

MINUTES OF THE THIRD MEETING
TECHNICAL ADVISORY COMMITTEE
FOR THE REVIEW AND REEVALUATION OF THE
REGIONAL CONTROL SURVEY PROGRAM

DATE: February 15, 2008

TIME: 9:00 a.m.

PLACE: Commissioners' Conference Room
Regional Planning Commission Offices
W239 N1812 Rockwood Drive
Waukesha, Wisconsin

Members Present

Kurt W. Bauer Chairman	Executive Director Emeritus, SEWRPC, County Surveyor for Kenosha, Milwaukee, Walworth, and Waukesha Counties
John M. Bennett	City Engineer-Director of Public Works, City of Franklin
John P. Casucci	Survey Land Development Manager, R.A. Smith National, Inc.
Harold S. Charlier	Executive Director, Wisconsin Society of Land Surveyors
Michael R. Duckett	President, Duckett Group; Executive Director, Southeastern Wisconsin Professional Baseball District
John T. Ellingson	Wisconsin State Geodetic Advisor, U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Geodetic Survey
Thomas M. Grisa	Director of Public Works, City of Brookfield
Gregory G. High	Director; Architectural, Engineering and Environmental Services; Milwaukee County Department of Transportation and Public Works
Marcia G. Lindholm	Civil Engineer Senior, City of Milwaukee Department of Public Works
Cecil F. Mehring	Former Manager of Planning and Engineering Services, Racine County Department of Public Works
George E. Melcher	Director of Planning and Development, Kenosha County
Robert W. Merry	Chief Technical Officer, Aero-Metric, Inc.
Glen R. Schaefer	Geodetic Engineer, Wisconsin Department of Transportation
Thomas J. Tym	Head, Technology Services Department, Ruekert-Mielke, Inc.
William T. Wambach	Former District Director, District 1, Wisconsin Department of Transportation

Members Absent

Kent B. Pena	State GIS Coordinator, U.S. Department of Agriculture Natural Resources Conservation Service
Daniel R. Talarczyk	Survey Services Supervisor, Milwaukee Metropolitan Sewerage District

Guest Present

Donald G. Dittmar

Manager, Land Information Systems Division, Waukesha
County Department of Parks and Land Use

Staff Present

Earl F. Burkholder

Consulting Geodetic Engineer

Donald P. Simon

Chief Planning Illustrator, SEWRPC; Deputy County Surveyor
for Kenosha, Milwaukee, Walworth, and Waukesha Counties

Lynn G. Heis

Staff Secretary, SEWRPC

CALL TO ORDER AND ROLL CALL

Chairman Bauer called the meeting to order at 9:00 a.m. Roll call was taken by circulating an attendance signature sheet, and a quorum was declared present.

CONSIDERATION OF REVISED MINUTES OF THE MEETING OF JULY 25, 2007.

Chairman Bauer noted that copies of the revised minutes of the first meeting of the Technical Advisory Committee for the Review and Reevaluation of the Regional Control Survey Program held on July 25, 2007, had been distributed to all members of the Committee for review prior to the meeting.

Chairman Bauer called attention to the Secretary's Note on page 5 of the minutes of the second meeting of the Committee. That note indicated that because the minutes of the meetings of the Committee are proposed to be appended to Mr. Burkholder's final report to the Commission; and, contrary to long-established Commission policy, the minutes of the first meeting held on July 25, 2007, were revised in their entirety to reflect all of the changes directed to be made in the initial draft of those minutes by the Committee at the meeting held on November 16, 2007; the revised minutes were therefore now being submitted to the Committee for consideration and approval.

Chairman Bauer noted that Mr. Schaefer had been of great help in completing the minutes of the Committee meetings, freely giving of his time, knowledge, and experience to review of the preliminary drafts of the minutes with particular emphasis on assuring the technical validity as well as to the quality of the text. Mr. Schaefer, he said, deserved much of the credit for the quality and completeness of the minutes.

There being no corrections, the revised draft of the minutes of the first meeting of the Committee held on July 25, 2007, were approved as submitted on a motion by Mr. Grisa, seconded by Mr. Bennett and carried unanimously.

CONSIDERATION OF MINUTES OF THE MEETING OF NOVEMBER 16, 2007.

Chairman Bauer noted that copies of the minutes of the second meeting of the Technical Advisory Committee for the Review and Reevaluation of the Regional Control Survey Program had been distributed to all members of the Committee for review prior to the meeting. He asked the Committee to consider approval.

Mr. Tym called attention to the third line of the last paragraph on page 2 indicating that the phrase "pen ultimate" should be one word "penultimate." Mr. Schaefer called attention to the second line of the second paragraph on page 3 indicating that "National Geodetic Vertical Datum" should be corrected to "North American Vertical Datum." Mr. Tym called attention to the fifth line of the fourth paragraph on page 6 indicating that the phrase "U. S. Public Sand Survey system" should be corrected to read "U. S. Public Land Survey System." Mr. Tym called attention to the third line of the second paragraph on page 9 indicating that "bi-directional" should be corrected to read "bidirectional." He also noted, that there were other places in the minutes where the term concerned had been hyphenated, and that this should be corrected throughout the minutes.

Mr. Tym called attention to the Secretary's Note on page 13 noting that the map referred to occurred on page 15 and not 14. Mr. Grisa called attention to the first line of the second paragraph on page 18 indicating that the word "nothing" should be changed to "noting." Mr. Wambach called attention to the fourth line of page 19 indicating that the term "relayed" should be corrected to "relaid." He also called attention to the sixth line of the second paragraph on page 19 indicating that the term "line" should be struck. Finally, he indicated that the term "inability" in the penultimate line of the first partial paragraph on page 23 should be changed to "instability." Mr. Schaefer noted that the last word in this partial paragraph should be changed from "axes" to "axis."

There being no further corrections or additions, the minutes of the second meeting of the Committee held on November 16, 2007, were approved as amended on a motion by Mr. Melcher, seconded by Mr. Grisa, and carried unanimously.

Chairman Bauer noted that since these minutes were to be appended to Mr. Burkholder's final report, following the practice instituted for the minutes of the meeting of July 25, 2007, a corrected copy of the minutes of the November 16, 2007, meeting would be prepared for attachment to Mr. Burkholder's report.

CONSIDERATION OF REVISED DRAFT REPORT ENTITLED "REVIEW AND REEVALUATION OF THE REGIONAL CONTROL SURVEY PROGRAM."

Chairman Bauer noted that copies of the revised draft of Mr. Burkholder's report had been distributed to all members of the Committee for review prior to the meeting. He then asked Mr. Burkholder to undertake a page-by-page review of the revised report. The following comments were made, questions raised, and actions taken in the course of the review.

Mr. Charlier called attention to page 3 of the draft report suggesting that the article "the" be removed from the definitions of acronyms Numbers 4 DOD, 16 IGLD (55) and (85), 33 Region, and 44 WisDOT. After a brief discussion, it was further agreed that whether or not the article concerned was to be used with the terms concerned in the text of the report would be determined on the basis of the context.

Mr. Schaefer suggested, and the Committee concurred, that the definition of the first acronym - CBN - be given simply as "Cooperative Base Network." He suggested further, and the Committee agreed, that acronym Number 6 FBN be defined simply as "Federal Base Network." Mr. Schaefer further suggested, and the Committee agreed, that the definition for acronym Number 3 CORS be changed to read as "Continuously Operating Reference Stations - permanent GPS receiver installations."

Mr. Schaefer suggested, and the Committee concurred, that acronym Number 16 - "IGLD 55 and 85" be separated to read as follows with the succeeding acronyms being renumbered: Number 16 - IGLD 55 International Great Lakes Datum of 1955 developed jointly by the United States and Canada. Number 17 IGLD 85 - International Great Lakes Datum of 1985 developed jointly by the United States and Canada. Mr. Schaefer further suggested, and the Committee agreed, that the phrase "for Wisconsin" be added to the definitions for acronyms Number 21 - NAD 83 (1991) and Number 22 - NAD 83 (1997), and that the phrase "and resulting from a National readjustment," be added to acronym Number 23 - NAD 83 (2007). Mr. Schaefer also

suggested, and the Committee concurred, that the word “subsequent” be struck from the definition for acronym Number 24 - NAD 83 (xxxx), and that the definition for acronym Number 25 NADCON be revised to read “Program written by NGS to perform data conversions between NAD 27 and NAD 83.” Mr. Schaefer went on to explain that the NADCON program was written to perform data conversions between NAD 27 and NAD 83. Subsequently, he said, what had originally been called "NAD 83" was renamed to "NAD 83 (1986)" and an option added to the program to convert from NAD 83 (1986) to HPGN; HPGN referring to adjustments done in different years in different states; the datum/adjustment for HPGN being NAD 83 (1991) in Wisconsin. He noted that NADCON does not have the capability to convert between NAD 27 and NAD 83 (1991) directly; but if the original program and the option program are considered one rather than two, then a loose interpretation could be that NADCON provides conversion between NAD 27 and NAD 83 (1991) even though it is two steps using different algorithms.

Mr. Schaefer suggested, and the Committee concurred, that two acronyms be inserted as Numbers 28 and 29 with the subsequent acronyms being renumbered accordingly; the additional acronyms being Number 28 - NAVD 88 (1991) - original adjustment of the new national vertical datum for Wisconsin; and Number 29 - NAVD 88 (2007) – “Adjustment of the new national vertical datum resulting from the Wisconsin Height Modernization Program.” Mr. Schaefer suggested further, and the Committee concurred, that the definition for acronym Number 40 be revised to read as “Program written by NGS to perform vertical datum conversions between NGVD 29 and NAVD 88.” Mr. Schaefer observed that the conversion was in fact between NGVD 29 and NAVD 88 (1991) and not between NGVD 29 and NAVD 88 (2007).

Mr. Schaefer called attention to acronym Number 43 and suggested that to be consistent with WisDOT’s utilization, this acronym be written as “WI-HMP.” Mr. Schaefer noted that the report contained exhibited inconsistencies regarding the form of terms, and suggested that throughout the report, when referring to a survey monument, the term “bench mark” be used not benchmark as had been agreed to at earlier meetings. Similarly, he said, the term “bi-directional” be consistently used as one word without hyphenation.

In response to a question raised by Mr. Burkholder, a brief discussion ensued concerning the need for length, and content of the section of the report on monumentation. Chairman Bauer, Messrs. Mehring and Wambach supported retention of the text concerned and the Committee agreed.

Mr. Ellingson suggested, and the Committee agreed, that the last sentence of the first unnumbered paragraph on page 5 be changed to read as follows: “within the seven-county Region, the datums in use include both NAD 27, NGVD 29, and the new datums of the NSRS.”

Mr. Tym objected to the second numbered paragraph on page 6 as written, noting that within the context that paragraph referred to property corners, broadly defined, and not just to U.S. Public Land Survey corners, yet stated that it was possible to locate such corners using satellite observation derived coordinate values. This, he said, implied that there is an existing database of coordinates for such corners, which was clearly not the case. It may be possible, he said, to reestablish in this manner U. S. Public Land Survey corners for which accurate coordinates have previously been determined, but this was clearly not the case for the vast majority of existing real property boundary corners.

A lengthy discussion ensued in which Chairman Bauer agreed with Mr. Tym, but noted that where newer land survey plats and certified survey maps had been properly tied to the Commission promulgated control survey system, State Plane Coordinates were available for the block and lot corners as platted.

Mr. Schaefer observed that the numbered paragraph concerned was linked to the first unnumbered paragraph on page 6 and indicated that, in his opinion, the first sentence of that paragraph was confusing and required revision.

Mr. Charlier agreed with Mr. Tym noting that although State Plane Coordinates were available for all of the U.S. Public Land Survey corners within the SEWRPC Planning Region, many surveyors will begin land surveys at the monumented U.S. Public Land Survey corners, ignoring the known State Plane Coordinate values, and assuming arbitrary coordinate values to the monument corners as a basis for the particular land survey being conducted. Consequently, he said, the resulting coordinates of the property corners concerned are not related directly to the State Plane Coordinate System. Mr. Casucci agreed and indicated further that his firm now utilizes county coordinate systems coordinates as a basis for work.

Mr. Wambach noted that the argument for utilizing coordinates in place of monuments to identify real property boundary survey corners was not only in his opinion unsound, but was an old one. He noted that a paper published in the September 1970 issue of the American Society of Civil

Engineers Journal of Surveying and Mapping contained a paper by Robert T. Howe, Professor of Civil Engineering, University of Cincinnati, in which he promoted the use of coordinates in place of monuments. Clearly, he said, the argument has over the almost 40 years since publication of Professor Howe's paper made little or no impression on the courts which are the ultimate determiners of real property boundary line locations and therefore of land survey practices.

Upon the conclusion of this discussion, it was agreed that the paragraph originally numbered three on page 6 be unnumbered and revised to read as follows: "It is now possible using currently available GPS equipment and measurements, to replicate in the field the location of any point for which State Plane Coordinate values have been previously determined, and to do so within a tolerance of less than one centimeter. The State Plane Coordinate positions, and to a lesser degree elevations, can be determined from measurements made to the orbiting satellites. Although such precise positioning is possible, the issue of datums must be addressed."

It was further agreed that the first sentence of the next paragraph should be revised to read as follows: "It may be argued that coordinates derived from measurements to orbiting satellites have effectively replaced monumented positions as a way for the end users to gain access to data in the NSRS."

Mr. Charlier called attention to the second sentence of the fourth full paragraph on page 6 suggesting that the phrase "it is viewed as premature" be changed to "it is inappropriate." The Committee agreed.

Mr. Schaefer called attention to the third line of the last paragraph on page 6, and recommended that the word "mean" be struck from the phrase. He noted that the title "National Vertical Datum of 1929" was currently used in place of the older title "Sea Level Datum of 1929," and that the word "mean" was not in the older datum title or definition.

Mr. Schaefer called attention to the four numbered paragraphs on page 7 dealing with vertical datums, and suggested that these be revised as necessary to reflect the agreed upon formats of the acronyms and terms concerned. More specifically, he suggested, that the article "the" be dropped from the leads into the statements numbered 1, 2, and 3; and that the statement Number 2 be revised to read as follows: "NAVD 88 is based upon one primary bench mark elevation and very precise differential level circuits covering the United States from coast to coast and border to

border. This datum has been designated by WisDOT as NAVD 88 (1991).” He suggested that the third numbered statement be rewritten to read as follows: “NAVD 88 (2007) is a more recent adjustment of the national vertical survey control network based upon observations made in Wisconsin under the WisDOT Height Modernization Program. The entire SEWRPC planning Region has been included in that program.” The Committee agreed.

Mr. Ellingson suggested, and the Committee agreed, that the word “sheer” be struck from the first sentence of the first full paragraph on page 7.

Mr. Schaefer noted that the names of the acronym notations utilized on page 8 were not in the format agreed upon, and should all be revised accordingly.

Mr. Charlier called attention to the tenth line of the last paragraph on page 9; indicating that the word “obrits” should be corrected to “orbits.”

Mr. Bauer called attention to the last sentence in the first paragraph on page 10 and suggested that the sentence be changed to read as follows: “NGS incorporates both ITRF and NAD 83 in the positions published for the CORS network.” Messrs. Ellingson and Schaefer agreed with the proposed change; Mr. Schaefer noting that the NGS software program referenced in the original version of this sentence is applicable only west of Longitude 111 degrees West and cannot be used in this Region.

Mr. Schaefer called attention to the second full paragraph on page 11, suggesting that the last sentence of that paragraph be rewritten and that an additional sentence be added so as to read as follows: for example, NAD 27 coordinate values should desirably be expressed in U.S. survey feet, while NAD 83 coordinate values should desirably be expressed in meters. Nevertheless, some practioners and agencies, including WisDOT, express NAD 83 coordinate values in feet, giving rise to potential confusion and mistakes.

Mr. Wambach suggested that the word “to” be struck from the lead-in phrase under the major heading on page 13.

Mr. Tym called attention to the last paragraph on page 14 and suggested that the first sentence be revised to read as follows: “Another alternative - the conversion of the existing database to an

integrated three dimensional database - would be a huge step and, whether done all at once or incrementally, would be very costly.” The Committee agreed.

Mr. Schaefer called attention to the second sentence of the penultimate paragraph on page 15, and suggested that this sentence be revised to read, “WisDOT has been engaged in the Height Modernization Program for several years.”

In his description of the text on page 16 concerning the use of GPS to establish orthometric heights, Mr. Burkholder suggested the addition of a figure illustrating the concepts involved. Chairman Bauer indicated that the figure which Mr. Burkholder apparently had in mind was often technically incorrect as presented in trade magazines and even peer reviewed journals; the commonly reproduced but incorrect version, ignoring the fact that the orthometric height, being measured along the normal to the geoid, does not lie along the normal to the ellipsoid, which is used to determine ellipsoid heights. Chairman Bauer indicated that he would provide a correct version of the envisioned figure.

[Secretary’s Note: The envisioned figure illustrating the relationships between the topographic surface of the earth, the geoid and the reference ellipsoid is provided below, and is intended to be referenced in Mr. Burkholder’s report.]

Figure 1

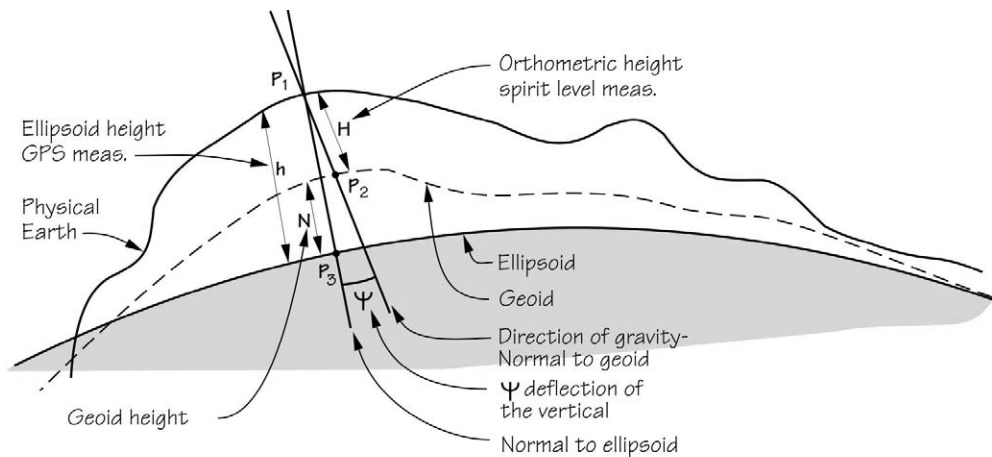


Fig. 1 Relationships between the topographic surface of the earth, the geoid and a reference ellipsoid
Source: Kurt W. Bauer, PE, RLS, AICP, and SEWRPC.

Chairman Bauer noted that the fourth equation on page 16 was in fact, an approximation, which ignored the effect of the deflection of the vertical on the height distances concerned. He suggested, and the Committee agreed, that this factual situation be described in Mr. Burkholder's report by the addition of a short paragraph following the fourth equation on page 16.

Mr. Charlier called attention to the first line on page 17 indicating that the word "be" be inserted as the penultimate word of the line.

Mr. Burkholder noted that the cost for Phase II of the proposed development work as listed on page 17 could not be accurately estimated until the completion of Phase I. Chairman Bauer accordingly suggested that the word "preliminary" be inserted before the word "estimated" in the fourteenth line on page 17.

In answer to a question by Mr. Charlier, Mr. Burkholder indicated that the "givens" listed on page 17 were indeed intended to be the published values for the existing First- and Second-Order NAD 27 stations within and adjacent to the Region, and the NGVD 29 bench marks within the Region. No field measurement was envisioned at this time although this assumption may change as the work proceeds. Mr. Duckett suggested, and the Committee agreed, that the word "published" should be inserted in the definition of the first two givens listed on page 17. Mr. Ellingson suggested, and the Committee concurred that the phrase "including on WisDOT Height Modernization Program control stations" be inserted at the end of the third given. Mr. Schaefer noted that in the phrase First and Second Order, hyphens should be placed between the words First and Second, and the word Order. This practice, he said, should be followed throughout the report.

Mr. Schaefer called attention to the list of "tools" on page 17 and suggested that the software tool listed under (1a) be identified as "GEOID03" and other geoid models. In this respect, Mr. Merry cautioned that it was important that the proper software be utilized in all work since there could be significant differences between elevations if the height separations involved are based upon the wrong ellipsoid.

Mr. Schaefer suggested, and the Committee agreed, that if the HTDP and ADJUST software programs were not intended to be used in the development program, they should be dropped from the list of tools.

Mr. Schaefer called attention to the first numbered item on page 18 and suggested that it be revised to read as follows: “Existing transformation procedures identified for NAD 27 to NAD 83 (1991) and NGVD 29 to NAVD 88 (1991) are set forth in the following publications: a. SEWRPC Technical Report No. 34, *A Mathematical Relationship Between NAD27 and NAD83(91) State Plane Coordinates in Southeastern Wisconsin*, December 1994, and b. SEWRPC Technical Report No. 35, *Vertical Datum Differences in Southeastern Wisconsin*, December 1995.

Ms. Lindholm suggested removing the parenthesis in the second procedure listed on page 18 and correctly hyphenating and capitalizing the identification of the order of the bench marks. Mr. Charlier agreed and indicated that the words “of published” should be inserted after the word inventory in Procedures Nos. 1 and 2 in place of the word “existing.”

Mr. Schaefer indicated that the term “GEOID 03” in the description of the fifth proposed procedure on page 18 should be corrected to “GEOID03.” This same correction, he said, should be made in three places on page 11, and in one place on page 19.

Mr. Schaefer called attention to the fifth listed procedure on page 18 and asked Mr. Burkholder to explain how GEOID03 was intended to be used since, he noted, GEOID03 is related to NAD 83 and NAVD 88 and not to NAD 27 and NGVD 29. Mr. Burkholder responded that in considering the procedure to be followed, he had considered the potential use of various geoids and their associated datums, but came to the preliminary conclusion that the best and most consistent results would be obtained by using a common geoid model at both ends of the transformation process, and that his initial inclination was to use GEOID03 as that common geoid in the development of the transformation equations. Mr. Schaefer then observed that one of the ways to determine geoid height is to find for a given horizontal location the algebraic difference between an ellipsoid height measured using GPS and an orthometric height determined by differential leveling. If, he said, different ellipsoids are used in this process; either the orthometric height or the ellipsoid height concerned will result in different vertical positions. Mr. Burkholder responded that the model process was intended to use the best data from each of what are acknowledged to be two different ellipsoids and fit the data together however imperfectly, it being impossible to do so with mathematical precision. He indicated further, that he had discussed the proposed procedure with other geodesists, including geodesists on the staff of NGS and remained convinced that the proposed approach is a valid one.

Mr. Schaefer noted that the spelling of the word “parameter” should be corrected in the description of Procedure 8 on page 18. He further noted that in the description of Procedures 9 and 10 on pages 18 and 19 the apostrophes should be removed from the references to the 1990s.

Mr. Schaefer called attention to the description of Procedure 11 on page 19, and indicated that the term “NAVD 88” in the fifth line of the description should be changed to “NAVD 88 (2007)”; that the last term in the description of Procedure 11a be changed to NAD 83 (1991); that in the first sentence of the description of Procedure 11b the term “Vertcon” be changed to “VERTCON”; and the term “NAVD 88” in the second sentence be changed to “NAVD 88 (2007).”

The meeting was adjourned at 12 o’clock noon for lunch and reconvened at 12:30 p.m.

After reconvening the meeting, Chairman Bauer reported that Mr. Duckett had indicated to him that a prior work commitment required him to leave the meeting at noon; that when the final Committee vote is taken on the approval of Mr. Burkholder’s report, he would like to be recorded as voting in favor of the approval. He indicated that he believed the report to be technically sound with good recommendations to the Commission; although he believed that the text could in appropriate places, including in the Concluding Recommendations section, be strengthened with respect to the need for the continued maintenance of the monuments marking the U.S. Public Land Survey corners within the Region. Specifically, he had indicated, that a strengthened version of Recommendation No. 2 on page 20 should, in his opinion, become the first recommendation with the original recommendation becoming the second. Chairman Bauer observed that if the Committee concurred with Mr. Duckett’s suggestion, Recommendation No. 3 as set forth on page 20 should then become Recommendation No. 2 and the original Recommendation No. 1 would become Recommendation No. 3.

Mr. Charlier indicated that Mr. Duckett had also discussed this matter with him before leaving the meeting and that based upon that discussion, Mr. Charlier believed that the recommendations could remain essentially as drafted by Mr. Burkholder. Upon brief discussion the Committee agreed that the recommendations should remain in the order and essentially as drafted by Mr. Burkholder.

Mr. Schaefer questioned the proposed procedure as described in Item 11A on page 19 for the reasons which he had previously raised concerning the different ellipsoids that would be involved. Mr. Schaefer indicated that although it may turn out that the proposed procedure in effect “works,” it will be important during the procedure development process to carefully review the results of applications of the preliminary equations to assure that the theoretical inconsistencies raised actually proves to be insignificant in the modeling process.

A lengthy discussion then ensued upon the conclusion of which the Chairman suggested, and the Committee agreed, that the text of the report be expanded to indicate that the proposed procedure involved an approximation and that the results would require careful testing and consideration to ensure that the transformation procedure developed actually performs at a level of accuracy adequate for land surveying and public works engineering applications. In this respect he said, it should be noted that the modeling process is in effect, an empirical approach and although not strictly rigorous, can provide excellent results.

In answer to a question by Mr. Bennett, Mr. Burkholder indicated that the end product of the recommended development work would consist of an algorithm that could be used to make the desired bidirectional transformations. He would, he said, provide to the Commission the proven and well documented software. With this software the Commission staff would be able to enter coordinate and elevation data based upon NAD 27 and NGVD 29 and obtain corresponding coordinate and elevation data based upon NAD 83 (2007) and NAVD 88 (2007) and to also do so conversely.

Mr. Schaefer suggested that the transformation procedure could be provided to users in the form of a spreadsheet set up for a limited number of points - for example 10 - so that it would be possible to readily make transformations for a single or multiple set of points.

Mr. Merry observed that the method should supply the parameters necessary for the transformations and that it should be possible to use these with any software. He indicated that the parameters should permit the user to readily convert, for example, coordinates and elevations from a WisDOT value based upon NAD 83 (2007) and NAVD 88 (2007) to corresponding coordinates and elevations based upon NAD 27 and NGVD 29; to perform the same transformations for field observations made utilizing GPS, and to transform information based upon NAD 27 and NGVD 29 to the newer datums for use in the field.

Mr. Wambach raised the issue of the use of the Wisconsin County Coordinate System (WCCS) within the seven-County Region. He noted that the impetus for the creation of the system had come from WisDOT and observed that when he was a District Director with the Department he had strenuously opposed the creation and use of this system as being technically unsound and had recommended the continued use of the State Plane Coordinate system as created by the former U.S. Coast and Geodetic Survey at the specific request of state highway agencies. Chairman Bauer agreed with Mr. Wambach that the creation and use of the WCCS represented poor professional practice, and noted that the problems, complication and confusion presented by the use of the WCCS had been discussed at the first meeting of the Committee.

A lengthy discussion ensued in which Mr. Casucci indicated that his firm, as indicated earlier by Mr. Charlier, had utilized arbitrary coordinate systems in the conduct of land surveys, but more recently had begun to use the County Coordinates systems as a basis for their land surveying work. Chairman Bauer noted that this raised, in addition to the datum issues, the issue of the use of a different coordinate system. He indicated that, in his opinion, better practice would be to use the State Plane Coordinate system which would place all of his firm's surveys on the same coordinate system and datums as the Commission's control survey network, and make the work of his firm compatible with the parcel-based land information and public works management systems being developed by the counties and local units of government within the region. He observed further that many county and local land subdivision control ordinances required that land subdivision plats and certified survey maps be tied to the Commission promulgated horizontal survey control network utilizing the U.S. Public Land Survey corner monumentation and State Plane Coordinate values available through that system.

Mr. Mehring objected to Mr. Casucci's firm's approach and indicated that, in his opinion, the counties within the Region should legislate that the State Plane Coordinate System and the NAD 27 and NGVD 29 datums be used within the seven-county Region. One of the original purposes of the Commission's and county effort to create a control survey network within the Region, he said, was to provide a single control survey network and related coordinate and elevation data system that would be uniformly used by all surveyors and engineers practicing within the Region. He suggested that the adoption of such county legislation be included as a recommendation within the report. Chairman Bauer responded that while he agreed fully with Mr. Mehring's observation, he questioned whether the counties had the legal authority to mandate

the use of a specific coordinate system or to prohibit the use of other coordinate systems within their jurisdiction.

Mr. Casucci indicated that he was not proposing the adoption by the Commission of the County Coordinate System, but suggesting that as surveyors occupy monumented U.S. Public Land Survey system corners and obtain coordinates for those corners using GPS technology, those coordinate values be transmitted to the Commission for recording and future use together with information on the coordinates system and datums used in obtaining the coordinates concerned. In this way, he said, a great deal of valuable field observations would be captured for use in the event that in the more distant future a decision is made to shift to the newer datums or to the County Coordinate Systems.

Mr. Mehring questioned the value of such collected data since there would be no practical way for the Commission to exercise quality control of the field observations. Chairman Bauer agreed with Mr. Mehring and indicated further that it was likely, as indicated by Mr. Charlier's earlier statement on their practices of his then firm, that most land surveyors in private practice tended to use either the State Plane Coordinates System in their work, or arbitrary coordinate systems as well as arbitrary vertical datums. In this respect Chairman Bauer asked Mr. Casucci how his field crews obtained county coordinate values for monumented U.S. Public Land Survey corners within the Region since the only published coordinates for such corners are State Plane Coordinates on the NAD 27. Mr. Ellingson responded for Mr. Casucci, indicating that if a surveyor intended to use county coordinates in conjunction with GPS surveys, they would utilize either the NAD 83 (1991) or NAD 83 (2007) adjustments, would occupy WisDOT established control points for which latitude and longitude are known with a base station unit and then use a roving unit to gather coordinate positions on points of interest. Chairman Bauer responded that he was aware of the procedure that Mr. Ellingson described. He indicated that that procedure would be largely unnecessary if the commission's control network and coordinates were used as intended and as necessary for land subdivision plat and certified survey map preparation within the Region. Chairman Bauer indicated further that the County Coordinate Systems within the State, had recently been revised and republished so that, to add to the confusion, two different sets of County Coordinate values may appear in the records. Mr. Schaefer noted that the differences between the two sets of coordinate values will usually be in the order of one to three millimeters.

Mr. Merry observed that fundamentally all of the field measurements made utilizing GPS technology were based upon latitude and longitude and those spherical coordinates could be readily converted to State Plane Coordinates on both the old and newer datums, to County Coordinates, and to Universal Transverse Mercator coordinates. Obtaining consistent orthometric heights, he acknowledged, was more complex and difficult using GPS technology.

Mr. Tym also expressed objection to the use of the County Coordinate systems indicating that the use of these systems provided needless complexity and confusion with respect to the continued development and use of the parcel-based land information and public based works management systems within the Region. He noted that the County Coordinate Systems were discontinuous at the County boundaries and provided an absurd problem, as for example, near the common corners of three or four counties.

Mr. Mehring expressed concern that under Mr. Casucci's suggestion, and at some cost, the Commission would be compiling a set of information for each control survey station without having any way of knowing which of the various coordinate values recorded and provided to the Commission was the right one. He noted that within Racine County, he was aware of a case of a U.S. Public Land Survey corner for which there were 23 documented locations; none of them the same, and suggested that the same situation would arise with respect to the usefulness of Mr. Casucci's suggested compilation of field survey values.

Mr. Ellingson indicated that as a former County surveyor he was surprised at the example corner location problem which Mr. Mehring had described and agreed that the same kind of problem could occur with respect to the multiple coordinate values that would be collected for a given corner under Mr. Casucci's suggestion. This and other problems, he said, could be resolved by the Commission if Mr. Casucci's suggestion was adopted. In this respect, Mr. Ellingson suggested that it might be possible for the Commission to create a spreadsheet for any of the approximately 12,000 U. S. Public Land Survey corners within the Region that were occupied by local surveyors whenever they are using GPS and the Wisconsin High Accuracy Reference Network (HARN) in the course of their survey work. Each time a surveyor submitted a set of coordinate values determined by GPS measurement for a monumented corner, together with information on the date, the name of the surveyor submitting the data, the coordinate values, the datum used in determining the coordinate values, and the field procedure used would be recorded together with perhaps, other pertinent information. He indicated that after a number of values -

for example, a dozen - had been submitted, an averaged NAD 83 (2007) position should be available that in most cases would be accurate to within 0.02' to 0.05', relative to the National Spatial Reference System (NSRS). This method would be valid for surveyed positions obtained from local surveyors using any of the following methods: GPS referenced to the Wisconsin HARN, GPS work referenced to the Wisconsin Real Time Network (RTN) or GPS positions calculated using OPUS solutions from the National Geodetic Survey (NGS) website. After enough positions were gathered on a particular mark to enable the Commission to obtain a satisfactory averaged position, surveyors would no longer need to supply new observations to the Commission for that survey mark. Often-visited marks might be done in a month or two, while seldom-used marks might take much longer to accumulate enough submittals.

Chairman Bauer responded that the Commission now had "pretty good" State Plane Coordinate values for each of the 11,753 U.S. Public Land Survey corners within the Region; the coordinate values having been determined by surveys that fully met NGS Third-Order, Class I standards, thus providing relative positions at an accuracy of one part in 10,000 or better. Indeed, he said, 40 years of experience, and literally thousands of field measurements, indicated that the relative positions of the U.S. Public Land Survey corners which comprised the horizontal control survey network within the Region, ranged from an actual minimum relative error of about one part in 18,000 to less than one part in 50,000.

Mr. Ellingson observed that the NSRS positions eventually collected under Mr. Casucci's suggestion would assist in refining the mathematical model used at some future date to determine the relationship between the Commission's existing control survey network and the newer NSRS datums in both horizontal and vertical survey applications. He noted that he thought Mr. Casucci's method could be accomplished for a very low cost and that it would eventually provide a great benefit to the Commission. He indicated that the surveying technology is rapidly changing, noting for example that NGS plans to obtain new gravity observations throughout the United States in order to develop a better geoid model and that this would further support the use of GPS technology in vertical survey applications.

Chairman Bauer indicated that the Commission had addressed the issue of the need to change datums in a report prepared by Mr. Burkholder in 1997 entitled "Definition of a Three-Dimensional Spatial Data Model for Southeastern Wisconsin," and had concluded that the older datums should remain in use until a truly dimensional earth centered X, Y, Z, coordinate

system becomes available - the kind of system that has been proposed nationally by Mr. Burkholder.

Chairman Bauer then asked Mr. Burkholder how the kind of collected data being suggested might be used 20 to 50 years from now to create a new three-dimensional datum within the Region. Mr. Burkholder responded that existing spatial data tends to lose its value when it becomes easier and cheaper to collect new data than it is to retrieve and utilize existing older data. Consequently, it was his opinion, he said, that it would be more cost effective to collect any needed additional data at such time as a datum conversion was undertaken.

Chairman Bauer observed that while it may become feasible, at some future date, to convert the horizontal positions and heights of the Commission control survey stations to a new earth centered X, Y, Z coordinate system, the problem of how such conversion would relate to the existing parcel-based Land Information and Public Works Management Systems within the Region would remain. He observed that the seven constituent counties and probably about half of the 147 municipalities within the Region, and such special purpose units of government as the Milwaukee Metropolitan Sewerage District have already developed massive data banks based upon the NAD 27 and NGVD 29 datums and related State Plane Coordinates values and orthometric heights. The data collected and placed in these systems, he said, includes among others, street address, ownership; assessed valuation; land use; soils; flood hazard; location of sanitary and storm sewers and related manholes and fittings; water mains and related valves, hydrants, and fittings; telecommunication and lighting cables; street and highway pavement edges and related traffic control signs and signals; and much more. There are literally millions of pieces of information contained in these systems, he said, and more is being added virtually on a daily basis. If the control survey system on which these information systems are founded is converted to other datums, or to an earth centered X, Y, Z coordinate system, the addition of new geographically related data to the data banks through field surveys would for practical reasons have to involve conversions of the positions back to the existing older datums. Mr. Burkholder agreed, and indicated that land information system technicians use absolute positions to describe where "things" are, while surveying and engineering technicians use relative positions of "points" in their work. Therefore, he said, the need will always exist to make the two types of data - absolute and relative - compatible, and the proposed bidirectional transformation method would accomplish this.

Mr. Tym agreed that future datum conversions would create problems for the existing developing land information and public works management systems within the Region. He noted that with respect to the utility infrastructure, for example, the systems contained locations for every single manhole on the sewer systems and for the water supply systems the location of every single, hydrant, valve and fitting together with attendant elevations and information on size, condition, and status of maintenance.

Mr. Bennett agreed with Mr. Tym, and reiterated his objection to the suggestion, and indeed to the entire discussion, indicating that as a municipal engineer, he needs and wants one set of coordinate values for each of the basic survey control stations - the monumented U.S. Public Land Survey corners - within his approximately 36-square mile municipality and that the Commission control survey network provides that single number for each corner. His staff, he said, had no trouble utilizing GPS technology with the City's known CORS station to obtain horizontal position data related to NAD 27.

Mr. Wambach observed that Mr. Burkholder had expressed the opinion that perhaps very little of the information proposed to be collected would be useful at a future date since it would be more cost effective to collect any needed new field observations at such distant future time at which a datum conversion was considered.

Mr. Melcher observed that the discussion of this issue had occupied almost an hour and a half and that, in his opinion, it was time for the Committee to act with respect to a resolution of the issue. Chairman Bauer accordingly suggested that Mr. Casucci move for the adoption of his suggestion.

Mr. Casucci then moved to add a Recommendation No. 7 to Mr. Burkholder's report that would request the Commission to develop and implement a procedure for the capture through the submission by practicing land surveyors within the Region of GPS determined coordinate positions for the Commission's monumented U.S. Public Land Survey corners; the submitted coordinate positions being accompanied by pertinent information to be determined, including the datums utilized. The motion was seconded by Mr. Ellingson. The motion failed on a vote of four in favor and eight opposed; with Messrs Casucci, Charlier, High, and Merry voting in favor, and Ms. Lindholm; Messrs. Bennett, Grisa, Mehring, Melcher, Schaefer, Tym and Wambach voting opposed; and Mr. Ellingson abstaining.

Mr. High called attention to the concluding recommendations beginning on page 19 and indicated that given Mr. Duckett's comments to the Chairman and Mr. Charlier, and given his own experience with appointed and elected public officials, such as those to which the report will ultimately be addressed, he believed that the recommendations needed careful editing in order to clearly state and strengthen the recommendations.

A lengthy discussion ensued after which Chairman Bauer observed that the report contained four particularly important recommendations: (1) The monumentation marking the U.S. Public Land Survey system corners within the Region be maintained in order to definitively perpetuate the location of those corners; (2) The system of bench marks providing orthometric heights in the immediate vicinity of each U.S. Public Land Survey corner be maintained; (3) The Commission promulgated and monumented horizontal and vertical control networks within the Region continue to be related to the NAD 27 and NGVD 29 datums; and (4) A method for the bidirectional transformation of coordinates between NAD 27 and NAD 83 (2007), and between NGVD 29 and NAVD 88 (2007) be developed and made available for ready use within the Region.

Based upon the discussion, Mr. Schaefer suggested changing the format of the recommendations to introduce each numbered recommendation by a short title or lead-in phrase which concisely captures the essence of the recommendation. The remainder of the text in each numbered recommendation could then remain essentially as submitted.

Mr. Mehring noted that while the report as drafted was addressed to the Commission, its recommendations would also be in effect addressed to the constituent counties and this should be acknowledged in the wording of the concluding recommendations, as for example he said, "the Commission in cooperation with its constituent counties should."

There being no further comments or questions, Mr. Melcher moved to approve Mr. Burkholder's report as amended for publication and transmission to the Commission. Mr. Wambach seconded the motion, which carried unanimously.

CONSIDERATION OF STAFF MEMORANDUM ON VERTICAL SURVEY CONTROL FOR KENOSHA COUNTY FEDERAL EMERGENCY MANAGEMENT AGENCY FLOOD HAZARD MAPPING PROGRAM.

Chairman Bauer noted that copies of a Commission staff memorandum (copy attached) concerning the vertical survey control to be used in the completion of the Kenosha County Federal Emergency Management Agency Flood hazard mapping program had been distributed to all members of the Committee for review prior to the meeting. He noted that this memorandum was being provided to the Committee at the request of the Commission Executive Director for the Committee's information and to solicit any comments that the Committee might have on the memorandum.

The Chairman then reviewed the memorandum with the Committee. The following comments were made, questions raised and actions taken in the course of the review.

Mr. Melcher observed that all of the large scale topographic mapping covering all of Kenosha County - at a scale of 1 inch = 100 feet or 1 inch = 200 feet with 1-foot or 2-foot vertical contour intervals, respectively, - were based upon NGVD 29 as are the County of Kenosha, City of Kenosha, and Village of Pleasant Prairie land information and public works management systems. Consequently, he said, the County believes it extremely important that the new FEMA flood hazard maps be based upon NGVD 29. Accordingly, he moved that the Committee be placed on record as fully supporting the Commission's position with respect to this matter as set forth in the staff memorandum concerned. The motion was seconded by Mr. Wambach.

Mr. Charlier noted that the FEMA procedural memorandum provided that if a community remained with NGVD 29, Federal funding may not be available in the future to update the flood hazard maps. Chairman Bauer and Mr. Melcher indicated that there was no Federal funding available at this time for this purpose, and given past performance probably would never be.

Mr. Schaefer noted that given the density of the NGVD 29 bench marks within the county as illustrated on Exhibit II attached to the memorandum, the Commission's position with respect to this issue was supportable.

The motion then carried unanimously, with, however, Mr. Ellingson abstaining.

AJOURNMENT AND DISSOLUTION OF COMMITTEE

There being no further business to consider, Chairman Bauer noted that the Committee's action on the revised draft report entitled "Review and Reevaluation of the Regional Control Survey Program" concluded its work.

The Committee's final report to the Commission would consist of a revised copy of the draft report, and the approved minutes of the Committee meetings. He noted that the first meeting of the Committee was held on July 25, 2007; and that the Committee had held three meetings to complete its work. He expressed his sincere appreciation on behalf of himself, the Commission staff, and the Commission to the Committee members for the contribution of their time, knowledge, and experience to the work of the Commission, all as a public service; and noted that such service was in the finest tradition of how government was and should be conducted in Wisconsin.

He noted that all of the Committee members would receive a copy of the minutes of this meeting; a copy of the final report; and a self-addressed postcard by which each Committee member will be asked to vote on approval of the minutes of this meeting. He noted that the worst possible outcome of the postcard poll would be a majority of no votes, in which case the Committee would have to be reconvened to collegially consider approval of the minutes.

He noted that in some cases the Commission does not act to dissolve an Advisory Committee upon completion of its work, but asks the Committee to continue to serve through implementation of the Committee recommendations. In the case of this Committee, the Commission may ask selected members to serve as a Task Force to work with Mr. Burkholder on the development of the recommended bidirectional datum transformation methods.

Chairman Bauer then indicated that a motion would be in order to adjourn sine die and to recommend its own dissolution to the Commission. This was done on a motion by Mr. Charlier, seconded by Mr. Wambach, and carried unanimously. The meeting was adjourned at 2:40 p.m.

Respectfully Submitted,

Lynn G. Heis
Committee Secretary

KWB/lgh
04/14/08
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