

**The Arizona Department of Transportation
Right of Way Survey & R/W Plans Preparation Process**

The following procedures shall be performed for the preparation of Right of Way Surveys and R/W plans that are to be used for the acquisition of properties for ADOT Right of Way. These procedures are not required for temporary construction easements or other temporary rights/easements.

Research

Pertinent record documents shall be obtained and researched. Document research for Right of Way Surveys begins at ADOT Records to obtain Right of Way plans, deeds of acquisition and as-built plans. Subdivision plats, Results of Survey plats and deeds shall be acquired from the County Recorders' Offices. An existing R/W report will also be provided by the Right of Way Titles Section.

Inquiries shall be made at municipal offices, utility company offices and other agencies for documentation of properties and/or evidence to support the definition of properties in the corridor. Applicable Public Land System plats and notes shall be obtained from the Bureau of Land Management Office. Information from County Surveyors and local surveyors will be obtained whenever possible. Parcel evidence will be acquired when necessary.

Right of Way Surveys

Right of Way Surveys are generally surveys of existing or proposed right of way. When necessary for highway purposes, properties adjacent to the right of way may be included in the Right of Way Survey. The acquisition of new highway right of way usually necessitates the severing of a portion of adjoining properties. This severing often results in the change of ownership lines and the destruction of existing monuments.

These procedures are intended to outline methods to perpetuate the location of these monuments and to monument the existing right of way lines and proposed new right of way lines. In this process, surveys and plans will be produced to document the existing conditions prior to acquisition and to fully define the new right of way line and its relationship to the Public Land System.

A thorough field survey shall be performed. Whenever possible, Global Positioning System (GPS) technology will be utilized. Proper and accepted GPS methods will be practiced. The survey shall conform to ADOT Right of Way procedures and standards as well as applicable procedures and standards set forth in the "Arizona Boundary Survey Minimum Standards", as adopted by the State Board of Technical Registration that are in effect at the time the surveys are performed. See Exhibit A.

All other applicable statutes and regulations are to be observed in addition to these standards. Adherence to the State statutes and procedures concerning entering properties and access to properties is required.

Right of Way Surveys shall be prepared to the extent necessary to substantiate right of way acquisition and to document the existing right of way. This policy is not intended to limit the area the surveyor must survey to establish the right of way. If the surveyor is unable to support the right of way documentation in the immediate area of the acquisition parcels, the survey must be extended to the limits necessary to recover sufficient evidence to support the right of way documentation for the project.

The field survey shall consist of the location of Section Corners, Quarter Corners including the Center of Section (Center Quarter Corner), and other monuments set by the Survey of the Public Lands, when applicable. Obliterated corners shall be identified, re-established, and re-monumented. Corners deemed to be "lost" shall be identified, re-established, and re-monumented as specified in the appropriate "Manual of Instructions for the Survey of the Public Lands of the United States".

The field survey shall make a reasonable attempt to find any and all existing corner monumentation relevant to any property parcels. This can include highway, canal, and railroad right of way monuments; as well as major and minor street centerline monumentation that either control the location of the existing right of way or are determined to be impacted by ADOT Right of Way acquisition.

If no monumentation is found for a sectional corner during the field survey search, note on results of survey "searched for not found". If any unfound section corners are re-established and either calculated or set, the method of its re-established position will be shown on the Results of Survey. Existing highway right of way, survey, and as-built centerline monumentation for the Project shall be tied to the Survey. Corners of Platted Subdivisions shall be tied to the Survey if it can be determined that the subdivision will be impacted by new Right of Way acquisition. ADOT corner recovery sheets will be completed for all found corners of the Public Land Survey System (PLSS), as well as for primary/secondary horizontal control points that were found or set. See Exhibit B.

The general policies and procedures of the applicable project's scope shall be adhered to as described in the Right of Way Survey section of the scope.

Records

A Results of Survey Drawing shall be produced and will be utilized to develop Right of Way Plans. The Results of Survey will be included in the Right of Way Plan set for the project. All subsequent Surveys performed for the preparation or revision of the Right of Way Plans including any Supplemental Surveys and the Monumentation Survey to document the monumentation of the right of way, will become a part of the Right of Way Plan set. These records will be archived in the Right of Way Plans Section's files and an electronic copy will be archived with ADOT's CADD Services. The Right of Way Plans Section shall maintain indexes for retrieval.

Recordation and Retention of Data

The Department will receive and retain a copy of the sealed and signed Results of Survey, Supplemental Surveys, and the Monumentation Survey in the R/W Plans Section's File Room. This satisfies the recording requirement of ARS 33-105. The individual Consultant preparing the Survey(s) is encouraged to record the Survey at the local County Recorder's Office. A calculation book containing the calculation printouts and corner recovery sheets of each project will also be maintained in the R/W Plans Section's file room.

Defining Right of Way

It shall be the responsibility of the surveyor to provide evidence necessary to define the existing and/ or proposed right of way within the project corridor. Sound professional judgment must be used in determination of the right of way. The surveyor shall use all evidence found in the field in conjunction with the existing R/W documentation to define the project right of way.

After the field survey has been completed and preliminary calculations have been made, a meeting will be arranged with the R/W Plans Section staff to review the evidence. General methodologies that will be used to solve the existing right of way corridor will be agreed upon in this meeting. This will be done prior to the preparation of the results of survey drawing.

In the process of defining the right of way some of the field evidence may be rejected. The results of survey drawing will show all evidence collected, and indicate the reason or reasons for any evidence that may have been rejected by the surveyor.

The primary factor for determining existing right of way is documentation that either calls for a centerline (construction, survey or right of way) strip description or directly describes the right of way line with ties to sectional corners and sectional lines. Depending on the nature of the record documentation and field evidence, the method used to re-establish the documented right of way shall be to either reconstruct the centerline, or the right of way lines. The documented right of way widths and courses can then be properly defined. The ADOT R/W Plans Section's

“R/W Corridor Survey & Analysis Guidelines” shall be adhered to when determining the existing right of way. See Exhibit C.

Right of Way Monuments

In accordance with the project’s schedule as determined by the Department, the right of way shall be monumented. The right of way shall be monumented at all angle points or changes of direction on the right of way. Locations of monuments shall also include intersections of new or existing right of way with surveyed section lines and recorded subdivision boundaries, and opposite centerline station equations. Monuments and witness posts shall conform to standards set forth in the current "ADOT R/W Plans Section Right of Way Monumentation Procedures & Standards". See Exhibit D.

Whenever possible, the land surveyor that performed the Right of Way Survey shall set these markers.

It should be noted that sometimes a road or highway will be monumented on the centerline; especially when the highway or road follows the sectional lines.

A Monumentation Survey drawing will be produced after the monumentation process to document all right of way monuments or reference monuments set, including documentation of what type of monuments were set and how they were stamped. The Monumentation Survey drawing will then be made a part of the overall Right of Way Plan set.

Datum Specification

Unless otherwise specified by the Department, the following shall apply:

The basis of coordinates for the Survey shall be the North American Datum (NAD) 1983/92 definition, or any subsequent update approved by the National Geodetic Survey Office, and codified in Arizona Revised Statutes.

Coordinates shall be Arizona State Plane Coordinates with the proper zone identified (East, Central, West);

Bearings shall be grid bearings. The project Ground Adjustment scaling Factor (GAF) shall be applied to provide ground coordinates, using the northing and easting value of 0,0 as the origin point of the scaling factor.

The Results of Survey shall clearly state the basis of coordinates, list any ADOT or NGS/NSRS Control Points used to control the Survey, the Ground Adjustment Factor used, and any other adjustments made to the survey.

For calculation purposes, the coordinates listed on the Results of Survey will be to at least 4 decimal places. This information shall be included in the Results of Survey in the form of general notes.

Supplemental Surveys

A Supplemental Survey will be performed if one of the following 2 situations arises:

1. If a New R/W control point falls on a parcel (property) line, a Supplemental Survey showing the reasoning used for the placement of the control point on a property line will be required.
2. If the calculation of a boundary of a parcel from which New R/W is needed cannot be reasonably harmonized with its adjoining parcel boundary using the field measured sectional control information and title report legal descriptions, a Supplemental Survey will be required to resolve the conflicting boundary.

Examples of evidence that are to be collected, used and analyzed in the final placement of the control point monument or parcel boundary calculation that is the subject of the Supplemental Survey are: chain of title information, existing property corner monuments, lines of occupation and testimony.

Depending on the size and location of the parcel(s) to be surveyed, and the amount of information that needs to be shown, either a separate Supplemental Survey drawing will be created and attached to the R/W plan set; or the information will be added to the Results of Survey drawing completed for the Right of Way Survey.

In the execution of the Supplemental Survey, all applicable State statutes and all applicable standards of the current Arizona Boundary Survey Minimum Standards will be adhered to.

R/W Plans Preparation

All cadastral related calculations and preparations necessary for the Right of Way plans that are produced for each project that requires permanent new right of way will utilize the information from the Right of Way Survey, parcel title report legal descriptions, and any Supplemental Surveys.

Results of Survey & R/W Plan Drawing Standards

All Results of Survey drawings and R/W Plans shall adhere to the standards and policies of the R/W Plans Section. Those standards and policies are detailed further at the website address below.

<http://www.azdot.gov/highways/row/rowplans/Exhibits.asp>

Exhibit A

ARIZONA BOUNDARY SURVEY MINIMUM STANDARDS

Definitions:

“Arizona Boundary Survey” means any one of more of the following:

- (a) The marking of boundaries, the setting of monuments, or the restoration or rehabilitation of any monument marking a corner or line that controls real property.
- (b) The determination of the location, on the ground, of any appurtenance which may potentially affect the rights and/or the enjoyment of real property.
- (c) The determination of the position of any monument, reference point, or any other mark, when such monument or mark controls the location of boundaries or rights of ownership in real property.
- (d) The presentation of any type of survey drawings, maps or plats, and/or reports-of-survey or any other documents as related to land boundary surveying, for the purpose of identifying the location of real property.

Land Surveying Minimum Standards

A land surveyor registered pursuant to the Act shall observe these minimum standards of practice as well as the applicable statutes and regulations of the Board.

1. There shall be a scope of services determined for every surveying engagement.
2. The land surveyor shall obtain and examine the record documents needed to perform the survey as described in the scope of services.
3. If the subject property is described as an aliquot part of, or as a fraction thereof, or referenced to the United States Public Land Survey System, the surveyor shall consult the pertinent United States Public Land Survey System source documents.
4. The land surveyor shall search for physical evidence that could affect the location and/or placement of boundary lines and property corners of the subject property.
5. The land surveyor shall determine the appropriate accuracy and make the required measurements necessary to adequately relate the positions of all apparent evidence pertinent to the boundary of the property. In no case shall the accuracy standard have a relative positional tolerance of more than 0.25 feet, plus 100 parts per million (PPM) with the accuracy given at the 95 per cent

confidence level. Positional tolerance is the maximum acceptable amount of positional uncertainty for any physical point on the boundary survey relative to any adjoining physical point on the survey, including the lead-in courses. Positional uncertainty in location, due to random errors in measurement, of any physical point on a boundary survey, based on the 95 per cent confidence level.

6. The land surveyor shall retain documentation necessary to adequately convey the methods and results of any land boundary survey where such results-of-survey were not publicly recorded.

7. In the event of a disagreement with the measurements and/or monumented corner positions of another registrant, the land surveyor must make and document all reasonable efforts to contact the other registrant in an attempt to resolve the disagreement. The other registrant(s) shall make all information relevant to the disagreement available, to explain objections, and afford an opportunity for discussions, explanation and corrections necessary.

8. The land surveyor shall represent the locations, consistent with the best evidence available, of corner positions and boundary lines, as follows:

A. If the land surveyor rejects an existing monument the land surveyor shall create a results- of-survey drawing that discloses the evidence, and shall explain in detail, the reason(s) for not accepting the monument. The surveyor shall file the drawing in the office of the county recorder, and provide a copy of the “record of survey” to the client.

B. When accepting a found monument of the surveyed property that does not have any record or physical evidence identifying its creator, then where practicable to do so, the surveyor accepting the monument shall affix his/her registration license number to the existing monument.

C. In no instance shall the surveyor be required to remove existing monuments unless the installation of a new monument is necessary to preserve the position of the corner. Existing monuments so replaced shall be noted in the field notes, and on the results-of-survey drawing or plat map, and where practical, shall be buried as a memorial alongside or beneath the new monument.

D. These minimum monumentation standards are not meant to apply to natural boundaries. These standards recognize that there are land surveys where the placement of monuments is not normally required, such as easement determination surveys.

E. Any land boundary survey performed as the basis for any division or partition of land shall cause all boundary corners to be monumented.

9. The following standards apply to establishing, replacing or setting boundary monuments:

A. If the monument is at either a Public Land Survey System section or ¼-section corner, refer to applicable state statutes relative to monumenting those positions.

B. All new monuments, including the surveyor’s Arizona registration number thereon, shall provide a degree of permanency, consistent with that of adjacent terrain and physical features.

- C. Whenever and wherever practicable, new or replacement boundary monuments, and witness corner monuments set shall satisfy the following minimum criteria:
1. The body of the monument shall be of metal or other such durable material.
 2. The body of the monument shall be at least 16 inches in length.
 3. The body of the monument shall be at least ½ inch in diameter.
 4. The surveyor's Arizona registration number shall be affixed to or clearly stamped into the body of the monument.
 5. The monument shall be magnetically detectable.
10. Where the point for a corner monument is such that, for all practical purposes, a permanent corner monument is not established, then at least one of the following two alternative monumentation procedures shall be used:
- A. Witness Corner Monument: Such a monument is used where the boundary corner position cannot be occupied. Such a monumented surveyed point is set on the surveyed boundary line, or a prolongation thereof, and it shall be stamped "WC".
- B. Reference Markers: Where a corner position is impractical to monument directly, or a witness corner cannot be set as described above, the surveyor shall cause to be set at least two Reference Markers. These are not set on the boundary lines and are to be identified as "RM".
11. In addition to sufficient mathematical ties to the controlling monuments of the survey, which enable the survey to be retraced by another surveyor, the surveyor's drawing must also show, as a minimum, the following items:
- A. A basis of direction or bearings.
 - B. The surveyor's Arizona RLS stamp, with signature and date.
 - C. The surveyor's statement that the survey was performed either by the surveyor or under the surveyor's direct supervision.
 - D. A legend or table that identifies and explains all symbology and abbreviations used.
 - E. A list of pertinent reference documents that were used as a basis for the survey.
 - F. When setting a monument is impractical, the recorded results-of-survey drawing shall detail the reason for not setting the monument and show bearings and distances to the nearest corner, witness corner(s) or reference marker(s).
 - G. A north arrow.
 - H. The scale of the drawing.

12. The following criteria shall be adhered to when the surveyor includes any of the following as part of the results-of-survey drawing(s):
- A. Horizontal and/or vertical control data, when used, shall be noted in detail. Where vertical data is referenced, the surveyor shall also include information about the controlling benchmark(s) and its (their) elevation(s).
 - B. Curve data shall be stated, as a minimum, in terms of radius, central angle, and length of curve, and as otherwise specified by local ordinance. In all cases, the curve data must be shown for the line(s) affected.
 - C. All non-tangent curve data shown must have sufficient additional information to allow them to be verified through mathematical analysis.
 - D. When any coordinates are shown on the drawing, such as those relating to the Arizona State Plane Grid Coordinates, Universal Transverse Mercator, or to any modified, or local coordinate system, then the following information shall be included:
 - 1. The data on which the coordinates are based.
 - 2. The zone(s) if applicable.
 - 3. Modifications.
 - 4. The coordinate basis of bearings.
 - 5. The adjustment factors.
 - 6. The source data of the coordinates.
13. The land surveyor shall ensure that the appropriate survey drawing(s) is(are) recorded whenever any of the following conditions are encountered:
- A. Any land boundary survey monument found, and incorporated into the new survey, where that monument is not referred to in or by any previously recorded public record instrument.
 - B. Any existing land boundary monument, or found monument, referenced in a previously recorded public document, when the public document fails to adequately identify said monuments.
 - C. Any land boundary monuments are set in conjunction with the new survey.
 - D. Any new land division as defined under state statutes.
 - E. Any difference as measured between the land boundary or property corner monuments, where the new measured distance, as compared to a previously determined (“record”) distance, where such

difference exceeds +/- 0.25 feet, plus 100 parts per million (PPM), of the overall distance between the points.

14. When created by a land surveyor, a written property description of a surveyed tract of land must provide information to properly locate the property and distinctly set it apart from all other property.

When the surveyed property's dimensions, boundaries and area are in substantial agreement with an existing recorded written description, then that existing recorded description shall be used.

For new descriptions, the following items and format apply:

- A. The description shall contain, where applicable, a caption, a body, and qualifying clauses.
- B. A metes, a bounds, or a metes and bounds description of an existing aliquot description, is as an additional description of the existing, precedent aliquot description, and shall be so noted as such.
- C. Every Public Land Survey System aliquot description shall contain the applicable county, meridian, township, range and sectional information.
- D. Every platted subdivision lot description shall contain the lot, block, unit (if applicable), name of the subdivision, city (if applicable), county, and recorder's document number.
- E. Every written property line boundary description shall contain the applicable portions of the following:
 1. The first part, called the caption, shall contain the applicable information from 14.C and/or 14.D.
 2. The second part, called the body, shall contain all of the following attributes that apply:
 - A. A clearly stated basis of bearings, referencing two controlling monuments, which were physically existing at the time the property was surveyed.
 - B. All controlling monuments, noting their physical description, and whether found, set or replaced.
 - C. Sufficient data to enable a mathematical verification of the property being inscribed by the body of the description.
 - D. Where described, curved property boundaries shall contain sufficient information to allow verification of the data by mathematical analysis. Curves are presumed to be circular, tangent curve, all other non-tangent, and/or non-circular curves must be so noted in the description.
 - E. Inclusion of complete citations to maps, plats, documents, and other matters of record, which are to be incorporated into and made a part of the description by reference thereto.
- G. The description shall be sealed with the surveyor's Arizona RLS stamp, with signature and date.

Exhibit B

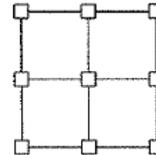
CORNER RECOVERY SHEET



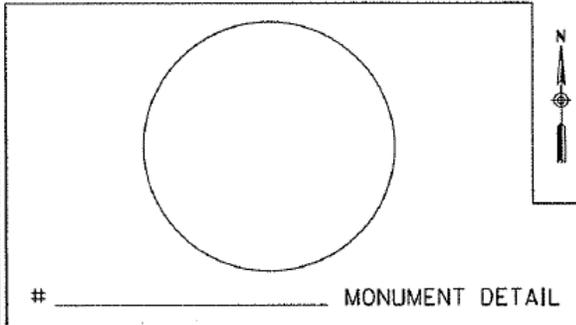
Right of Way Plans Section
205 S. 17th Avenue
Mail Drop : 612 E
Phoenix, Arizona 85007

ADOT PROJECT NO: _____
 ADOT LOCATION NAME: _____
 CONSULTANT FIRM: _____
 CONSULTANT PROJ NO: _____
 COUNTY: _____
 DATE: _____ / _____ / _____
 SURVEY _____ _____
 CREW _____ _____

POINT NUMBER: _____
 SECTION: _____ T _____ R _____
 CORNER:
 NW N $\frac{1}{4}$ NE
 W $\frac{1}{4}$ C $\frac{1}{4}$ E $\frac{1}{4}$
 SW S $\frac{1}{4}$ SE
 OTHER: _____



DESCRIPTION: _____



DIRECTIONS ("GO TO") _____

AREA SKETCH

ADDITIONAL REMARKS: _____

Field Book No.: _____ Page No.: _____

Exhibit C

ADOT RIGHT OF WAY PLANS SECTION

July 2003

Last Amd. July 2007

RIGHT OF WAY CORRIDOR SURVEY & ANALYSIS GUIDELINES

The following guidelines are to assist right of way on-call consultants and other surveyors in the analysis and calculation of State Highway right of ways. The methodologies and guidelines discussed below represent the ADOT Right of Way Plans Sections' recommended and preferred way of solving highway corridor alignments.

A. RESEARCH

First, proper research of the right of way corridor is performed. This should include researching and obtaining surveys, right of way plans and strip maps at the R/W Plans Section's records room, engineering as-built plans of the highway at ADOT's engineering records room, recorded surveys of the project area, subdivision plats along the highway, adjacent property deeds, and if available at the time, the existing r/w report produced by the R/W Titles Section. If ADOT Photogrammetry & Mapping has mapping files, they can also be utilized for rough checking in regards to pavement and fence locations.

B. FIELD SURVEY

Second, a right of way corridor field survey is performed. This survey typically will accurately locate appropriate sectional corners, all existing highway r/w monuments, and private property/subdivision monuments along the existing right of way lines, along both sides of the highway. If any centerline monumentation exists, it should also be located. GPS equipment and methods should be used for the field survey whenever possible. Whenever feasible, the extent of the survey will go beyond the construction project limits, to the next point of centerline alignment change, and perhaps further than that depending on circumstances - i.e. if the end of the project is in the middle of a curve, you should not end at the end of the curve; you would need to ascertain the next tangent section to adequately define the curve.

C. ANALYSIS AND CALCULATIONS

After the field survey has been completed, then the analysis and calculation of the right of way corridor begins. Generally speaking, the found monumentation is used as a guide in trying to fit the record intent and geometry of the right of way documentation. If the existing R/W report is available in a timely manner, the documentation and its intent will be held and will also be compared to the existing R/W shown on the available R/W maps and plans. If there is a discrepancy between the existing R/W report documentation and the R/W maps/plans, the documentation will be held and the discrepancy will be relayed to the R/W Plans Section.

If the existing R/W report is not available in a timely manner, the existing R/W maps and plans will be used to calculate a preliminary alignment and existing right of way. After the existing right of way report is received, the documentation will be reviewed and compared to the preliminary alignment and any necessary revisions will be made and relayed to the R/W Plans Section.

A discussion is needed concerning existing right of way monumentation. It is the position of the ADOT Right of Way Plans Section that in general, existing highway right of way monuments, especially if they were set pre-2000, are not considered to be “errorless” or “original” monuments, and most of the time their position should not, or cannot, be literally “held”. Many of these monuments were set using inaccurate field methods, and/or were set by non-surveyors who did not have the knowledge or place the value on the monument location, that a surveyor would. Nor is it possible to hold the intended record highway right of way width (give it its due – no more or no less) when a pair of monuments at a control station do not match the record width. Depending on when they were set, the right of way angle irons may or may not be “the” monument. If it can be reasonably established that the angle iron was set pre-1959, then it may be considered as the R/W monument. If the angle iron was set post-1959 it will then be considered as a reference marker or witness post. Customarily, the angle irons that are reference markers were set on the right of way line, but were usually set plus or minus 2 foot up or down station from the right of way monument.

The first thing that needs to be established is the existing right of way centerline. The centerline will typically not represent a “simple” or quick solution such as splitting pairs of found monuments and connecting the dots, or holding one pair of monuments and then holding the record geometry for the rest of the alignment. The centerline is usually solved piece by piece, by a trial and error method, until the entire project is solved. For projects that have no curved sections, and for tangent sections of highway, a linear regression can normally be performed on the found monumentation. This will result in a best-fit alignment for the corridor and/or tangent sections.

For projects that have curved sections, the alignment of tangent sections are usually solved first, then the PI’s of the curves are solved, then the PC’s, PT’s, SC’s, etc. are solved. It should also be noted that preliminary calculations of centerline – section line intersections and comparing them to record ties can also have an influence on the position of the alignment.

General rules for solving the centerline alignment are:

- a) Hold the record degree of curvature and let the arc length (and delta) float to generally fit the monumentation and/or the best-fit alignment. If the radius distances are large (greater than 10,000’) the radius can be adjusted, if necessary to solve the centerline.
- b) All points of curvature should be tangent. If absolutely necessary, non-tangent curves can be used if all “tangent options” have been exhausted, and upon approval by the R/W Plans Section.
- c) Straight tangent segments should remain straight and not have minor deflections or angle points introduced in the alignment, when none have never been recorded or intended. An exception may be made if : 1. the tangent is located within private property, 2. there is a preponderance of evidence to create an angle point, and, 3. approval is given by the R/W Plans Section.
- d) Spiral lengths are normally held at their record lengths.
- e) Basis of Stationing – the basis of stationing should be at the location of a centerline control point (PC, PT, TS, etc.) where a pair of R/W monuments have been found at that location and their measured relationship to each other is good compared to the record. Whenever possible, the station value for the basis of stationing will be a record station from an existing R/W map or

R/W plan. If no R/W maps or plans exist, then a record as-built station can be used, if available. A secondary alternative is to hold the record station at the intersection of the R/W centerline and a measured section line. If there is more than one suitable choice for the basis of stationing on a project, the location that should be chosen is the one that will create the most harmony between record station values and measured station values on the found R/W monuments. Unless otherwise approved by the R/W Plans Section, all record station equations will be re-established.

As far as what kind of measured or calculated differences there are between the final position of centerline control points and existing r/w points, and existing monumentation, there is not a set rule or difference. However, what is considered to be acceptable is on the order of several tenths of a foot to as much as 1-3 feet in other places. This applies to both the station and offset components.

In the centerline analysis process, all monuments need to be considered, but not necessarily in the final accepted determination of the alignment. For example, in a hypothetical 3 mile project with several curves and tangents you field locate 12 existing r/w monuments. After doing some initial analysis and trial and error solutions you find that 10 of the monuments all relate to each other quite well, according to the record geometry, and that the deviation of error in your centerline solution using only the 10 monuments is on the order of a couple of tenths. If introducing the other 2 monuments in the analysis then significantly moves the alignment and the maximum deviation then is close to one foot, then you can reject those monuments and not use them in the determination of the final alignment.

After the Consultant has:

- a) completed the field portion of the survey,
- b) performed preliminary centerline alignment calculations,
- c) developed a general methodology and framework of how they will calculate and solve the corridor, and
- d) before they have commenced with the production of the Results of Survey drawing, a meeting will be held between the Consultant and the R/W Plans Section. The Consultant will go over the monumentation and evidence that was found, and outline the methodology they plan to use. Examples would be what record station(s) will be held, if they intend on not holding record degree of curvature for any curves, use of any station equations, if they will reject any monuments in the analysis, etc. At this time, the Consultant will also indicate any sectional corners that may not have been found during the field portion of the survey.

After the centerline alignment is solved, then the existing right of way lines will be calculated. For corridors where the existing right of way lines are parallel and concentric to the centerline, that concentricity and parallelism will be held, using the record r/w width. For existing r/w lines that are not parallel to the centerline, the solution will best follow the record intent, as evidenced by the monumentation. If no monumentation exists, then a proration of record intent is regularly performed. Unless otherwise shown on the r/w plans, or in a deed, r/w lines opposite centerline spirals should be chorded. If a deed or the r/w plans indicate a parallel spiral, although technically impossible, an approximate parallel spiral will be calculated. One way of doing this is to hold a radial point opposite the centerline TS and SC (or CS and ST) and force-fitting a spiral curve in; the ease and accuracy of doing this may rely on the capabilities of your COGO software.

For all existing R/W corner locations, you will customarily end up with a “good” calculated coordinate value at the existing r/w corners, and a found coordinate value at the r/w monument, with the difference in position being on the order of what was discussed earlier.

D. SUMMARY

The time it takes to properly analyze and calculate a right of way corridor using the above guidelines can vary greatly depending on the length of the project, the number of segments to the alignment, how good the existing documentation is, and how much monumentation is found. At the one end of the spectrum, you can have a short 1 mile project that only encompasses one tangent section that begins and ends just beyond the project limits. You only found 2 pairs of existing r/w monuments at the beginning and end of the tangent section, and they all fit good within themselves and with the record information. In this example, the entire corridor could be calculated and solved within several hours. At the other extreme, you can have a 20 mile long project containing dozens of curved sections, spirals and tangent segments, and you found multitudes of monumentation, some of which is conflicting. For this example, a number of days may be necessary.

Another factor that can influence the time and effort in solving the corridor is the nature of the adjacent property ownership. In general, if the project is within private ownership, more care and effort must be exercised than if it is located solely within public lands.

It is the opinion of the R/W Plans Section that if the above guidelines are used, a higher level of consistency and corridor location will be achieved, even if different surveyors were to execute the survey and analysis.

The above guidelines shall be used for all projects being performed by on-call consultants hired by the ADOT R/W Plans Section, and are highly recommended to be used by other consultants and surveyors doing right of way determinations along the State highways. Although the above guidelines will apply and work for the vast majority of situations, some projects may have unique characteristics that deviation from the above guidelines is acceptable.

Exhibit D

ADOT R/W PLANS SECTION RIGHT OF WAY MONUMENTATION PROCEDURES & STANDARDS

5/03/06

RWM-1 Initial Right of Way Staking

RWM-1.01 General

The staking of the new right of way is an essential task that is performed prior to the commencement of the construction. The initial R/W monuments will typically be set 2 weeks to one month prior to the start of construction for projects requiring new right of way. The initial R/W monuments will be set at all locations identified by the R/W Plans Section and will be set by the R/W On-Call Consultant. The Construction Contractor is responsible for straddling, referencing or otherwise maintaining the location of the initial R/W monuments during the term of construction, until the final R/W monumentation is set. If any initial R/W monuments are reset by the Construction Contractor, the nature of the monument will be such that it shall be in compliance with the current Arizona Boundary Survey Minimum Standards.

RWM-1.02 Location and Description of Initial Right of Way Monuments

The initial R/W monuments will typically be set at the following locations:

- a) At all new right of way corners;
- b) At the intersections of new right of way lines and surveyed section lines, mid-section lines, and subdivision boundaries;
- c) On the new right of way lines opposite Station Equations of the centerline(s) controlling the new right of way lines.

The initial monument that is to be set will be of a material and size that conforms to the current Arizona Boundary Survey Minimum Standards (ABSMS), with the registered land surveyor's identification number affixed to it. A ½ inch diameter rebar of suitable length for the conditions, with a plastic cap, is an example. Where feasible, a guard type stake, such as a 4 foot wood lath, will be placed in the immediate vicinity of the monument.

At the initial R/W staking stage it may not be possible to stake some locations due to physical obstructions or other such reasons.

In some instances the initial monument will not be replaced and will serve as the final R/W monument, such as where new right of way will be abandoned to the local jurisdiction after construction.

In other instances the R/W On-Call Consultant will set a final ADOT R/W monument (RWM-2.02) at existing R/W corner locations where a) the existing R/W is not being superseded by new R/W, and b) no monument previously existed or c) an existing monument was determined to be grossly out of tolerance (RWM-2.05) and d) where the new monument will likely not be disturbed by the intended construction.

RWM-1.03 Right of Way Staking Plans

At the completion of the initial R/W staking, the R/W On-Call Consultant will prepare the R/W Staking Plans. The Staking Plans will describe the monuments that were set at all locations, as well as identify those locations where a) a monument could not be set, b) the initial monument will serve as the final R/W monument, and c) where final ADOT R/W monuments have been set at existing R/W corner locations. The Staking Plans will also contain a table that lists the point number, ground coordinate values, and R/W plans station and offset for each location. The Staking Plans will be provided by the ADOT R/W Plans Section to the ADOT Project Manager, the Construction Contractor and/or the ADOT Resident Engineer after they have been reviewed and accepted by the R/W Plans Section.

RWM-2 Final Right of Way Monumentation - General

The Final R/W Monumentation Survey process will commence when ADOT District personnel and/or the ADOT Project Manager notifies the R/W Plans Section at the earliest of the following 2 occasions: a) at such time when the final R/W monuments can be safely set, or b) at least 2 months prior to the end of all construction. After notification, the R/W On-Call Consultant will be tasked with performing the Final R/W Monumentation Survey. The R/W On-Call Consultant will also locate/tie-in any sectional corner monuments that were replaced by the Construction Contractor. In cases where the R/W On-Call Consultant had previously located the sectional corner monument prior to construction, and if the sectional corner monument set by the Construction Contractor was set within positional tolerance, but was not punched/stamped by the Construction Contractor, the R/W On-Call Consultant shall punch/stamp the monument as required.

For some projects (typically urban projects that have not fenced the new right of way) the Final Monumentation Survey may not take place until after the landscaping improvements are completed. For these projects the decision of when the Final R/W Monumentation Survey will be performed will be decided by District personnel near the end of the construction phase of the project, on a project-by-project basis.

RWM-2.01 Positional Tolerance

Any sectional monuments that are set by the Construction Contractor that are determined by the R/W Consultant to be out of tolerance, as compared to the position of the prior monument, will be reset by the Construction Contractor at no expense to the Department. A sectional corner monument set by the Construction Contractor shall be considered out of tolerance if a punch mark identifying the actual location of the corner cannot be placed on the cap.

RWM-2.02 Drivable Monument Requirements and Specifications

Near the end of the construction phase, the R/W On-Call Consultant will set an acceptable drivable type monument (refer to diagrams A-1 & A-2) for the final R/W monument at locations that were initially staked. The body of the final monument that will typically be set by the R/W On-Call Consultant will be magnetically detectable, have a diameter of one-half inch to 1 inch, and a minimum length of 24 inches. A three-inch aluminum or brass cap will be attached to and

placed over the top of the body of the monument. The top of the cap can be flat or domed. The informational items that shall be stamped into the cap are:

- a) The R/W On-Call registrant's license number
- b) The year (four digits)
- c) The words "ADOT ROW"
- d) The R/W project TRACS number (i.e. 260 GI 272 H4472 01R)
- e) The reference Station as shown on the R/W plans (i.e. 105+58.73)
- f) The point number – as assigned by the R/W Consultant and shown on the R/W Monumentation Survey
- g) A circular punch mark at the actual point location (do not use a triangle or plus/cross symbol)

The lettering size will be 3/16ths of an inch high. Refer to diagram A-2 for the positioning of each text item. When ordering the caps for each project, the R/W Consultant shall have as many of the items as possible pre-stamped into the cap by the manufacturer, with the exception of the punch mark.

In loose soil conditions, the body of the monument shall be 36 inches in length and/or concrete will be poured around the body of the monument to stabilize it. If the location of the monument is in bedrock or similar substance, then a hole will be drilled into the bedrock so that magnetic material can be placed under the cap, and the cap will be fastened with epoxy glue.

In urban areas the top of the monument will typically be set flush to the ground surface or approximately one-tenth of a foot below the ground surface, depending on circumstances. In rural areas the top of the monument will typically be set flush with the ground surface to one-tenth of a foot above the ground surface.

RWM-2.03 Witness Posts

After the R/W Consultant sets the final R/W monument, a witness post shall also be typically set next to the monument. The witness post will be of a durable fiberglass construction, such as carsonite. The post will be 2-1/2 inches wide, and a minimum of 5 feet in length. The post will be driven in to the ground to a depth of at least 18 inches, and shall leave a minimum height of 3 feet above the surface. Where extra stability is needed, an anchor kit will also be utilized in the installation of the witness post. Whenever possible, the witness post will be set on the right of way line at a distance of 1 foot from the monument, in the direction of increasing station from the monument. Refer to diagram A-1.

The witness post shall be brown in color. A decal will be attached to the face of the post at the top end. The decal will face the highway. The decal shall have a white background with black lettering. The decal should be UV resistant whenever possible. The size of the decal will be approximately 2-3/8 inches wide and 8-1/2 inches long. Refer to diagram A-1 for decal text. In urban areas, the witness post will not typically be set for each point, unless otherwise directed by the Department.

RWM-2.04 Use of Witness Corners and Reference Marker Monuments

If the R/W corner position falls in a location that is deemed un-settable for physical or other reasons, the R/W On-Call Consultant will first try to set a witness corner monument on the right

of way line, as close as is practicable to the actual corner. If setting a witness corner is impractical, the R/W Consultant will set 2 reference marker monuments at convenient locations in the vicinity of the actual corner, within the ADOT right of way. The reference monuments can be set in one of the two following manners: a) approximately at 45 degree angles from the actual corner location, as measured from the right of way line(s), or b) set perpendicular on a straight line as referenced to the centerline of the highway, opposite the actual corner location – i.e. a 5 foot and 10 foot offset at the same station as the corner being referenced. When practicable, the witness corners and reference monuments will be set to a whole foot distance from the R/W corner position. Refer to diagram A-3.

If a witness corner is set, the stamping on the cap will also include, in addition to the items listed in Section RWM-2.03, the letters “WC”, an arrow pointing in the direction of the actual corner, and the distance from the witness corner to the actual corner. Station information in this situation should not be included on the cap. Refer to diagram A-3.

If reference monuments are set, the stamping on the cap will also include, in addition to the items listed in Section RWM-2.03, the letters “RM”, an arrow pointing in the direction of the actual corner, and the distance from the reference monument to the actual corner. Station information in this situation should not be included on the cap. Refer to diagram A-3.

If in the R/W On-Call Consultant’s judgment and as agreed upon by the R/W Plans Section, it is not viable to set either a witness corner or reference monuments for a right of way corner location, and a well-defined permanent type structure is close to the corner position, such as the corner of a block wall, tie dimensions to the structure shall be documented on the R/W Monumentation Survey in lieu of setting the monuments.

RWM-2.05 Discovery of Existing Right of Way Monuments

When the R/W On-Call Consultant is setting new monuments along the existing right of way line, a situation may be encountered where an existing monument is in the general vicinity of the calculated corner position. The existing monument may be an ADOT type monument, or a private monument. In this situation, the R/W Plans Section and the registrant will decide if a new monument will be set or not, with the stipulation that a new monument shall not be set any closer than one foot from an existing monument, and that a new monument shall be set if the calculated position is greater than three feet from the existing monument. In no situation shall the Consultant remove or otherwise alter the existing monument, unless approval or direction is given by the R/W Plans Section. An exception to this is if the existing monument is within positional tolerance as defined by the current Arizona Boundary Survey Minimum Standards, and, the existing monument has no identification and/or pedigree, the registrant has the option of either affixing his registration number to the monument, or refurbishing it with a new ADOT right of way drivable monument as described above.

When the R/W On-Call Consultant is setting new monuments along the new right of way line, the situation may be encountered where an existing monument is in close proximity of the calculated corner position and that it can be determined that the existing monument was intended to have been set for the legal corner position. The existing monument will typically be a private monument. If the existing monument is within positional tolerance as defined by the current Arizona Boundary Survey Minimum Standards, the R/W On-Call Consultant will accept the existing monument. If the existing monument has no identification and/or pedigree, the

registrant has the option of either attaching his registration number to the monument, or refurbishing it with a new ADOT right of way drivable monument as described above. If the existing monument is out of positional tolerance, the registrant will refer to the instructions in the preceding paragraph.

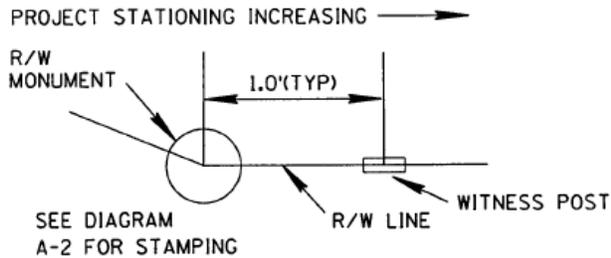
RWM-2.06 Right of Way Monumentation Survey Drawing

After the field portion of the final R/W Monumentation Survey has been completed, the R/W On-Call Consultant will prepare a Right of Way Monumentation Survey drawing. The drawing will document the final monumentation of the right of way corridor. The drawing will recite the location and description of all monuments set and found, including any witness corners, reference marker monuments, un-set corner locations, recently found right of way corners and reset section corners.

After acceptance by the ADOT R/W Plans Section, the Monumentation Survey drawing will be attached to and become a part of the right of way plan set. This plan set will be filed in the File Room of the ADOT Right of Way Plans Section and become a part of the public record.

RIGHT OF WAY MARKER UNIT

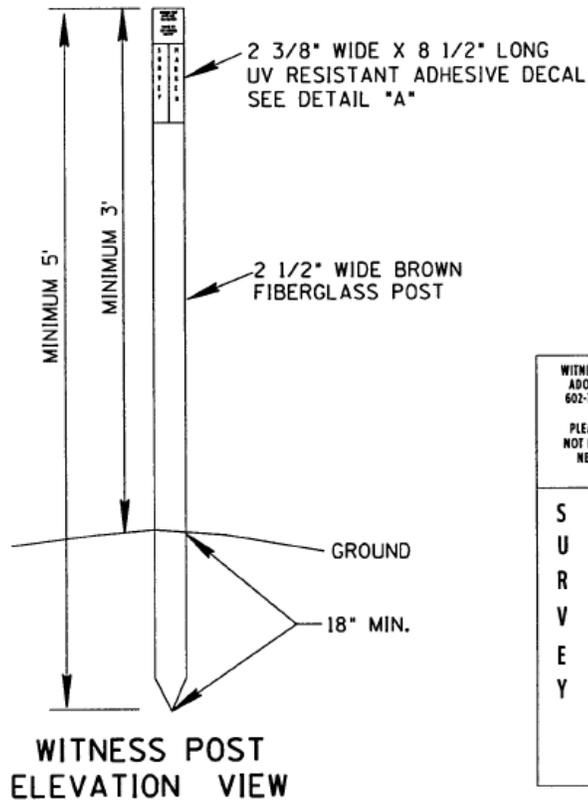
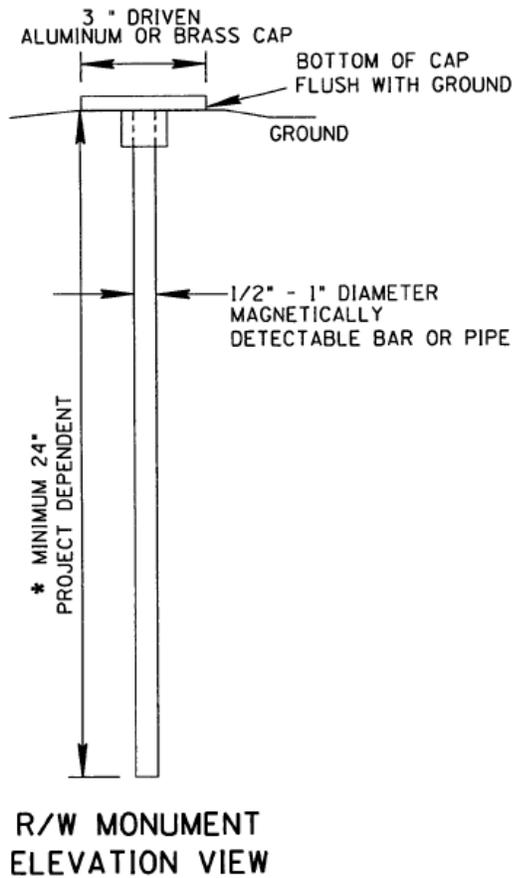
DIAGRAM A-1



PLAN VIEW

GENERAL NOTES

1. A RIGHT OF WAY MARKER UNIT SHALL CONSIST OF A SURVEY MONUMENT, CAP AND AND WITNESS POST WITH DECAL.
 2. ALL R/W MARKER UNITS SHALL BE PLACED AT LOCATIONS SHOWN ON THE R/W PLANS OR AS DIRECTED BY THE DEPARTMENT.
- * THE LENGTH OF THE MONUMENT IS DEPENDENT UPON SOIL CONDITIONS. IN BEDROCK OR CONCRETE CONDITIONS, THE CAP AND MAGNETIC MATERIAL ONLY WILL BE SET UTILIZING EPOXY. IN LOOSE SOIL CONDITIONS, A MINIMUM LENGTH OF 36" SHALL BE UTILIZED.
- ** WITNESS POSTING REQUIREMENTS IN URBAN AREAS TO BE DETERMINED BY ADOT

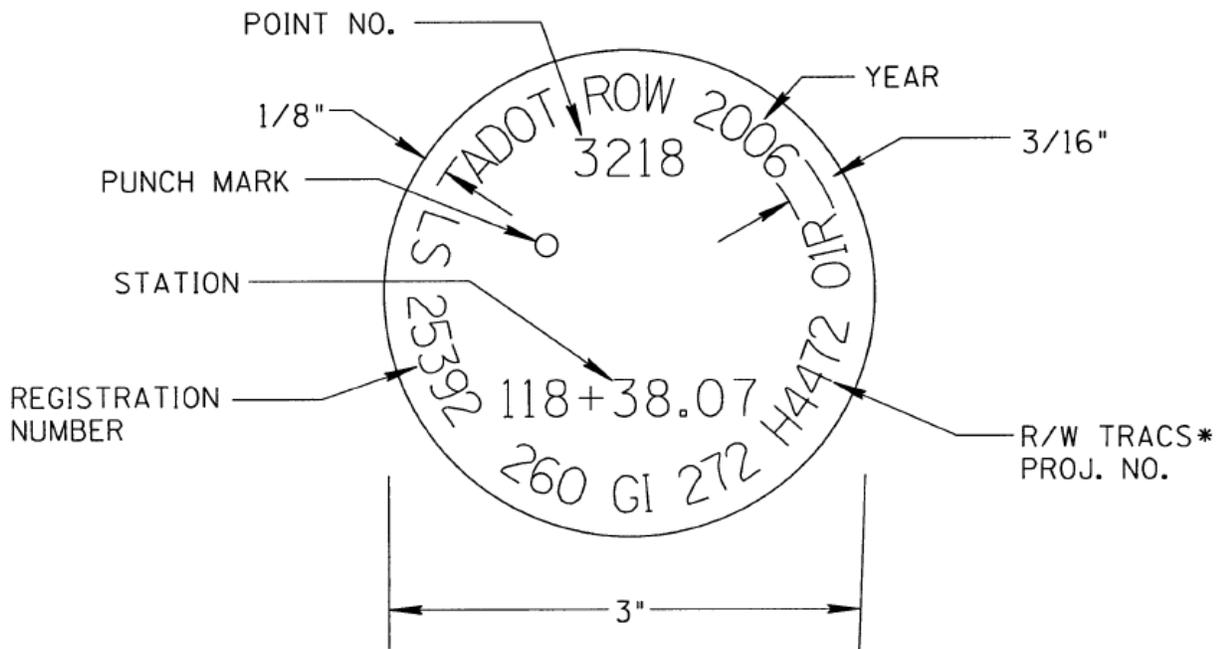


** DETAIL "A"

05/03/06

RIGHT OF WAY MONUMENT STAMPING INFORMATION AND LAYOUT

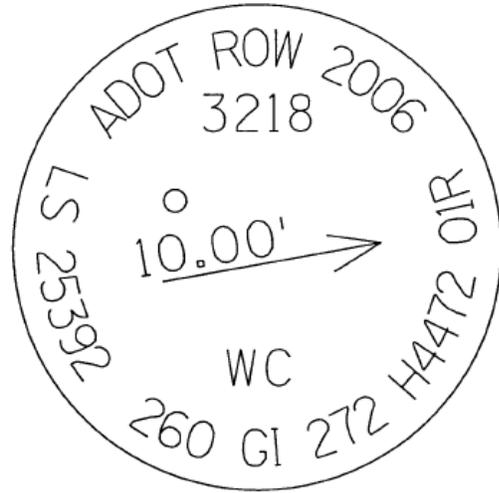
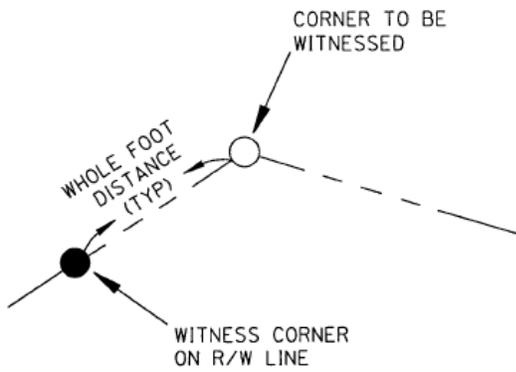
DIAGRAM A-2



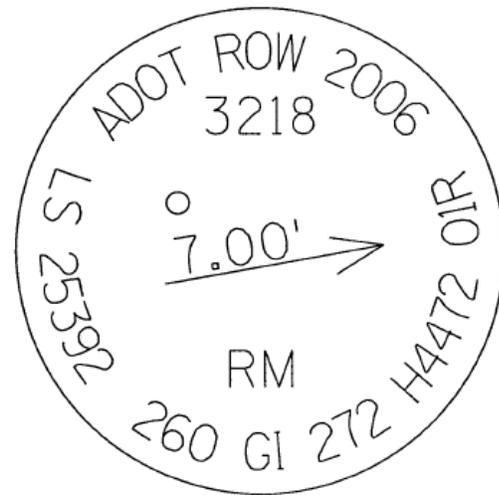
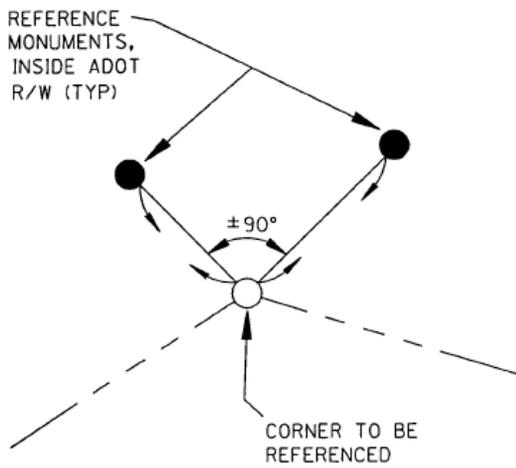
* UNTIL THE USE OF THE FEDERAL ID PROJ. NO. IS PHASED OUT,
THIS MAY INSTEAD BE THE FEDERAL ID PROJECT NUMBER.

05/03/06

DIAGRAM A-3

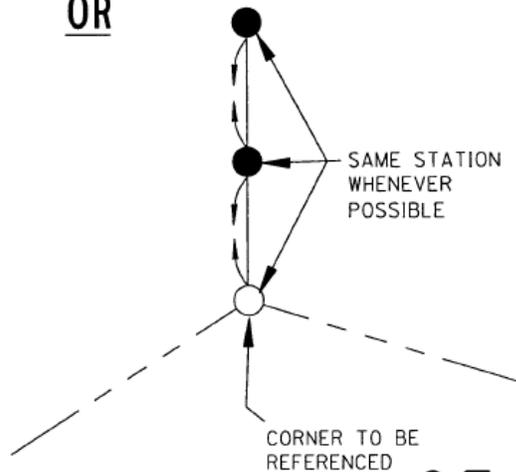


WITNESS CORNER



REFERENCE MONUMENT

OR



05/03/06