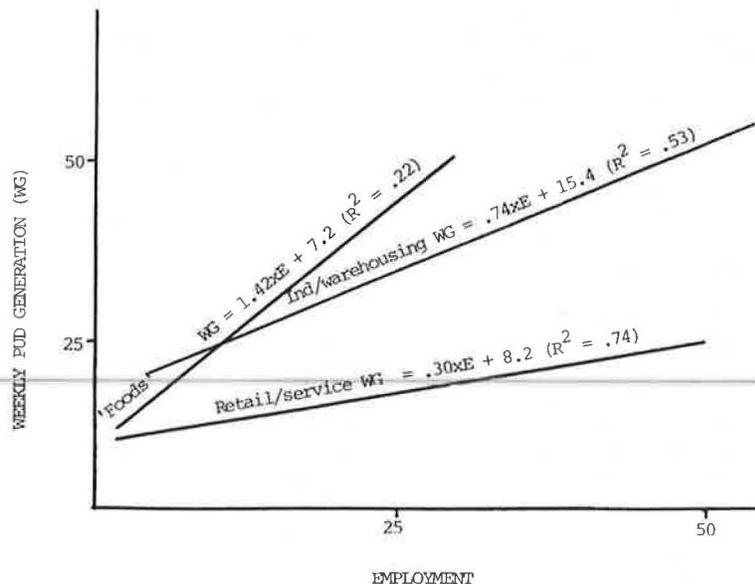


Figure 3. PUD trips generated per week versus employment.



SUMMARY

The data base from which this research was developed is a comprehensive one that encompasses statistics from six cities stratified by size, location, and industrialization. The research could not validate some hypotheses. For example, the research could not substantiate whether demand characteristics vary by city size and location. Another hypothesis was that shipment characteristics within each land use vary by the size of the generator. This was not substantiated within the ranges studied. Therefore, the generation of shipment size and weight for a particular site can be found by using the trip-generation rate and the average shipment characteristics for that land use (Tables 2 and 3).

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Factors That Influence Freight-Facility Location Preference

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An analysis of factors that affect freight-facility location is presented. A multinomial logit formulation is used. Correlation between attributes in the model is minimized by means of a factor analysis. The modeling

approach is then shown to be a suitable and potentially valuable approach to analyzing facility location. By using data collected in Melbourne, Australia, the model calibration shows that the decision on facil-

ity location can be modeled by using four attributes of alternative locations: truck transportation, markets, site availability, and labor availability. Of these, the first was the most influential. This result is of value in a transportation planning context because it means that transportation system variables have an effect on the choice of freight-facility location.

In recent years, there has been an increasing awareness of the need to consider goods movement in urban transportation systems planning. As Lay (1) has noted, "The incompatibility of essential and inevitable urban freight movements with the aspirations of urban dwellers . . . is surely one of the . . . major unsolved problems of urban transportation." It is now realized, for example, not only that commercial vehicles form a distinct and significant proportion of all vehicles in the traffic stream but also that a substantial proportion (perhaps 50 percent) of total urban transportation costs is attributable to freight transportation (2). Furthermore, both passenger and freight transportation systems have important spatial ramifications. Transportation effects, for instance, often influence the location decisions and the viability of industry (3-5). However, the extent of this influence and the nature of the relationship are as yet generally not well understood.

Although the amount of urban land occupied by freight-distribution facilities is relatively small, such land uses are among the most volatile from a community viewpoint (especially where large, heavy trucks are involved). Data from the United Kingdom (6) have shown that freight depots and warehouses in London are highly footloose. If this is so in other cities (and Australian cities in particular), it may be possible to influence the location of such freight-generating land uses through the planning process to reduce transportation costs and broader community costs associated with environmental and social impacts. In fact, Ogden (7) has suggested that control of the location of freight-generating activities is one of the main influences that the planner can exert on the urban freight system.

However, although a large body of theoretical and empirical work on the location of manufacturing (i.e., secondary) industry already exists, comparatively little has been reported on the location of freight-distribution activities, which mostly fall within the tertiary or service-industry sector. Consequently, the level of understanding of the location behavior of firms that operate such facilities, and the extent to which their choice processes might be common, is quite limited. Thus, before we even attempt to make predictions about the spatial impact of policy initiatives on urban goods movement, it is essential to investigate further the location characteristics of such freight firms. The successful derivation of an explanatory capability for the location preference of individual freight firms would ultimately lead to the development of disaggregate behavioral models of freight-facility location for use in transportation and land use planning of urban systems (8).

This paper reports some results of a study of the locational preferences of firms that operate freight facilities in Melbourne, Australia (9). The study included a range of firms whose main function was the distribution of goods, including freight forwarders, trucking firms, wholesalers, and distributors. Some firms whose main function was not transportation or distribution but that had a significant distribution function were also included (e.g., oil companies and major retailers). Freight terminals, depots, storage facilities, distribution centers, warehouses, and similar facilities were included in the study.

UTILITY MODEL OF LOCATION CHOICE

In order to analyze the effect of transportation and land use policy decisions on the location of freight facilities, a model sensitive to the influence of such policy decisions was used. The model was based on the random utility approach (10), which assumes that a firm will select the location from which it receives the maximum utility. Hence, in a choice between locating a freight facility in area A or area B, area A will be preferred if

$$U_k^A > U_k^B \quad (1)$$

where U_k^j = utility of area j to firm k .

If it is assumed that utility is a function of the satisfaction obtained from each characteristic of the location (11), and if an assumption of additive utilities is used, then area A will be preferred if

$$\sum_{i=1}^n U_{i,k}^A > \sum_{i=1}^n U_{i,k}^B \quad (2)$$

where $U_{i,k}^j$ = utility of characteristic i for area j to firm k , and n = number of characteristics. For each characteristic, the utility is composed of two independent elements. These are the degree of importance the firm associates with each location characteristic and the degree of satisfaction that firm perceives for each characteristic, for the particular location in question.

Thus, the utility of each characteristic can be expressed as

$$U_{i,k}^j = I_{i,k} \cdot S_{i,k}^j \quad (3)$$

where $I_{i,k}$ = the importance of characteristic i to firm k and $S_{i,k}^j$ = the satisfaction with characteristic i in area j as perceived by firm k . Substitution of Equation 3 into Equation 2 gives the result that area A will be preferred to area B if

$$\sum_{i=1}^n I_{i,k} \cdot S_{i,k}^A > \sum_{i=1}^n I_{i,k} \cdot S_{i,k}^B \quad (4)$$

Noting that the importance associated with each characteristic is independent of the particular location, we derive the following expression:

$$D_k = \sum_{i=1}^n I_{i,k} (S_{i,k}^A - S_{i,k}^B) \quad (5)$$

If $D_k > 0$, area A is preferred; if $D_k < 0$, area B is preferred; if $D_k = 0$, the firm is indifferent with respect to location. At this stage, the model is expressed deterministically. That is, if $D_k > 0$, area A will always be preferred. In real life, however, this is not always the case. There will always be errors or omissions in the list of characteristics and, given the same level of preference for one characteristic, the levels of satisfaction perceived by different firms may be different.

Therefore, in expressing the utility of an area to an individual firm, there should also be a random component in the utility. Thus, the utility of an area (Equation 3) can be more fully expressed as

$$U_{i,k} = \sum_{i=1}^n I_{i,k} S_{i,k}^j + e_k^j \quad (6)$$

where e_k^j = error term in the utility perception of area j for firm k . Substituting in Equation 5 gives

$$D_k = \sum_{i=1}^n I_{i,k} (S_{i,k}^A - S_{i,k}^B) + (e_k^A - e_k^B) \quad (7)$$

or

$$p_k(A,B) = \phi \left[\sum_{i=1}^n I_{i,k} (S_{i,k}^A - S_{i,k}^B) \right] \quad (8)$$

where $p_k(A, B)$ = probability of firm k choosing area A in a choice between areas A and B and ϕ = cumulative distribution function of $(e_k^A - e_k^B)$.

If at this point it is assumed that e_k^A and e_k^B are independently and identically distributed with the Weibull distribution, then Equation 8 results in a logit model (12):

$$p(A,B) = 1 / \{1 + \exp[-(U^A - U^B)]\} \quad (9)$$

The above derivation has dealt with the binary-choice situation only. In many cases, more than two alternatives exist. Fortunately, the above model is capable of extension to a choice situation that involves more than two alternatives. For the logit model, Luce and Suppes (13) have extended the above theory to form the multinomial logit model:

$$p_k(A) = e^{U^A} / \sum_{j=1}^L e^{U^j} \quad (10)$$

where L = number of alternatives and $p_k(A)$ = probability of choosing alternative A .

EMPIRICAL STUDY

Although the choice model outlined above has been applied to residential location choice (14, 15), it has not previously been applied to the location preference of firms and, more particularly, to firms involved in the distribution of freight. Accordingly, to the extent that the empirical study reported in this paper breaks new ground, the research must be considered exploratory and one of its major objectives to be to provide and stimulate directions for future research.

Sample Selection

In selecting a sample from which to obtain data for the building of location choice models, two criteria should be met. The first is that the sample should be homogeneous with respect to location choice. This criterion was partly met in this study by selecting only firms that were (a) involved in the distribution of freight and (b) located in Melbourne. However, since the distribution sector is large, different firms have different market and location characteristics and therefore the sample could not be said to be truly homogeneous.

The second criterion is that the firms should be in equilibrium so that the factors that affect the decision to locate will be the same for all firms in the study. It is unlikely that this criterion will be satisfied, since different firms in the sample had been at their present location for different lengths of time and each firm was probably faced with a unique set of characteristics when it made its latest location decision. However, after that decision was made, changes in the firm's circumstances, or in the urban and economic environment, may have resulted in another location being more appropriate. To

overcome this problem of lack of equilibrium, respondents to the survey were asked to compare their existing location with one other possible location, as of the time of the study and not as of the time when their last location decision was made. They were also asked which of these two locations they would select if they were making their location decision now. This preferred location, rather than the firm's actual current location, was used in the development of the models presented in this paper.

It is important at this point to note the distinction between the preferences of a decision-making unit and its final decision since, even if it is assumed that a firm's location behavior is rational and that the choice set for the firm is completely specified, a firm's preference for a location other than its current one need not necessarily lead to a relocation. The preferences of individual firms for alternative locations can be viewed as a measure of the demand for alternative locations but, before a choice decision will result, the supply side of the equation and, more specifically, the interaction of demand and supply must be considered. Moreover, unless the perceived "benefit" to the firm in moving to an alternative location exceeds the cost of that move, perhaps by some threshold amount, the firm is unlikely to relocate regardless of its stated preferences.

Questionnaire

To apply the model outlined earlier in this paper, data on importances and satisfactions are required. In this study, these data were obtained by using a questionnaire completed during interviews with senior management personnel of a sample of firms in Melbourne (16). These firms covered a range of activities in the transportation and distribution sector. A total of 71 questionnaires were obtained in this way.

More specifically, each respondent was first asked to rate on a semantic scale, whose end points were 1 and 100, how satisfactory two locations were with respect to 19 location characteristics. The two locations were the firm's current location and one other possible location nominated by the respondent. (Note that all areas in the urban region can be considered alternative locations. For example, land use planning regulations may prohibit freight activities in certain localities. Thus, if all locations were considered in calibrating the model, a biased result might be obtained. This study only included one alternative, selected by the respondent, to ensure that the alternatives considered were valid for that firm.)

The 19 location characteristics were as follows: closeness to existing customers, closeness to expanding markets, closeness to other facilities operated by the firm, closeness to arterial roads, closeness to freeways, access to country highways, closeness to rail freight facilities, closeness to port facilities, closeness to public transportation, traffic congestion and delay, availability of suitable sites, investment potential, company prestige, cost of land and buildings, cost of council rates (land taxes), cost of operating the respondent's vehicle fleet, availability of labor, and environmental impact of the respondent's facility.

Respondents were then asked to rank, on a similar semantic scale, how important each of these characteristics would be in their selection of a location for their freight facility. Finally, they were asked to rate both location alternatives overall. It is interesting to note that, although most respondents ranked their existing site higher, many did not.

The result of this part of the questionnaire was a set of data on satisfactions and importances for each of the 19 characteristics given above. From these, it was pos-

Table 1. Location characteristics included in prime factors determined by factor analysis.

Factor	Variance Explained (%)	Characteristics Included in Factor	Variance (%)		
			In Factor	In Other Factors	Factor Loading
Truck transportation	27.6	Firms	36	9	0.60
		Roads	55	1	0.74
		Freeways	20	2	0.45
		Operating costs	36	10	0.60
Rail and public transportation	13.3	Railways	16	3	0.40
		Public transportation	96	4	0.95
Markets	12.8	Customers	66	21	0.81
		New markets	46	2	0.65
		Facilities	24	1	0.48
Site cost	11.2	Land cost	74	1	0.86
		Council rates	18	0	0.42

sible, by using the above theory, to build a model of facility location preference.

ATTRIBUTE FORMATION BY FACTOR ANALYSIS

Before the formulation of the model of facility location preference is explained, it is necessary to explain how the data obtained in the questionnaire survey were made suitable for analysis.

The characteristics introduced into the process of model calibration were in the form of differences in the utility gained from each characteristic (Equation 4), the preferred location being taken first. However, the characteristics described above are by no means unique or mutually exclusive and so may be interrelated. For example, several of the characteristics given above relate to closeness to transportation, whereas perhaps only one relates to the availability of labor. Since correlations between independent variables can lead to a spurious model, it was necessary to determine which, if any, of the characteristics were correlated and to combine those that were into a single factor. To do this, a factor-analysis technique, which measures the latent dimensions present in the data set, was used (17, 18).

It is first assumed that many of the characteristics in the data set can be combined linearly to represent the general factors that are being sought. This linear relation is determined by measuring the correlation between each of the characteristics. The principal components are determined from these correlations. These principal components are then "rotated" until the first component explains the maximum possible variance in the data. The second component is then the one that explains the second largest amount of variance and is also at right angles to (i.e., uncorrelated with) the first component. The process continues until all of the variance is explained. The amount of variance explained by each factor can be represented by the eigenvalue (19).

Since each of the components explains progressively less of the total variance, there comes a point at which a factor explains less of the variance than a single characteristic. This point is reached when the eigenvalue of the factor is less than 1.0. Therefore, only components that had eigenvalues greater than 1.0 were used in this study.

The procedure used to isolate the factors was iterative in nature. The factor analysis was carried out on all of the characteristics, and factors whose eigenvalues were greater than 1.0 were then used as the underlying dimensions of the data set. All characteristics that were not highly correlated with these factors were then set aside from the analysis. This procedure was repeated until all remaining characteristics were highly correlated with one of the factors.

The factor analysis showed that 11 of the 19 characteristics could be replaced by four prime factors, those for (a) truck transportation, (b) rail and public transportation, (c) markets, and (d) site cost.

Table 1 summarizes the features of these four factors. The individual characteristics that constitute each of the four factors are given, together with (a) the percentage of the variance in that characteristic explained by the factor and (b) the percentage of the variance in that characteristic explained by the other three factors. The fact that a was much greater than b in each case indicates that the factor analysis was indeed associating each characteristic with a closely related factor.

The percentage of the total variance in all characteristics included in the factor analysis is also given. It can be seen that the truck-transportation factor "explained" the highest proportion of the variance in the characteristic set. But, as will be discussed later, this result does not necessarily mean that this explains the greatest amount of variance in the respondent's preferences.

The factor loading given in Table 1 is the square root of the proportion of the variance in that characteristic explained by the factor (17). This was used in the calculation of factor scores, as follows:

$$F_{kq} = \sum_{j \in S_F^q} (x_{kj}) [a_{kq} / (\lambda_q)] + n_q \quad (11)$$

where

- F_{kq} = factor scores for factor q for firm k,
- S_F^q = set of characteristics forming factor F_{kq} ,
- x_{kj} = characteristic values for firm k and characteristic j,
- a_{kq} = factor loadings for firm k for factor q,
- λ_q = eigenvalue corresponding to factor q, and
- n_q = error introduced by neglecting variables that have a_{kq} values not significantly different from zero.

These factor scores substitute for the values of the individual characteristics included in each factor (as discussed below).

As noted previously, when the factor analysis reached a point at which a particular factor explained less of the variance than an individual characteristic, there was no point in combining individual characteristics to form new factors. Thus, the characteristics that were not absorbed into factors by that stage remained as separate characteristics not correlated with any factor. These characteristics were (a) highways, (b) port, (c) congestion, (d) site availability, (e) investment, (f) prestige, (g) labor availability, and (h) environment.

Thus, in building a location model, both factors (Table 1) and uncorrelated characteristics (as listed above) were incorporated as independent variables. These two types of variables are referred to as attributes, and the resulting model may be termed an attribute model.

THE MODEL

The theory outlined earlier states that a location preference is a function of the utility difference between alternative locations. The utility difference in turn is a function of a number of relatively uncorrelated attributes, as just defined. Thus, the total utility difference that firm *k* perceives, in comparing locations *i* and *l*, is represented by

$$dU_k^{il} = \sum_{j \in \gamma^k} b_j^{il} Y_{kj}^{il} + \sum_{q \in \theta^k} c_q^{il} F_{kq}^{il} + \epsilon_q \quad (12)$$

where

- b_j^{il} = weighting given to unfactorable characteristic *j*,
- Y_{kj}^{il} = characteristic value for characteristic *j* by firm *k*,
- γ^k = set of unfactorable characteristics for firm *k*,
- c_q^{il} = weighting given to factor *q*,
- F_{kq}^{il} = factor score for factor *q* for firm *k*,
- θ^k = set of factors for firm *k*, and
- ϵ_q = error function for factor *q*.

Calibration of the model involved determination of the *b* and *c* coefficients above. The model was initially calibrated by using all 12 attributes—the four factors in Table 1 and the eight uncorrelated characteristics. The resulting model is described by the data given below ($-2 \log \lambda = 56.5$; percentage correctly predicted = 85 percent):

Attribute	Coefficient (10 ⁻³)	Standard Error of Coefficient (10 ⁻³)	T-Statistic
Truck transportation	1.009	0.574	1.76
Rail and public transportation	0.091	0.385	0.23
Markets	0.763	0.401	1.90
Site costs	0.130	0.296	0.44
Highways	0.189	0.389	0.49
Port	0.079	0.292	0.27
Congestion	-0.987	0.419	-0.24
Site availability	0.299	0.203	1.47
Investment	-0.055	0.233	-0.24
Prestige	-0.120	0.325	-0.37
Labor availability	0.628	0.466	1.35
Environment	0.079	0.297	0.26

It can be seen that many of the coefficients were not significantly different from zero, which implies that a model with fewer than 12 attributes could suffice.

The progressive elimination of attributes that had coefficients not significant at the 90 percent level eventually produced a model with only four attributes: truck-transportation factor, markets factor, site-availability characteristic, and labor characteristic. The results of the calibration of the model that incorporated these four attributes are given below ($-2 \log \lambda = 58.0$; percentage correctly predicted = 86 percent):

Attribute	Coefficient (10 ⁻³)	Standard Error of Coefficient (10 ⁻³)	T-Statistic
Truck transportation	1.01	0.39	2.61
Markets	0.73	0.32	2.26
Site availability	0.30	0.14	2.24
Labor availability	0.59	0.37	1.58

It can be seen that the standard error of the estimate was generally only a small proportion of the value of each coefficient, which indicates the robustness of the model. As explained earlier, the prediction of location preference was not based on firms' actual location but on their stated preferred location, which in some cases was the alternative site.

The second of the two tables above also provides an indication of the significance of the model as a whole. The likelihood ratio statistic ($-2 \log \lambda$), where $\lambda = [L(0)/L(\hat{\theta})]$, shows that this model, with its four degrees of freedom, is significant at the 95 percent level (20).

The four attributes that appeared in the model to be the most significant cover the sorts of considerations that, intuitively, would be expected.

The truck-transportation attribute included not only proximity to arterial roads and freeways but also truck operating cost and closeness to firms that provide services (e.g., spare parts, fuel, and financial services). However, closeness to nonhighway transportation facilities, such as a port or a rail terminal, was not included in this attribute.

The markets attribute included proximity to both existing and future markets and also to other facilities operated by the same firm. In the interviews, several respondents pointed to the advantages and operational flexibility of having all their firm's Melbourne activities together. Similarly, many firms had only relatively few clients or a specialized segment of the market and mentioned the obvious advantages of locating near their clients.

The site-availability attribute referred to the availability of a suitable site in the area concerned. Many firms nominated as their alternative location an inner-suburban or near-central locality (reasons for this, in the Melbourne context, included proximity to rail yards for firms that serve these markets, accessibility to radial freeways and arterial roads, and the cost advantages of having trucks running in the counter-peak direction). Since few suitable sites exist, this attribute figured quite prominently as a governing factor in location choice.

Finally, the labor-availability attribute was significant. Although much of the labor used in the freight and distribution sector is relatively unskilled, respondents would apparently consider the availability of suitable labor an important factor in their location choice.

Of the attributes eliminated from the model (rail and public transportation, site costs, highways, port, congestion, investment, prestige, and environment), none had a significance level greater than 70 percent.

The lack of significance of public transportation results from the dominance of the automobile as a means of transportation to and from work in locations outside the Melbourne central business district. For site costs, it may be that, as in the choice of residential location (21), the cost of the site acts as a constraint and therefore serves to restrict the choice set open to the decision maker rather than being an element of the utility function. Alternatively, the cost of the site may be a secondary consideration alongside such variables as truck operating costs and site availability and, if a suitable site were to become available in the preferred locality, its price

would not (within reason) be a prime factor.

The three transportation-related characteristics that were excluded (highways, port, and congestion) apparently figured less than the transportation-related variables that were included. Perhaps the fact that only a minority of the sample was engaged in either country or interstate work or on port-related work explains the low significance of the highway and port variables. A much larger sample that would enable separate models to be developed for different market segments would be needed to check this.

The investment potential of the property and the prestige gained from a particular location appeared to be relatively unimportant in the freight and distribution sector; this contrasts with office location, in which these attributes may be quite important (22).

The environmental impact tended not to be an important factor in its own right, possibly because an individual firm had little control over it. The various environmental protection laws have to be complied with but, once that is done, these factors cease to be important. For this reason, it may be that environmental considerations are reflected in the land costs.

ELASTICITIES

Although the model includes only those attributes with coefficients that are significant at the 90 percent level, it does not indicate which of the four attributes has the most influence. To do this, it is necessary to develop elasticities of the preference probabilities with respect to each of the attributes. The direct elasticity for the multinomial logit formulation is expressed as follows (23):

$$E_{Z_{mi}} = d_m Z_{m\ell} (1 - P_{i\ell}) \quad (13)$$

where

- $E_{Z_{mi}}$ = direct elasticity with respect to Z_{mi} ,
- d_m = coefficient of Z_m ,
- $Z_{m\ell}$ = utility of m th explanatory attribute for alternative area ℓ , and
- $P_{i\ell}$ = probability of preferring area i to area ℓ .

The results are summarized below:

Attribute	Attribute Mean	Direct Elasticity ($p = 0.87$)
Transportation	4720	0.62
Markets	3788	0.36
Site availability	3850	0.15
Labor availability	4485	0.34

The mean value of the attribute utility given above is calculated from

$$Z_{m\ell} = \text{attribute mean} = \sum_{k \in \alpha^j} I_{kj} (S_{kj}^j) / N \quad (14)$$

where

- α^j = set of firms rating attribute j ,
- I_{kj} = importance placed on attribute j by firm k ,
- S_{kj}^j = satisfaction gained from attribute j by firm k if located in area ℓ , and
- N = total number of firms rating attribute j .

The direct elasticities, calculated from Equation 13, at the mean value of each attribute are also given in the table above for the probability of choice associated with the average respondent (with the logit model, because

elasticity varies with the probability p of a firm choosing location i , the elasticities can only be expressed for a given value of p). The interpretation to be put on the values of elasticities given in the table is that they show how the model output changes if one attribute is varied. At any value of p , the higher the value of the elasticity for any attribute, the more sensitive is the location choice to changes in the value of that attribute. For example, the table above shows that, for a 1 percent increase in the respondent's perception of, say, the truck-transportation attribute for area i , there will on average be a 0.62 percent increase in the probability of preference for area i .

The table indicates that the truck-transportation attribute had by far the most influence. Access to labor and the market attribute had a lower elasticity but were still found to have some influence on the location decision. Availability of suitable sites was the attribute least sensitive to change.

This result is important in a transportation planning context because the truck-transportation attribute (which includes closeness to arterial roads and freeways as well as vehicle operating costs and closeness to other facilities operated by the firm) is one that is partly under the control of the public sector. Thus, by influencing the perception of this attribute, there is some scope for the planner to have an influence on the location of freight facilities.

DATA LIMITATION AND IMPLICATIONS

The research outlined in this paper involves the application of an existing choice model to the location preferences of freight firms. Since the study is exploratory in nature, it is important to highlight some of the biases that may be present in the approach and to suggest ways of avoiding them in the future.

One possible bias results from the fact that the respondent was required to rate only two locations. In reality, it is more likely that a firm would consider several alternatives in its choice of a location. If the two locations considered in this study are not representative of all of the alternatives that would be considered by the decision maker, it is likely that a derived model will reflect this bias. One way of overcoming this problem is to incorporate a wider range of alternatives in the survey method.

A second bias results from the hierarchical nature of choice processes (21). Since it is impossible for firms to consider all sites in an urban area in making a location decision, it is likely that they would reduce the number of alternatives to a workable number. The process of reducing the choice set may result in the decision maker looking at a group of alternatives that are very biased spatially. Any model built on this subgroup of alternatives is only valid for the final location choice and thus overlooks the initial choice-set decision. Attempts to overcome this bias can only be made if the entire location-choice process is investigated.

Finally, the point that was mentioned earlier in relation to the linkage between preference and choice should be emphasized. The model and the assumptions inherent in its construction apply to the respondents' preferences for particular locations. In fact, physical, institutional, and social constraints may prohibit a firm from choosing the preferred location. It may, in fact, choose a sub-optimal location. Therefore, more detailed knowledge about the process linking preference and behavior is necessary before the model can be applied with confidence.

CONCLUSIONS

This paper presents an analysis of factors that affect freight-facility location preference by using a multinomial logit model formulation. Because of the exploratory nature of the study and the relatively small sample size involved, the results can only be taken as preliminary.

This qualification notwithstanding, the results are encouraging. It appears that the factor-analysis technique used to minimize the correlation between attributes in the model was successful, and the modeling approach itself appears to be a suitable and potentially valuable approach to analyzing facility location preference.

The results of the model are also interesting and valuable. For the Melbourne data, the location decision can be modeled by using four attributes of the alternative locations: truck transportation, markets, site availability, and labor availability. Of these, the truck-transportation attribute was by far the most influential. This result is of value in a transportation planning context because it means that, by varying the transportation system and by influencing perceptions of the transportation attribute, the planner is able to have some influence on the location of freight facilities in urban areas.

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