

EDGAR FALKNER*
Surdex Corporation
Chesterfield, Mo. 63017

Land Use Changes in Parkway School District

Periodic photo study can be an asset
in predicting future land use trends.

INTRODUCTION

THIS TEXT REPORTS a study involving short range time lapse aerial photo analysis to determine physical land use changes in the Parkway School District, which is located in central St. Louis County, Missouri (Figure 1). In terms of land surface the Parkway District is one of the largest in St. Louis County. Encompassing approximately 40,380 acres this particular district is larger than the city of St. Louis. Consolidated in 1954, Parkway was, by September 1965, ranked as eighth in student enrollment among the 25 St. Louis County school districts. The September 1966 enrollment has subsequently elevated this relative position to fourth. Parkway is currently purported to be the fastest growing public school district within the state of Missouri. Although now classified as semi-rural, the district is undergoing a rapid metamorphosis toward urban stature. Today eight incorporated suburban communities are within the geographic confines of this school district.

THE STUDY

In order to fulfill the intent of this study it was decided to initiate a series of aerial photo samples to determine various land use proportions at periodic intervals. This evidence could be coupled with discrete district facts to investigate the possibility of corroborative analogies. Aerial negatives covering St. Louis County were immediately available for the years 1960, 1964 and 1966. Negatives had been exposed during late winter and were

* Submitted under the title "Land Use Changes in the Parkway School District, 1960-1966."

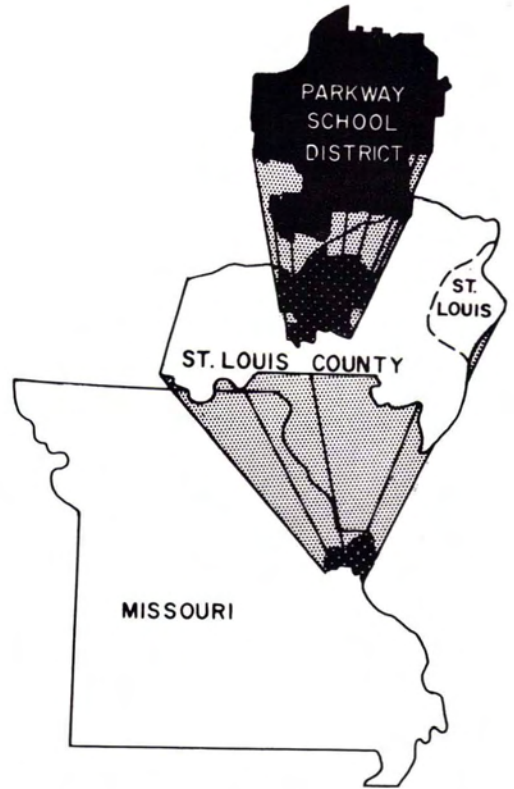


FIG. 1. An exploded view showing the relative location of the site discussed in this text.

characteristic of mid-term school years 1959-60, 1963-64 and 1965-66. A statistically oriented photo point sample was executed to evaluate the land usage for each of the three photographic periods, and photo sampling was intended to conform to an accuracy tolerance within 1.5 percent in urbanized areas. A total of 13,233 photo points were randomly selected, stereoscopically examined, and interpreted as to use (Table I). Initially, these sample points were separated into four land use classes: rural, urban, water, and woodland. Urban class points were further categorized as commercial, public service, residential, or transportation. Admittedly, no attempt was made to ascertain the veracity of this photo sample by a field check. Interpretive checks relied upon reference to published 15-minute U.S.G.S. quadrangles of a fairly recent date as well as consultation with several local inhabitants whose first hand knowledge of the area was gained by lifetime association. Individual sub-classes within the urban group designation are not necessarily ex-

TABLE I. TABULATION OF THE NUMBER OF PHOTO POINTS SAMPLED IN EACH PHOTOGRAPHIC PERIOD ACCOMPANIED BY THE RESULTANT SIGNIFICANCE OF THE URBAN CLASS SAMPLE

Year	Total Points	Significance
1960	3805	±1.38%
1964	4568	±1.37%
1966	4860	±1.35%

pected to maintain the same order of precision as the total urban class, but they are reasonably acceptable trend indicators. A graphic presentation of the percentages of sample falling into each basic land use by

were forthcoming for the entire study period (Figure 5). Since annual census tallies are nonexistent, population estimates for each school year were reckoned by the formula:

$$\text{Total Population} = \frac{\text{Spring Enumeration}}{0.24}$$

According to the 1960 national census the Parkway population was 14,619 residents and the 1960 spring enumeration totaled 3,529 school age children; hence, the constant divisor of 24 percent was assumed for ensuing annual population estimates.

During the 1960-66 period the proportion of the spring enumeration actually comprising public school enrollment averaged 84 percent, while the remaining portion of the eligible

ABSTRACT: This personal study was initiated to emphasize the use of time lapse photography in determining short range land use changes in the Parkway School District through periodic photo inspection. Sampled land use data was coupled with pertinent information obtained from the School Superintendent, and upon comparing these data certain trends are immediately recognizable. Periodic photographic study provides visual documentary proof as to the consistent development of this school district as it swings from a rural setting toward a typical suburban community.

study period is found in Figure 2, and subclass portions within the urban class are shown in Table II.

Survey findings disclosed that water and woodland areas were practically static. On the other hand, rural areas have been urbanized at a credibly constant rate. Comparisons of the rural and urban trends are presented in Figure 3. It should be noted that the urban parameters are depicted as dual juxtaposed curves in which the lower line represents established suburban development only, whereas the upper line embraces both intact urbanization and apparent urban fabrication. A selected portion of the district in which land use change is readily discernible through time lapse photography is shown in Figure 4. This illustration is not intended to imply that this immediate area is wholly indicative of the exact degree of change in all sections of the district; instead, it is presented to convey the striking change patterns observable in the relatively short time span of this study.

The Office of the Superintendent of the Parkway School District was most helpful in furnishing pertinent statistics for this study. Annual peak public school enrollment data

children attended educational institutions other than the Parkway public schools. It was desirable to calculate the number of households within the district limits, and this was accomplished simply by dividing the average number of persons in a typical suburban St. Louis County household (3.5) into total population. As a matter of fact, the national average number of persons per household is steadily increasing, whereas in St. Louis County during the past several decades the number of members in the average household has been decreasing.

TABLE II. BREAKDOWN, EXPRESSED AS PERCENT OF TOTAL LAND SURFACE, OF EACH CATEGORY WITHIN THE URBAN CLASS

Land Use Class	Year		
	1960	1964	1966
Residential	15.4	21.5	23.6
Public Service	4.7	5.3	5.9
Transportation	3.5	4.2	4.8
Commercial	1.7	2.2	2.3
Total Urban	25.3	33.2	36.6

Results of these population and household computations for each mid-term school year are posted in Table III. It is realized that these formulations do not render indisputable statistics; hence, the figures presented are to be considered strictly as logical estimates. As in any school district, a perceptible increment in student enrollment creates a need for additional facilities. Location of existing Parkway public education structures are pinpointed on the map in Figure 6 (left).

COROLLARIES

During the 1960-66 period there was a total urban increase of 11.3 percent with a corresponding rural decrease of 11.2 percent. Based on these factors, and considering that water and woodland changes were almost neutral, it seems a logical assumption that urbanization was occurring only in what were previously rural areas. Consequently, there was a total expansion of over 242 percent in public school enrollment during the seven years. A list follows of the total increase in

urban subclass land uses where the degree of change is expressed in relation to total land surface: Residential 8.1%; Transportation 1.3%; Public Service 1.2%; Commercial 0.6%.

These factors tend to point out that, in terms of land area:

- The bulk of urban evolution was residential.
- Public service and transportation development were of equal magnitude.
- Commercial change was about half as great as transportation or public service.

According to this study a 1 percent expansion in suburbanization has produced a 21½ percent accretion in public school enrollment.

Surmising that the near future rural-urban conversion rate continues as the recent past trends indicate, it is conceivable that rural predominance will bow to urban supremacy prior to the beginning of next school year. Parkway is said to have an ultimate saturation of 48,000 public school students with an attendant population of 230,000 persons in some 65,000 households, and it has been

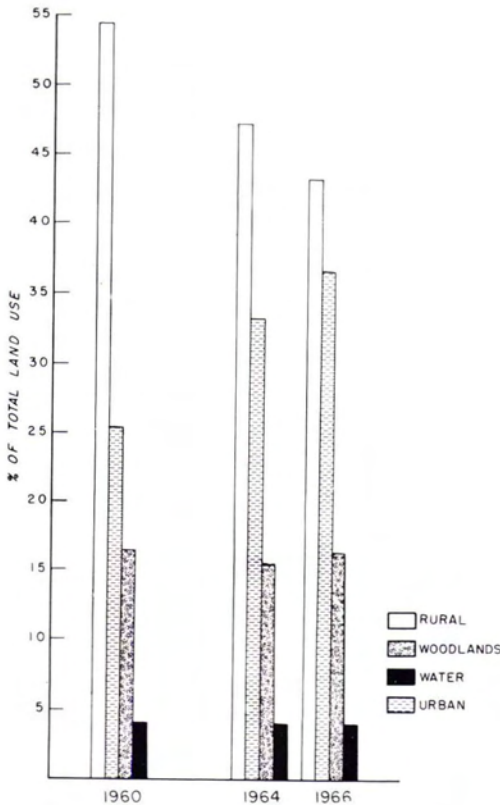


FIG. 2. Relative portions of the Parkway School District devoted to the four basic land use classes as discussed in the text.

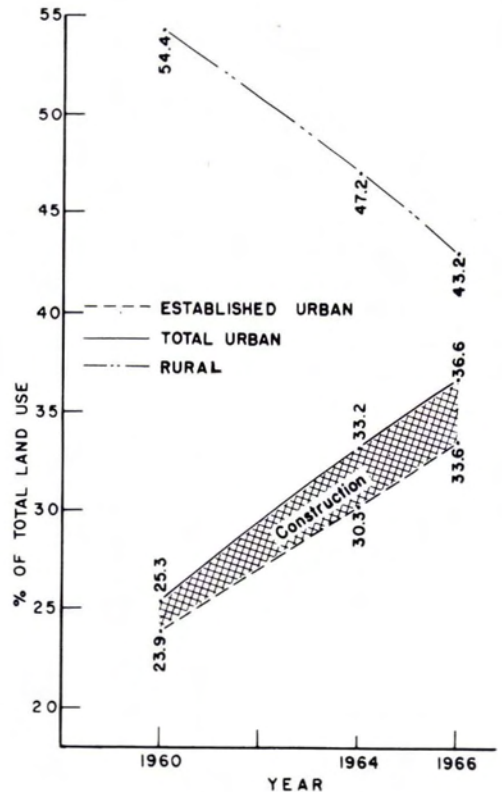


FIG. 3. A comparison of the trends of rural and urban land usage with the urban portion showing established urban as well as construction.



FIG. 4. A selected portion of the Parkway School District which exemplifies land use change during the three photographic periods. *Top*—1960; *center*—1964; *bottom*—1966.

TABLE III. A TABULATION OF THE VARIABLE FACTORS HIGHLIGHTING TRENDS IN THE PARKWAY SCHOOL DISTRICT

Variable	School Year						
	1959-60	1960-61	1961-62	1962-63	1963-64	1964-65	1965-66
Enumeration	3,529	4,185	5,272	6,503	8,496	10,427	12,421
Population	14,619	17,440	21,970	27,100	35,400	43,450	51,750
Households	4,175	4,980	6,275	7,740	10,115	12,415	14,785
Peak Enrollment	2,474	2,826	3,674	4,702	6,004	7,673	9,677
Personnel—							
Teachers	120	132	155	205	273	339	409
Non-teachers	63	76	93	117	156	182	215
Buses	18	19	21	25	33	43	47
Acreages—							
Residential	6,218	6,834	7,450	8,066	8,682	9,106	9,530
Public Service	1,898	1,958	2,019	2,079	2,140	2,261	2,382
Transportation	1,413	1,484	1,555	1,626	1,696	1,817	1,938
Commercial	686	737	787	838	888	909	929
Urban (total)	10,215	11,013	11,811	12,609	13,406	14,093	14,779
Rural	21,968	21,251	20,534	19,816	19,100	18,272	17,444
Woodland	6,582	6,501	6,420	6,340	6,259	6,400	6,542
Water	1,615	1,615	1,615	1,615	1,615	1,615	1,615
Dwelling Cover	1,171	1,262	1,353	1,444	1,534	1,595	1,656
Urban Construction	565	716	868	1,019	1,171	1,191	1,211

forecast that this density will perhaps be attained sometime during the 1980-85 period. Population densities (expressed as the number of persons per urban acre) during the photographic periods were: 1960—1.4; 1964—2.6; 1966—3.5. At ultimate saturation the population density could conceivably approach seven persons per improved acre.

In past years habitation has been predominately of a scattered nature comprised of large estates, isolated rural homes and small scattered groups of houses. Present mode of urban development is pointed toward the contemporary design of high-density suburban subdivisions with the accessory buildup of large-scale shopping centers. Current district zoning is delineated on the map in Figure 6 (*right*), but it is not an entirely unreasonable conjecture to presuppose future modifications. Zoning appears to be premised upon eventual development of about 80 percent residential. An overall picture of the yearly changes in the Parkway School District during the 1960-66 period is tabulated in Table III. Actual values are presented where available, supplemented by the best practical estimates and straight-line interpolations.

CONCLUSION

It would be folly to suggest that time lapse aerial photo analysis solves all of the planning

problems for educational agencies, but the author believes that, where periodic photo coverage is now available or future planning can make it available, certain of these agencies could advantageously insert this system into prognosticative procedures. When properly applied, periodic photo study can be a definite asset in determining past land use trends, which have a definite value in predicting future patterns.

ACKNOWLEDGEMENTS

There is no denying that this text was made possible only because of the aid provided by those other than the author. Personnel in the Superintendent's Office of the Parkway School District were most cooperative and helpful in supplying pertinent information. Special thanks are extended to Frederick Rehkopf for his unstinted aid and critical review of this text. Facilities made available

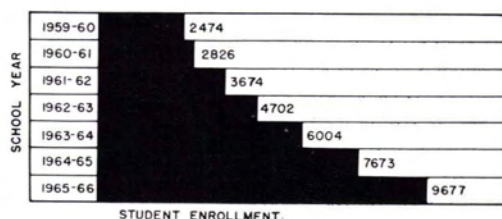


FIG. 5. Yearly peak public school enrollment.

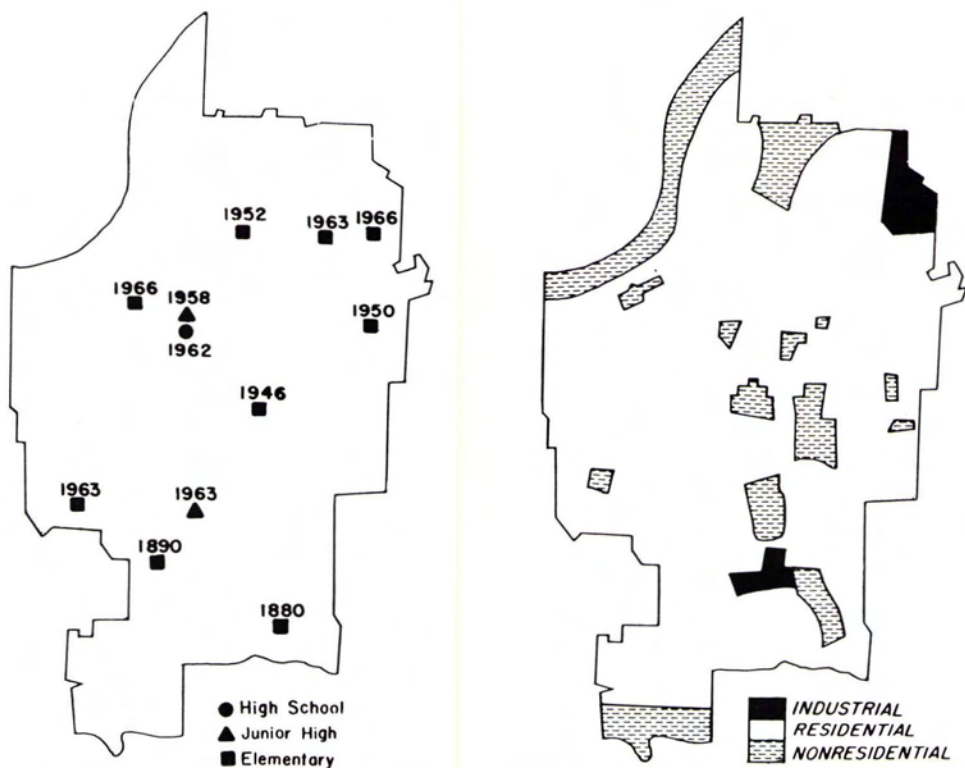


FIG. 6. (Left) Locations of existing public school facilities with the date when each site originally supported an educational structure. (Right) Current county zoning of the Parkway School District.

by Surdex Corporation were necessary for completion of this study, and the cooperative efforts of James Walker were most appreciated.

REFERENCES

American Society of Photogrammetry (1960); *Manual of Photographic Interpretation*; The George Banta Company, Inc.; Menasha, Wis.
 Arkin, Herbert and Raymond R. Colton (1939); *An Outline of Statistical Methods*; Barnes & Noble, Inc.; New York, N. Y.
 Avery, T. Eugene (1962); *Interpretation of Aerial Photographs*; Burgess Publishing Company; Minneapolis, Minn.
 Board of Education (1966); *General Information for New Residents of the Parkway School District*; Parkway School District; Chesterfield, Missouri.
 Forbes, Reginald D. (1959); *Forestry Handbook*; The Ronald Press Company; New York, N. Y.
 Lueder, Donald R. (1959); *Aerial Photographic Interpretation*; McGraw-Hill Book Co., Inc.; New York, N.Y.
 Odell MacConnell Associates (1966); *A Master Plan for School Facility Needs in Parkway School District*; Odell MacConnell Associates; Palo Alto, Calif.

See announcement of 1968 Congress in Switzerland on page 104.