A BRIEF HISTORY OF LAND SURVEYS IN SOUTH DAKOTA

Prepared by Robert S. Fodness, P.E., L.S.

Prepared for South Dakota State Board of Technical Professions 2525 W. Main St., Suite 211 Rapid City, SD 57702

JANUARY 1994

INTRODUCTION

The following historical account of Land Surveying in our state is intended to help educate the young developing surveyors, give a sense of where, when and how to aid the present practitioners in their retracements and to help non-resident registrants gain knowledge of the past in areas they may someday be asked to practice.

The topic is treated in a broad sense in order to acquaint the practitioner with the beginnings of the survey systems within in our state. Time and resources do not permit expansion into more local accounts nor into the intervening types of practice that have been performed to date.

It falls to each practitioner to become familiar with the history within his or her area of work. As such, we become historians, whether we retrace last year's monuments or those set over a hundred years ago.

The commission wishes to thank Bob Fodness, P.E., L.S., for the research and preparation of this paper. In keeping with the scope and intent, much material had to be set aside for, perhaps, more detailed accounts in future publications. The commission would also like to thank the several authors who gave their permission to use their material.

<u>Editorial Note</u>. Since the time when this paper was written in 1994, the name of the South Dakota State Commission of Engineering, Architectural and Land Surveying Examiners has been changed to the South Dakota Board of Technical Professions. References to the Commission in this paper shall be understood to refer to the South Dakota Board of Technical Professions (Board). The Board is making this paper available to benefit the land surveying profession in South Dakota, but does not warrant to the accuracy or completeness of the information contained therein. In preparing this paper to be an electronic text searchable file, the Board re-typed the text portions of this paper, whereas the graphic portions in Figures 1 through 8 where scanned to electronic image files. This re-typing resulted in slight formatting differences from the original printed version of this paper.

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(Editorial note: pages 22, 24, 26, 28, 30, 32, 34 and 36 were not used)

GENERAL

The history of land surveying in South Dakota can hardly be addressed without some review of the events prior to the establishment of Dakota Territory.

The rectangular system of surveys in the United States began with passage of the Land Ordinance of 1785. It provided for Congress, or a Committee of the States, to appoint a surveyor for each state. These surveyors would act under the direction of the Geographer of the United States. The ordinance set out the basic six-mile square township to be subdivided into thirty-six sections of one square mile with 640 acres. It left out many details on field notes, monuments, and township subdivision.^[1] The system would be modified and expanded by many subsequent acts of Congress and instructions from the General Land Office.

Three factors which existed from the beginning to nearly the completion of the surveying of the public domain had a negative influence on the accuracy of the field work:

First, compensation for the surveying work was woefully inadequate. Referring back to the Land Ordinance of 1785, the surveyor was to be paid two dollars a mile for line actually run; and this was to cover wages of the crew as well as any other expenses. ^[2] Thomas Hutchins, the United States Geographer, in surveying the Seven Ranges in the Ohio Territory, expressed difficulty with surveying to the true median for a rate of two dollars a mile. Consequently, Congress passed resolutions in May of 1786 rescinding the requirement to survey by the true meridian. ^[3] This resulted in the range lines run for the Ohio Land Company being off about four degrees from the cardinal directions. ^[4] The requirement for reference to the true meridian was restored by the Act of May 18, 1786, 1Stat. 464.

The Act of June 1, 1796, 1 Stat. 490 raised the compensation to three dollars a mile. ^[5] In subsequent years some adjustments were made for bad field conditions and in recognition that some lines were more important and merited higher compensation. In 1833 the average rate in Iowa was \$3.00, with township lines being \$3.50 and section lines being \$2.75. These were raised to \$3.75 and \$3.00 respectively in 1851. The wooded areas of Wisconsin might be fifty percent higher and the swamps of Louisiana double the normal rate. ^[6] When the surveys moved west into the mountains and forests, the General Land Office established variable rates for flexibility in covering all situations for standard, township, and section lines. These amounts were respectively \$9, \$7, and \$5 minimum; \$13, \$11, and \$7 intermediate; \$18, \$15, and \$12 maximum; and \$25, \$23, and \$20 special maximum.

The purpose of achieving more reasonable compensation was largely defeated because competitive bidding was introduced. Often the successful bidder was not qualified, so the propensity for inferior work remained.^[7] The rate of pay was not properly and adequately dealt with in most instances and was probably the leading cause of inferior or unacceptable surveys. The common rate in South Dakota was around \$8.00 a mile and was considered to be quite profitable.^[8]

Second, pressure to complete the surveys was very intense. Congress was deeply in debt under the Confederation with no power to levy taxes on the land or the states. It looked to land sales to raise revenue. ^[9] Land was cheap and plentiful and haste was placed before accuracy. Military bounty warrants were issued to pay for military service during the Revolutionary War by the states as well as by the Continental Congress. The war veterans pressed to occupy the land and wanted boundaries established. ^[10] This was done by the Congress again following the War of 1812. General William Rector, Principal Deputy Surveyor in Missouri, was directed in 1815 to survey two million acres of land between the St. Francis and Arkansas Rivers for military bounties. ^[11]

Unpleasant relationships between settlers occupying un-surveyed land and the Government could only be avoided if surveying of the land progressed ahead of settlement. ^[12] The tide of settlers to the west was relentless. Two major acts of Congress at mid-century kept the situation acute when surveying started in Dakota Territory. The first was the Act of September 20, 1850, 9 Stat. 466 which introduced the policy of granting large land subsidies to the railroad companies. The railroads wanted surveying completed so that land could be sold for capital. ^[13] The second was the Homestead Law enacted by Congress on May 20, 1862. This law provided that 160 acres of agricultural land would be given to anyone who would settle on the land and plant a crop there. Patent to the land could not be granted until the survey was completed. ^[14]

That the surveys failed to keep pace with demand is illustrated by consistent requests by the Surveyors General for larger appropriations. In 1864 the Surveyor General for Dakota Territory asked for \$40,000 while receiving only \$5,000. The Surveyor General for Dakota Territory in 1880, in a somewhat subtle plea for more money in his annual report to Congress said that:

The territory is steadily and rapidly growing, and farmers are prospering. Three railroads are built many miles in advance of the public surveys, and everything moves to the front except surveyors a matter over which the people of the territory have no control.^[15]

The **third** factor was that General Land Office was understaffed and loosely run. This led to autonomous actions by the Deputy Surveyors and Surveyors General and conflicting and erroneous instructions. When Thomas Hutchins -- the Geographer of the United States under whose direction the first surveys were run -- died in April of 1789, Congress did not appoint a successor. The state surveyors had no one to report directly to. ^[16] This condition continued until the Act of May 18, 1796, 1 Stat. 464 which called for the appointment of a Surveyor General who was to engage deputies. He was to frame regulations and instructions for the deputies. The act placed the Secretary of the Treasury in charge of credit sales. The patent to the land was to be signed by the President and the Secretary of State. This dual responsibility and scattering of records caused confusion for the next forty or more years.

Rufus Putnam was appointed as the first Surveyor General on November 5, 1796. ^[17] On May 1, 1802 Congress appropriated money to hire a clerk in the Surveyor General's office. ^[18] Jared Mansfield succeeded to the Surveyor General's office in 1803. ^[19] A very capable person, he was quite instrumental in the passage of the act of February 11, 1805, 2 Stat. 313 setting forth the mode of surveying of the Public Lands of the United States. This act brought the public land surveys to the basic system still in use today and is still the law of the land, Title 43 of the United States Code. ^[20] He is credited with the first written instructions to the deputy surveyors. ^[21]

Subsequent acts of Congress extended the authority of the Surveyor General to all of the Louisiana Territory and provided for appointment of deputy surveyors in the new territories and states. ^[22] The Act of April 25, 1812, 2 Stat. 716 created the General Land Office within the Treasury Department. The chief officer was called the Commissioner of the General Land Office. A chief clerk was to be appointed to act in his absence. Unfortunately, the act did not give clear authority to the Commissioner over the Surveyor General. Because of this, the Surveyor General would operate somewhat independently for the next twenty five or more years, a circumstance which led to non-uniformity in survey execution. ^[23] Apparently, the Surveyor General had always operated away from Washington, being actively engaged in the field work. The title Surveyor General was eventually passed on to the Chief Deputy Surveyor in each territory, and there being no Chief Surveyor General, each reported to the Commissioner.

Edward Tiffin was appointed as the first Commissioner in 1812. He had the task of organizing the new bureau and bringing order to the land records.^[24]

Elijah Hayward was appointed Commissioner on September 30, 1830, and began immediately to establish his authority over the Surveyors General. On July 28, 1831, he sent very long instructions to Surveyor General Fitz in Mississippi on how surveys were to be made and directed him to prepare written instructions to his deputies. He followed this with nearly identical instructions to all the other Surveyors General in a circular dated September 23, 1831. Surveyor General Fitz was the first to comply by issuing his instructions to Deputy Surveyors in 1833. The others followed at various times.

The Surveyor General for Wisconsin and Iowa, who would direct early surveys in Dakota Territory, issued instructions in 1846 and again in 1851. While all had the same instructions from Commissioner Hayward, each incorporated his own ideas and interpretation of the law into his instructions to deputy surveyors, thus continuing diverse practice to some degree. ^[25] Nevertheless, Commissioner Hayward had started the process which would evolve into the Standard Manual of Survey Instructions in 1855.

The next step was the Act of July 4, 1836, 5 Stat. 107 which made into law the reforms that Commissioner Hayward had initiated. This act reorganized the General Land Office and provided for a Principal Clerk for each of the functions of Public Lands, Private Land Claims, and Surveys. The Principal Clerk of Surveys was to: "direct and superintend the making of surveys, the returns thereof, and all matters relating thereto, which are done through the offices of the Surveyor General;…." This increased the control from Washington but still left some autonomy in the field offices. ^[26]

John M. Moore was appointed the first Principal Clerk of Surveys and is largely credited with writing the standard instruction manuals. The first of these manuals was officially issued to the Surveyor General of Oregon on March 3, 1851. Copies were sent to other offices also.^[27]

On July 10, 1852, Surveyor General George B. Sargent, Dubuque, Iowa, was instructed to apply the Oregon Manual to surveys in the Minnesota Territory.^[28] The Dakotas were a part of the Minnesota Territory at that time.^[29] The 1855 Manual of Surveying Instructions was officially issued on February 22, 1855. It was an expansion of the Oregon Manual and was prepared by John M. Moore.^[30]

It is necessary to digress here and introduce William A. Burt, a noted surveyor of the times. Experiencing problems with the magnetic needle in the iron ranges of Michigan, he invented his "True Meridian Finding" instrument in 1835, which later became known as Burt's Solar Compass. The advantages of this instrument were readily apparent, and the Surveyor General of Wisconsin and Iowa, in General Instructions of 1846, required the use of such an instrument in the running of all meridians, baselines, correction, and township lines. ^[31]

The Oregon Manual recommends but does not require the solar compass except in cases where uniformity of the magnetic needle is not found. ^[32] The 1855 Manual has the same language. ^[33] The Instructions of 1864 made use of the Solar Compass mandatory on all but section subdivision and meandering. The 1894 Manual of Instructions eliminated use of the magnetic needle on the rectangular surveys. ^[34] Only a small portion of southeastern South Dakota was surveyed prior to 1864. Although the Standard Manual was to be used on all surveys 1850 and thereafter, the Act of May 30, 1862, 12 Stat. 409 mandated that the 1855 Manual of Surveying Instructions be a part of every contract along with Special Instructions of the Surveyor General when not in conflict with the Manual or Instructions from the Commissioner. ^[35] This would help to enforce use of the manual.

Approaching the time in history when survey of the Public Domain in Dakota Territory is to have begun in earnest, administration of the work appears to be pretty well in hand. Some problems with instructions still remained. Both the 1851 and 1855 manuals specify five townships between Standard Parallels south of the Baseline.^[36] This was changed to four in the 1881 Manual.^[37] Actually, the Black Hills Meridian baseline established in 1878 is the only one in South Dakota from which townships were laid off to the south, and the four township criteria was followed. Also, neither of the earlier manuals addressed subdivision of sections or restoration of lost corners.

The Commissioners and the Surveyors General continued to issue individual instructions leading to continued inconsistencies. To illustrate, in the spring of 1856 John Loughborough, Surveyor General of Illinois and Missouri, issued instructions to Deputy Surveyors that called for closing corners on the north and west boundaries of townships, for restoration of lost corners by single proportionate measurement on north-south lines only, for increased tolerance in closing townships, and for locating the center of the section at midpoint of the east-west quarter line. Commissioner Hendricks received two hundred copies from Loughborough which he sent out to

Deputy Surveyors who inquired about section subdivision until the supply ran out in 1863. Loughborough stated in the instructions, "None of the Acts of Congress, in relation to the public lands, make any special provision in respect to the manner in which the subdivisions of sections should be made by Deputy Surveyors."

In the words of C. Albert White, "This seems incredible in view of the fact that all Surveyors General were supplied with copies of the Acts of Congress, including the Act of February 11, 1805, and the Act of April 5, 1832, which most certainly states how sections are to be subdivided." ^[38] J.S. Dodds, in his writings on public land surveys, states "Many erroneous ideas have been held by surveyors at various times in spite of ample instruction." ^[39] Commissioner Edmunds, in letters dated June 29, 1863; February 16, 1865; and January 20, 1865, outlines the correct methods, referring back to the Act of February 11, 1805. ^[40] The matter of restoration of lost corners was addressed again in the Circular of March 13, 1883. ^[41] Circular 119 dated June 2, 1887 ^[42], again clarified the proper procedure for subdividing sections, even though the Manual of 1881 had done so. ^[43] The first circular devoted to restoration of lost or obliterated corners and subdivision of sections was issued on October 16, 1896, combining all previous circulars on these subjects. ^[44]

The discovery of gold in the Black Hills further strained the resources for surveying in the Dakota Territory. When the Black Hills Region was transferred to the United States by the Sioux cession of September 26, 1879, there was a great demand for survey of the mining claims. Of necessity, these surveys were done ahead of the public land surveys. The mining claim surveys were done by Deputy Surveyors and paid for by the applicants. Direct contracts were entered into between the Deputy Surveyor and the applicant. There was no method of tying these claims together. Many of the monuments were not well identified and were short lived. The exact location of many of the claims was not known. The first public land survey in this area was undertaken in 1879, with little progress until 1900. ^[45] The mining claims had to be tied into the public land survey. By Act of April 28, 1904, 33 Stat. 545, the corners of mineral surveys were given the same legal status as rectangular survey corners and had to be treated in the same manner. ^[46]

The Forest Reserve Act of 1897 provided for the survey of the Forest Reserve boundaries, townships and subdivisional lines by the United States Geological Survey. Surveys of the Black Hills Reserve were made in 1898 and monumented with three-inch iron posts. The survey of townships adjacent to the Forest Reserve boundaries by the USGS continued until 1899 after which only the boundaries were surveyed.^[47]

The survey of the public lands was plagued with inferior and fraudulent execution from the very beginning. On March 8, 1852, Surveyor General Charles Noble was ordered to hire an examiner of surveys on a daily basis in an attempt to prevent fraudulent and grossly erroneous surveys. ^[48] This practice was not very effective because it became a system of checks by peers. Each was reluctant to report on the other. In his 1881 annual Report to Congress, Commissioner Noah C. McFarland, along with the Secretary of Interior, asked for examiners of surveys to be direct employees of the Commissioner using the following language: "It is an absurdity to suppose that the truthful and honest returns of examinations in every particular will

be made by deputy surveyors, upon whom Surveyors General are more than ordinarily dependent for examiners, when it is considered that the examining deputy will at some time, if not already under obligations, have his own work examined by the very deputy whose work he has, if honest, condemned. The temptation of overlooking defects, either in the survey of lines or the marking of the same, has proven too great to be resisted by them. It is safe to say that not one percent of the number of examinations is satisfactory to this office in the results obtained." ^[49]

In his Annual Instructions dated July 25, 1884, Commissioner McFarland directed that all money appropriated for examinations would be expended by the Commissioner only. At the same time he reaffirmed that the same deputy could not both survey and subdivide a given township. An April 27, 1893 Circular prohibited any deputy from examining surveys. ^[50] The portions of South Dakota surveyed relative to these dates can be obtained from Figures 2 and 3.

Much has been written about the deposit survey system. During the period from March 3, 1879, until sometime in 1885, endorsable certificates could be obtained for the deposits made by settlers for surveys. This led to land swindles and office surveys, a practice most prevalent in the timber lands in Colorado and California.^[51] The Commissioner of the General Land Office described the fruits of the Act of March 3, 1879, in these words: "Since that time… 1ands of no present practical value and on which there are no settlers have been largely surveyed; … applications for survey are fraudulently prepared by or through the instigation … of deputy surveyors, who, for the purpose of securing the contract for making the survey … advance the money for the deposit, thereafter sell and assign the certificates, and thus reimburse themselves and secure their profit from the surveying contracts".

Much of the land was platted and returned with little or no field work. To illustrate the affect of this law further, from 1862, when provision was first made for surveys by special deposit, to 1879 when certificates were made assignable, total deposits for the whole United States were only about \$368,000. For the years of 1880 through 1884, the figure was nearly \$6,000,000. The regular appropriation for surveys in 1882 was \$250,000 while the survey deposits for that year were about \$2,000,000.

Special deposits in Dakota Territory exceeded the regular appropriation in all but one year in this time span. Surveys in the Territory reached an all time high of 6,797,417 acres in 1884. ^[52] Reference to Figures 2 and 3 will indicate the portions of South Dakota surveyed during this period. One cannot suppose that no unsatisfactory surveys were run in South Dakota. South Dakota Contract No. 110 was examined and found to be worthless. On the other hand, in 1905 the Commissioner included South Dakota with three other states in which no surveys were rejected. ^[53]

The practice of stubbing out in running east-west section lines appears to have been quite prevalent everywhere. This was often used to justify single proportionate measurement in restoring lost corners. C. Albert White wrote: "The argument for the method was usually given about as follows: 'It is also well known that most deputies do not run the east-west section lines all the way, instead they stub out from a section corner just 40 chains and set the quarter corners on the east-west lines, but return field notes with the quarter corner as being at midpoint on a true line!' "^[54]

Of interest here is that many complaints were received because someone had moved one of these markers to straighten out the section line. This floating corner, as it came to be called was to be honored if it could be positively identified. If a questionable marker was found more than one chain out of proper position, it was to be treated as a lost corner, and the new marker placed on line at midpoint.^[55] Perhaps the controversy over double proportionate measurements for lost section corners was not over proper procedure but rather the recognized unreliability of this quarter corner.

Mention might be made here of the possible extensive use of the buggy wheel method of measurement in the prairie states. A rag was tied to a wheel spoke, and the revolutions of the wheel counted. One man drove the team, another kept line with a compass, and a third counted the wheel revolutions. This is described as a rapid and crude method of survey. ^[56]

Lest we be too harsh with these early surveyors, consider what it must have been like walking across this state without shelter from downpours, hailstorms, and blizzards; tramping through mud; swimming or wading swollen creeks; fighting of swarms of mosquitoes; and dealing with hostile Indians. The South Dakota Historical Collections contain many colorful accounts of the experiences of this hardy vanguard.

The 1855 and 1881 Manuals specify the method of marking corners which should have been followed in South Dakota. In timbered country the corner was to be a tree if one fell at the exact spot; otherwise a wood post tied into bearing trees was to be used. In country where stone abounded, the township corner was to be a small mound of stone by a single stone; all other corners were to be a single stone. In country where neither trees nor stone are available, a mound of earth of prescribed size and varying to suit the case was to be used. A wooden stake was to be planted in the mound. The Manuals described the proper construction of the pits and mounds and the inscriptions and markings to be used for the different corners. ^[57] For the most part the pits and mounds did not conform, nor did the stones have the proper markings. Many of the stones were of poor quality.

THE BEGINNING

South Dakota was a part of the Louisiana Purchase. As settlement progressed new territories and states were created, and responsibility for surveying an area changed. The following were significant to South Dakota:

Act of June 12, 1838, 5 Stat. 235 - The Iowa Territory was divided from the Wisconsin Territory and was to include all lands west of the Mississippi River. The Surveyor General Office was established in Dubuque. Early surveys in South Dakota would be contracted by that office. ^[58]

Act of December 28, 1845, 9 Stat. 117 - Iowa became a state leaving a large part of Minnesota and the Dakotas unattached to any territory for almost three years.^[59]

Act of March 3, 1849, 9 Stat. 403 - Created Territory of Minnesota to include all lands north of Iowa, west of Wisconsin, and east of the Missouri River and the White Earth River. The White Earth River flows from the north into the Missouri in western North Dakota and completed the west territorial boundary. Section 16 and 36 were designated as school lands. The Iowa Surveyor General would still be in charge of the land surveys. He was instructed on July 9, 1849, to keep Minnesota records separate from those of Wisconsin and Iowa.^[60]

Act of May 30, 1854, 10 Stat. 277 - Territories of Kansas and Nebraska were created. The Nebraska Territory included all territory north of 40 degrees North Latitude between the Continental Divide and the Missouri River and the White Earth River. This explains why a portion of south central South Dakota was surveyed from the sixth Principal Meridian.

John Calhoun was appointed Surveyor General for Kansas and Nebraska and was directed to establish the initial point for the 6th Principal Meridian.^[61]

Act of May 11, 1858, 11 Stat. 285 - Minnesota became a state. ^[62]

Act of March 2, 1861, 12 Stat. 239 - Created Dakota Territory with a Surveyor General. The Dakota Territory included all of the Nebraska Territory between Minnesota and the Rocky Mountains and between 43 degree and 49 degrees North Latitude. George D. Hill was appointed Surveyor General and established his office in Yankton on July 1, 1861. ^[63] The Iowa Surveyor General would finish out the contracts he had previously awarded in Dakota Territory. ^[64] The Surveyor General office was moved to Huron in 1883 and remained there until closed in 1922. ^[65]

Act of February 22,1889, 25 Stat. 676 - Divided Dakota Territory into North Dakota and South Dakota and enabled statehood. Statehood took place on November 2, 1889. ^[66]

MERIDIANS AND BASELINES

South Dakota was surveyed from three principal meridians as shown in Figure 1.

1.) The Fifth Principal Meridian and Baseline was used for that portion of South Dakota north of the Nebraska border and east of the Missouri River plus Gregory, Tripp, and Lyman Counties which lie west of the river. ^[67] Edward Tiffin, Surveyor General, instructed General William Rector, the Chief Deputy Surveyor for Missouri to run a line from the confluence of the Arkansas and Mississippi Rivers due North according to a true meridian to intersect a baseline run due West from the mouth of the St. Francis River. Deputy Surveyor Joseph C. Brown began the survey of the baseline on October 27, 1815.

On the same date Prospect C. Robbins began the survey of the meridian and intersected the baselines in the 58th mile approximately 26 miles west of the Mississippi River where he established the initial point on November 10th. ^[68] The initial point is at 34 degrees 38 minutes 45 seconds North Latitude and 91 degrees 03 minutes 07 seconds West Longitude. ^[69] The meridian was extended into Iowa by William Burt in 1836 and 1837. ^[70] In March 1852, the Iowa-Minnesota border was surveyed along 43 degrees 30 minutes North Latitude from the Mississippi River to the Big Sioux River.

The initial point on the Mississippi River was established by astronomic observations in the fall of 1849 by Thomas J. Lee of the Topographical Bureau of the U.S. Army. Captain Andrew Talcott, an astronomic surveyor, contracted for the work. He sent James Marsh ahead to run a random line with a solar compass for a check while he followed with a tangent line using a transit and making astronomic observations every 48 miles. The two lines were so well run that neither would have been needed as a check on the other. Permanent section and quarter corners were set for the Minnesota side. This boundary was established as a second baseline for the 5th Principal Meridian and was used for surveys in Minnesota west of the Mississippi River.^[71]

The Surveyor General contracted with William J. Neely to extend this baseline from the Big Sioux River to the Vermillion River in South Dakota on June 15, 1859. Apparently Neely did not complete the survey, because a second contract was awarded to Ball and Darling in the spring of 1860. ^[72] It was later extended westward to the eastern boundary of Mellette -- which coincides with the Third Guide Meridian west from the sixth Principal Meridian -- to complete the surveys in the portion of eastern South Dakota north of that baseline.

The portion of eastern South Dakota south of the second baseline from the Big Sioux River to the Mellette County line was referenced to the original baseline in Arkansas.^[73] The U.S. Geological Survey quadrangles for this area show no correction lines or closing corners until reaching the second baseline.

2.) The Sixth Principal Meridian and Baseline was used for a portion of south central South Dakota. This area can best be described as the counties of Shannon, Bennett, Mellette, and Todd plus the portion of Jackson south of the White River.^[74] Surveyor General Calhoun was directed on August 26, 1854, to run the 40 degree parallel west 108 miles from the Missouri River as a baseline for the Sixth Principal Meridian and to form the boundary between Kansas and Nebraska. He was to install a permanent monument at the river. He contracted with J.P. Johnson on November 2, 1854, to survey the baseline and with Charles A. Manners to install the monument and to check the work of Johnson. The monument was a cast iron post installed 52.55 chains west of the river to preserve it. The work of Johnson was found to be grossly in error, and a contract was given to Manners to resurvey the baseline in April of 1855. Because of the delay, the baseline was extended only 60 miles west, and the first guide meridian extended the guide meridian north into Nebraska so that township surveys could begin.^[75]

The initial point at the 108th mile was established by Manners on June 11, 1856, and the baseline was later extended to the summit of the Rocky Mountains. From this point, lands were surveyed in a 200 million acre area in Kansas, Nebraska, Colorado, Wyoming and South Dakota. A group of land surveyors from these five states, following a meeting in Kearney, Nebraska in May of 1986, formed the "Professional Surveyors of the 6th P.M." to relocate and monument the initial point. The initial stone in the intersection of two roads was left in place, and a permanent monument was erected one chain due east of the Stone. ^[70] The initial point is at 40 degrees 00 minutes 07 seconds North Latitude and 97 degrees 22 minutes 08 seconds West Longitude. ^[77]

3.) The Black Hills Meridian and Baseline was used for all the remaining area west of the Missouri River. The meridian was run as the western boundary of South Dakota by Rollin J. Reeves in 1877. The baseline was established by Deputy Surveyor Charles Scott in 1878 starting at mile post 69 on the South Dakota Wyoming border. ^[78] The initial point for this meridian is 43 degrees 59 minutes 44 seconds North Latitude and 104 degrees 03 minutes 16 seconds West Longitude. ^[79]

EASTERN BOUNDARY

The eastern boundary with Minnesota was the first surveyed. The enabling act for Minnesota statehood set the western boundary as beginning where the center of the Red River crosses the Canadian border and following the center of the Red River, the Bois des Sioux River, Lake Traverse, and Big Stone Lake. From the outlet of Big Stone Lake, the boundary was to run due south to the Iowa border.^[80]

A contract was awarded in 1859 to Chauncey H. Snow and Henry Hutton to survey the boundary from the south end of Lake Traverse to the Iowa border. Their instructions were to set cast iron posts six feet vertical height by one foot in width at the base, tapering to seven inches at the top, and weighing not less than 300 pounds each at the south of Lake Traverse and at both ends of Big Stone Lake. A fourth monument was to be set at the Iowa line. They were to run a true meridian line from Big Stone Lake to the Iowa border, planting an eight foot long wood post three feet in the ground with a three foot mound at each mile.

The survey began on July 11 and was completed on August 4, 1859, using a "Wurdemans Improved Field Astronomical Transit". They intersected the Iowa border at mile post 123 plus 81.10 chains at a point 5 chains 23.56 links west of the corner to sections 34 and 35, T 110 N, R 47 W. The cast iron monument was installed at that point, with inscriptions in raised capital letters as follows: 'W.B. Minn' north face, 'Iowa' south face, '43 30 N.L.' on the east and west faces. They had meandered around Lake Hendricks, and had also run meander and random lines around Lakes Traverse and Big Stone.

Ehud N. Darling was dispatched from St. Paul in the fall of 1859 to check the survey. He reported that Indians had attempted to destroy the iron monument at Lake Traverse and had removed all the meander posts between the lakes. He proceeded hastily to the Iowa border inspecting only ten miles by measurement because of severe winter. The General Land Office advised the St. Paul Surveyor General in January of 1860 that Snow and Hutton had not set markers and posts between the lakes, and that this work would have to be done and inspected. Apparently, Snow and Hutton returned in July of 1860 and installed wood mile posts, giving the distance between the iron monuments as 349.43 chains. This work was checked by Fredric Wippermann in September. He verified the mile markers and gave the distance as 348.68 chains, a difference of 49.5 feet. ^[81]

When surveying T 125 N, R 49 W, in October 1882, Miles Wolley set a 13 x 9 x 6 inch granite stone 9 inches in the ground, dug pits at right angles, and raised a mound of earth 2 feet high over the stone for mile post 3. He found mile post 2 and replaced it with a stone with pits and mound. At mile 1 he set a 4 foot wood post with pits and mound. ^[82]

Research done by Emory E. Johnson, PE/LS, former Head, Civil Engineering Department of South Dakota State University, confirms that the iron monument at the south end of Lake Traverse is now incorporated in U.S. Highway 10, and that the one at the Iowa line exists but

has been moved out of the traveled way and is northwest of the actual corner location. Through the USGS he also confirmed that the one on the south end of Big Stone Lake was in place in 1971. The condition of the one on the north end of Big Stone is unknown.

From the iron monument on the Iowa border, the eastern boundary of South Dakota would follow the parallel west to the center of the Big Sioux River and then along the center of that river to the Missouri River. While surveying interior lines in T 101 N, Carl C. P. Meyer established the center of the Big Sioux at 7 miles, 36.39 chains west of the southwest corner of Minnesota. He made no mention of the monumentation placed when the north Iowa border was surveyed in 1852 and which is described in a sketch prepared by Andrew Talcott.

The center of the Missouri River at the mouth of the Big Sioux is probably more stable now with control of river flows than it was when townships were surveyed in South Dakota along the Big Sioux in 1860 through 1863. Emory E. Johnson determined from Missouri River Commission maps published in 1892-1895 and the latest USGS topographic map that this point shifted during that time span by 2" in latitude and 1' 25" in longitude, a distance of about 200 feet south and about 1.4 miles east. The USGS map gives the latitude as 42° 29' 23" and the longitude as 96° 26' 36". The length of the bed of the Big Sioux River has never been run, but meander lines were run along the river during township surveys. Measuring along the survey plats approximates the distance at 125 plus miles to the point established by John Ball in 1860. ^[83]

Similarly, the boundary north from the south end of Big Stone Lake was never surveyed except as part of township surveys. James C. Blanding, when surveying north of the Sisseton-Wahpeton Indian Reservation in 1868, established the northeast corner of South Dakota 11 chains east of the north quarter corner of Section 3, T 128 N, R 47 W. Again, scaling on the survey maps gives an approximate distance of 60 miles from the northeast corner to the monument at the south end of Big Stone. The total length of the east boundary is about 316 miles.^[84]

SOUTH DAKOTA-NEBRASKA BOUNDARY

The enabling act for Nebraska statehood set the north boundary as beginning at the intersection of 27 degrees West Longitude and 43 degrees North Latitude, then east along the 43rd parallel to the center of the Keya Paha River, then along the channel of the Keya Paha and Niobrara Rivers to the Missouri. The area north of these two rivers and south of the 43rd parallel had been included in the Dakota Territory when it was created in 1861. That area was transferred to Nebraska in 1882 making the north boundary of Nebraska the bed of the Missouri River to the 43rd parallel and west to the northwest corner. ^[85]

A contract was awarded to Chauncey Wiltse, a civil engineer and Astronomer, to survey the North boundary of Nebraska west from the Keya Paha River on June 24, 1873. The survey was accomplished between August 30 and September 25 inclusive, 1874. Wiltse started at the corner common to Townships 33 and 34 North, on the 2nd Guide Meridian West and ran West and North to the South bank of the Keya Paha. There he observed the latitude to be 42 degrees 59' 47.73'' and calculated the 43rd parallel to be 17.90 chains further North. He erected a stone shaft 12 inches by 10 inches by 5 feet long at the observation point, marking the stone with "Latitude Station No.1, 1874'' and "Lat 42 59 47.73''.

At the 43rd parallel as determined, Wiltse established the true meridian by Polaris and began the Westward Survey. He established the Keya Paha midpoint at 47.50 chains, and at 1.20 chains further West (48.70 chains from the meridian) erected a 12 inch by 12 inch by 5 feet stone. The stone was marked "Initial Point, 43rdParallel, 1874" on the East, "Dakota" on the North, and "Nebraska" on the South. At each mile corner he set a 6 inch square wood post, 7 feet long, 2 feet deep with charred wood on the north side, dug 3 feet square by 18 inches deep pits to east and west, and built a 3 foot high and 6 foot diameter mound. The posts were marked the same as the initial point except that the mile number replaced the initial point data. He did not set ½ mile posts. The tangent offset method was used, and Astronomic Stations were established near mile posts 56, 112, and 170.

Wiltse intersected the 27th meridian at 224 miles 12.20 chains west of the initial point and 5.31 chains north of the stone monument set earlier by Chaffee. He accepted the Chaffee stone as correct and adjusted his line to correspond. Wiltse noted that he found the Chaffee stone lying down to the east. He re-erected the stone and rebuilt the mound. ^[86]

Perhaps this is a good place to discuss the 27th meridian. By Act of September 28, 1850, 9 Stat. 515, Congress ordained that the Washington Observatory Meridian should be used for all astronomical purposes. The meridian was used to describe land boundaries until repealed on August 22, 1912. The Washington Meridian is 77 degrees 03' 02.3" west of the Greenwich Meridian. The 27th meridian west of Washington is therefore 104 degrees 03' 02.3" west of Greenwich.^[87]

Joseph H. Jenkins was given a contract on May 20, 1893, to resurvey the Nebraska-South Dakota boundary from the Keya Paha River West and to survey the new boundary established in 1882 east from the Keya Paha to the Missouri. He began his survey from the Chaffee monument

on July 24, 1893, noting closing corners and setting temporary ½ mile corners. He found marked stones with pits and mounds at miles 221 through 215. Mile 214 was pits and mound only. Approaching the east end he found pits and mounds only for miles 10 through 1. The writer did not examine intervening field notes, but apparently many of the markers set by Wiltse were still in evidence. Jenkins found the initial point monument broken into three pieces and lying in the river but no trace of the original location. He retraced from Latitude Station No. 1 set by Wiltse and reestablished the initial point by proportionate measurement 78.47 chains east of mile post No. 1. There he set a new stone monument 10 inches square by 7 feet long marked on the east face "Initial Point 1.20 C.E.". He then ran West using the Secant Method, setting an 8 inch square by 6 foot quartzite post at each ½ mile and a 10 inch square by 7 foot quartzite post at each mile corner. The monuments were marked SD on the north, N on the south, and the mile post on the east. He also installed a 7 foot quartzite monument to the northwest of the Chaffee monument which he marked "1893 T. Mon. 224 Mi 12.13 C." on the East face with the state markings on the other faces. The total distance was 224 miles, 12.13 chains. ^[88]

Jenkins then returned to the Keya Paha and surveyed in like manner to the Missouri River. He set the east terminal monument, a 7 foot quartzite stone, 72.70 chains east of mile 57, being 0.12 chains from the edge of a steep bank. Mile posts were numbered both East and West from the Initial Point at the Keya Paha River. The survey was completed on October 12, 1893. A Gurley transit with solar attachment was used for the survey.^[89]

Latitude and Longitude positions were determined for mile posts 56 and 222 ¹/₂ in 1912 by the U.S. Coast and Geodetic Survey. The 1927 N.A.D. longitude for miles 222 ¹/₂ is 104 degrees 00' 02.73" W. ^[90] From this data the calculated longitude for the terminal monument is 104 degrees 01' 59.47" W.

In June of 1987, Rollin and Jackie Curd along with William Wickersham, visited the monuments at the West end of the Nebraska-South Dakota boundary. They reported the Chaffee monument in excellent condition and the Jenkins monument leaning slightly. Restoration of the monuments and a dedication ceremony was held September 6, 1989. A search headed by Rollin Curd for the initial point at the Keya Paha River in August of 1987 succeeded in locating the west ½ mile and the East 1 mile posts, but the initial marker is not visible. They did at that time locate the terminal marker at the Missouri River. ^[91]

WESTERN BOUNDARY

The west boundary with Wyoming was first surveyed from the 43rd to the 45th parallel by Rollin J. Reeves, a U.S. Astronomer and Surveyor, under contract dated April 6, 1877. In starting north, Reeves set cottonwood posts at each mile corner with pits and mounds. The posts were marked with mile number on the south, "1877" on the north, and the state on the east and west faces. Pine posts and stones were also used in some cases. No half mile posts were set. They finished the 132nd mile on July 21, at which time an Indian attack resulted in the loss of the transit and field notes. Reeves had to replace the records from field notes of the crew. When work was resumed on July 30, the line was projected north by backsights. The terminal mark was a cottonwood post with pits and mound. The post was marked "Dakota" on the east, "Wyoming" on the southwest, "Montana" on the northwest, and "45 N Latitude" on the southeast. The survey was completed on August 1, 1877. The recorded distance was 138 miles 32 chains. ^[92] Of interest is that the chained distance through that rough terrain was within about 0.3 miles of the calculated arc length.

The boundary with Montana was surveyed by Daniel G. Major, a U.S. Surveyor, under contract dated June 20, 1885, and performed during August and September of that year. Major determined the 27th meridian from the Mingusville Astronomic Station and ran a random line South, taking Polaris shots every clear night. He located the Wyoming terminal marker which had been set by Reeves 70 chains 68 links west of his random line. Due east of that point on his random line he constructed an elaborate, well witnessed monument for the Montana southeast corner. He then proceeded north setting 6 inch square 6 foot posts for mile corners. He dug pits north and south and built a 3 foot mound 5 feet in diameter. The posts were marked with the states, station, and meridian. Stones were also used. ^[93]

The boundary north from mile 104 was resurveyed by Frank S. Peck, U.S. Surveyor, in 1904. The map of this survey shows the offset at the Wyoming-Montana boundary as 70.73 chains and the longitude for the southeast corner of Montana as 104 degrees 02' W, which is very near the value at the 43rd parallel monument. The maps also indicate that very few closing corners were located. ^[94] The longitude of the southeast corner of Montana is given by the Geological Survey as 104 degrees 02' 20.83". The markers for both of these corners as well as all of the mile corners were replaced by 6 foot cut stones in 1904. ^[95]

The south 104 miles of the west boundary, except for the 57th through 81st miles, were resurveyed in 1904 by U.S. Surveyor Edward F. Stahle. The survey began on September 3, 1904, and was completed on June 22, 1905. A Young and Sons Light Mountain Transit was used. Stahle established a true meridian and ran a random line falling east of the first line post. He then returned to the initial point and ran a true line, repeating this process each mile. Stahle installed either a quartzite stone or an iron post for mile corners. He dug 3 foot square pits 8 feet north and south of the mile post and built a mound south of the corner. ^[96] The stone monuments were 10 inches square by 6 feet long and were installed through mile 39. The iron posts were 3 inches in diameter and 4 feet long with a brass cap and were installed on the balance of the line. He encountered Forest Service marker 156 in mile 54. He was then advised to skip to mile 81 as the intervening line had been done by the Geological Survey. He continued on to mile 104 where he installed an iron post. All of the mile posts were marked with the year, station, and states. ^[97]

SOUTH DAKOTA-NORTH DAKOTA BOUNDARY

The north boundary was surveyed in 1891 and 1892 by U.S. Deputy Surveyor Charles Bates under contract dated June 4, 1891. He used a Heller and Brightly Transit with Smith Solar Attachment and a Burt's Solar Compass with Young and Sons telescope attachment. Measurements were made with 2 steel tapes graduated in links. The monuments set were a 7 foot by 10 inch square stone from a quarry near Sioux Falls known as Sioux Falls Quartzite or Jasper. The use of these durable monuments spread to the south and west boundaries and to other states. A very detailed and interesting account of the survey of this boundary is given in "The Quartzite Border" written by Gordon L. Iseminger, Pine Hill Press, Freeman, SD, 1988.

Bates began the survey at the Seventh Standard Parallel at the corner to Sections 32 and 33, T 129 N, R 78 W from the 5th Principal Meridian. He ran a line east identifying and marking old section and quarter corners. Near the boundary of the Sisseton-Wahpeton Indian Reservation he made solar observations and continued the line east on tangent across the Indian Reservation by double backsights and foresights. He made additional solar observations every 12 miles. Finding no evidence of meander corners at the Bois des Sioux River, he retraced the south side of Section 34, T 129 N, R 47 W. He intersected the river banks at 12.00 and 28.00 chains from the southeast corner of Section 34 and established the Initial Point midway at 20.00 chains. Nine chains west from there he installed a monument marked "In. P.T.9.C.E." on the east face, "N.D." on the north face, "S.D." on the south face, and "1891" on the west face. No mention was made of the point set by Blanding 11 chains east of the north quarter corner of Section 3 in 1868.

Bates continued west to Mile 190 near the east bank of the Missouri River setting monuments at each quarter and section corner. He reached that station on November 18 and suspended work for the winter. Bates returned to Mile 190 on June 6, 1892, and surveyed the line on west using the Secant Method. He measured across the Missouri by triangulation both North and South. The Montana boundary was intersected 48.35 chains north of Mile Post 65 where Bates installed the Terminal Monument. The monument was marked "1892 T.M. 360 M. 45.35C." on the east face with the states on the other faces. He recorded the Montana line bearing as N 1 degree 01' 30" W. The completion date was August 17, 1892. ^[98]

INDIAN LAND SURVEYS

Most of the Indian Reservation boundaries were surveyed under the rectangular survey system dating back to the Greenville Treaty boundary in 1797. Some of the interior allotments were surveyed under specific executive orders in a haphazard manner with no regard to cardinal direction or the rectangular survey system. This resulted in many odd lots when the surveys were completed. Surveys were done under both the General Land Office and the Commissioner of Indian Affairs. The Act of April 8, 1864, placed survey of the Indian land allotments under the General Land Office. Most of the Indian lands in the western territories were surveyed after that time and followed the rectangular survey system except for section subdivision.

Figure 4 depicts the system of corner designation devised by the Bureau of Indian Affairs and illustrates how the 40 acre tracts were laid out. The 1/16 corners on the exterior section lines were set equidistant between section corners and ¼ corners. Straight lines were then run between opposite corners on the east and west sides setting interior 1/16 corners equidistant. This has been referred to as the "Three Mile Method" taken presumably from these three east and west interior lines. The north and south interior lines simply connected established points. Figure 5 shows division into 20 acre allotments. Figure 6 shows division into 10 acre allotments. The 1/16 corners were called 1/8 corners and the 1/64 corners were called 1/32 corners. Retracement of these surveys must be done in the same manner. ^[99]

The first reservation lands surveyed in Dakota Territory were 14 whole and fractional townships in the Sisseton-Wahpeton reservation just west of Big Stone Lake in 1864-1866. Actually, this was land taken from the Indians after the Sioux uprising in 1862 and was to be sold for the benefit of the Indians. No money was appropriated for this work, and the Deputy Surveyors were to be paid with proceeds of the land sales. This was the only surveying done in Dakota Territory in 1866 because Congress appropriated no money for other surveys either. The survey was poorly done, and the land was resurveyed in 1883. ^[100]

Theodore H. Barrett surveyed the exterior boundaries of the Sisseton-Wahpeton reservation, divided it into townships and sections, and subdivided it into 40 acre tracts by the "Three Mile Method" under contract dated August 22, 1868. ^[101]

Other surveys were accomplished on the "flatiron" reservation of the Sisseton-Wahpeton and the Yankton Sioux Reservation in 1869. Some surveying was done on reservation land along the Missouri River in the middle seventies. The Act of March 2, 1889, took about 9,000,000 acres from the "Great Sioux Reserve" created in 1868. The remaining Indian land was divided into six reservations: Rosebud, Pine Ridge, Cheyenne River, Standing Rock, Lower Brule, and Crow Creek. Survey of these lands began in Pine Ridge and Rosebud in 1892 and were still being done on the Cheyenne River Reservation in 1933. ^[102] Figure 7 shows the present boundaries of the reservations.

PROGRESS OF TOWNSHIP SUBDIVISION

Figures 2 and 3 are based upon data taken from an unpublished paper written by Ralph J. Borkowski, Department of Geography, South Dakota State University, November 1987 titled "Township Subdivision in South Dakota: 1850-1934". The paper includes a series of computer generated maps of South Dakota showing in five-year increments the years in which townships were subdivided into sections. The subdivision year for each of the 2,319 full and partial townships was entered into the computer, and each individual township is outlined on the map. Figures 2 and 3 are simply a combining of these maps into two maps by using colors. The time span for the survey of any given township may be determined from these two maps.

The data for township boundary survey was also entered into the computer, but this information was not mapped. Data from 31 selected townships east of the Black Hill Meridian shows an average span of 1.7 years between township survey and subdivision. A 7, 12, and 13 year interval warps the average. Twenty of these townships were subdivided in the same or following year. ^[103]

South Dakota was 1/4 surveyed by 1879, 1/2 by 1889, and 3/4 by 1894. Total acres surveyed by 1900 were 49,000,000. The next ten years added 110,000 acres. Another 26,000 acres were surveyed by 1932 when the work was completed. ^[104] The Act of June 25, 1910, 36 Stat. 703 ended the contract surveys. Future surveys were to be done by Government employees. By that time only the above 26,000 acres remained un-surveyed in South Dakota. ^[105]

GENERAL TOPOGRAPHY OF SOUTH DAKOTA

Figure 8 is a map of South Dakota prepared by the South Dakota Geological Survey and which shows the "Major Physiographic Divisions of South Dakota".

The state may be broken into main acres roughly divided by the west line of the James River valley. The east river area is comprised of the Minnesota Valley, a lowland in the extreme northeast corner between the Mississippi River and the Hudson River drainage systems; the Coteau Des Prairies, a rough, lake-dotted highland rising sharply above the surrounding land, being in excess of 2,000 feet above sea level; and the James River Basin, a level lowland crossing the state in a north-south direction. This eastern region may be described as glacial formation.

The west area, exclusive of the Black Hills, may also be divided into three regions: The Coteau Du Missouri which extends from the James River Valley to the Missouri River is somewhat of a transition between the eastern prairie plains and the Great Plains west of the Missouri and is made up of glacial hills and deep valleys; the High Plains is an area of about 400 square miles near the Nebraska border in Shannon and Bennett counties and is basically considered sand hills; the Missouri Plateau is made up of the Cretaceous Table Lands, the Pierre Hills, and Tertiary Table Lands. This entire area was formed by upheaval and is generally cut by canyons and buttes but with large areas of nearly level lands. The Tertiary Table Lands contain the Badlands and is generally very rough. The Slim Buttes area in the northwest may be called a minor badlands area. Much of Harding County is made up of Custer National Forest.

The Black Hills are forested mountains rising about 3,500 feet above proximate terrain and were formed by uplift. Harney Peak at 7,424 feet elevation is the highest point in North America east of the Rockies.^[106]

LAND USE

The region east of the Missouri River and North of a line east from Big Bend Dam is predominantly pasture and wheat land with annual rainfall of 18 to 22 inches except for the east one-fourth which is a general farming area with 22 to 24 inches of annual rainfall. The east third of the area south of that line is intense soybean, corn, and livestock production. The middle third is on the corn belt fringe with moderately intensive crop and livestock production. The west third is a transition area between farming and ranching.

The land west of the Missouri River is used primarily for grazing with fairly extensive wheat production. Annual rainfall is less than 16 inches. ^[107] There is limited impoundment/canal irrigation along the Belle Fourche River, Rapid Creek and Cheyenne River along their valleys eastward from the Black Hills.



FIGURE I

ADAPTED FROM FIGURE BY RALPH BORKOWSKI, TOWNSHIP SUBDIVISION IN SOUTH DAKOTA



FIGURE 2

23



FIGURE 3



From C. Albert White, A History of the Rectangular Survey System

FIGURE 4 27



FIGURE 5

C. Ca	or. 58 59			1	■ ^{1/4}					
	8	7	6	 5	4	3	2			
	9	10	Ш	12	13	 14	15	16		
	24	23	22	21	20	 	 	17		
	25	26	27	28	29	30	31	32		
	40	39	38 38	37 • ³⁷	 36	35	34	33		
	41	42	43 ×	*44 44	45	46	47	48		
1	East on random, setting temporary corners at every 10 chains									
	56	55	54	(as determ 53	ined by random 52	") 51	50	49		
	57	58	59	60	61	62	63	64		
		i	i		1/4		i			

Diagram 2 (Showing method of subdividing Sections into 10 Acre Tracts.)

From C. Albert White, A History of the Rectangular Survey System

FIGURE 6





NOTES

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