

TECHNICAL REPORT ON SURVEY CONTROL PUBLISHED

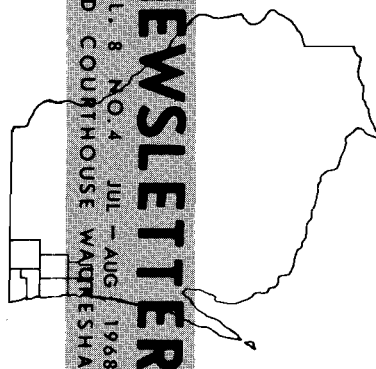
The Southeastern Wisconsin Regional Planning Commission recently completed and published a Technical Report on horizontal and vertical survey control in southeastern Wisconsin. This report provides an unusual example of both the effectiveness of the ongoing cooperative regional planning effort and the kind of valuable by-products which can accrue to an area through sound regional planning and the coordinated efforts of state and local agencies of government.

In February of 1964, the Southeastern Wisconsin Regional Planning Commission published its Planning Guide No. 2, Official Mapping Guide. This guide contained a description of an unusual system of survey control, which was recommended to governmental agencies operating within the Southeastern Wisconsin Region as a basis for the compilation of large-scale topographic and cadastral (real property ownership) base maps for planning and municipal engineering purposes and for the preparation and administration of certain plan implementation devices, particularly the Official Map.

The recommended survey control system requires the relocation and monumentation of the U. S. Public Land Survey section and quarter-section corners and the utilization of these monumented corners as stations in highly accurate traverse and spirit-level nets, both nets being tied to the national geodetic control survey nets. The traverse net thus establishes the exact lengths and the bearings of all quarter-section lines, as well

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as the geographic positions in the form of state plane coordinates¹ of the U. S. Public Land Survey corners themselves, while the spirit-level net establishes the exact elevation above sea level of the monuments marking the corners.

ADVANTAGES OF RECOMMENDED SYSTEM

The recommended system of survey control has the following important advantages:

1. It provides a consistent and accurate system of control for real property (real estate) boundary line mapping, as well as for topographic mapping. Since the boundaries of the original government land subdivision form the basis for all subsequent property divisions and boundaries within the Region, the accurate re-establishment of the quarter-section lines and corners permits the compilation of property boundary line maps, as well as the compilation by photogrammetric methods of topographic maps. Moreover, these property boundary line maps can then be readily and accurately updated and extended into newly developing areas, since all new land subdivision plats must, by law, be tied to corners established in the public land survey and since the accuracy of these plats can be readily controlled by local subdivision regulations.
2. It provides a common system of control for both topographic and real property boundary line maps. By relocating the U. S. Public Land Survey corners and accurately placing them on the State

¹ *State plane coordinates are derived from the State Plane Coordinate System established by the U.S. Coast and Geodetic Survey for the purpose of defining and stating the position or location of points on the surface of the earth within the State of Wisconsin. Wisconsin Statutes specifically permit the use of this coordinate system for land survey and description purposes as a supplement to the U.S. Public Land Survey System.*

Plane Coordinate System, it becomes at once possible to prevent the future loss of these corners and to correlate accurately property boundary line information with topographic details supplied by aerial mapping. This placing of property boundary and topographic data on a common datum is essential to sound urban mapping, yet such a common control datum has rarely been used in the past. The establishment of state plane coordinates for the public land survey corners permits the transfer of details supplied by aerial mapping to property boundary line maps by simple overlay methods. Great savings in office research time are made possible during the planning and design phases of municipal public works projects by having all available information—topography, property boundaries, survey control—accurately correlated on one map. Moreover, such complete and correlated information and control make possible the consideration and analysis of many alternate routes for such public works facilities as trunk sewers, water transmission lines, and major trafficways and of many alternative solutions to sewerage, water supply, and transportation problems.

3. It provides an extremely practical horizontal control network readily useable by both private and public surveyors and engineers for all subsequent survey work within the urban area. The control system outlined places a monumented, recoverable control station of known position on both the U. S. Public Land Survey and State Plane Coordinate Systems and of known elevation at half-mile intervals throughout the area covered. This monumented control net not only greatly expedites the conduct of such engineering surveys as are made almost daily, year in and year out, by public works agencies for planning, design, and construction layout purposes but also correlates and coordinates all of the survey work throughout the entire area. In this regard, the control system outlined is particularly valuable in providing a common system of control for the precise location and mapping of underground utilities, both public and private.

4. It, for the first time, makes the State Plane Coordinate System available as a practical matter for property boundary survey control without violating long-established principles of boundary law and land survey practice, thus preparing the way for the ultimate use of state plane coordinates in boundary descriptions and for a modern system of automated land records. The fact that the control survey system utilized requires the permanent monumentation of public land survey corners does much in itself to stabilize real property boundaries and makes the control net of great value to property owners and private land surveyors. Indeed, in many cases, the proposed control net will provide the first meaningful control net available to the land surveyor. By utilizing this control, local land surveyors can, without changing their methods of operation or incurring any additional expense, "automatically" tie all of their surveys to the State Plane Coordinate System; and all bearings used in land surveys, plats, and legal descriptions can be directly referenced to grid north and thereby to geodetic north.
5. It permits lines drawn on public maps—whether these lines represent the limits of land to be reserved for future public use, the limits of land to be taken for immediate public use, the limits of districts to which public regulations are to be applied, or the location and alignment of proposed public works projects—to be accurately and precisely reproduced upon the ground at the time of plan implementation or facility construction.
6. It is readily adaptable to the latest survey techniques and is of relatively low cost as compared to alternative urban survey control systems, such as first-order triangulation systems with attendant supplementary control nets.

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The recommended system of survey control becomes particularly economical when carried out as an integral part of a photogrammetric mapping program. When it is realized that the cost of control surveys executed in the usual manner for aerial topographic mapping projects can account for one-quarter to one-third of the total cost of the finished maps and when it is further realized that this control is largely unrecoverable and unuseable by local engineers and surveyors, the real economy of utilizing a control system, such as outlined herein, becomes apparent. By allocating to the control survey work a relatively small additional amount of the total resources that might be available for mapping, far more effective and useful finished maps can be obtained; and a valuable and permanently useful system of survey control can be concurrently provided. The only significant increases in costs actually assignable to the control system proposed are relatively small and are solely those incurred for the relocation and monumentation of the public land survey corners and the small amount of additional traversing required to coordinate these corners. Experience indicates that this amounts to approximately 20 percent of the total cost of an urban mapping project, a very small increase in the total cost when weighed against the benefits to be derived.

SYSTEM WIDELY ACCEPTED

The recommended system of survey control has been widely adopted and applied within the seven-county Region. As of December 31, 1967, the Cities of Franklin, Hartford, New Berlin, and Oak Creek; the Villages of Brown Deer, Germantown, Menomonee Falls, and River Hills; and the County of Racine, as well as the Regional Planning Commission itself, had adopted and applied the recommended survey control system as an integral part of extensive large-scale floodplain, highway corridor, and general municipal base mapping programs. In addition, the State Highway Commission of Wisconsin has adopted the recommended system of survey control as a basis for its highway corridor mapping efforts within southeastern Wisconsin. Consequently, the system has

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been extended to date throughout 287 square miles of area within the Region; and 1,636 U. S. Public Land Survey section and quarter-section corners have been relocated, monumented, and positioned accurately and precisely on the State Plane Coordinate System. In addition, work is presently underway which will extend the recommended system into an additional 76 square miles of area within the Region and which will result in the relocation, monumentation, and coordination of an additional 475 U. S. Public Land Survey section and quarter-section corners. Thus, the recommended system of survey control will shortly have been extended over a total area of 363 square miles, or over 13 percent of the 2,689 square mile Region (see Map 1).

System Useful to Many

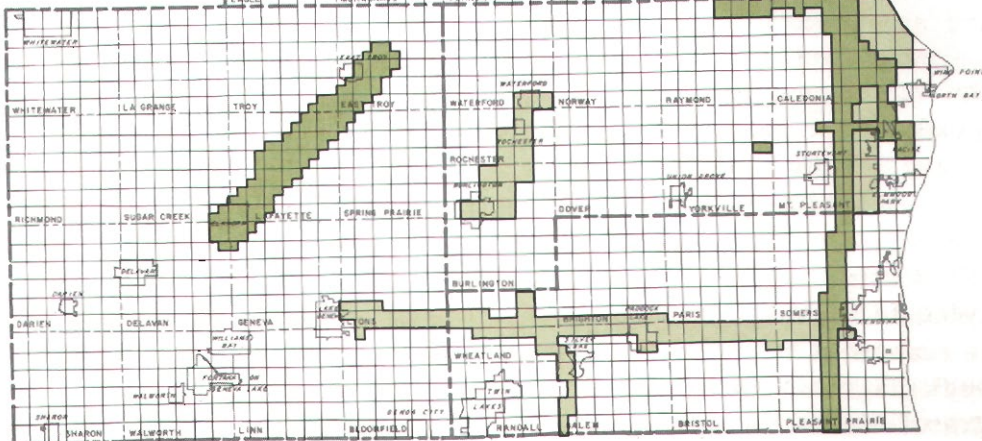
The survey control system is of use to attorneys, abstractors, assessors, surveyors, and civil engineers in private practice and to private utility corporations, as well as to governmental officials and agencies, such as county, town, city, and village treasurers; assessment, planning, and engineering departments; county and state highway departments; sewerage, expressway, airport, harbor, and park commissions; and soil and water conservation districts. It was, therefore, believed desirable to assemble all of the survey data obtained to date through application of the system and to publish this data in a single report for ready use by interested public and private agencies. SEWRPC Technical Report No. 7, Horizontal and Vertical Survey Control in Southeastern Wisconsin, July 1968, presents a collation of all of the survey control data collected to date within the Region through application of the Commission's recommended system of survey control. The report includes maps indicating the areas covered by new large-scale topographic maps and throughout which the U. S. Public Land Survey corners have been relocated, monumented, and coordinated. The actual survey information is presented by county in a series of control survey summary diagrams, each diagram covering six U. S. Public Land Survey sections. The diagrams show: the exact sea level grid length, the ground level length,

LEGEND

- GRID NORTH



GRAPHIC SCALE



LAKE MICHIGAN

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and the grid bearings of the exterior boundaries of each quarter section surveyed; all monuments erected; the number of degrees, minutes, and seconds in the interior angles of each quarter section surveyed; state plane coordinates of all remonumented quarter-section corners, together with their public land survey system identification; the bench mark elevation of all monuments set; and the basic U. S. Coast and Geodetic Survey control stations utilized to tie the public land survey corners to the national geodetic control survey data. In addition, the diagrams indicate the area in acres of the U. S. Public Land Survey quarter sections surveyed (see Figure 1).

The diagrams thus provide all of the information necessary to prepare base maps, to make engineering and land survey office computations and analyses, and to plan field surveys. The basic survey data contained in the report should have permanent value for the conduct of ongoing survey work within the Region.

PERPETUATING LAND SURVEY CORNERS

The U. S. Public Land Survey System, established by an act of Congress in 1785, was carried out in southeastern Wisconsin between 1830 and 1836. It stands today as the basis for all division of land and for all real property boundary description within the Region. The system is one of the finest ever devised for describing and marking land. It provides a basis for a clear, unambiguous title to land, together with the physical means by which that title can be related to the land which it describes. The system provided the basis for the swift, orderly development of land within much of the United States by private enterprise and was an important element in the creation of the Nation. It also made possible the compilation of fairly accurate maps of the vast wilderness areas controlled by the Federal Government after the formation of the United States, the Louisiana Purchase, and subsequent territorial expansions. It provided a valuable inventory of the natural resources of these wilder-

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ness areas, of the rivers and lakes, mineral deposits, special geologic and topographic features, woodlands, and soils and an efficient means of locating rights-of-way for railroads, highways, telegraph, and other transportation and communication facilities essential to a developing Nation. Through its widespread application, the U. S. Public Land Survey System became an indispensable public facility. Because it is used so fundamentally and so intensely, its worth and value is inestimable.

The system, however, has a serious flaw. Its use requires the perpetuation of the monuments set by the original government surveyor, monuments the positions of which were not precisely related to the surface of the earth through a scientifically established map projection. This fact makes the preservation of the U. S. Public Land Survey corners extremely important to all real property owners. The state, in whose care the completed survey system was placed, has been negligent in preserving this indispensable facility; and time and the activities of man have served to destroy many of the public land survey corners within the Region.

Eventually even as good a survey as the U. S. Public Land Survey System will, by loss of original monuments and errors in replacement, become little more than a paper record beyond the power of the surveyor to transform into a ground pattern of monumented lines without the aid of court decisions prescribing how conflicting records and survey discrepancies are to be construed and interpreted. The accurate retracement of property boundary lines under such conditions is extremely difficult and expensive, and the accurate mapping of such boundaries by public agencies is well nigh impossible. Moreover, the uncertainties of title and accompanying litigation resulting from such conditions become more and more unsatisfactory as urbanization intensifies and land values increase.

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By relocating and adequately monumenting the public land survey corners and accurately and precisely placing these corners on the State Plane Coordinate System, many of these kinds of difficulties plaguing land-owners, realtors, attorneys, abstractors, assessors, land surveyors, and civil engineers within the Region can be eliminated, and the U. S. Public Land Survey restored to the condition that will permit its continued use in engineering and land surveys in a sound and efficient manner. Thus, one of the valuable by-products of the recommended survey control system is the perpetuation of the U. S. Public Land Survey corners, a by-product which will have lasting value within the Region. This by-product is also perhaps one of the most unusual associated with any regional planning operation within the United States.

SEWRPC NOTES

New Commissioner Appointed

Mr. Leonard C. Rauen, Mayor of the City of Burlington, Racine County, has been appointed to the Regional Planning Commission by Governor Warren P. Knowles. Mr. Rauen replaces Sam Rizzo, who resigned due to the pressure of commitments in his work as Subregional Director of the U.A.W. Mr. Rauen, Mayor of the City of Burlington for two years, will serve an unexpired term on the Commission ending September 15, 1970. He has been appointed to the Administrative and Planning and Research Committees of the Commission.

New Division Heads Named

William D. McElwee assumed his duties on May 1, 1968, as head of the Commission's Natural Resources and Environmental Design Division, replacing Lawrence E. Wright. Mr. McElwee comes to the staff after 10 years as City Engineer and Director of Public Works for the Cities of Muscatine and Sioux City, Iowa. On August 1, 1968, Philip C. Evenson was appointed head of the Community Assistance Division, replacing William J. Kockelman. Mr. Evenson formerly was assigned to the Commission's Land Use Planning and Research Division.

Recent SEWRPC Publications

As noted in the lead article of this Newsletter issue, the Commission has published SEWRPC Technical Report No. 7, Horizontal and Vertical Survey Control in Southeastern Wisconsin. The report constitutes a valuable assembly of survey control data within the Region and should be of interest to attorneys, abstractors, assessors, private utility officials, and many governmental officials, as well as to surveyors and engineers practicing within the Region. Copies of the report are available from the Commission at prices of \$5.00 within the Region and \$10.00 outside the Region.

The Commission also has available for distribution to interested parties SEWRPC Technical Report No. 8, A Land Use Plan Design Model, Volume One, Model Development. This report documents the first phase

of a research program aimed at the development of a mathematical model that can be used to design land use plans that will satisfy predetermined community development objectives and standards while minimizing costs. This research program is being financed entirely by an urban planning research and demonstration grant from the U. S. Department of Housing and Urban Development.

Also available for distribution to interested citizens and agencies is the Comprehensive Library Planning Program Prospectus, which was highlighted in the preceding issue of the SEWRPC Newsletter. The Prospectus discusses the major problems facing local library boards in the Region today and outlines the major work elements of, and organization for, a comprehensive regional library planning program. Copies of the Prospectus are available from the Commission at prices of \$1.50 within the Region and \$3.00 outside the Region.

Regional Sanitary Sewerage System Planning Program

The Commission has been notified by the U. S. Department of Housing and Urban Development that approval has been given to a planning grant application submitted by the Commission for funds in partial support of the preparation of a regional sanitary sewerage facilities plan. Such a plan is very important to the coordinated development of sanitary sewerage facilities in the Region, to regional land use plan implementation, and to sound areawide review by the Commission of applications by local governments for federal grants-in-aid for sewerage facility construction. The plan is intended to meet the federal planning prerequisites for federal grant approvals relating to such constructions and, as such, to meet the Commission's responsibilities in this respect to the constituent local units of government. The Commission is now in the process of forming a Technical Coordinating and Advisory Committee on Regional Sanitary Sewerage System Planning to structure and guide the program and to achieve the necessary intergovernmental coordination and active participation of local officials in this important planning program.

Compilation of Residential Building Permit Statistics

In cooperation with the Metropolitan Builders Association of Greater Milwaukee, the Commission is now placing on computer tape file residential building permit data furnished by the local building inspectors in the four-county Milwaukee Standard Metropolitan Statistical Area. The Metropolitan Builders Association has been collecting this information and publishing monthly summaries for 12 years. The introduction of electronic data processing methods to the collection and dissemination of the residential building permit data will permit quicker retrieval and use of the information by the Metropolitan Builders Association. It will provide the Commission staff with valuable basic data useful in the preparation of annual current population estimates on a small geographical area basis.

AROUND THE REGION

Racine County

Recently the Racine County Soil and Water Conservation District Supervisors prepared and distributed a booklet, entitled A Homesite in the Country??, advising prospective homesite purchasers that Racine County is zoned, requires building permits, and that certain soils have severe and very severe limitations for private soil absorption sewage disposal systems.

City of Kenosha

The City of Kenosha Planning Commission, in accordance with Section 62.23(2) of the Wisconsin Statutes, adopted on June 6, 1968, the comprehensive plan and implementation recommendations prepared for the Kenosha Planning District. The Kenosha Planning District includes all that area in Kenosha County lying east of IH 94 and is comprised of the City of Kenosha and Towns of Somers and Pleasant Prairie. On June 17, 1968, the Common Council of the City of Kenosha acknowledged and concurred with the Planning Commission's action. The plan provides for the orderly growth and development that will occur within the District in the years ahead and meets the desires of the people of the District for a safer, more healthful, and pleasant environment.

QUESTION BOX

WHAT IS MEANT BY THE TERM "SURVEY CONTROL"?

A survey control system consists of a network of points whose horizontal and vertical positions and interrelationships on the surface of the earth have been accurately established by field surveys and to which map details and other surveys may be adjusted and against which they may be checked. The establishment of a basic system of survey control is essential to any accurate mapping effort and to the conduct of engineering and land surveys on a day-to-day basis.

In urban areas it is essential that any survey control system meet two basic criteria if maps and surveys based upon it are to be effective planning and engineering tools. First, it must permit the accurate correlation of property boundary line information with topographic data. Second, it must be permanently monumented on the ground so that lines on the map may be accurately reproduced in the field, both for public works construction and for the exercise of land use controls, such as zoning and official mapping.

QUOTABLE QUOTE.....

"In the inheritance which you will hold in the land that the Lord your God gives you to possess, you shall not remove your neighbor's landmark, which the men of old have set.

"'Cursed be he who removes his neighbor's landmark.' And all the people shall say, 'Amen.'"

Deuteronomy 19:14
27:17

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