Differentiation of Vacant Land-Use Change in the Densely Built-up Area

Vacant Land Change Detection in Barcelona, Spain 1974—1977

In Kim, Ph. D.*

CONTENTS

1. INTRODUCTION

Functional land-use classifications are often performed in urban areas for the purpose of updating maps, updating data, monitoring land-use change, implementing land-use plans, and so on.

* Assistant Professor, Department of Geography, College of Social Sciences, Seoul National University.

Vacant land, as one of functional land-use categories, was not specifically classified and recorded in these conventional land-use studies. However, most studies seem to simply identify the class of vacant land without paying attention to its changing aspects. Professor Chapin emphasized that "the purpose of classifying vacant land is to determine its suitability for various forms of urban development: for industrial, residential, recreational, and other classes of land uses".(1) And he further discussed various ideas of vacant-land study, but without going into specific consideration of the dynamic aspects of vacant-land change.

Studying change of development of vacant land requires sound knowledge so as to understand the process of vacant-land conversion into other land uses. It is also recognized that the dynamics of vacant land are even more important, not only in relation to academic research but also to make easier urban-development plans and to carry them out successfully.

A relatively new concept and practice of urban change detection is being developed by employing aerial photo interpretation technique.(2) However, the studies related to the concept urban change detection pose rather broad questions on the entire urban growth or change. Specific interest in the detection of change in vacant land has not flourished in both academic and practical fields.

Within built-up areas of a city, a considerable number of vacant lands is frequently found. The present study is interested in discussing and developing an idea of vacant land change detection without duplicating conventional land-use survey methods. To meet the purpose of vacant land change detection three specific questions are raised:

1) Where do the vacant lands often occur in built-up urban spaces?
2) How is the vacant land changed during a certain span or time? In other words: what are their current land uses?
3) Why are the vacant lands changed? In other words: do any regularities or patterns exist in vacant land change?

Through the sequence of the questions, the purpose of this paper is to analyze and explain general aspects of changing patterns of vacant lands within built-up areas of the

(1) F. Stuart Chapin, Jr., Urban Land-Use Planning, Univ. of Illinois Press, 1965, p. 300 and chapter 7.

(2) Bruce E. Howlett, "Determining Urban Growth and Change from Aerial Photograph Comparisons", Highway Research Record, No. 19, pp. 1-16.
ITC-Urban Survey, Enschede, the Netherlands, Urban Change Detection, Research project 1976-77.

city.

2. METHOD: RESEARCH DESIGN

To discuss the problems specified in the previous section, a design of research outline is made at an operational level.

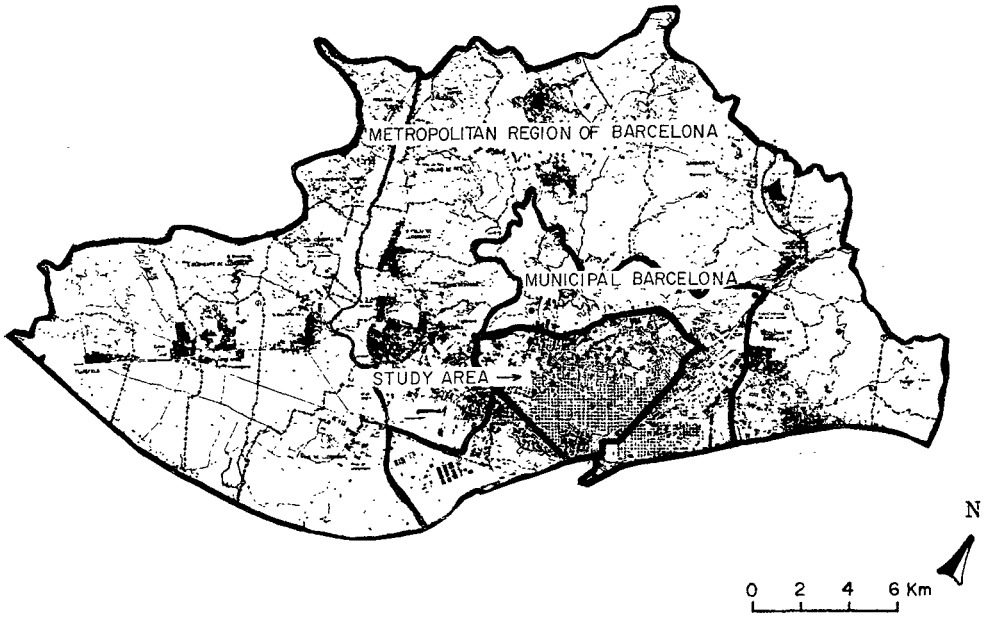
2.1 Definition of vacant land

The term vacant land to be dealt within this study is slightly different in concept from those which have been commonly defined by the conventional land-use studies. Vacant land is defined in this study as a parcel of land in which no land-use functions or building structures exist. Hence, in terms of land-use function, it is simply an idle land.

2.2 Delineation of study areas

The general area of study is shown on Map 1. The boundary of the study area mostly covers the heavily built-up areas within the municipality of Barcelona. Since the vacant lands which occur in the study area are surrounded by the heavily built-up sections of the city, it is not difficult to expect that their future land uses or developments will be more urban oriented rather than any other land-use functions. To determine the study area, a broader areal boundary can be depicted by the built-up areas in the metropolitan

MAP 1. STUDY AREA WITHIN BARCELONA



region of Barcelona.

However, the author is more interested in examining the vacant lands in the heavily built-up sections of municipal Barcelona than in the metropolitan region. Hence, the delimitation of the present study area is quite reasonable and operational, as it enables the author to obtain the necessary amount of data and to manipulate relevant data to be gathered through the vacant land change detection.

2.3 Interpretation of aerial photographs

To identify the vacant lands in the delimited study area, the technique of aerial photo interpretation was used. For this study, the 1974 coverage of Barceaona, photo scale 1 : 5000, has been used. Each aerial photograph was carefully scanned and interpreted to check the spots of idle lands by using a mirror stereoscope. Forty different vacant lands, of which the lot size is less than one hectare were arbitrarily selected by the author. Since the actual location of vacant lands in the city is rather uneven and the frequency of ocurrances varies from district to district in the built-up area, the distribution pattern of the forty selected sample vacant lands appears with an irregular distribution form, as illustratrated in Map 2. It represents approximately the same distribution pattern as the actual universal location of the whole vacant lands in the study area.

2.4 Field check

Field check for every spot of the forty vacant lands was performed in 1977 in order to examine whether they have been changed or not during the three years' period. If it is possible to obtain photo sets for two different years, for instance the 1974 and 1977 aerial photographs of Barcelona to cover the identical areas, the analysis of the change detection can be carried out by aerial photo interpretation technique in the laboratory without going out to do field work. Unfotunately, however, since the 1977 photographs were not available, it was not possible to detect change by using the technique of comparing two successive photographs.

2.5 The survey form for the recording of the change of vacant land

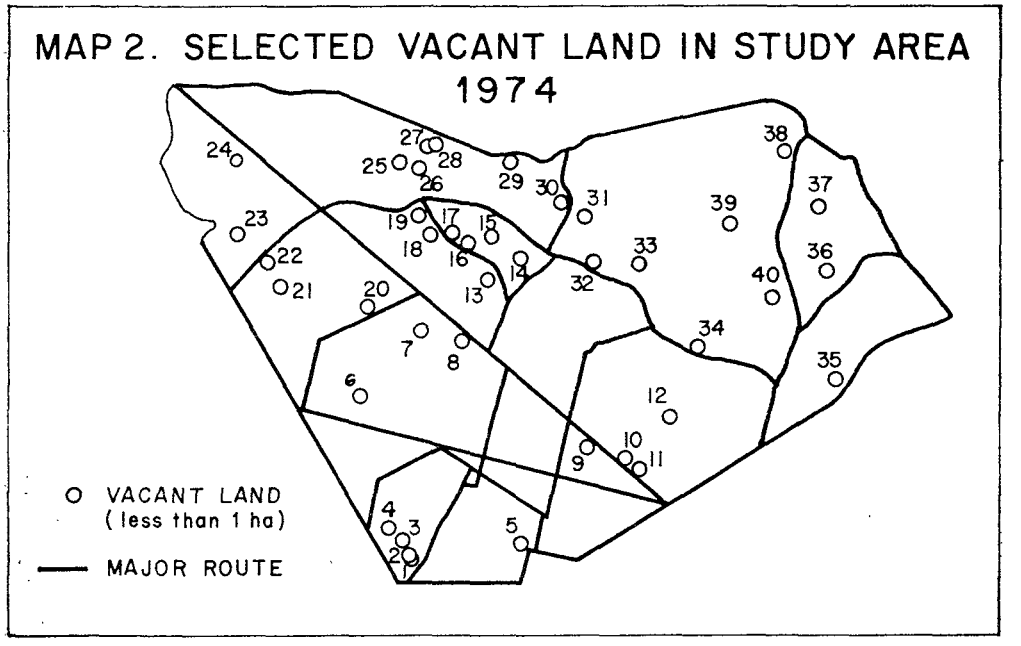
To get relevant information about the changing aspects of vacant land, a recording form for the field survey has been devised. (Table 1). Column one is used for the identification of the list of vacant lands, column two shows whether the particular vacant land has been changed or not, column three indicates current land-use function, column four measures the degree of land-use diversification by counting various functions to be checked in column three, column five describes in detail actual land-use types.

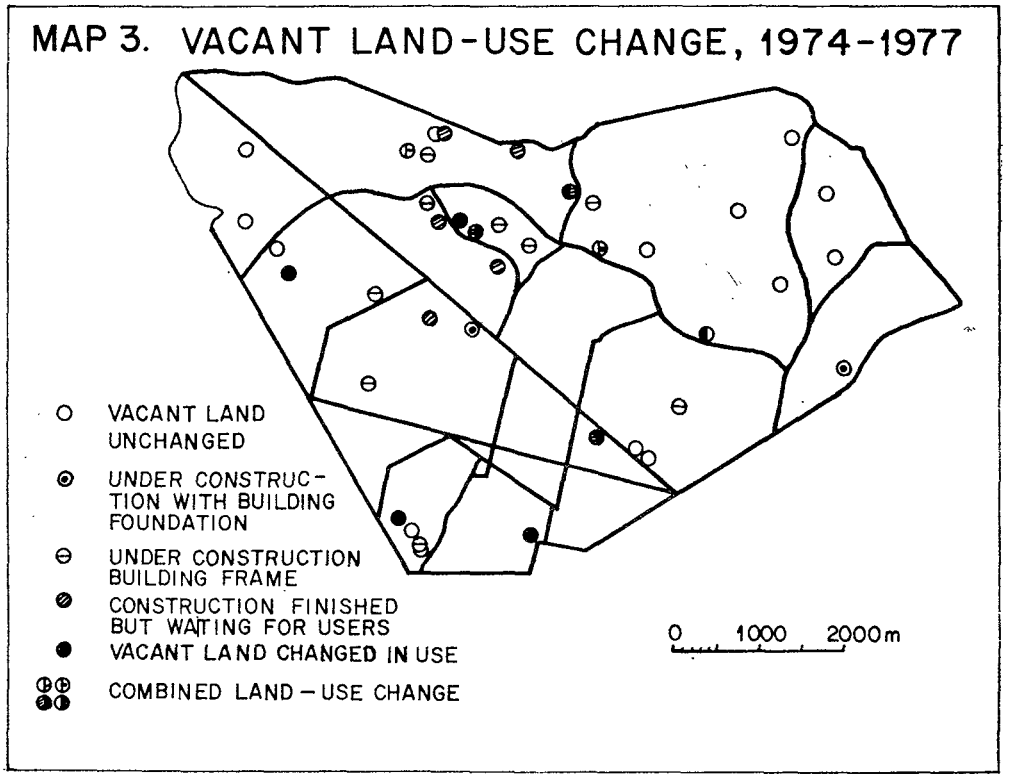
Table 1. Survey form of Vacant Land Change Detection

Date:
Surveyer:

Identified No. of Vacant Parcel in 1974	Change of Vacant Land in 1977			Current Land use function (on the ground level)									Land use diversification index	Current Actual Land use (on the ground level)	Highest building within the identified area (No. of storeys)			Dominant Land use function in the Surrounding Areas								
	No.	Party	Completely	0	1	2	3	4	5	6	7	8			0-4	5-10	<10	0	1	2	3	4	5	6	7	8

Functional Landuse class	Actual Landuse types
0 Vacant	Idle land
1 Commercial	Hotel, shop, supermarket, bank, etc.
2 Iustitutional	School, health, religion, culture, public/private office, etc.
3 Recreational	Parks, amenity green space, sports field, playground, garden, sports hall, estates, zoo, etc.
4 Entertainment	Theater (cinema), bar, cafe, restaurant, etc.
5 Residential	Detached, semi-detached, rowhouses, multi-family houses, special housing, etc.
6 Transportation	Parking lot, road, garage, railway station, bus terminal, etc.
7 Agricultural	Horticulture, farmhouse, brushes, forest, orchard, water body, etc.
8 Industrial	Warehouses, storages, building industries, processing production, utilities, etc.


MAP 2. SELECTED VACANT LAND IN STUDY AREA
1974
VACANT LAND
(less than 1 ha)
MAJOR ROUTE


MAP 3. VACANT LAND-USE CHANGE, 1974-1977
VACANT LAND
UNCHANGED
UNDER CONSTRUC-
TION WITH BUILDING
FOUNDATION
UNDER CONSTRUCTION
BUILDING FRAME
CONSTRUCTION FINISHED
BUT WAITING FOR USERS
VACANT LAND CHANGED IN USE
COMBINED LAND-USE CHANGE
0 1000 2000m

as itemized at the bottom of the table, column six counts the heights of buildings developed within the vacant lot in storeys, and the last column gives some general information about the land-use characteristics of surrounding areas of the particular land.

3. THE CHANGE OF VACANT LAND

As shown in the survey form for the field work, attention was paid just to the changing aspects of the vacant land on the ground level. In other words, in the case of vacant lots changed as building block, the groundfloors were examined and the current land use recorded. Then the upper floors were examined rather more generally to obtain other related information about changing dynamics of vacant land. The changing aspects of vacant land use from 1974 to 1977 in Barcelona show some degree of variation. Among the forty selected vacant lands, three types of vacant land changes have been recognized with respect to the vacant land development: lots not changed at all, which means the vacant land still remains idle. There are fourteen unchanged vacant land units out of forty, which represents 35.0% of the total vacant units. There are 13 lots under construction (33%). And 13 lots are complely changed (33%). This class included a land-use function that has been completely converted into another type of land use and building-construction is finished but is currently in no use and waiting for users.

The status of land development in these three distinguished categories could be described in greater detail. (Map 3): (1) 14 vacant lots, (2) four under construction with building foundation, (3) nine lots under construction with building frames, (4) five lots of building constructions completely finished but currently empty and waiting for the users, (5) eight vacant lands currently being used.

The actual current land uses in the previous eight vacant lands(4, 5, 9, 16, 17, 21, 30 and 34) include open parking space, garage, bank, shop and office on the groundfloors. On the other hand, the upper floors are mostly being used as residential units.

Six vacant lots have been partly changed, like the lots (9), (16), (25), (30), (32) and (34) within the combination of the land-development stages. (Map 3).

The measure of index of diversification of land-use function indicates maximum three in the lot (9), which serves as commercial, institutional, and entertainment land use at the ground level. Howevr, most vacant lots which have been changed serve now one dominant function, namely commercial land use.

All new buildings are multi-storey buildings. The height differences among the new

building constructions mean that only one building in the lot (14) is less than 5 storeys and in the lot (7) the building height is more than 10 storeys. The rest of the new buildings are in the height range of five to ten storeys.

The characteristics of the dominant land-use function in the surrounding vacant lands are found in general to be commercial. However, this characteristic is different from section to section in the Barcelona area according to whether the commercial activity has a city-wide orientation or is only locally oriented.

Finally, a curious phenomenon was found during the study of vacant land change detection. The fact was that there exists a time-lag condition in processing or developing vacant lands into another type of land use. First of all, in the analysis it was recognized that there are considerable amounts of vacant lands which are still empty without any change during the three years (14 vacant lots out of forty and 3 lots of partly vacant).

Even when the lots under construction are considered as functionless, 27 vacant lands out of forty (68%) are still in the state of no specific land use. Perhaps it means that it takes a certain period to convert a vacant unit into another functional unit in a land market mechanism. The time-lag cycles can be considered in the land-development stage due to such conditions as speculation, purchasing behaviour, owner's decision-making of the lot use, contracting specific building construction, actual duration of building construction, and so on. Upon such considerations and the present actual analysis it might be tentatively concluded that it takes at least more than three years to convert a vacant land unit into another actual land-use unit. This conclusion could speak more convincingly about the phenomenon of the time dimension of the vacant land change by considering earlier time sequences, for example the 1973 and 1967 aerial photographs.

4. DIFFERENTIATION OF VACANT LAND CHANGE WITH RELATION TO URBAN SPACE ACCESSIBILITY

4.1 Factors influencing vacant land change

It is intended in this section to discuss on a conceptual basis the major factors influencing the spatial variation of land-use change in relation to vacant land. The ownership of vacant land might have an effect on its development. Depending upon different land-ownership, for example, public, private or commecial developer, the type and duration of vacant land development will be different. Land value itself might also be a singnificant factor influencing vacant land development. In particular, land values

are directly related to effective demand, i.e. demand backed up by a capability of purchasing power, so that the actual demands and willingness to pay a given price for the land meet on the market.

Accessibility to vacant land in urban space is another factor to be taken into consideration. The locational situation of vacant lands, for example, near the city centre, near the main streets, or near main road junctions, will perhaps be a strong factor facilitating the development of these vacant lands, because under such conditions interaction potential is high. Institutional constraints, e.g. zoning system or municipal ordinances, will influence land change as a control factor. Even though an owner of vacant land is willing to develop his vacant land, if the land is reserved only for specific land use under zoning regulations, it might not be developed if the specific land use is in conflict with the landowner's own interest.

Site condition of vaccant land is another factor to be considered; according to the physical conditions of vacant land, e.g. lot size, slope, soil type, or bedrock of lot, the technical advantage or the development cost might become different.

4.2 Application of the theory of the economic rent function

On a conceptual basis, the possible major factors to influence vacant land change have been briefly discussed. Of course, those individual factors will have an impact on the eventual use of the vacant land under different condions. Therefore it is necessary to understand in an integrated way how these factors are related to change in vacant land.

However, the present analysis is not concerned with every possible factor influencing vacant land change. This study is rather interested in konwing how the spatial differentiation of vacant land change comes out in relation to the urban space accessibility condition.

From an econmic point of view, every land in a city tends to be used according to the principle of "the best and highest" content of land use. In other terms, land is used expecting the maximum returns under its locational situation. Hence, the condition of accessibility to the particular land is one of the most important factors determining profits from the use of the land. To the extent of applying the theory of economic rent function, the rational sorting process of agricultural land use[3] and urban land use spatial pattern[4] has been

(3) E.S. Dunn, "The equilibrium of land-use patterns in agriculture", Southern Economic Journal, Vol. 21, 1955, pp. 173-187.

(4) William Alonso, "A Theory of Urban Land Market", Papers and Proceedings, Regional Science Association, Vol. 6, 1960, pp. 149-157.

studied with respect to maximizing profits for the land users. If the accessibility to a certain land is high, the interaction becomes intensive in the location, and one is encouraged to use that land optimally.

Depending upon the location of the vacant land in relation to accessibility, the potential development of the land will become also different. Hence, the spatial differentiation of vacant land change over the urban space can probably be explained by utilizing the theory of economic rent function, other things being equal. It may be predicted that if a vacant land is more accessible than others, it will be more intensively used and even the duration of vacancy will become shorter due to the higher demands for that land.

4.3 Hypothetical approach to the problem

To test the question, the relationship between the vacant land change and vacant land accessibility, three alternative hypotheses are formulated: (1) differentiation of vacant land change due to the distances from the city centre, (2) differentiation of vacant land change due to the distances from the nearest main routes in the city, and (3) differentiation of vacant land change due to the distances from the nearest junction of the main routes in the city. Map 4 illustrates the three spatial models of vacant land change in order to picture the hypothetical statements described in relation to the conditions of accessibility. The map models are named as concentric zone models, route model, and junction model respectively. (See Map 4).

In Barcelona, the location of Plaza Catalunia is considered as the city centre. (See Map 4a). The major routes of Barcelona are shown in Map 4b. The major road junctions, where more than four streets meet, are considered to be bench marks for the accessibility analysis (see Map 4c).

The forty different vacant lands were already analyzed about their changing aspects in the previous section, and three distinguished types of vacant land uses have been recognized, as (1) no change, (2) under construction site, and (3) current actual use. In the following section, the spatial variation of the three distinguished types of vacant land change will be examined in conjunction with the three hypothetical statements.

4.4 Empirical assessment of the hypotheses

The frequent occurrence of the three distinguished types of vacant land change in particular concentric zones is investigated by the tabulated form as Table 2a.

As shown in Map 4a and Table 2a, there exists no vacant land at all within the 1000 meter distance zone from the city centre, Plaza Catalunia. In the other successive outer

MAP 4. MODELS OF VACANT LAND CHANGE IN RELATION WITH SPATIAL ACCESSIBILITY IN URBAN SPACE

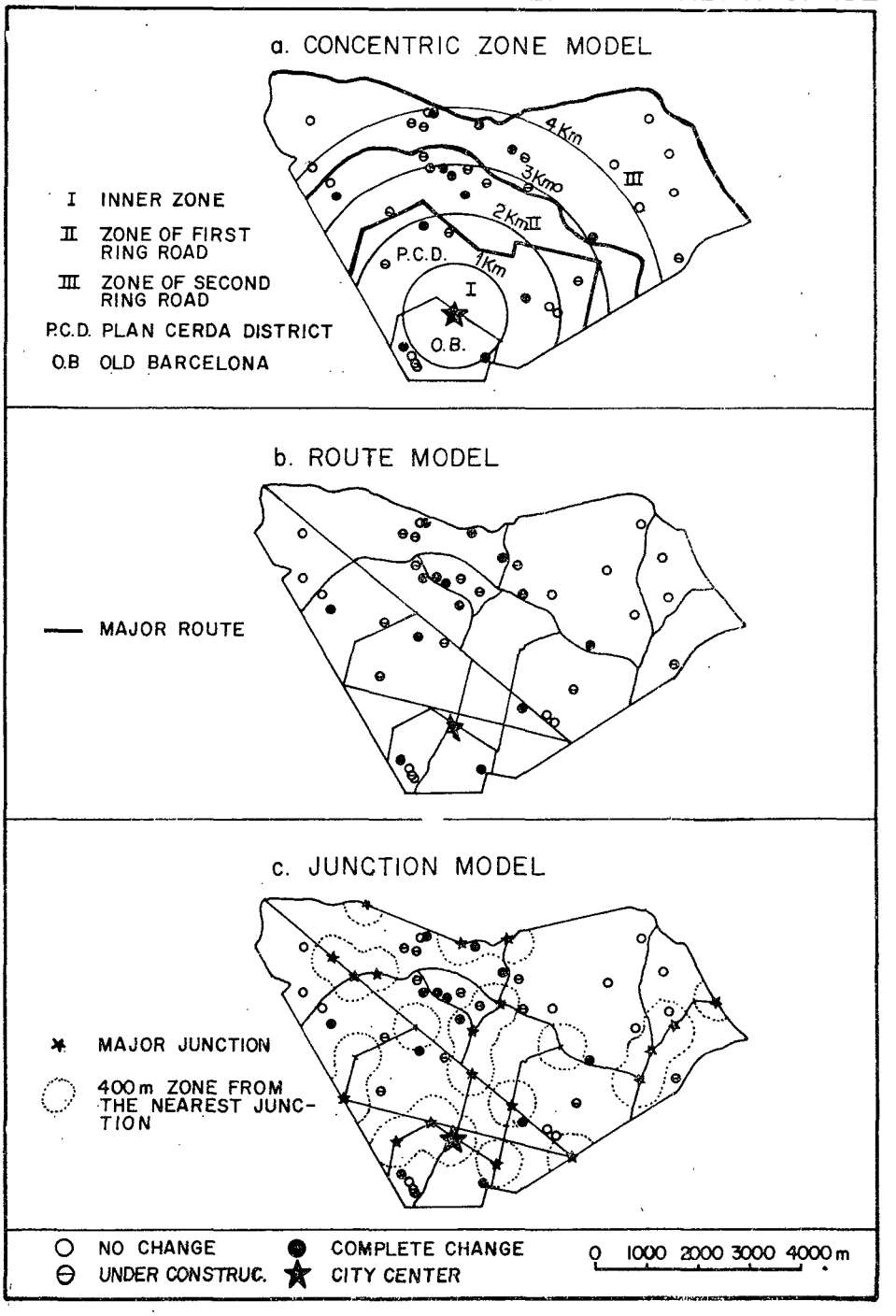


Table 2. Distance from city centre and vacant land change

	Dist. from city centre	Identified vacant land	No.	Land change		
				Vacant	Under constr	Changed
A	0—1km		0	0 (0%)	0 (0%)	0 (0%)
	1—2	1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11.	11	4(36%)	3(28%)	4(36%)
	2—3	12. 13. 14. 15. 16. 17. 18. 20. 32.	9	0 (0%)	5(56%)	4(46%)
	3—4	19. 21. 22. 23. 25. 26. 27. 28. 29. 30. 31. 33. 34.	13	4(31%)	4(31%)	5(38%)
	>4	24. 35. 36. 37. 38. 39. 40.	7	6(86%)	1(14%)	0 (0%)
			40	14	13	13
B	Inner city	1. 2. 3. 4. 5. 6. 7. 8. 9. 10. 11. 12.	12	4(33%)	4(33%)	4(33%)
	Zone of first Ring Road	13. 14. 15. 16. 17. 18. 19. 20. 21. 22.	10	1(10%)	4(40%)	5(50%)
	Zone of second Ring Road	23. 24. 25. 26. 27. 28. 29. 30. 31. 32. 33. 34. 35. 36. 37. 38. 39. 40.	18	9(50%)	5(23%)	4(22%)
			40	14	13	13

Table 3. Distance from the nearest major route and vacant land change

Distance from nearest route	Identified vacant land	No.	Land change		
			Vacant	Under constr.	Changed
0—100m	1. 5. 8. 9. 10. 11. 16. 17. 18. 19. 20. 22. 28. 29. 30. 32. 34.	17	4(24%)	4(24%)	9(52%)
100—200	2. 4. 13. 14. 24. 27. 31. 35. 38	9	3(33%)	4(44%)	2(23%)
>200	3. 6. 7. 12. 15. 21. 23. 25. 26. 33. 36. 37. 39. 40.	14	7(50%)	5(36%)	2(14%)
		40	14	13	13

Table 4. Distance from the nearest junction and vacant land change

Distance from nearest junct.	Identified vacant land	No.	Land change		
			Vacant	Under constr.	Changed
0—200m		0	0 (0%)	0 (%)	0 (%)
200—400	9. 13. 14. 29. 36.	5	1(20%)	1(20%)	3(60%)
400—600	4. 5. 7. 8. 11. 20. 30. 31. 32. 40.	10	2(20%)	4(40%)	4(40%)
>600	1. 2. 3. 6. 10. 12. 15. 16. 17. 18. 19. 21. 22. 23. 24. 25. 26. 27. 28. 33. 34. 35. 37. 38. 39.	25	11(44%)	8(32%)	6(24%)
		40	14	13	13

concentric zones from the city centre, however, the vacant lands appear. No vacant lands within core areas of the city might be due to the high accessibility from the whole city of Barcelona. Therefore, the great demand and high competition for the lands in the zone would not leave this area to be vacant.

On the other hand, within the 4000 meters outer zone from the city centre, seven vacant lands among forty are counted and among the seven vacant lands six remain still vacant

and one is under construction. Thus, the vacant lands in this zone have not yet been converted into a real use. In general, the picture of change among the forty vacant lands represents a pattern in which the nearer a vacant land is to the city centre, the more its likelihood of change.

The changing aspect of the concentric zone pattern is also obvious when the location of the forty vacant lands is examined in the actual concentric zonal districts of Barcelona; for instance in the inner zone of the city including the areas of old Barcelona and Plan Cerdá, in the middle zone of the first ring road, and in the outer zone of the second ring road. (See Table 2b).

The second hypothesis, the matter of the distances from the nearest major route, has also been examined by the tabulated form of Table 3. Among the forty vacant lands, seventeen are located within the 100 meters distance from the nearest major streets or avenues. The four vacant lands among the seventeen are still left as vacant lots, while nine have completely changed. The nine vacant lands are located within the hand of 100 to 200 meters from the nearest major routes, which are approximately two blocks from the nearest route. In this case, three lots among the nine are still vacant and lots have been completly changed. As we examine in detail the changing aspects of vacant lands in relation to the distance from the nearest routes, it is also found that those nearer to the major route tend to change more.

Finally, the third hypothesis has also been tested by the tabulated form (Table 4). In both the Map and Table analysis it is also found that if the location of vacant lands is nearer to the major route conjunction, complete change of vacant lands occurs more frequently, and vice versa. In the continuum of the distance categories in each model, particularly within both extreme interval categories, the occurrence frequencies of the three distinguished types of vacant land changes are inversely related to the distances. Based upon the assessment of the statistical figures, it can be concluded that the results of the three hypothetical approaches have their own merits in arguing and understanding about the existence of the relationship between the spatial differentiation of vacant land change and the vacant land accessibility.

5. CONCLUSION

The scope of this study was confined to mainly detecting the change of vacant lands and to understanding the phenomenon of differentiation of vacant land change in relation

to vacant land accessibility in the urban space.

To obtain the necessary data for vacant land change detection, the aerial photo interpretation technique was employed and in the process of detecting vacant land change, a field survey was carried out along with the aerial photo analysis.

The idea of economic rent function was applied to explain the relationship between the condition of accessibility to vacant land and its impact upon vacant land use and/or development. Three hypothetical approaches could prove the fact that there exists a tendency of spatial differentiation of vacant land change according to the degree of the vacant land accessibility over the urban space. Of course, the approaches cannot be entirely effective in taking into account the full range of the spatial phenomenon of vacant land change. However, in terms of shedding light on the dynamics of the vacant land change, the result of this study will provide certain amounts of benefits for digging up more fruitful knowledge, not only for the present subject matter but also for the more complex urban growth and change problems.