

AERIAL MAPPING USED IN REGIONAL HIGHWAY PLANNING

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SYNOPSIS

Air photographs and air maps have been used more and more effectively during the past 18 years, which the officials of the many jurisdictions comprising the metropolitan region of Chicago have collaborated in planning street and road work.

Air photographs and maps were used by the Cook County Highway Department to plan the construction of an express highway from the central business district of Chicago to connect with the major highways at the northwesterly city limits. The photographs were taken from directly above the center of each quarter-section of land and when assembled provided a mosaic of the whole area. Generalized land value maps and maps showing all buildings, with their character and use were also used.

From these photographs and maps it was easy to study a number of alternative routes. Similar practices have been followed by almost every highway agency within the area.

Unusual, in the planning process, is the established practice in the Metropolitan Region of Chicago in which the many public highway officials have collaborated in programming, planning and scheduling highway and street construction work. The large number of municipalities which almost completely ring and radiate from the central City of Chicago, the 15 near-in counties (three in Indiana, three in Wisconsin and nine in Illinois) and the three States themselves with Public Roads Administration aid have carried forward a surprisingly well integrated improvement program for the past 18 years or more.

During that period, air photographs and air maps have been used more and more effectively. The early oblique photographs, without reference to topography, helped the state and county highway engineers to visualize greater lengths of the routes to be improved. When the vertical air photographs and the mosaic maps reached greater degrees of accuracy, their use increased more rapidly.

During the late 1920's the Chicago Regional Planning Association obtained a series of air map mosaics of portions of the great belt of Cook County Forest Preserves, now 36,000 acres in extent. These were worn thin, not only by forest preserve officials in planning their required public facilities, but also by the State and county highway engineers who were persuaded to border these preserves, not slash great rights-of-way across them, largely as a result of study of the air map themselves.

Municipalities were persuaded to obtain

mosaic maps of their own areas, including the surrounding territory, in order that they, too, might better visualize the local street system and its relation to the principal highways, and thereby plan more adequately for protection of their residential neighborhoods.

Among the highway agencies which have utilized air photos and air maps, the Cook County Highway Department has not only made effective use of air photography, but has applied two other sources of information with unusually effective results. Directed by the Board of Commissioners to plan the construction of an express highway within the City of Chicago and extending from the central business district northwesterly to connections with major highways at the city limits, Major George A. Quinlan, County Superintendent of Highways, obtained a complete set of air photographs, of a wide belt of the City of Chicago within which this route would lie. These photographs were taken from directly above the center of each 160 acre quarter-section of land, and were printed at a scale of 1 inch to 200 ft. They were fitted together, and for all practical purposes served the purpose of a mosaic with the advantage that they could be taken apart and studied in further detail. The photographs were made by the Chicago Aerial Survey Company, and a typical fragment is shown in "Chart 8"¹

¹ A limited number of copies of Charts 8, 9 and 11 are available for distribution at the office of the Highway Research Board, National Research Council, Washington 25, D. C.

On these maps several alternate alignments were sketched, selecting the least densely occupied locations, so far as they could be determined from the air photographs. Consideration was given to the widths required for the express highway traffic lanes which would be above or below grade, the additional space required for slopes in the cut or fill sections and for the side or access street pavements on the surface. Of course, study was made of the layout of the approaches to the main intersecting arteries where access should be given and to the design at intersecting streets which would not be carried across the express highway. In turn, this also involved the future treatment of those streets which would be interrupted—the present occupancy of their frontage for one or more blocks away, their classification under the zoning ordinance and the possible claims for damage.

From the air photos the locations of neighboring industries, parks, schools and churches could be visualized and some of the more obvious decisions could be made fairly early in the study.

Parallel to the air photographs was the compilation of generalized land value maps. From the records of valuation for assessing purposes, and from long experience in buying and condemning lands for county highway purposes, which experience gave the actual relation between assessed valuation and purchase price, maps were compiled showing the estimated cost per square foot to acquire each block which might be traversed by the express highway. Using this generalized map, which was colored to portray values on three different bases—under \$1.50 per square foot; \$1.50 to \$2.99 per square foot, and \$3.00 and over per square foot—the objective was, of course, to follow the lowest cost route where such a location would be as good in all other respects as a more costly one. A small section of the original map is shown in "Chart 11".¹

Still a third source of information, readily available, was the set of Sanborn Fire Insurance maps. Among other things these maps accurately show every building, its height in stories (generally), whether built of frame, brick, concrete or structural frame, and usually the use to which it is put—dwelling, apartment, store—and the owner, if a large industry. A unit of one of these insurance map sheets is shown in "Chart 9".¹

Combining the use of these air photographs, land valuation maps and Sanborn maps showing structures, a series of preliminary locations and combinations of routes, with their costs, could be studied with a greater degree of accuracy, and at considerably less expense for such reconnaissance than in any other way. The relatively large scale of the air maps, and the breadth of the band covered by them gave the highway engineers full information concerning the character of the neighborhoods being traversed.

As a result of this collaborative work, including the exhibiting of the several sets of maps to the many officials and civic agencies, the conclusions of the engineers have been generally accepted, and the smallest number of local objections and political repercussions has occurred.

Although this one study by the Cook County Highway Department within the City of Chicago is the only one described here in detail, the same practice with some variations has been followed by almost every state and county highway agency which has responsibility for highway improvements in the Metropolitan Region of Chicago.

As many as twelve different alignments and combinations of locations were first laid out, then these were boiled down to a smaller number of routes that could be considered feasible, and then field-checked repeatedly. When field checking was done it was found that the preliminary conclusions were generally sound. The revised layout of local streets and their traffic flow, the possible interference with local neighborhood affairs such as shopping, attendance at churches and schools, and the use of parks and playgrounds, all had been fairly well visible from the air maps.

The highway engineer who has the job of designing and building a new limited access highway through a large metropolitan center such as this statement describes, of necessity has many things beside the highway itself to consider. Any disturbance of neighborhood business centers and their approaches, of industries large and small, of the layout of the area tributary to public and parochial schools, of the accessibility of churches to their congregations and parishioners must all be weighed with great care and reduced to a minimum. These factors are of real importance comparable to the engineering problems of drainage,

of readjustment of other existing underground utilities including sanitary sewers, water and gas mains, telephone and electric power installations and the many other costly investments in underground as well as overhead work.

Actually, the air photographs have proved an invaluable method of making reconnaissance surveys, and it is doubtful if the location and design of any of the limited access routes now

being planned within the densely built up areas of the Region of Chicago will be finally determined upon without the use of such air photographs.

In studying and weighing all of these detailed matters, the Cook County highway engineers were constantly in close touch with the staff of the Chicago Plan Commission, the zoning authorities and the engineers for all of the overhead and underground utilities.

AERIAL PHOTOGRAPHS AND THE DISTRIBUTION OF CONSTRUCTIONAL MATERIALS

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SYNOPSIS

Any means that speeds the mapping of extensive foundation areas and helps in the location of materials for borrow purposes is immediately valuable. Aerial photographs record individual and distinctive photographic patterns and textures of the different types of soil and rock. It is the interpretation and mapping on the basis of limited sampling, that lend value to the aerial photographs.

By sampling at the critical places revealed by aerial photographs, the respective soil or rock types can be identified over wide areas.

Sources of data on the distribution of constructional materials in an area are contained on soil maps and geologic maps; and aerial photographs should be considered as another form of map for distribution studies. Since detailed soil and geological maps are not available everywhere, aerial photographs may be the only source of information preliminary to field surveys. Aerial photographs may best be interpreted by considering them as soil maps or geologic maps. Soil and geologic maps are briefly described, and their relation to aerial photographs is illustrated. The examples chosen demonstrate the great utility of aerial photographs in mapping soil types as well as hard rock formations.

The engineer in charge of soil and rock investigations for an airport or highway project will appreciate any method that speeds up the survey work necessary to secure accurate information on the nature and distribution of the constructional materials. Aerial photographs are being used advantageously to this end, and already several publications (11)¹ have appeared that demonstrate their utility in soil and bedrock mapping. The present article is chiefly a summary of the earlier reports.

¹ Numbers in parentheses refer to the list of references at the end of the paper

AERIAL PHOTOGRAPHS AS DISTRIBUTION MAPS

Aerial photographs record individual and distinctive patterns and textures of the different types of soil and rock, and the boundaries of these types can usually be readily traced on the photographs. A soil or rock sample of each photographic pattern will usually serve to identify the material of the entire area of the distinctive pattern. It is this feature, viz, interpretation and mapping on the basis of limited sampling that lends value to the aerial photographs. The boundaries are commonly revealed in a detail not caught by ground surveys, and often variations are recognized