

covered varied in width between 2 and 3½ mi over the 25-mi length. These were enlargements of 1 in. equals 300 ft made from photography of 1 in. equals 1,000 ft.

There are now enlargements for immediate and future use, for nearly 300 mi of highway locations for all presently planned Interstate, Primary and Secondary Federal-Aid, and State Projects (except spot hazard removal work).

Both time and money are being saved by using this medium. Also, better information is being obtained, providing the appraisers with means of making better and more realistic appraisals, and have an additional and better means of presenting the case to the owner and when necessary before the Board and in Court.

The Legal Section has stated they believe about \$10 per title or \$150 to \$200 per mi is being saved. Drafting time saved per project is running \$50 to \$100 per mi. Appraisal cost has been reduced about \$10 per appraisal or about \$150 to \$200 per mi. The other possible savings have not been estimated. Time-saving and better results are the most important things that use of this procedure has accomplished. The Commission is now current with the construction divisions and is expected to remain so even though it is furnishing appraisal and negotiation sections with material that was previously not possible.

Use of Aerial Mosaics and Photogrammetry

In Right-of-Way Acquisitions

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• THE Michigan State Highway Department executed its first contract for an aerial survey on September 22, 1925. An excerpt from the contract states "we will desire to do enough work in the neighborhood to find out the value of this 'sort' of mapping to us in hilly country." As a result of this contract, made with Talbert Abrams, the Department was furnished with an uncontrolled mosaic of photographs taken at a scale of approximately 800 ft per in. The aerial mosaic was subsequently used to establish the alignment for a particularly scenic section of US 31 near Beulah. The photographs were taken with a World War I Eastman camera from a standard J-1 90-hp World War I training plane.

Apparently the highway officials at that time recognized the value of this "sort" of mapping immediately, because the Department has had contracts with Abrams Aerial Survey Corporation for aerial mapping every year since.

Immediately after World War I, the people of Michigan demanded a system of weather-proof roads to get them out of the mud. By the middle of the 1950's their children and grandchildren were demanding a road system that would free them from the strangling python of traffic that had grown up to choke the very life of the State.

The national government being aware of highway needs of the entire nation, provided a great boost with legislation authorizing a national system of interstate highways to be completed in 1975. The Michigan legislature, heedful of the demands of the populace, authorized the Highway Department to borrow money through the sale of bonds to speed the construction of the Interstate System, and a system of arterial freeways and farm-to-market State roads. Michigan expects to complete this system by 1967, and at a cost of \$2 billion.

Confronted by a program of this scope, the State administration is using every advanced engineering tool available in order to meet the program deadlines. One of these valuable tools is photogrammetry. Photogrammetric methods are used in all phases of work prior to contract letting. One of these phases includes the use of aerial mosaics and photogrammetry in the acquisition of rights-of-way for the projects. It has been found that aerial mosaics can be used to a great advantage in land evaluation work during the study of alternate project alignments, and that the same mosaic can be used to

start the actual right-of-way acquisition processes, and actively to purchase parcels for the road project as soon as the alternate lines are weighed and the final alignment chosen.

Figure 1 shows a portion of a photographic mosaic used in the location studies for



Figure 1. Portion of photographic mosaic used in location studies for Interstate 75 northwest of Detroit.

Interstate 75 northwest of Detroit. Three locations were studied within the given area. After weighing the advantages of each, the line shown in detail was selected. Land ownership boundaries are indicated for each land parcel affected by each line for the use of appraisers evaluating right-of-way costs.

It is from such mosaics that right-of-way acquisition processes are started on projects that are expected to require considerable amounts of time to secure the land parcels. In cases, this plan of action has saved a considerable amount of time. Of course, a few slips have occurred in getting too far ahead of the design process. However, it is believed that the few errors made are insignificant when the over-all accomplishment is considered.

Figure 2 shows a portion of Interstate 94 just north of the City of Detroit and in the City of Saint Clair Shores. This project is an extension of the now-completed Edsel Ford Freeway which traverses Detroit from west to east. The original right-of-way for this project was ordered from a 200-ft-per-in. mosaic used for the route location studies. All parcels wholly enclosed within the necessary right-of-way, as determined on the route location studies, were purchased or negotiations for purchase were started before the beginning of the detailed plans. The view is the complete coverage of a finished right-of-way plan sheet showing the following:

1. The right-of-way requirements for that portion of the project shown.
2. The platted subdivisions, streets and service alleys.
3. Excess properties resulting from the purchase of entire lots or parcels.
4. The construction limits for the project (slope lines).

This plan is used by right-of-way personnel for the the following purposes:

1. Appraisals of properties to be purchased and retained for highway use.
2. Appraisals of excess or residual parcels to be disposed of by public sale.
3. Negotiations with property owners.
4. For visual record of lands and improvements prior to construction.

Right-of-way plan sheets such as that shown in the figure are reproductions scaled

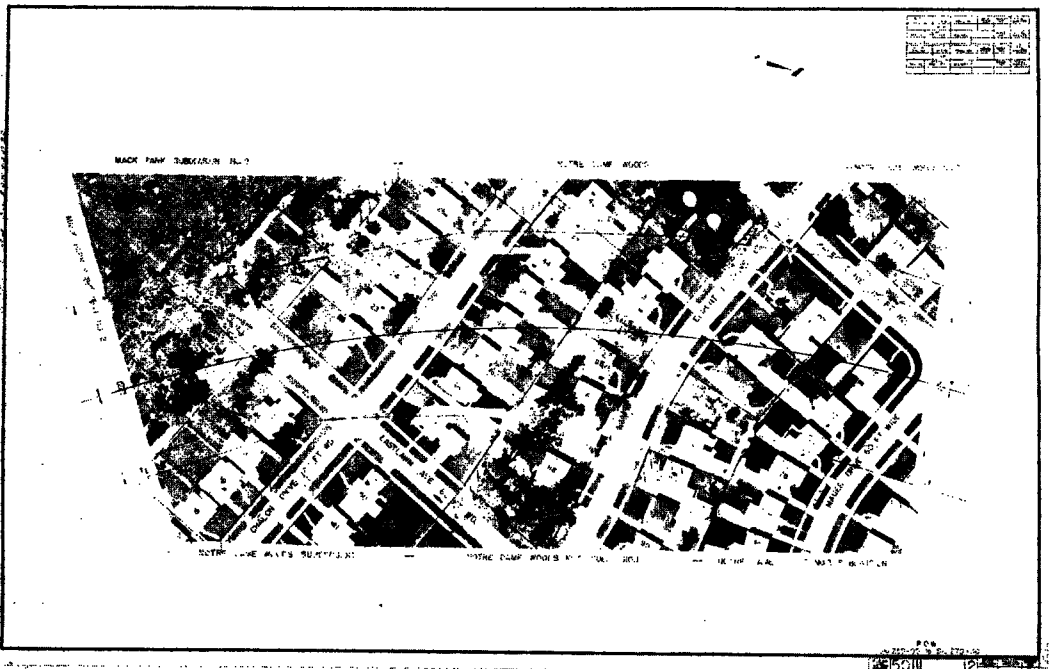


Figure 2. Portion of Interstate 94 north of Detroit in city of Saint Clair Shores.

to 1 in. = 40 ft. Scaled dimensions are shown for residual areas. These plans are considered as acceptable by the Bureau for reimbursement for rights-of-way purchased for Interstate projects. Other reproductions are used in the detailed construction plans to carry items of site clearing. For this use, it is found that aerial plans such as these are more accurate than are manually drawn plans, and are much less costly.

Figure 3 shows a matching of an aerial photograph with a planimetric map of the same area of coverage at the site of a rural road crossing over Interstate 96 near Lansing. Plan base sheets of this nature are produced in the Department's photographic laboratories for use by designers in preparing the details for ultimate highway improvements.

The lower half shows the plan view of the road improvement as designed. Except for the road profiles and other special detailed drawings which are furnished on supplementary sheets, all details including the necessary rights-of-way are shown on this portion of the plan. Permanent right-of-way limits are shown by the heavier lines. Right-of-way lines enclosing land parcels required on a temporary basis (for example, grading easements, land for temporary roads, and borrow areas) are shown by the lighter lines. Dimensions for right-of-way takings, as referenced to an established road centerline, are shown on this plan.

The upper part of this plan is a photographic coverage of the same area. The photographic portion shows the proposed right-of-way lines for the project as an aid to right-of-way personnel.

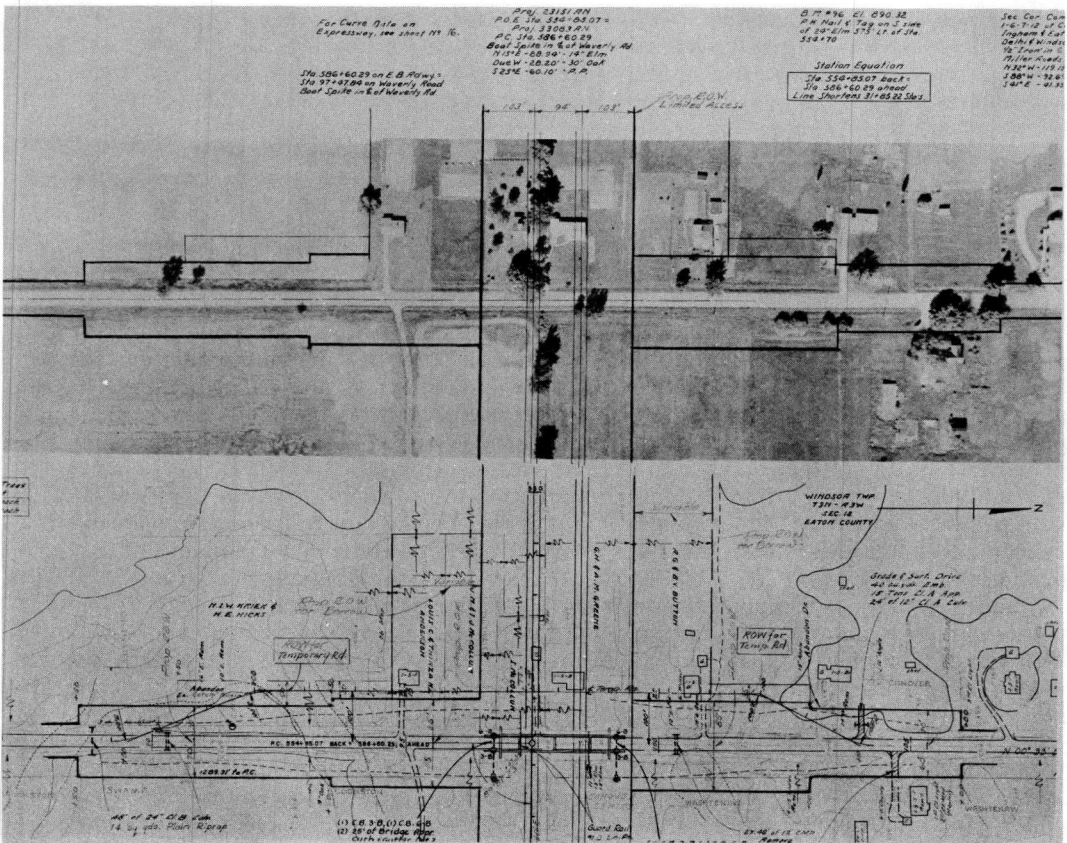


Figure 3. Matching of aerial photograph of rural road crossing over Interstate 96 near Lansing with planimetric map of same area.



Figure 4. Segment of Interstate 96 southeast of Lansing.

It should be apparent that plan base sheets such as these save a considerable amount of design time for road projects. It has been found that the plan sheet combination, along with a minimum of field survey information and the stereo-pairs covering the area, gives the design personnel about all of the information needed to produce a complete set of construction plans. The photographic section is most helpful, because it provides details not otherwise available at such small cost.

Right-of-way buyers find the plan combination to be most helpful in their negotiations with property owners. The photographic portion, because of its complete showing of recognizable features, is of great aid to land owners in their understanding of the road problems.

Figure 4 shows a segment of Interstate 96 southeast of Lansing. The figure is an oblique photograph of a parcel of land acquired for highway use through negotiation. This particular view was used by the Right-of-Way Appraisal Section in illustrating the appraisal procedures approved by the Bureau for right-of-way acquisition on the Interstate system. Oblique views of properties such as this are often used by right-of-way personnel in court cases as are mosaics and larger scale plan views.

Although the value, in dollars and cents, of this type of presentation in courts is not known, it is believed that the pictorial representation of the site conditions are better understood by all participants in the action. Planimetric maps have been used on occasions to the advantage of the State. In one case, a saving in the neighborhood of \$30,000 was affected through the use of planimetric map on a drainage dispute. In another, the ability to make a reasonably close estimate from a planimetric map of a

disputed volume of core sand available on a land tract being severed by a highway project resulted in a saving to the State.

Photogrammetric methods are of proven value in the right-of-way acquisition processes. The development of newer and better techniques are eagerly awaited.

Use of Photographic Enlargements in Right-of-Way Problems in Kansas

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The use of photographic enlargements has been made by various departments of the Kansas Highway Commission for the solutions to several and varied problems. One of the greatest uses of photographic enlargements has been in the area of right-of-way problems, especially in the trials and court cases arising in the settlements of area acquisition. Although Kansas can report some use in the preconstruction stages of the right-of-way processes, this report concerns itself primarily with the use of photographic enlargements in the post-construction phases of right-of-way problems.

Use of enlargements in various court cases arising in the settlement of various actions is discussed, as is a second use of enlargements being made by resident engineers after projects have been completed.

The report also reviews the promising feature of enlargements in their use in these areas and the difficulties that have been and could be encountered with their use.

• **AERIAL** photographs have been found useful in practically all of the stages of highway location and design in Kansas. Among the uses of contact-size aerial prints, enlargements, and photographic mosaics, one could list these in the areas of preliminary location surveys, project reports, public meetings, drainage area determinations, materials investigations, right-of-way appraisals, land use studies, highway inventories, condition surveys, traffic counts and turning movements, and right-of-way negotiations and condemnations. This report is concerned with photographic enlargements of aerial prints or mosaics as they are used in post-construction right-of-way and allied problems.

During the past two years, Kansas has attempted to photograph all major construction projects before the first signs of construction to obtain a record of the route before construction changes have occurred. This photography is taken even when normal on-the-ground surveying methods have been used to obtain design data. Aerial photographs have also been taken of many highway projects after construction has been completed or nearly completed.

For various reasons, the Kansas Highway Commission may be involved in damage claims, land separation cases, or easement questions after construction has been initiated or completed. When such cases arise, enlargements of aerial photography taken of the area in question before construction are made to some convenient scale so that the enlargements may be used as a public display. The same area is photographed at a time when construction changes are being made or have been completed. Enlargements of these photographs are also made at the same scale as the pre-construction enlargements. To these enlargements are affixed taped lines showing such items as property lines, section lines, location of the new route and easement lines, directional arrows, scales, date of photography, and similar data, depending on the scope and type of case in question. The enlargements, when placed in evidence, are displayed in