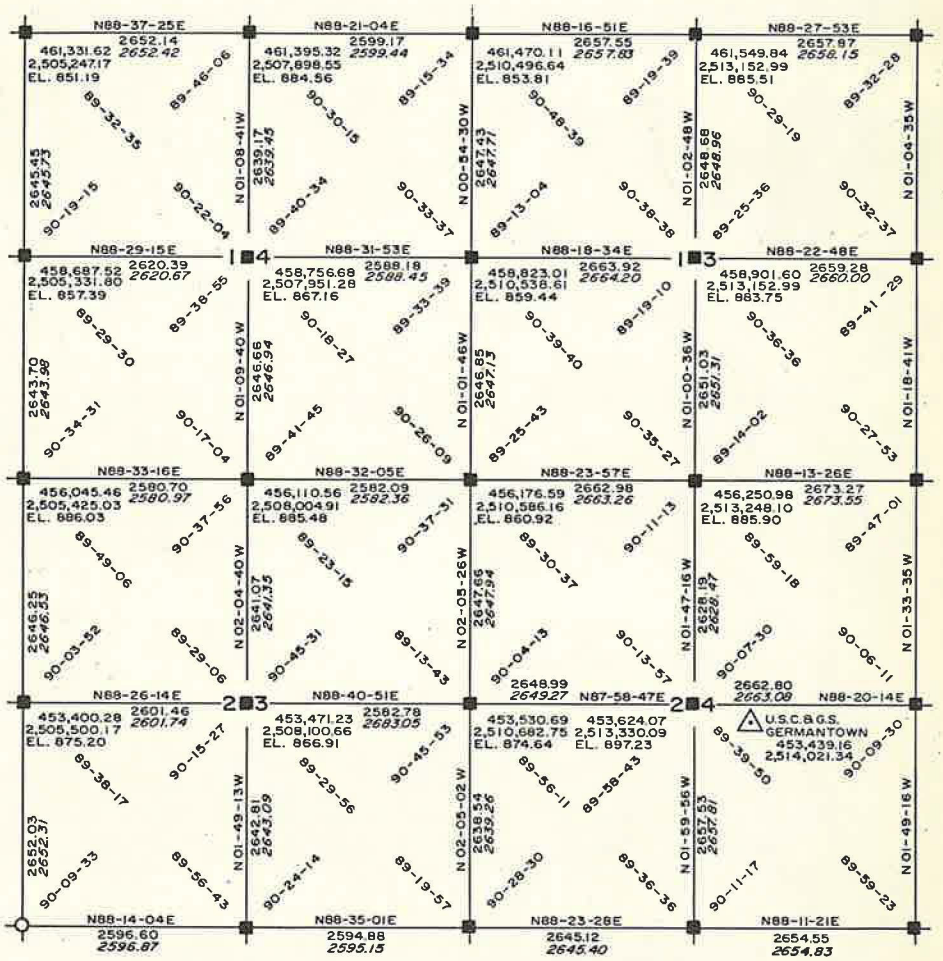
HOOSIER SURVEYOR

Indiana Society of Professional Land Surveyors, Inc.

SAMPLE SHEET SHOWING PORTION OF REQUIRED
HORIZONTAL AND VERTICAL CONTROL SURVEY DATA SUMMARY SHEET



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DATE: NOVEMBER 1967

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EXHIBIT "B"

VOLUME 4
NUMBER 2
SPRING 1977

- UNIFIED SYSTEM OF MAPPING AND SURVEY CONTROL
- REVIEW OF ISPLS WORKSHOPS • LEGISLATIVE REPORT
- NEW HEADQUARTERS OFFICE • ACSM LITTLE ROCK MEETING

HOOSIER SURVEYOR

VOLUME 4, NO. 2 SPRING 1977

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Orwic Johnson
Emil Beeg
John McEntyre (Special Advisor)

Budget & Finance
David Wolf (Chairman)
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COVER: The cover picture is a figure from a technical report of the Southeastern Wisconsin Regional Planning Commission on "Horizontal and Vertical Survey Control in Southeastern Wisconsin "showing the format of their survey data summary sheets. Article describing this unified system is contained in this issue.

EDITOR'S NOTE:
Deadlines for copy for various planned issues of the HOOSIER SURVEYOR are as follows:
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Summer issue – July 31
Fall issue – October 31
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Kenneth S. Curtis
Editor

THE PRESIDENT'S PAGE

"OUR DAY WITH THE 1977 GENERAL ASSEMBLY

Field Notes by John V. Schneider

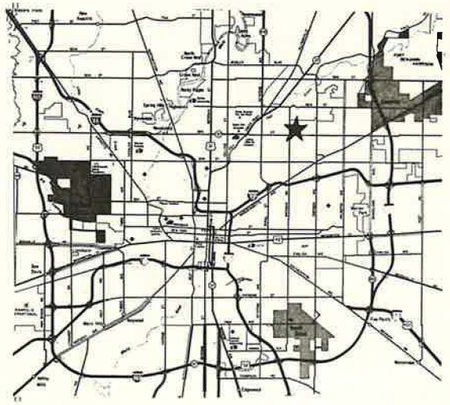
Stated simply, ISPLS Legislative efforts in the 1977 General Assembly were a stand-off. We stood and were turned off.

Many hours were devoted to this effort by the Legislative Committee Chairman and Board Members and all performed admirably. Following are minutes for what I'll call a typical Legislative Committee Meeting. Some of the narrative actually happened in Committee Meetings, some in special meetings, some just reflect the attitudes prevalent among legislators.

"Mr. Chairman, Committee Members". Interruption by Johnny Legislator, "Please Mr. Schneider get to the point, we are very important and busy people". (Text of the right of entry bill is presented). (Background for its importance is partially presented). Interruption by Johnny Legislator. "You guys just want to get on other peoples property so you can leave gates open and chop down trees". "No sir, we just want access to necessary section corners, and modern electronic measuring equipment allows us measure along lines without damaging . . . ", interruption by Johnny Legislator, "I know all about your electric equipment. Did I ever tell you guys about that surveying case I was involved in? I tell you this new stuff is less accurate than radar was when they first introduced it. You'll never catch me using this new equipment". "But Sir . .", interruption by Jack Congressman, who just walked in, "Hey, whats going on, we hearing this Land Surveying Bill? These guys know as well as I do they don't need to get these points. I used to do work for the State Highway and I know for a fact, that they can calculate the location of all these points. Anyway, if they need to get on someone's property, they can hire a lawyer, and he'll figure something out, right fellows", "RIGHT". "Anyway, an important lobbist is taking me to dinner and tennis tonight so I move we table this bill for further study and adjourn this meeting".

To do Battle, you must know your enemy. We are learning!

John Schneider
President



New State Headquarters Office, ISPLS, is at 3919 Meadows Drive, Suite 103, Indianapolis, Indiana 46205 Phone: (317) 545-8907

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REPORT FROM THE LEGISLATIVE CHAIRMAN, Luther R. Condre:

It has been said that every cloud has a silver lining. If successful legislative efforts result in a silver lining, ISPLS is still in a cloud. Many of the problems in legislative effort were anticipated and the committee was well prepared to present the background information in support of two house bills; HB 1161 Right of Entry sponsored by State Representative William Soards, Indianapolis, and HB 1162 - A Plat Act sponsored by State Representatives Jack McIntyre, Lyons and Dennis Heeke, Dubois.

Unfortunately, HB 1162 was never heard in Committee. HB 1161 was heard briefly in the House Judiciary Committee, but was tabled by the Chairman, State Representative John Donaldson, Lebanon, just when it seemed to this writer that a "do-pass" vote was imminent.

It seems that although we as surveyors are acutely aware of our problems, very few of the legislators are. Much to our surprise, the legislators stated flatly that no one (not even surveyors) were trespassers unless they were on posted land or were ordered off the land by the land owner, which was an interpretation of Indiana Trespass Law alien to this writer. Also, the legislators were under the impression that the language in the existing laws pertaining to perpetuating section corners and to legal surveys prevented all surveyors from being prosecuted - until we pointed out the fact that this immunity from trespass was only while doing the work of perpetuating section corners or while performing legal surveys.

We also learned that the Acts of 1976 has repealed that section of Chapter 69, Burns 35-1-69-1 providing penalties for defacing or removing boundary markers. Now, in Indiana, only King Solomon's instruction "Remove not the ancient landmark, which thy father have set" remains to protect our corners.

The legislative committee shall meet again and ponder new approaches to providing correct information to our legislators. If you have input in this respect, the committee will certainly be happy to bring your ideas to the Board of Directors for evaluation and guidance. Help! We can use it!

I.S.P.L.S. SPRING AND FALL WORKSHOPS

By Roger Woodfill, 1976 Workshop Chairman

The I.S.P.L.S. education committee sponsored two single-day workshops in 1976. Both were held on Saturdays at the Roof Lounge of the Union Building at the Indiana-University-Purdue University-Indianapolis Campus on Michigan Street. Since they were supported with high attendance, the workshops contributed $2900 to the I.S.P.L.S. treasury. Although both were open to all, the Spring Workshop was oriented toward the principal, and the Fall Workshop was geared to the surveying technicians.

SPRING (1976) - LIABILITY INSURANCE

The June 5th workshop took advantage of Paul McVearry expertise as a claims manager of the Victor O. Schinnerer liability insurance company. Mr. McVearry had traveled from Washington D. C. to explain several of the clauses existing in most liability policies. He pointed out that some surveyors invalidate their policies and expose themselves to unnecessary risks by routine field and office procedures. The slides presented in the morning session showed, that although land surveyors are not expecially high risks, they are more frequently being sued, and the insurance rates are expected to climb.

The afternoon session was conducted as a panel discussion. Sitting on the panel was McVearry; Theodore Nering, representive attorney for a mortgagor; Richard Turley and William Shebesta, attorneys for two different title insurance firms; and Dixon Dann, representative attorney for an average surveyor. Diverging opinions were expressed as the discussion polarized around the "Surveyor's Certificate". Many questions were answered, and several new questions arose for us to consider.

FALL (1976) - ROADS AND STREETS

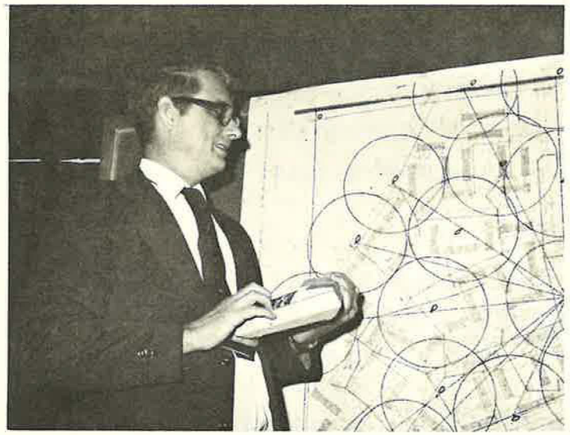
The October 23rd workshop was less stormy, but not less educational. Billed as a review of the basic surveying involved in the roads and streets, the program drew sixty-two participants. Barry Elkin, who has been with the Indiana State Highway Commission Training Program since 1967, instructed. Mr. Elkin is a licensed Land Surveyor and Engineer, and has worked as a project engineer with I.S.H.C. for eight years before turning his energies to the Research and Training Center in Lafayette.

Substantial handouts were distributed concerning the horizonal curve, the vertical curve, and slope staking. After a lecture in each of these three areas, the participants worked pertinent problems and compared their solutions. Exchange of residential subdivision standards for street designs concluded the program. It was of interest that the geography of Indiana dictated materials availability and therefore varied engineering street design, and that the topography also dictated the arrangements of lots within the development.

Although attendance is not the most important item in judging successful workshop, it is very important. In the Spring the total attendance was forty-four with thirty-four listing themselves as members, seven representing member firms, and three being non-members or students. The Fall session, drew sixty-two participants with thirty-eight listing themselves as members, eighteen representing members firms, and six non-members. It is hard to tell if the increase was because of the subject matter, the fees for the workshop, in increase in firm membership, the time of year, or some other cause. We would appreciate your opinion on this question and your suggestions for workshops in future years.

SPRING (1977) - RADIAL STAKING METHODS

Thirty-nine surveyors participated in the Saturday, April 30, 1977, ISPLS Spring Workshop at the 38th Street Campus of IUPUI. Charles C. Campbell of our own Society presented the topic of "radial staking methods", with the morning session devoted to lecture and computational procedures. In the afternoon, a couple of field problems were staked radially in the parking lot of the campus using an HP 3810 Total Station and 200 ft. steel tape. One was a horizontal curve and the other a building with several offsets. Bob Cochran of the Hewlett Packard, St. Louis, furnished the EDM and hand calculators.



TWO PROMINENT INDIANA LAND SURVEYORS DIE

C. B. WOOD

ISPLS past-president Cleaphos B. Wood of Angola, Indiana, died Saturday, May 14, 1977, after an illness and surgery which revealed cancer He was 73. A retired civil engineer and land surveyor, he was graduated from Tri-State College. He was former owner of Boone, Wood, and Associates of Angola and served as Steuben County Surveyor during 1961 and 1962.

Woody was a charter member (1954) of the Indiana Society of Professional Land Surveyors and served as president in 1960. He received the Society's "distinguished service award" in 1961. For several years around 1970-71 he was the ISPLS national delegate to ACSM.

Woody, who was born October 15, 1903, in Fulton County, Ohio, was very active in community and church activites.

He was a World War II veteran and a member of Veterans of Foreign Wars, Angola Post 31 American Legion, Disabled Veterans, Order of Eastern Star, Angola Chapter, York Rite, and Masonic Lodge of Angola, Scottish Rite of Fort Wayne. He was a charter member of the Angola Kiwanis Club and first president of the Steuben County Youth Center. He was for many years a leader in the Boy Scouts of America.

He was an active member of the Church of Christ, Christian, of Angola, where he served many years as Deacon and later as Elder, He was teacher of an adult Bible School Class and served on many committees. He was one of the original members of the board of directors, serving as Vice-President, for the Golden Years Homestead, a church sponsored home for the elderly in Fort Wayne, Indiana.

He will be missed by the many Indiana land surveyors who have shared good fellowship with him. Condolences go to wife, Juineta; daughter, Debbie; and the Wood family.

C. B. LENAHAN

State Registration Board member Charles B. Lenahan of Vincennes, Indiana, died Sunday, May 22, 1977, after suffering a heart attack. He was 65. He was a native of Vincennes and a graduate of the University of Notre Dame. He was a registered professional engineer and land surveyor and had been Knox County Surveyor continuously since 1947.

During his career, Bernie had worked for the Resettlement Administration of the U. S. Government, with Dupont at the Charlestown powder plant and with the Army Corps of Engineers. In addition, he has had a private surveying practice since 1950 and was affiliated with Lenahan and Konen, Incorporated, producers of sand, gravel, and redi-mix concrete. He has served on the Registration Board since 1961 and was honored during the administration of Governor Welsh by being named a Sagamore of the Wabash.

As we go to press, we have been informed of the death of William P. McGrath of Dillsboro, Indiana, on M[illegible] 27, 1977.

Integrated Large-Scale Mapping and Control Survey Program Completed by Racine County, Wisconsin

by K. W. BAUER

Executive Director, Southeastern Wisconsin Regional Planning Commission

Introduction

Racine County, Wisconsin, has marked the nation's bicentennial year and the 140th anniversary of the completion of the U.S. Public Land Survey in the county with the completion of a countywide, integrated, large-scale topographic mapping and control survey program. The completion of this project is a unique achievement by county government within Wisconsin and is believed to be a unique achievement within the United States as well. The Racine County program is unique not only with respect to the size of the area but also with respect to the surveying and mapping concepts applied in the program. These concepts simultaneously provide high quality topographic and cadastral maps and a permanently monumented system of horizontal and vertical survey control, incorporating the best features of the U.S. Public Land Survey and State Plane Coordinate systems.

Background Information

Racine County, with an area of 340 sq. mi. and a resident population of about 171,000, is located on the shore of Lake Michigan in the rapidly urbanizing Southeastern Wisconsin Region. It contains two incorporated cities, the largest of which is the City of Racine with a population of about 95,000 persons, as well as seven incorporated villages and ten largely rural towns. The county, located between the Chicago and Milwaukee metropolitan areas, is experiencing rapid population growth and urbanization. Racine County enjoys a diversified economy, dependent upon major industrial concentrations, rich agricultural areas, and attractive recreational resources. About 15 percent of the total area of the county is devoted to urban land use, 68 percent to agricultural land use, and the remaining 17 percent to recreational and related open space use.

Prior to 1968 the only accurate maps available on a uniform, areawide basis within Racine County were the small-scale 1:24 000. 10-ft. C.I. (contour interval) U.S. Geological Survey 7½-minute topographic quadrangle maps. The only true scientific system of survey control within the county consisted of the triangulation stations and spirit level lines established by the U.S. Coast and Geodetic Survey (now the National Geodetic Survey (NGS), NOS, NOAA). These triangulation stations and benchmarks, however, were so widely spaced and so inconveniently located within the county, and also the techniques involved in their use were so unfamiliar to many local surveyors and engineers that the system was rarely, if ever, used. In contrast, the U.S. Public Land Survey system, intended to provide control for land surveys, was widely used by land surveyors and engineers within the county. The system, the care and maintenance of which rests in Wisconsin with the counties, had been neglected; and time and the activities of man had served to destroy many of the monuments marking the location of the Public Land Survey corners within the county and threatened the very existence of the system as an efficient means of controlling real property boundary line surveys.

Thus, large-scale maps of the accuracy and precision required for sound planning and engineering and, therefore, for resolution of pressing environmental and developmental problems within the county were lacking. Existing city, village, and town maps were often no more than sketch compilations of paper records so poorly done as to make definitive planning and engineering very difficult and costly. Thus, plan implementation through application of such legal devices as the official map was virtually impossible.

Due to the lack of an effective survey control system within the county, the conduct of both land and engineering surveys was both costly and time consuming. Uncertainties concerning the location of real property boundaries was a growing problem, and the results of field surveys often provided conflicting information concerning the location of real property boundaries as well as natural and cultural features. Survey bearings were commonly referred to assumed reference meridians through some point on a local survey and, therefore, were not only relative but varied from survey to survey. Elevations were commonly referred to differing local datum planes. Land and engineering surveys were carried out and plotted on local maps without reference to a map projection; the scales of the local maps were referred to local ground level with written dimensions supplementing scaled distances.

As survey operations were extended over ever-increasing areas of the county, individual surveys and maps could no longer be correlated. Accurate composite maps of the county could not be compiled. Relative bearings based upon assumed meridians could not be correlated. Distances, direction, and areas could not be accurately

EDITOR'S NOTE: This article is reprinted with permission from Surveying and Mapping, December 1976. This quarterly journal is published by the American Congress on Surveying and Mapping. An Application form to join this national society is published elsewhere in this issue. All land surveyors should be members!

The decision to reprint this article stems from the editor's strong belief that, if automated land data systems with land parcel identifiers (as described by Darrell Dean in the Winter 1977 issue of the HOOSIER SURVEYOR) are ever to become a reality, there must be a concerted effort to densify the basic horizontal control net in order to provide an adequate local plane coordinate grid. What better way to accomplish this task then to tie the operation to the control needs for an extensive topographic mapping program and use the section and quarter-section corners for this purpose! The Southeastern Wisconsin Regional Planning Commission, under Kurt W. Bauer, has been the leader in this far-reaching program. Your editor believes this to be one of the milestone accomplishments of the land surveying profession in this century!

scaled from composites of maps which utilized no projection in their construction, and topographic maps based on local vertical datum planes became difficult and costly to correlate with each other and with cadastral maps and records. Moreover, existing maps could not be maintained current because, due to the lack of a good survey control network, it was impossible to relate accurately new facility construction and new land use development either to existing maps or to each other. Also, water-related facilities, such as sewers, drains, and water control structures, the elevations and locations of which were related to local datum planes, could not be related readily to areawide maps or to each other, making systems analyses and design difficult.

Recognizing the costs and inefficiencies caused by the inadequate and unsatisfactory status of mapping and control surveys within the county, the Racine County Board of Supervisors, in 1968, acted upon a recommendation of the Southeastern Wisconsin Regional Planning Commission and undertook a major resurvey of the county. The resurvey was carefully planned to provide not only the large-scale maps required to carry on both efficiently and effectively public and private development activities within the county but also to restore and revitalize the U.S. Public Land Survey system within the county as an effective survey control system.

A Unified System of Mapping and Survey Control

In authorizing the resurvey of the county, the County Board recognized that two factors require constant and careful consideration in the conduct of much of the county's business: the land itself, with its configuration and other physical characteristics, and the locations of the boundaries of real property ownership.

It should be emphasized here that good maps are a means of collecting, coordinating, and presenting this information in a permanently useful form, and, as such, represent a sound, long-term, public capital investment. This information is essential to public and private planning and engineering operations required for the proper use and development of the land and for the supporting transportation and utility systems. In Wisconsin, the proper application and effectiveness of certain public plan implementation devices, including the official map, subdivision control ordinances, and precise neighborhood unit development plans, all depend to a considerable extent upon the quality of the available maps. Inadequate, improperly constructed maps can represent a real loss of money to the community, not only in funds expended for the maps themselves, but also in direct and indirect costs associated with their use. The quality, versatility, and permanent utility of the proposed maps were clearly seen as linked directly to the type of survey control established for the mapping program.

It was then determined that two types of maps were required and should be prepared:

1. Accurate large-scale topographic maps showing the exact configuration and elevation of the ground, stream and watercourse lines, and other natural and manmade features of the landscape. It was determined that the scale of these maps should be 1 in. = 200 ft., that the maps should have a contour interval of 2 ft., and that the maps should be prepared to National Map Accuracy Standards. The maps should permit drainage areas to be precisely defined and measured; should permit distances between existing cultural and topographic features and between such features and existing and proposed property boundary lines and public and private works construction to be accurately scaled, profiles drawn, gradelines established and computed; and should permit alternative route locations for various types of facilities to be selected and evaluated.

2. Accurate property boundary (cadastral) maps showing the location, arrangements, and dimensions of all real property boundary lines, all existing streets and highways, and all existing land subdivisions. The property boundary maps were to be prepared at the same scale as the topographic maps, and the maps were to be so designed that data presented on the cadastral maps could be easily and accurately correlated with that presented on the topographic maps by simple overlay processes.

It was determined that the topographic maps should be prepared by photogrammetric methods. But in order to make the topographic maps the truly effective planning and engineering tools they ought to be and thereby save much needless duplication of survey efforts at a later date, it was decided that the maps should be based on a permanently monumented survey control network. This survey control network was to meet two basic design criteria. First, it was to permit the accurate correlation of property boundary line information with topographic data. Second, it was to be permanently monumented on the ground so that lines drawn on the maps could be accurately reproduced in the field when planned land use development and supporting public works projects reached the construction stage or when public land use controls, such as zoning and official mapping, required precise enforcement. The survey control system was to be such as to provide finished maps which reflected accurately both topographic and cadastral conditions, maps with lines which could be reproduced easily and accurately on the ground as well.

The establishment of a basic system of survey control was viewed as essential to accurate mapping efforts and necessary for accurate engineering and land surveys within the county. A survey control system which meets basic, large-scale, map production preparation requirements should also meet basic engineering survey requirements, since both are based upon principles derived from the application of the science of measurement. Real property boundaries, however, are creatures of the law, and any system of survey control which is to be useful to a land surveyor must be properly founded on the principles of property law as well as on the science of measurement. Accordingly, the specifications for the topographic mapping program required the use of a unit system of horizontal control based upon the U.S. Public Land Survey system, as well as upon the national geodetic datum.

System of Survey Control

The specified control survey system required the relocation and monumentation of all U.S. Public Land Survey section and quarter section corners within the area to be mapped and the utilization of these corners as stations in second-order traverses to be tied to the national geodetic datum. It was considered essential that the horizontal control surveys have second-order accuracy at least, even though this accuracy was not required for the topographic mapping work itself, in order that the survey control net have permanent utility in all subsequent survey and mapping operations within the county. The control traverse net was to establish the exact lengths and bearings of all U.S. Public Land Survey quarter section lines, as well as the geographic positions of the Public Land Survey corners in the form of state plane coordinates. [*Note:* To employ state plane coordinates in legal work *requires* second-order control within one-half mile of the property (by statute).] Second-order spirit level lines were required to establish the elevations of the monuments marking the U.S. Public Land Survey corners and supplementary benchmarks. This system of control has the following important advantages over the systems usually used by photogrammetric engineers for the preparation of large-scale topographic maps:

1. The control survey system provides a common reference system for both topographic and real property boundary line mapping. Since the boundaries of the original government land subdivision form the basis for all subsequent real property divisions and boundaries within the county, the accurate reestablishment of quarter section corners permits accurate compilation of property boundary line maps and topographic maps. Moreover, the property boundary line maps can be readily and accurately updated and extended, since all new land subdivision plats must, by law, be related to corners within the Public Land Survey and the accuracy of these plats can be controlled by local land subdivision regulations.

The use of a common system of survey control permits the accurate correlation of property boundary line information supplied by ordinary land surveys with topographic information supplied by photogrammetric techniques. This placement of real property boundary and topographic data on a common datum is essential to sound mapping. Establishment of state plane coordinates for the Public Land Survey corners permits ready transfer of details supplied by aerial mapping, including contour lines, to property boundary line maps and easy transfer of property boundary line data to topographic maps by simple overlay techniques. Great savings in office research time are possible during the planning and design phases of municipal public works projects by having all available information—topography, property boundary lines, and survey control—accurately correlated on one map. Furthermore, this information makes possible the consideration and analysis of many alternate routes for such public works facilities as highways, trunk sewers, water transmission lines, other utilities, and problems concerning drainage, sewerage, water supply, and transportation.

2. The system provides an extremely practical horizontal control network which is available to public and private surveyors and engineers for subsequent survey work within the mapped area. The control survey system places a monumented, recoverable control station in both the Public Land Survey and State Plane Coordinate systems and a known elevation at half-mile intervals throughout the mapped area.

Not only does this monumented control net expedite engineering surveys made by the county and municipal highway, park, sewerage, airport, and harbor departments for planning, design, and construction layout purposes, but it also correlates and coordinates all of the survey work throughout the mapped area. The control survey system is particularly valuable in providing a common system of reference for the accurate location and mapping of underground utilities.

3. The control survey system makes the State Plane Coordinate System available on a practical basis for real property boundary survey control. The system requires permanent monumentation of Public Land Survey corners, which does much in itself to stabilize real property boundaries and makes the control network of great value to private land surveyors. By utilizing this control net, local land surveyors can, without changing their methods of operation or incurring any additional expense, automatically relate all of their surveys to the State Plane Coordinate System and reference all bearings used in land surveys, plats, and legal descriptions to grid north and to geodetic north.

4. The control survey system permits boundaries to be drawn on maps, whether these boundaries represent the limits of land to be reserved for future public use, for immediate public use, the limits of districts to which public relations are to be applied, or the locational alignment of proposed public works, to be accurately and precisely reproduced in the field at the time of plan implementation or construction.

Monumentation

The specifications governing the work required that the monuments marking relocated Public Land Survey corners be either precast reinforced concrete monuments or manufactured cast iron monuments with engraved bronze caps embedded or permanently attached to their tops (Figure 1). The bronze caps carry a Racine County legend, a warning against destruction, and are stamped with corner notation, quarter section, town, and range. The specifications required that elevation referred to National Geodetic Survey Vertical Datum of 1929 be obtained for all monuments marking the section and quarter section corners in the county so that the monuments would also serve as permanent benchmarks. In addition, the specifications required that a supplementary benchmark be established for each U.S. Public Land Survey corner monument and be set so that the elevation of the corner monument could be verified from the supplementary permanent benchmark, employing a single level setup. These supplementary benchmarks were set on objects which were unlikely to be displaced vertically, such as bridge abutments, headwalls of large culverts, water tables of large buildings, and outcroppings of bedrock, or on poured-in-place concrete monuments extending below the frost line.

The monuments marking the U.S. Public Land Survey corners were to be referenced by ties to at least three witness marks. The specifications further required that the survey engineer provide a dossier on each monumented corner in order to permit its recovery and use. The dossier sheets were prepared on 8½ by 11-in. mylar base material and provide for a sketch showing the monument erected in relation to the salient features of the immediate vicinity; at least three witness monuments, together with their physical ties; the state plane coordinates of the corner; the angle between geodetic and grid bearing; the Public Land Survey description of the corner, with the monuments marking centers of sections being identified as marking the "true" or "occupied" center of section; the benchmark elevation of the monument; the elevation of the supplementary benchmark set in the immediate vicinity of the monument; and the bearing to an azimuth mark visible from the station. Also, the dossier carries an affidavit by the land surveyor setting forth the classification assigned to the corner—existing, obliterated, or lost—during the recovery and the salient factors determining its location or relocation with particular emphasis on old monumentation and accessories thereto found and used in the remonumentation process. These dossier sheets are recorded with the county surveyor and the County Highway Department and are available as public documents to all land surveyors and engineers working in the county (Figure 2).

Control Survey Data

The specifications also require the control survey data to be summarized by means of a control survey summary diagram showing the exact length and grid bearing of the exterior boundaries of each U.S. Public Land Survey quarter section; all monuments erected; the interior angles at the nearest second of arc of each quarter section corner; the state plane coordinates of all section and quarter section corners, together with their Public Land Survey system identification; the benchmark elevations of all monuments

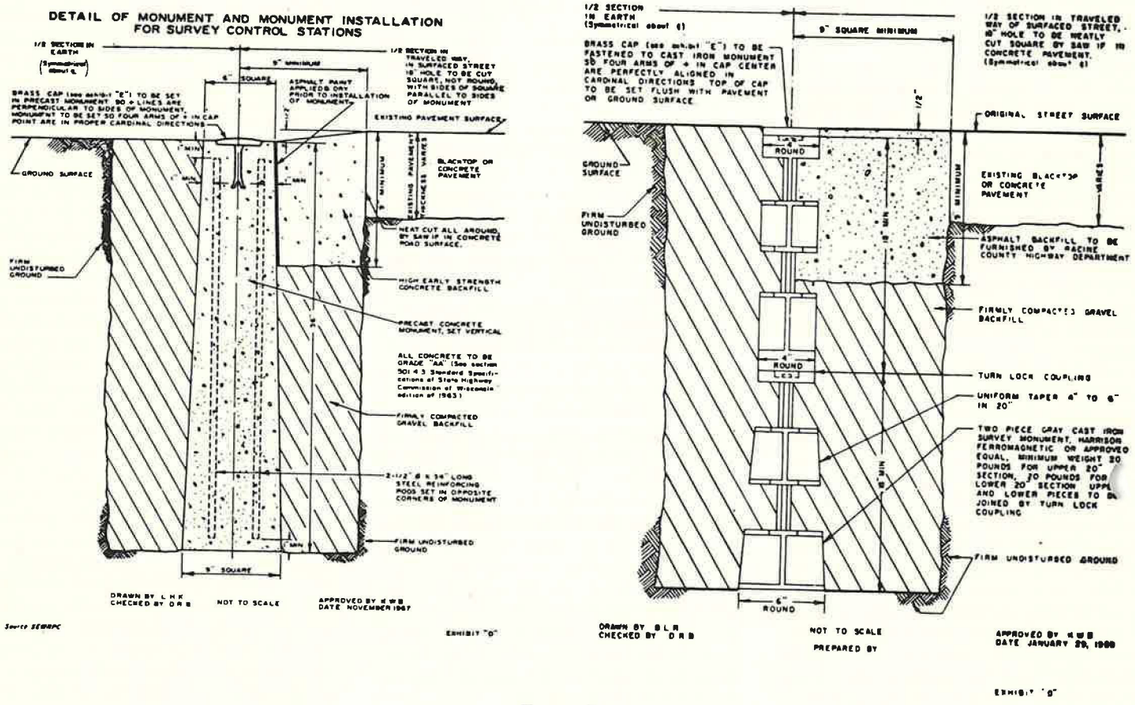


FIGURE 1.

erected; the basic geodetic survey control stations utilized to tie the Public Land Survey corners to the geodetic control network, together with the coordinates of the stations; and the area of the quarter section. The angle between geodetic and grid bearing, the combined sea level and scale factor, and the datum equation between any local vertical datum and NGS level datum must be given on the diagram (Figure 3).

Maps

The specifications required that finished topographic maps be provided to National Map Accuracy Standards. In addition to the contour lines and spot elevations, planimetric details, and hydrographic features, the maps show all section and quarter section lines and corners established in the field surveys, the grid lengths and bearings of the lines, the state plane coordinates, and the benchmark elevations of the monuments marking the corners. The map sheets also show the angle between geodetic and grid bearing, a combined sea level and scale factor, and the equation between the NGS level datum and any local level datum previously established in the area covered by the map. Each map sheet covers one U.S. Public Land Survey section (Figure 4). Completed maps are field checked to insure conformance to National Map Accuracy Standards.

When the topographic map sheets were partially completed—the plotting of all planimetric detail, all U.S. Public Land Survey section and quarter section lines and corners and all control survey data relating to such lines and corners, and all lettering related to the names of salient geographic features—reproducible duplicates were prepared on dimensionally stable base material. These duplicates are the base sheets for the preparation of cadastral maps by the county. The cadastral maps are then prepared by assembling copies of all recorded subdivision plats and certified survey maps showing real property boundaries; copies of all legal descriptions for real property boundaries in areas not included in recorded subdivision plats or certified survey maps; and copies of all legal descriptions and plats relating to public utility easements and street rights of way. This information is used to construct real property boundary line maps, using the U.S. Public Land Survey corners and lines

RECORD OF CONTROL SURVEY STATION

QUARTER SECTION CORNER 31 | 36 TOWNSHIP 4 N, RANGE 23 E, Racine COUNTY, WISCONSIN

GEODETIC SURVEY BY ALSTER & ASSOCIATES INC. ENGINEERS, MADISON, WISCONSIN.

STATE PLANE COORDINATES OF: ~~Section Corner~~
NORTH 282,908.34
EAST 2,583,703.20

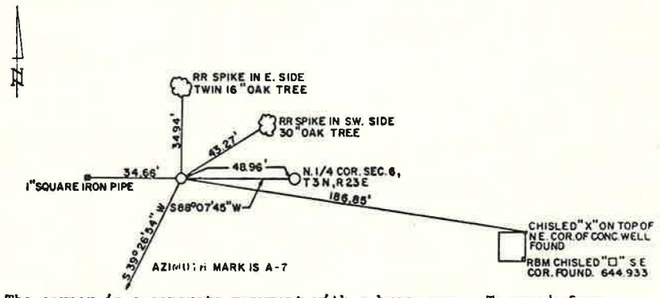
ELEVATION OF STATION: 645.329 THETA ANGLE: +01-29-37'

HORIZONTAL DATUM: WISCONSIN STATE PLANE COORDINATE SYSTEM, SOUTH ZONE

VERTICAL DATUM: MEAN SEA LEVEL, 1929 ADJUSTMENT

HORIZONTAL & VERTICAL CONTROL ACCURACY: SECOND ORDER

LOCATION SKETCH:



The corner is a concrete monument with a brass cap. To reach from Highway 31 at Root River, go North past Old Mill Tavern along a private drive about 1300' to corner on left as described.

SURVEYOR'S AFFIDAVIT:

STATE OF WISCONSIN) SS
RACINE COUNTY)

I HEREBY CERTIFY THAT I found a 1" square steel rack bar stake set at this corner by James H. Larsen, S-130, by reference to records of former County Surveyor, Byron Henry.

DATE OF SURVEY April 1965

REGISTERED LAND SURVEYOR S-338

WISCONSIN JOHN H. NIELSEN RACINE, WIS. LAND SURVEYOR

FIGURE 2.

shown on the base sheets as control. The cadastral map preparation is the responsibility of the office of the County Tax Lister.

Conduct of the Work

It was determined that all of the work necessary to execute the control surveys and provide the finished topographic maps should be done on a negotiated contract basis with a photogrammetric engineering firm. It was essential to retain a firm familiar with second-order field survey methods and procedures and with associated geodetic survey computations and adjustments, whose crews were properly equipped with the necessary instrumentation, and competent in photogrammetric mapping. In order to assure consistency with other survey and mapping projects within the seven-county Southeastern Wisconsin Region, Racine County requested the Southeastern Wisconsin Regional Planning Commission to prepare the contracts and specifications for the proposed mapping project. Although the specifications governing the work made the photogrammetric engineer responsible for overall supervision and control of the mapping work and for the quality of the finished maps, the specifications required that the actual relocation of the Public Land Survey corners be done by a local land surveyor employed as a subcontractor by the photogrammetric engineer. By the specifications, it is recognized that this portion of the work required expert knowledge of local survey custom and boundary and title law; the assembly and analysis of all authoritative survey information, such as title documents, subdivision plats, survey records; and existing monumentation and occupation, in order to arrive at the best possible determination of the location of the Public Land Survey corners. The land survey portion of the control survey work requires a high degree of professional competence as many of the Public Land Survey corners within the county were known to be either obliterated or lost. The importance of the land survey phases of the total work program and its impact on property boundaries throughout the county can hardly be overemphasized.

The work was staged over a ten-year period. The first contract was executed in 1968 and the delivery of the last of the finished map sheets was specified for 1977. The photogrammetric firm selected to carry out the mapping work was Alster & Associates, Inc., Madison, Wisconsin, while the land surveying firm selected was Nielsen-Madsen of Racine, Wisconsin. The work was accomplished through close coordination between the two firms, with some of the geodetic control survey, as well as land surveying work, being accomplished by the local land surveying firm.

The county budgeted approximately $100,000 per year for a ten-year period to complete the work. The amount allocated constituted about .4 percent of the average annual county budget of $26 million over the ten-year period and about 1 percent of the average annual county tax levy of about $9 million over this period. This modest capital investment produced large-scale topographic maps covering the entire 340-sq.-mi. county, together with the base sheets necessary to produce companion cadastral maps efficiently. In addition, this modest investment relocated, monumented, and placed on the State Plane Coordinate System all 1,523 U.S. Public Land Survey corners within the county. Also, 1,843 supplementary second-order benchmarks were established within the county, of which 320 are marked by permanent concrete monuments.

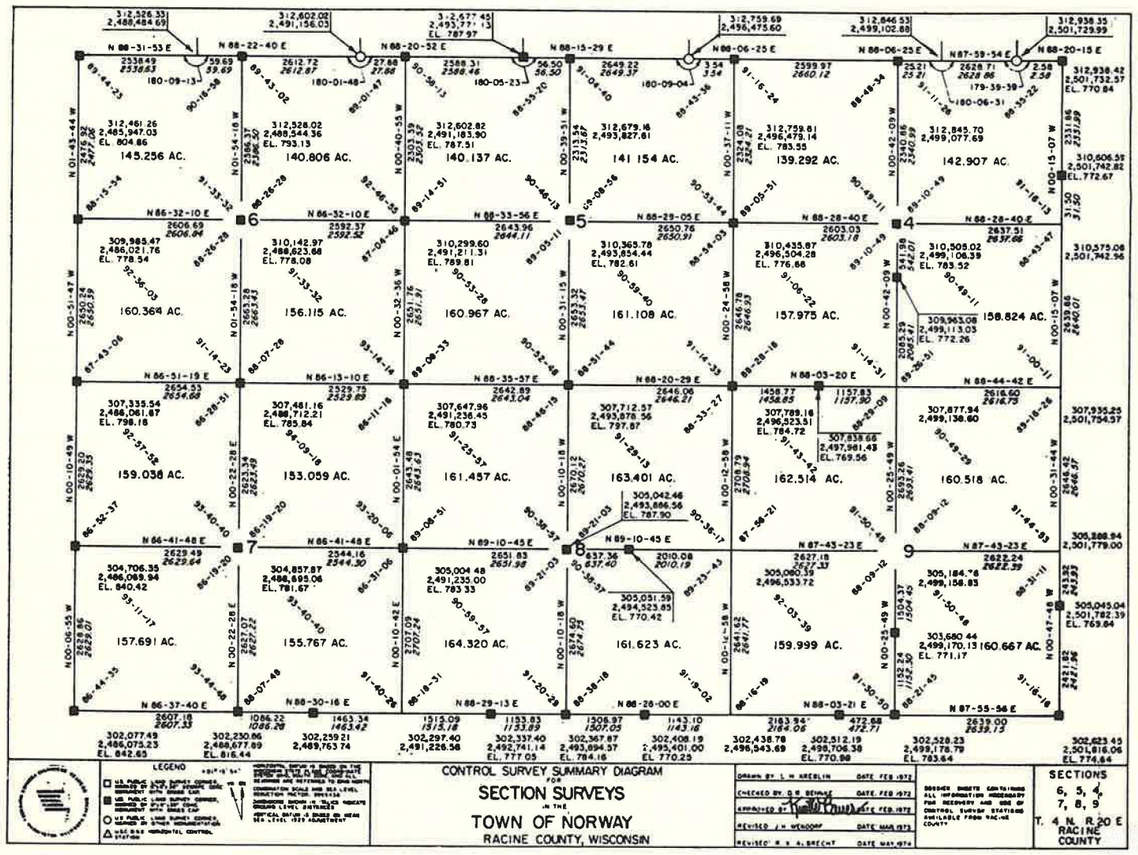


FIGURE 3.

Utilization of the System

The topographic maps and survey control network have been well received and widely used within the county. The maps and survey control system have been found to be most useful to attorneys; abstractors; assessors; land surveyors; civil engineers in private practice; private utility corporations; governmental agencies, such as city, village, and town planning and engineering departments; county and state highway departments; county planning and park departments; and the county soil and water conservation district.

Applications of the map and control survey system by the Racine County Highway Department have included highway location studies, including determination of horizontal and vertical alignments for county and local trunk highway improvements and alternatives thereto; land ownership studies for the development of highway right-of-way plats; appraisal of properties proposed for acquisition of land to be used for highway purposes; and the establishment of line and grade for construction, including the identification of new right-of-way lines in relationship to existing property boundaries. Control survey costs entailed in the engineering of three relatively short sections—totaling about nine miles in length—of county trunk highway proposed to be improved prior to the availability of the control survey system totaled almost $17,000 and provided information which did not have the permanent utility of the integrated mapping and control survey system.

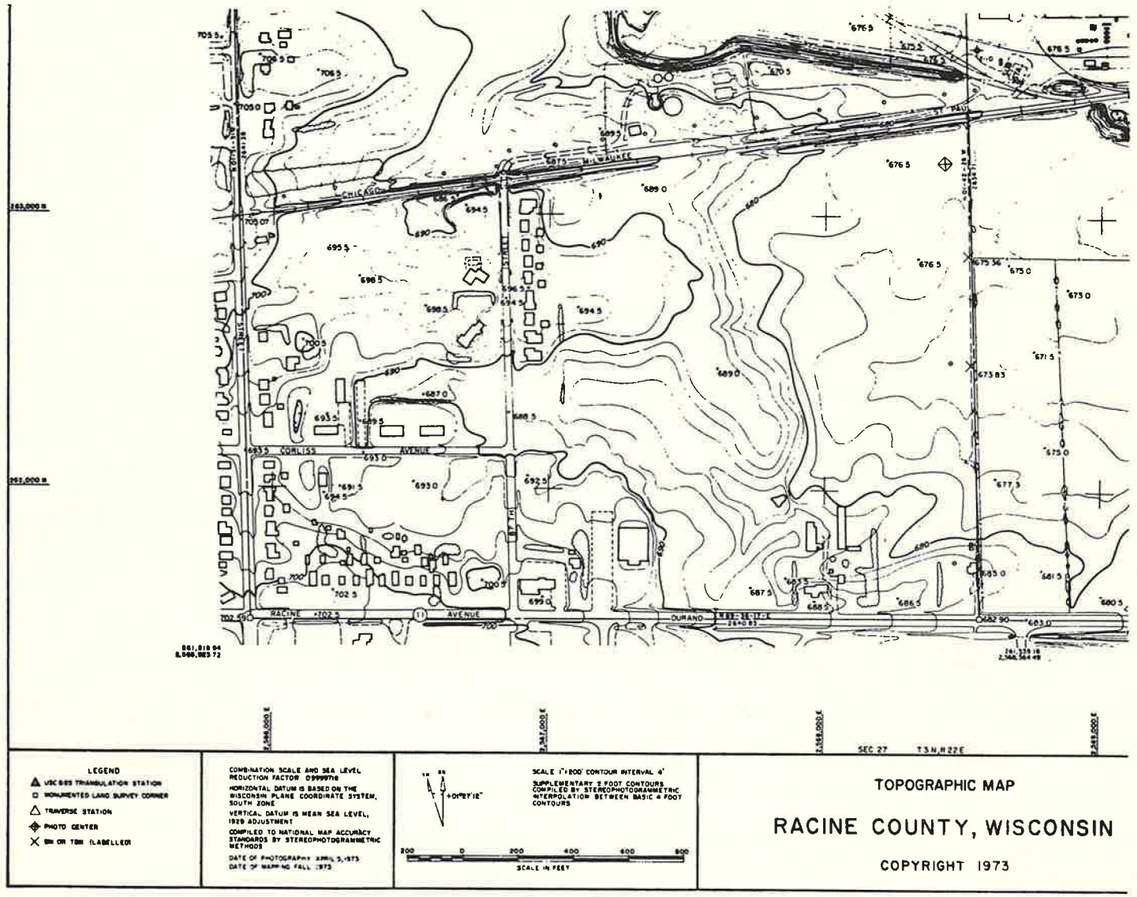


FIGURE 4.

The maps have proven particularly useful in highway drainage studies. A recent application serves to illustrate the cost savings possible through the availability and use of good large-scale maps. The design of a county trunk reconstruction project was begun prior to the availability of the large-scale maps, and eight cross culverts required in the project were located and designed, using the best available data. Prior to actual construction, the large-scale topographic maps became available and the highway design was revised. The information provided by the large-scale maps resulted in the reduction in size of five of the eight cross culverts, saving about 40 percent of the cost of the required drainage improvements.

Applications of the map and control survey system by the Racine County Park Department have included the analysis of alternative park road and parking lot layouts; the location of hiking trails and pedestrian circulation routes; the location of stairways and retaining walls; selection of park building sites and the preparation of site improvement plans; the analysis of drainage problems with alternate solutions; the development of master plans for nine major county parks; the location of ball diamonds and tennis courts and the selection of play areas; the location and design of campgrounds; the development of grading plans for various types of recreational areas, including ball diamonds, tennis courts, and ice rinks; preliminary designs for golf courses; and the identification of acquisition

boundaries for various park and parkway facilities.

Applications of the map and control survey system by the Racine County Planning and Zoning Department have included land subdivision planning; site location and planning studies for proposed county facilities; establishment of an areawide house numbering system; real property ownership studies; and extensive use in day-to-day administrative activities, including subdivision plat review, certified survey map review, and review of requests for conditional use permits and zoning changes.

Applications of the map and control survey system by the municipal units of government and by public utilities within the county have included the preparation of sanitary sewerage facilities; storm water drainage; and water supply system and facility plans; location of cross-country power transmission lines and control of the location and alignment of high voltage power transmission line towers; the study of airport runways, flight path location, and related land use control problems; the administration of local subdivision control and zoning ordinances; and lakeshore erosion studies. The maps have proven to be particularly useful agricultural drainage and flood control studies in the central and western portions of the county; in the engineering design of water control facilities, including major dams; in the conduct of areawide water quality management programs within the county; and in floodland delineation and mapping.

Summary and Conclusion

Racine County has, in 1976, marked the completion of a unified large-scale topographic mapping and control survey program which covers the entire county. The completion of this major surveying and mapping effort is a unique achievement by county government within Wisconsin and is also believed to be unique in the United States. Not only has the program produced large-scale, small contour interval topographic maps covering the entire county, but it has provided the county with a permanently monumented system of horizontal and vertical survey control, combining the best features of the U.S. Public Land Survey and State Plane Coordinate systems. The survey control system provides a monumented, recoverable control station of known position on both the U.S. Public Land Survey and the State Plane Coordinate systems and a known elevation at half-mile intervals throughout the entire county. The application of these two survey systems provides a unified system of survey control within the county; assures the full correlation of all engineering and cadastral surveys and maps; permits the preparation of both large-scale topographic and cadastral maps to National Map Accuracy Standards; and permits the effective use of these maps for planning and engineering purposes. Importantly, the application of this system of survey control perpetuates and revitalizes the long-established U.S. Public Land Survey system.

Under the Racine County program, large-scale topographic maps have been prepared to National Map Accuracy Standards covering an area of 340 sq. mi.; 1,523 U.S. Public Land Survey corners have been recovered or relocated, permanently monumented, and placed on the State Plane Coordinate System; and 1,823 second-order benchmarks have been established throughout the county, supplementing the elevations determined for the Public Land Survey corner monuments. For the first time the positions of these corners have been established accurately and precisely on the surface of the earth, relating these positions to a scientifically established map projection.

The survey control network can now be used for accurate cadastral and topographic mapping efforts and for land and engineering surveys. The large-scale topographic and cadastral maps produced under the program are truly effective planning and engineering tools. The network provides an efficient and economic means by which the maps produced under the program can be kept current. The maps and control survey network provide the county with an invaluable information data base, a basis for accurate public and private engineering and land surveys, and a basis for sound resolution of developmental and environmental problems of all types. ■

The following is a list of ISPLS member firms:

Anderson & Associates, Engineering
222 East Main Street
P. O. Box 585
Lebanon, IN 46052

B & K Engineering, Inc.
P. O. Box 546
Kendallville, IN 46755

H. R. Blankenbeker & Son
P. O. Box 157
Jeffersonville, IN 47130

Edwin O. Boyd
602 Main Street
Petersburg, IN 47567

Brady Land Surveying, Inc.
55308 Jay Dee Street
Elkhart, IN 46514

Columbus Surveying & Engr. Co.
P. O. Box 1171
Columbus, IN 47201

Paul I. Cripe, Inc.
150 East Market Street
Indianapolis, IN 46204

Richard E. Davidson
125½ West Main Street
Portland, IN 47371

Dickerson Aerial Surveys
729 S. Fourth St.
Lafayette, IN 47905

District 9 Land Survey Co.
202 West High Street
Lawrenceburg, IN 47025

John R. Donovan
2030 Inwood Drive
Fort Wayne, IN 46805

John E. Fisher
1526 Main Street
Lafayette, IN 47905

Indiana Surveying Co., Inc.
25 West Main Street
Greenfield, IN 46140

Mid-States Engr. Co., Inc.
107 North Pennsylvania Street
Indianapolis, IN 46204

O'Brien Engineering
448 Meadow Lane
Madison, IN 47250

Plumb, Tuckett & Hubbard
6481 Taft Street
Gary, IN 46410

Reid, Quebe, Allison, Wilcox & Assoc. Inc.
3901 Industrial Boulevard
Indianapolis, IN 46254

Schneider Engineering Corp.
3675 N. Post Road
Indianapolis, IN 46226

Sieco, Inc.
309 Washington Street
Columbus, IN 47201

Alan Stanley & Associates
15½ S. Indiana Street
Greencastle, IN 46135

William S. Tanke
R. R. 4, Tower Road
Valparaiso, IN 46383

Weihe Engineers, Inc.
10505 N. College Avenue
Indianapolis, IN 46280

ISPE EXECUTIVE SECRETARY RETIRES

Lloyd D. Hickerson of Indianapolis (6130 Evanston Avenue; phone: 255-5588), formerly of Peru, will retire June 30 after 14 years as executive secretary of the Indiana Society of Professional Engineers, President Dean P. Stanley, Fort Wayne, has announced.

He is a member of the Indianapolis Press Club and a charter member of the Indianapolis Public Relations Society.

Hickerson joined the engineers' organization in July, 1963 after 21 years with the Indiana State Police where he attained the rank of staff captain. He was administrative assistant to Superintendents John J. Barton and George A. Everett, both of Indianapolis.

On completing the department's recruit training at Culver Military Academy in 1942, he was assigned to Ligonier District as trooper and later transferred to the department's public relations division at Indianapolis headquarters. He organized safety education, visual aids and media support units to develop citizen participation in law enforcement programs.

Hickerson was responsible for a prize-winning, department-produced motion picture, "Operation Disaster," which depicted the reaction of emergency forces and citizens following a 1960 commercial plane crash near Tell City in which 63 persons perished. A weekly radio traffic safety series, developed from taped, roadside interviews with motorists by uniformed safety education personnel, was circulated among Hoosier public radio outlets under his supervision.

A former Peru resident, Hickerson served on the editorial staffs of the Peru Daily Tribune and the former Peru Republican. He also was area correspondent for the Associated Press and the Indianapolis News.

TRI-STATE LAND SURVEYORS' CONVENTION FOR FEBRUARY 1978
INDIANA – OHIO – KENTUCKY

During these warm to hot months a few surveyors are planning next winters annual conference. Kentucky, Indiana, and Ohio are joining together for a super conference to be held at the Drawbridge Inn near Cincinnati, February 16, 17, and 18, 1978. If a few are making preparations for all of us, then all of us should plan to attend.

It appears now that there will be at least three simultaneous programs and several nationally known speakers along with large exhibits (remembering they are trying to reach three states with one show), the comraderry, and the regular convention atmosphere.

Now comes the Suggestion

Plan part of your winter vacation in conjunction with the Tri-State in '78 conference. Many surveyors from northern Indiana and northern Ohio visit Florida in the winter time. The Drawbridge Inn is on I-75 if you are traveling by auto; and the Inn has free limosine service from the Greater Cincinnati Airport is you are coming by air.

The convention facility has a large indoor pool for the family and a unique wives program is being planned. The traveling expenses involved with attending the conference could be met with tax-free dollars.

FEBRUARY 16, 17, and 18, 1978

AMERICAN CONGRESS ON SURVEYING AND MAPPING
210 Little Falls Street, Falls Church, Virginia 22046

A.C.S.M.

(Please read both sides of this application blank)
(Please typewrite or print)

APPLICATION FOR MEMBERSHIP

Name _____
(LAST NAME) (first) (middle)

Occupation _____

Engaged in: (private practice ____) (industry ____) (public utility ____) (education ____)
(agency of government: municipal ____; county ____; state ____; federal ____)
Other (describe): _____

Employed by: _____

[ ] Business address _____
street and number

City _____ State _____ Zip Code _____

[ ] Home address _____
street and number

City _____ State _____ Zip Code _____

CHECK THE PREFERRED Mailing-Plate address, for receiving ACSM Publications and Correspondence.

Date and Place of Birth: _____

Education: Years completed: high school ____; college ____; other _____

Diplomas, certificates, or degrees _____

Name of school _____

Experience in occupational field of interest:
Number of years: sub-professional ____; pre-professional ____; professional ____ (____)
total

Professional Registration — if registered give State and registry number:

[ ] Land Surveyor _____ [ ] Engineer _____

[ ] Other _____

Membership in kindred national societies:

ASP ____; ASCE ____; NSPE ____ (____); SAME ____; AGU ____; other _____
State

Membership in local surveying or mapping group: No ____ Yes ____ Name the group or organization _____

See Membership Qualifications on back of this application form. Check the membership applied for:

[ ] Member; [ ] Associate; [ ] Affiliate; [ ] Student.

Check the ACSM Division under which criteria you wish to be qualified. Check ONE only.

[ ] Control Surveys; [ ] Land Surveys; [ ] Cartography.

Check other interest: [ ] Education; [ ] Instruments; [ ] Computing; [ ] Marine Surveying and Mapping;

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Date _____ **19**____ **Signature** _____

NOTE: (Inclusion of appropriate dues payment will expedite processing of application)

ACSM 85/77

AMERICAN CONGRESS ON SURVEYING AND MAPPING
Membership Qualification and Dues (1973 Revision)
Effective January 1, 1974

MEMBER ANNUAL DUES $27.50

Any person who has attained professional qualification by education and/or experience in any of the various fields of surveying, mapping or charting, *the criteria for which will be determined by each Division of primary interest* subject to approval by ACSM Board of Direction, and administered by the Committee on Admissions, may become a Member of ACSM.

DIVISIONAL CRITERIA FOR CORPORATE MEMBER

CARTOGRAPHY DIVISION –

Graduation with a Bachelor's or higher degree from an accredited college or university in a discipline or area of study which would qualify the applicant for a professional position in the field of mapping or charting

or

eight years of active experience in mapping or charting, with a minimum of four years in recognized professional activities. The cited record of these qualifications having been verified and approved by the Cartography Division Membership Committee. Up to four years of higher education may be substituted for experience.

CONTROL SURVEYS DIVISION –

(a) Any person may become a member who is professionally qualified in the mathematical, physical or applied sciences or engineering arts, with specialist interests in control surveys, geodetic or precise plane surveys, geodesy, geophysics, optical or radio astronomy, earth environmental or space physics, specialized precision measurements and related adjustments and computations, or the development of optical, electromagnetic, mechanical, photogrammetric or other appropriate means of metrology, and who

(1) Has graduated with a Bachelor or higher degree from an accredited college or university in a discipline related to the fields noted in the foregoing item (a), or;

(2) Is a licensed Professional Engineer, or a licensed Land Surveyor, or a licensed Photogrammetric Engineer, or a licensed Planner, competent and experienced in one of the fields noted in the foregoing item (a), or;

(3) Has attained professional grade competence in one of the fields noted in the foregoing item (a) by specialized education or self study, with not less than 8 years experience in the fields of item (a) and the cited record of these qualifications having been verified and approved by the Control Surveys Division Membership Committee. Up to 4 years of higher education may be substituted for experience.

LAND SURVEYS DIVISION –

1. Any person registered to practice Land Surveying in those political areas where such registration is a legal requirement.
2. Any person practicing Land Surveying under an engineer's registration in those political areas where such registration to practice Land Surveying is a legal requirement.
3. Any person practicing Land Surveying under an engineer's registration in those political areas where such practice is permitted under such registration and where such practice conforms with the guide lines established in 6 below.
4. Any person practicing Land Surveying in those political areas where no legal registration to practice Land Surveying is required who meets the guide lines established in 6 below.
5. Any person practicing Land Surveying by virtue of his employment in public services who meets the guide lines established in 6 below.
6. The phrase "practicing Land Surveyor" as used in 3, 4 & 5 above shall refer to one who has been in responsible charge for a period of not less than 8 years (up to 4 years of higher education of a satisfactory character may be substituted) in any field of service identified as Land Surveying in any existing or future State statute governing the registration of Land Surveyors. The cited record of these qualifications having been verified and approved by the Land Surveys Division Membership Committee.

FELLOW ANNUAL DUES $55.00

Any corporate Member in good standing who has belonged to ACSM for 8 or more years may be invited to apply for the grade of FELLOW. Persons with records of outstanding service to the profession who do not qualify under the above may be invited to apply for the grade of FELLOW.

ASSOCIATE MEMBER ANNUAL DUES $16.50

Any person with an associative interest in the profession of surveying, mapping and charting, *the criteria for which shall be determined by each Division of primary interest* subject to approval of ACSM Board of Direction, and administered by the Committee on Admissions, may become an Associate Member of ACSM.

DIVISION CRITERIA FOR ASSOCIATE MEMBER

Any person with an associate interest or actively engaged in the scope of interest of a Division, whose qualifications do not meet the requirements of member, may become an associate member.

STUDENT MEMBER ANNUAL DUES $5.50

Any person pursuing a course of study as a graduate or undergraduate student on a fulltime basis (at least 9 semester hours) leading to a career in the profession of surveying, mapping and charting.

INDIVIDUAL AFFILIATE MEMBER ANNUAL DUES $22.50

Members of other allied professions or persons with scientific acquirement or technological experience in their special pursuit to qualify them to cooperate with Members of ACSM in the advancement of professional knowledge and practice in surveying, mapping, and charting, who might not otherwise qualify for corporate membership in ACSM.

* * * * * * * * * * * * *

REFERENCES (Persons in knowledge of applicant's qualifications)

Name _____ Occupation and title _____

Address _____
street city state zip code

Membership in ACSM [ ] or kindred society [ ] (indicate) _____

If professionally registered, give State and Registry number.

Land Surveyor [ ] _____ Engineer [ ] _____

Remarks: _____

* * * * * * * * * * * * *

Name _____ Occupation and title _____

Address _____
street city state zip code

Membership in ACSM [ ] or kindred society [ ] (indicate) _____

If professionally registered, give State and Registry number.

Land Surveyor [ ] _____ Engineer [ ] _____

Remarks: _____
(Attach extra paper if required)

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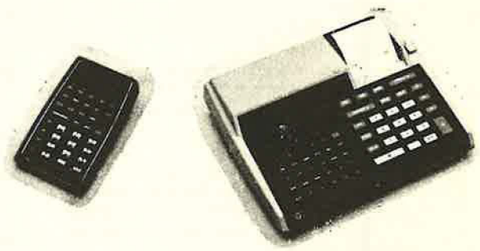

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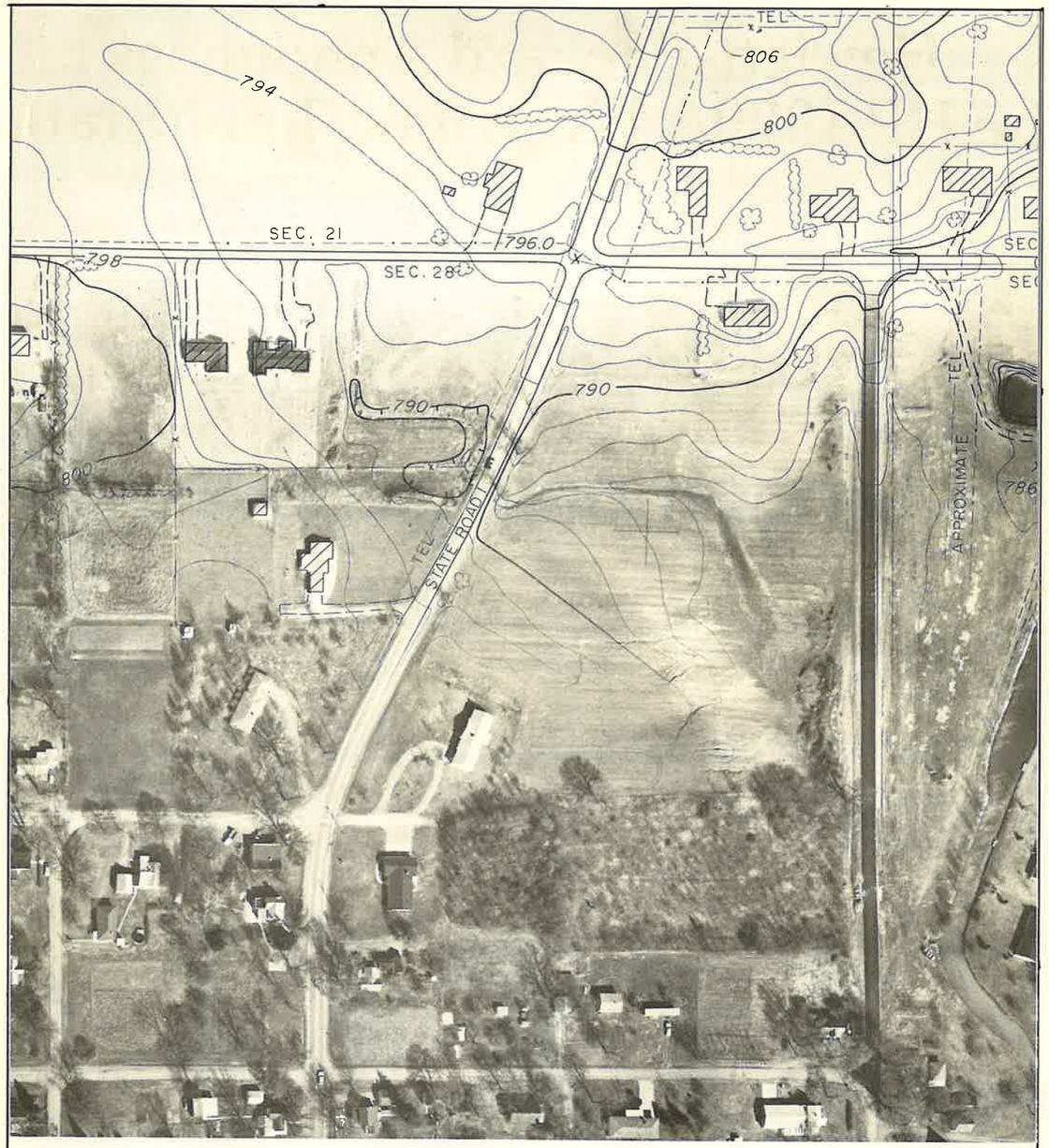

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