PART VI: BOUNDARY SURVEYING

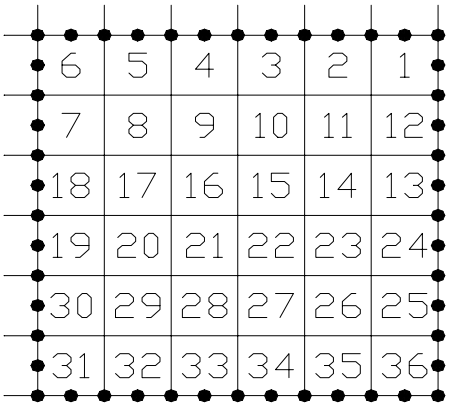
6.1 The U.S. Rectangular Survey System (Overview)

The Public Land Survey System in Michigan is referenced to two axes. The North and South axis is the Michigan Principal Meridian which defines the West line, and West line extended, of the Treaty of Detroit signed in 1807. The line runs due North from the mouth of the Au Glaize River at Fort Defiance, Ohio.[17]

There are actually two East and West axes, or Base Lines. The 1850 General Instructions to deputy surveyors described the base line as beginning "... at a point on Lake Saint Clair, 173 links South of the Northeast corner of Claim No. 222 and extends thence West to Lake Michigan."[18] Due to several accidents of history there are actually two Michigan base lines which here will be called Base Line East and Base Line West. Base Line West begins at the Michigan Principal Meridian at a point about 939 feet South from Base Line East and was surveyed West to Lake Michigan. The Principal Meridian and Base Lines were established in segments under different contracts by different individuals.

The intersection of a principal meridian with a base line is referred to as an initial point. From an initial point townships are numbered North or South from a base line and ranges are numbered East or West from a principal meridian. A township referenced as T8N, R11W, means that it is the 8th township north from the base line in the 11th range west from the principal meridian.

Figure 6.1
Standard Township



A statutory township contains 36 sections each having a nominal area of one square mile or 640 acres. Sections are located and numbered in the townships as shown in Figure 6.1.

The exterior boundaries of the township were surveyed and monumented first, with a monument being set at every half mile, or 40 chains, along the perimeter.

Original monuments set along the East line of the township and along the south line of the township provided subsequent control for the subdivision of that township. In general, original monuments set along the northern perimeter of the township control the subdivision of the township to the north, and in general, original monuments set along the western perimeter of the township control the subdivision of the township to the west. These general principles varied with subsequent instructions to deputy surveyors.

6.2 Units of Measure

The unit of record distance in the Public Land Survey System was the chain of four perches or rods, subdivided into 100 links. Distance was measured with a chain of two perches or rods, subdivided into 50 links. In this discussion the term “Chain” will refer to the chain of 100 links, or 4 perches. The unit of area is the acre, being 10 square chains. Area is computed by multiplying the length in chains by the width in chains and dividing the product by 10. For example to compute the area of a parcel 40 chains long and 20 chains wide:

Area = (L x W)/10 = (40 x 20)/10 = 80 Acres

In English units, a chain is 66 feet long.

Directions were determined with a magnetic compass in earlier instructions, a solar compass in later instructions.

6.3 Original Instructions to Deputy Surveyors (Summary)

Townships in Michigan were subdivided under four sets of general instructions and several sets of special instructions. These instructions may be found in *Special Instructions to Deputy Surveyors in Michigan 1808 - 1854*, by Dr. Ralph Moore Barry which is available from the Michigan Museum of Surveying.

6.3.1 Tiffin's Instructions of 1815

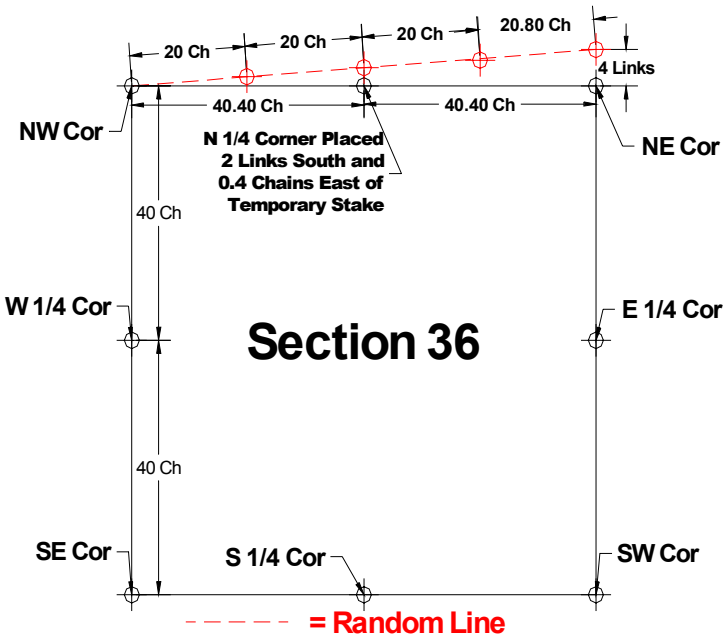
The subdivision of the township began at its southeast corner. The South 1/4 corner and SW corner of Section 36 were verified. From the SW corner of Section 36 the survey proceeded North 40 chains and a quarter corner was set. From this quarter corner, 40 chains were measured North and the Northwest corner of Section 36 was set. From the Northwest corner of Section 36 a random line was established to the East with temporary corners being set at 20 chain intervals. When the East township line was reached the total distance measured was determined as well as the distance or "falling" north or south from the existing monument at the Northeast corner of Section 36. Temporary points were adjusted so that the North quarter corner of Section 36 would be located half way and on line between the two section corners. This pattern was repeated for each section to the north until the North line of Section 12 was established. From the Northwest corner of Section 12 (being also the Southwest corner of Section 1) the survey proceeded North and the West 1/4 corner of Section 1 was set at 40 chains. The survey continued to the North and a closing corner was set on the township line with the falling distance from the Southwest corner of Section 36 of the township to the North noted. The intent was to place all error in the last half mile of the range of sections. These closing corners control line and proration.

This pattern was continued for each range of sections. Quarter corners on the North lines of sections adjacent to the west township line (except Section 6) were set by measuring due West from the Northeast section corner and setting a monument at 40 chains. The line was continued West until the West township line was reached, a closing corner set and the falling distance noted. Like their counterparts on the North line of the township, these closing corners control for line and proration only.

Key points to be recognized in townships surveyed under Tiffin's Instructions are:

- Meridional Lines were measured in 40 chain intervals with the exception of the last half mile of the closing sections.
- Longitudinal lines closed on existing corners with the exception of the Western range of sections. Quarter corners were set at 40 chains and the last half mile measured to the West township line.
- Closing corners exist on the North lines and the West lines. Closing corners control line and proration only.
- Centers of Section, the North quarter corners of Sections 1 through 6 and the West quarter corners of Sections 6, 7, 18, 19, 30 and 31 were not set.[19]

Figure 6.2
North Quarter Corners, Tiffin's Instructions



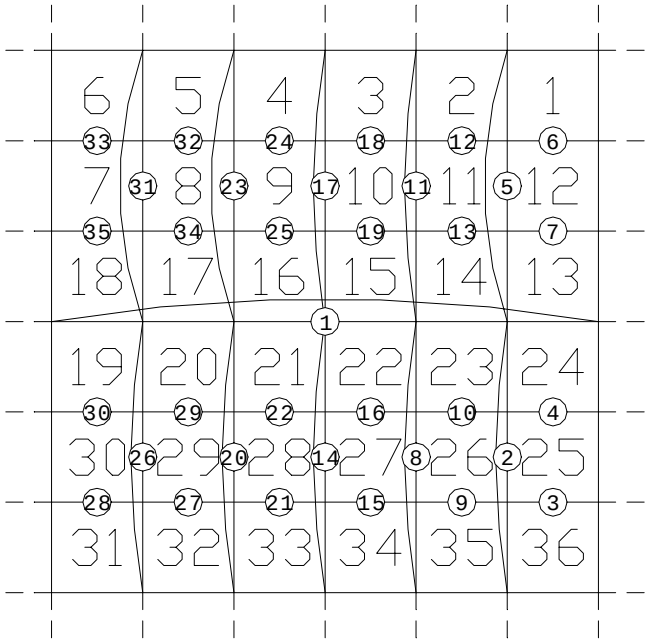
6.3.2 Instructions of 1833

The subdivision of townships under the Instructions of 1833 was very similar to those of Tiffin with a major exception. Closing corners were not set along the West township line. From the Northeast section corner in the last range of sections, except section 6, a temporary stake was set at 40 chains to the West, the line then extended to the West township line. The distance and falling were noted. The temporary stake was adjusted for line only, resulting in distance error being thrown into the last half mile.

6.3.3 Instructions of 1850

The Instructions of 1850 departed radically from those of Tiffin or from those of 1833. The scheme of survey is shown in Figure 6.3.

Figure 6.3
Subdivision of Township under the Instructions of 1850



6.3.4 Instructions of 1852

The Instructions of 1852 were a special set of instructions issued to William Austin Burt for the resurvey of those townships subdivided under the Instructions of 1850 which contained gross errors

or omissions. There are minor differences that the reader is encouraged to study.

6.4 Current Instructions

Current Instructions are contained in the *Manual of Instructions for the Survey of Public Lands of the United States;* Bureau of Land Management, United States Department of the Interior; Washington, D.C., 1973 which is available on the Internet at the following address: **http://www.ca..blm.gov//webmanual/id1.htm.**

6.5 Private (French) Claims

Certain lands in Michigan were granted by French kings to individuals to develop and support the fur trade. These grants were honored by the United States after the Revolutionary War. In the early 19th century Aaron Greeley surveyed the perimeters of many of these claims and referenced them to the Public Land Survey System. Long, narrow parcels radiating from a body of water can be an indication of an early French claim. Retracement of these boundaries is beyond the scope of this manual.

6.6 Subdivision of Standard Sections

6.6.1 Centers of Section

Sections are subdivided by intersecting quarter lines. The point of intersection is the Center of Section. Both federal and state laws are in agreement. While there is virtually no disagreement on the proper method of establishing a center of section, there is considerable controversy over holding existing or historical monuments which the modern surveyor finds to be some distance away from his or her determination of the point of intersection. No attempt will be made here to present a final resolution to this issue. However, the prudent surveyor faced with this situation should evaluate the following questions.

1. Uncertainty in Control Monuments. Are the quarter corners being used by the modern surveyor those that were used by the earlier surveyor and are they in their most probable original location?

2. Intent. Was it the intent of the earlier surveyor to set his monument at the intersection of the quarter lines?

3. Uncertainty in Observations. Does the position of the existing monument conform to standards of accuracy achievable using the methods and equipment available at the time it was set? For that matter, does the "new" position conform to standards of accuracy using the methods and equipment available today?

4. Court Decisions. Has a court ruled that a historical monument not at the intersection of quarter lines is controlling?

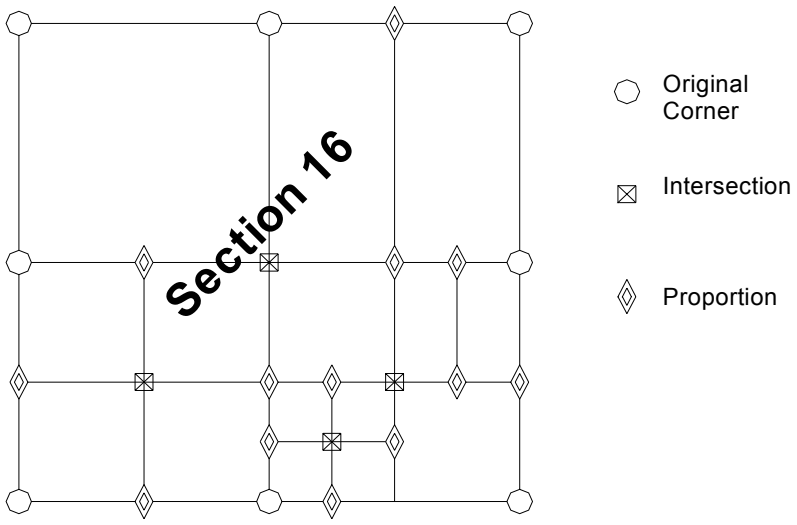
5. Special Instructions and Resurveys. Was the historical monument set in conformance with special instructions or a part of a resurvey conducted by the General Land Office or Bureau of Land Management?

Ultimately, the decision lies with the practicing professional whose name and seal are affixed to the survey documents.

6.6.2 Corners of Aliquot Parts

Figure 6-4 shows in graphic form how to properly establish the corners of the aliquot parts of a standard section.

Figure 6.4
Subdivision of Section



6.7 Subdivision of Fractional Sections

Fractional Sections are those bordering the North and West lines of the township and those not conforming to the standard configuration due to water boundaries, treaty lines, private claims, etc.

6.7.1 Fractional Sections on Township Lines

Fractional sections on township lines present an additional challenge to the surveyor due to the absence of an original quarter corner. The key to properly positioning the quarter corner along the North or West township line may be found in the area.

While surveyors were instructed to place the error in the last half mile to the North and the last half mile to the West, further subdivisions were usually, but not always, protracted on the plats. In the fractional halves, two standard aliquot parts 20 X 40 chains were typically drawn. Remaining was a tract divided into 4 lots at 20 chain intervals. When this took place, these lots absorbed the error. On the plat map, the distances on both sides of the fractional section are given along with areas of the lot. With this information, the surveyor can, through a series of computations, determine the distance along the township line that was used to compute the area. This distance can be prorated against the measured distance to properly position the quarter corner on the township line.

With the location of the quarter corner determined, the quarter lines can be intersected and the Center of Section set.

The exterior eighth corners are set by measuring the distances from quarter corners to closing corners and comparing them with the record distances along the same lines. A proportional factor is computed, applied to the 20 chain distance, then the fractional distance as a check.

The interior eighth corner is set by taking the mean of the record distances on the exterior fractional section boundaries. A proportional factor is computed by comparing this value with that distance measured between the Center of Section and the quarter corner set as described above. The factor is applied to the 20 chain distance, then to the remaining distance as a check.

In all cases it must be remembered that "Closing corners are intended to be established where a closing line intersects a boundary already fixed in position. A closing corner not actually located on the line that was closed upon will determine the direction of the closing line, but not its legal terminus; the correct position is at the true point of the intersection of the two lines."[20]

6.7.2 Government Lots and Meander Lines

Government lots are found typically, but by no means exclusively, along major bodies of water and watercourses where standard quarter-quarter sections could not be established. Where meander lines were run their purpose was to define the sinuosities of the water's edge and to determine the areas of usable, salable land. Meander lines are not boundary lines. Boundaries are determined by the water, a natural monument. The reader is referred to **Public Act 451 of 1994**, Parts 301 and 325 for guidance on the ownership of bottom lands.

6.8 Restoration of Lost or Obliterated Corners

" The original township, section and quarter section corners must stand as the true corners which they were intended to represent, whether in the place shown in the field notes or not. The distance between such corners as returned shall be held and considered as the true length thereof. The monuments set at the time of the original survey are the best evidence as to where the original boundaries were established, and as such the position of the monuments must remain unchangeable."[21]

6.8.1 Existent Corner

"An existent corner is one whose position can be identified by verifying the evidence of the monument or its accessories, by reference to the description in the field notes, or can be located by an acceptable supplemental survey record, some physical evidence or testimony. Even though its physical evidence may have entirely disappeared, a corner will not be regarded as lost if its position can be recovered through the testimony of one or more witnesses who have a dependable knowledge of the original location."[22]

6.8.2 Obliterated Corners

" An obliterated corner is one at whose point there are no remaining traces of the monument or its accessories, but whose location has been perpetuated, or the point for which may be recovered beyond reasonable doubt by the acts and testimony of the interested landowners, competent surveyors, other qualified local authorities, or witnesses, or by some acceptable record evidence. A position that depends upon the use of collateral evidence can be accepted only as duly supported, generally through proper relation to known corners and agreement with the field notes regarding distances to natural objects, stream crossings, line trees, and off-line blazes, etc., or unquestionable testimony."[23]

6.8.3 Lost Corners

" A lost corner is a point of a survey whose position cannot be determined, beyond reasonable doubt, either from traces of the original marks or from acceptable evidence or testimony that bears upon the original position, and whose location can be restored only by reference to one or more interdependent corners."[24]

When a corner is lost, a number of methods have been prescribed to replace it depending upon its nature and location. Following in the foot steps of the original surveyor is the best method. These methods are used when all else fails.

6.8.3.1 One Point Control

If the lost corner was originally established at the end of a line run from a single direction it should be placed at the record bearing and distance from the nearest known corner.

6.8.3.2 Two Point Control

" When a lost corner was originally established at the terminus of lines from two directions, it should be restored at the record distances (cardinal equivalents) with the possibility of a index correction. One distance controls latitudinally and the other controls meridionally. " [25]

6.8.3.3 Three Point Control

"When a lost corner was originally established at the terminus of lines from three directions, it should be restored at single proportionate distance in one direction (between control corners in opposite directions), and by letting the record distance (cardinal equivalent) control the position from the remaining direction. Examples of this situation may exist where lost township or section corners were originally established with control lines in only three directions."[26]

6.8.3.4 Double Proportionate Measurement

Double proportionate measurement is used to position a lost corner common to four sections within the interior of a township and lost corners common to four townships not on the principal meridian, the base lines or correction lines.

6.8.3.5 Single Proportionate Measurement

Single proportionate measurement is used to position any lost corners on township lines, any lost township corners on the principal meridian, base lines or correction lines, and lost quarter corners between section corners.

The reader is referred to *Manual of Instructions for the Survey of Public Lands of the United States* (BLM Manual) for details and procedures for establishing lost corners by single or double proportional measurement..

6.8.4 Collateral Evidence

" Collateral Evidence is additional or auxiliary evidence which supports or reinforces the primary evidence of a corner point. The primary evidence is the actual corner monument or its accessories. Collateral evidence may be in the form of acts or testimony of interested landowners, competent surveyors, or other qualified local authorities or some acceptable record evidence in identifying the true original position of a corner. Collateral evidence in surveying is similar to circumstantial evidence in law (by itself it is insufficient; but an abundance of it is conclusive)." [27]

6.9 Platted Subdivisions

As one needs to survey the perimeter of a section to determine an aliquot part (s)he must define the limits of a block to properly establish a lot or lots. Lots are created simultaneously. There are, therefore, no junior or senior rights established relative to original lots. The plat boundary and any lot splits are subject to junior/senior rights.

In surveying platted areas, plat boundaries and dedicated street or right of way boundaries are determined first. Any error in the resulting block is isolated or prorated. Once original lots are established, the splits can be applied.

6.10 Order of Conflicting Elements

When elements in a deed conflict with evidence on the ground the following order of precedence has generally been accepted.

1. Unwritten Rights

2. Identified lines or monuments to a survey called for.
3. Natural Monuments
4. Artificial Monuments

> Note 1: "Monuments set after the deed was written, and not occupying the spot of an original monument, are not controlling except where the deed calls for a survey to be made."[28]
>
> Note 2: "Where two monuments, otherwise equal, are in conflict, the one in harmony with distance, angle, or area becomes controlling."[29]

5. Direction and Distance, preference given to the one having the greatest certainty.

6. Area, except when clearly stated by the parties in the deed to control.

The prime directive of the boundary surveyor to locate a deed description on the ground, then locate lines of occupation relative to it. Questions of ownership are resolved by statute, by parties involved or by courts of law.

6.11 Deliverables

Deliverables are defined by the scope of work. Boundary surveys for MDOT will typically involve establishing alignment in a long, narrow corridor. When new or additional right of way is to be acquired it is referenced to the alignment (see **Part VIII, Route Surveying**).

Specific requirements for relating alignment with corners and lines of the Public Land Survey System, platted subdivisions, condominiums, private claims and the like are defined by statute, by the scope of work and by mutual understanding between the MDOT survey project manager and the professional responsible for conducting the survey.

The recording of documents such as surveys conforming to **P.A. 132 of 1970** as amended, land corners under **P.A. 74 of 1970** as amended and others as may be appropriate is the responsibility of the provider. MDOT is given copies of signed, sealed and recorded documents.

Right of way lines shall be monumented with 1 meter long steel reinforcing rod appropriately capped. Right of way caps can be obtained through the Lansing Survey office. In the past, concrete monuments were used. Specific requirements are coordinated with the MDOT survey project manager.

End Notes

17. Ralph Moore Berry, *Special Instructions to Deputy Surveyors in Michigan 808-1854* (Lansing, MI: Michigan Museum of Surveying, 1990) 376

18. Ibid., 353

19.John G. McEntyre, *Land Survey Systems* (Rancho Cordova, CA: Landmark Enterprises, 1985) 61

20. MSI, 1973, Sec. 3-69 and 5-41, Closing Corners

21. 43 U.S.C. 742

22. Bureau of Land Management Oregon/Washington, *Surveying Casebook-Fundamentals of Corner Restoration* (**http://www.or.blm.gov/NILS/casebook/corner-**restoration/)

23. Ibid.

24. Ibid.

25. Ibid.

26. Ibid.

27. Ibid.

28. Curtis M. Brown, Walter G. Robillard and Donald A. Wilson, *Brown's Boundary Control and Legal Principles* (New York, NY: John Wiley and Sons, Inc. 1995) 251

29. Ibid.