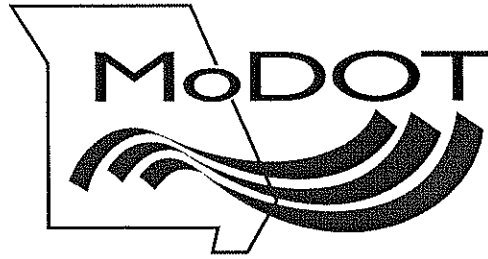


Missouri
Department
of Transportation



105 West Capitol Avenue
P.O. Box 270
Jefferson City, MO 65102
(573) 751-2551
Fax (573) 751-6555
www.modot.org

Pete K. Rahn, Director

November 6, 2008

Dear Consultant:

The Missouri Highways and Transportation Commission is requesting the services of a surveying consulting firm to provide control survey and 1 second GPS control survey for Airborne GPS on the list of projects provided on the attached scope of services; jobs may be added or deleted before estimates are requested. The projects are scattered over the entire state with some being large corridor projects of at least 10 miles in length.

Please limit your letter of interest to no more than two pages. Please make sure to include the following information: location of office branch assigned for this flight program, brief summary of personnel qualifications including number of staff available for this project, and a summary of similar work recently completed and any other information which might help us in the selection process. We will utilize the consultant information already on file so we will not need a lengthy submittal of other general company information.

Any firm unable to provide services on one of the projects will not be considered to provide services on any of the projects.

We encourage DBE firms to submit letters of interest. You must list any sub consultants that you need to complete the professional services requested by MoDOT.

If your firm would like to be considered to provide these services, submit a letter of interest. All letters must be received by 4:00pm, November 21, 2008 to the address listed below.

Missouri Department of Transportation
P.O Box 270
601 W. Main
Jefferson City, MO 65102
Attention: Bradley D. McCloud – Photogrammetry

You may also submit letters of interest by fax to (573) 526-4535 or E-mail at bradley.mccloud@modot.mo. A fax or E-mail will be sent to notify the sender that the letter of interest was received. If you have any questions feel free to contact Bradley McCloud at (573) 526-2955.

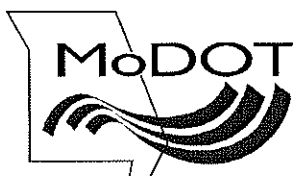
Sincerely,

Dave Nichols
Director of Project Development

bm/gt

Attachments

cc: Ms. Kathy Harvey – de



CONTROL SURVEY SCOPE OF SERVICES

EXHIBIT I

SCOPE OF SERVICES

The work covered by this Agreement shall include furnishing equipment materials, professional, technical, and personnel resources necessary for the performance of photogrammetric surveying services for design and development of the specified highway project.

The following information will explain and define the items of importance relating to this project. All the elements of work that are necessary, to satisfactorily complete the surveying of this project may not be listed. The lack of a specific listing of an element or item of work does not in itself, constitute a basis for additional services or work supplement, and/or adjustment in compensation.

I. PROJECT

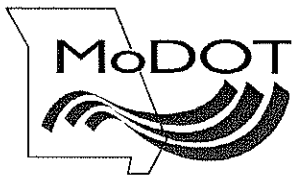
Control surveying for the specified project areas, these services shall provide data necessary for application in preliminary highway design.

II. PROJECT LOCATION AND LIMITS

The project sites are located in Missouri. The limits of each site are located in files furnished by MoDOT. Refer to table provided below for specific descriptions of each project.

**TABLE II-1
EASTERN MAPPING PROJECT LOCATIONS**

Job #	County	RTE	Mile +/-	PhotoScale	Description of Project / Special Conditions
J1U0752	Buchanan	169	1.5	1:5080	West side of I-29 to Rt. AC extension
J1P0875	DeKalb	I-35	1	1:5080	At intersection of U.S. 36
J2P2157	Livingston	65	3.5	1:5080	Bridge replacement
J3P0426	Marion/Ralls	61	11	1:5080	Four-lane roadway relocation from Rte. 24 south junction in Marion County to south of Rte. M in Ralls County
J4S1746	Jackson	350	1.5	1:5080	Realign lanes, Maple to Sterling in Raytown
J4P2256	Jackson/Cass	71	1	1:5080	Interchange at 155th Street, Also fly 3000 feet along 155th east and west of Rte 71
J4I1942B	Jackson	470	10	1:5080	Capacity improvements from 39th Street to Route 50
J4P1342B	Platte	92	10	1:5080	Capacity improvements from Kansas State Line to I-29
J4I1942C	Jackson	70	2.5	1:5080	Improve interchange at I-470. This is within limits of I-470 Job listed above. Map from Lee's Summit Road to Little Blue Pkwy
J4P2257	Cass	7	4	1:5080	Add lanes to improve capacity from Commercial Street (South Jct - Harrisonville) to Route EE



CONTROL SURVEY SCOPE OF SERVICES

Project #	County	RTE	Mile +/-	Photo Scale	Description of Project / Special Conditions
J6S2228	Franklin	T/V	20	1:5080	Install Guardrail / Need mapping for length of need calculations. Franklin/St Louis Co Line to Route 50
J6S2194	Franklin	A	8	1:5080	Scoping to add 3 ft shoulders and add surface treatment. Route 100 to Route 47.
J8P2154	Greene	60	0.1	1:5080	Intersection Scoping at Oakwood/FR 93 in Republic
J8S2174	Webster	38	0.2	1:5080	Br Scoping Greer Ck East of Marshfield
J8S2168	Webster	38	0.2	1:5080	Br Scoping Osage Br East of Marshfield
J8P0850	Greene	65	0.4	1:5080	Scoping Chestnut Exp and Railroad intersection area
J8I2167	Laclede	I-44	0.2	1:5080	Br Scoping WB BR over Gasconade
J8S2170	Dallas	F	0.2	1:5080	Br Scoping Greasey Creek South of Buffalo
J8S2169	Dallas	73	0.2	1:5080	Br Scoping over Coatney Br, North of Buffalo
J8P2162	Laclede	32	0.2	1:5080	Br Scoping Gasconade
J8P2163	Laclede	32	0.2	1:5080	Br Scoping Osage Branch
J8S2195	Greene	D	0.1	1:5080	Br Scoping A3055 over BNSF Tracks and A3056 over Pearson Ck
J9P2146	Phelps	63	6.5	1:5080	Capacity improvements

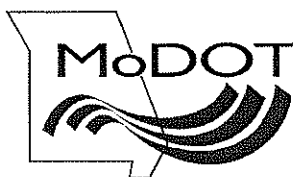
**TABLE II-2
RECON MAPPING PROJECT LOCATIONS**

Project #	County	Rte.	Miles +/-	Photo Scale	Description of Project/Special Conditions
J2P0498	Saline	65	63.5	1:5080	Upgrade Rte. 65 to shared 4-lane from Chillicothe to Marshall
J9P0584	Howell	63	8.2	1:5080	Capacity improvements

III. SERVICES AND DATA PROVIDED BY THE COMMISSION

The Commission will provide available information of record to the Consultant. In addition, the following specific items will be furnished or performed by the Commission:

- 1) The project location and limits (.dgn format).
- 2) Flight plans (ASCII and .dgn format).
- 3) Mapping & photography limits (.dgn format)
- 4) Found horizontal and vertical control points to be used in the control survey



CONTROL SURVEY SCOPE OF SERVICES

IV. SCOPE OF WORK

Work covered in this document shall include furnishing the professional, technical, and other personnel necessary for targeting and control survey for the project. The services shall address the following:

- 1) **Planning.** The Consultant is responsible for project planning as it relates to coordination of the photo control targeting prior to the photo mission.
- 2) **Project Limits.** Targeting and control surveying will be performed within the limits that are graphically marked and indicated on the Commission provided map files.
- 3) **Target Planning.** All projects requiring mapping are targeted. Projects are to be targeted so that the use of vertical only points and photo identifiable points are not required. The preliminary flight plan designates the mapping area and any additional photo coverage requested by the district. Control of the largest practical area will be done to allow for the possibility of mapping extra area if needed. Target placement at a minimum must satisfy the control requirements of the mapping area.
- 4) **Valley Sections.** The Consultant shall perform a Valley Sections survey for the project when requested. All valley section locations are shown in the target plan provided by the Commission.
- 5) **Airborne GPS Control Survey.** The Consultant shall perform an Airborne Global Positioning System (AGPS) survey for the project when requested. This survey will ensure precise Static GPS information for the post processing of the airborne survey data.

The Survey Consultant shall coordinate with the Aerial Consultant to ensure the minimum requirements are met.

- 6) **Standards.** The Consultant shall comply with the most recent and applicable state and federal laws.

V. SPECIFICATIONS FOR SURVEYING

- 1) **Notification of Target Placement.** The survey Consultant shall notify the photogrammetric Consultant upon placement of targets for each job. This notification may be by phone if followed up by e-mail.



CONTROL SURVEY SCOPE OF SERVICES

- 2) **Material for Targets.** White paint or reflective white marking tape is used for targets on paved surfaces. Unbleached muslin or white plastic is used for grass, dirt and aggregate surfaces.
- 3) **Location of Targets.** The mapping project must begin and end with three control targets, which are placed roughly in a triangular pattern. The two lateral targets should be spaced at the offset distance and the third target should be near the mapping corridor. No mapping will be done beyond the last target so enough targets should be placed to ensure adequate coverage. Position targets in locations with a good field of view to minimize the cutting of vegetation and reduce the number of required ground setups. Targets are located as required for visibility from the air in areas free of shadows.

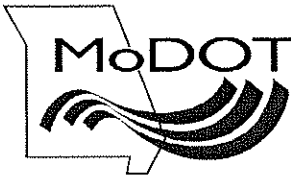
When targets are placed upon paved shoulders of the roadway, it is suggested that the northern shoulder be used to avoid obscuring the target with shadows from objects on the southern side of the road. When cloth targets are placed, they should be located on level areas, with all underbrush and weeds adjacent to the targets removed.

Targets shall be located where they are least likely to be disturbed. Targets are placed so that the time lapse between placing the targets and the photography is held to a minimum. If the time lapse is of such duration as to cause doubt of the target condition, the targets are to be checked immediately prior to photography.

GPS locations shall be collected for each target placed (5/8 X 12-15 inch iron pin with center punch or chiseled X-cut set below the ground surface). This will allow the pin to be re-located if the target is removed. Guard lath shall be driven next to targets where possible. The name and phone number of the survey Consultant shall be on the lath.

Consultant shall notify each property owner prior to placement of targets. Consultant shall notify MoDOT immediately of any problems encountered with property owners.

- 4) **Size and Shape of Targets.** Acceptable sizes and shapes of targets for the various flights heights are illustrated on Figure 3-03.1 of the departments Project Development Manual.
www.modot.mo.gov/business/manuals/projectdevelopment.htm

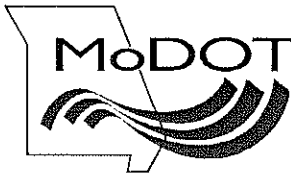


CONTROL SURVEY SCOPE OF SERVICES

- 5) **Control Survey.** The Consultant shall perform a control survey for the project. This survey will ensure precise positions of traverse stations and/or GPS network stations throughout the project.

The survey shall comply with the following specifications. If any portion of the survey does not comply with these specifications, a written report substantiating the material variances for the specification with the responsible surveyor's signature is required. The Commission reserves the right to disallow variation.

- a. Horizontal Control. The control point pairs will be tied to the National Spatial Reference System (NSRS) through direct GPS ties to first or second order stations as defined in 20 CSR 2030-18.010 NSRS horizontal and vertical monuments using post-processing software or by NGS OPUS solutions. All OPUS solutions shall be based on a minimum of two hours of dual frequency data. On projects with more than one intervisible pair, the adjacent pairs will be tied together. On projects of two or three pairs the beginning and end points shall be joined by a GPS vector. On projects having four or more pairs, the beginning and ending pairs so connected will have ties into the NSRS. The control station is to be described in such a manner as to facilitate navigation and recovery of its location. Only static or rapid-static GPS procedures are permitted for this survey type.
- b. Vertical Control. The control points will be referenced to NGS Vertical control. Benchmarks near the project should be used for the vertical reference for a project. If the NGS vertical control marks are not found nearby or a considerable distance away, then the GPS derived, elevations should be used for the project.
- c. Benchmarks. Benchmarks should be placed approximately 1200 to 1800 feet apart throughout a project. Benchmarks should be without movement and set on objects and in locations that will remain undisturbed. Some examples listed in order of preference are bridge abutments and culvert headwalls that aren't involved in a project, anything on a concrete structure that can be located (square in sidewalk near building, etc.), fire hydrants, railroad spikes in power polls, and railroad spikes in trees. A tie to these benchmarks is required in the form of a navigation description to the benchmark and three-point reference ties.



CONTROL SURVEY SCOPE OF SERVICES

- 6) **Linear measures.** Linear measures will be made in the English System. The base unit will be the United States Survey Foot (and decimal parts thereof).
- 7) **Coordinate System.** All coordinates shall be based on the State Plane Coordinate System, North American Datum (NAD) of 1983 (1997) in the appropriate zone.
- 8) **Vertical Datum.** The elevations shall be based on the North American Vertical Datum (NAVD) of 1988.
- 9) Consultant will use Global Positioning System (GPS) survey technology to establish the ground control. The elevations shall be based upon ellipsoidal heights that have been modified by the NGS Geoid 03 model.
- 10) **Projection Factor.** The Consultant is responsible for developing a project projection factor based on the Missouri Coordinate System of 1983 Manual for Land Surveyors.
 - a. Scale Factor. Using the most easterly and westerly control points within the project to develop a centroid point for a project. Use the converted English easting of the centroid point in the correct zone formula below.

East Zone =
 $(\text{easting} - 820,208.3333) * 0.00000000045 * (\text{easting} - 820,208.3333) + 0.9999333 = 393,700$

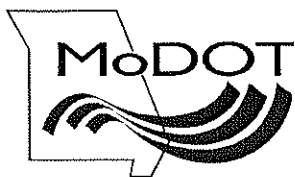
Central Zone =
 $(\text{easting} - 1,640,416.6665) * 0.00000000045 * (\text{easting} - 1,640,416.6665) + 0.9999333 = 393,700$

West Zone =
 $(\text{easting} - 2,788,708.3331) * 0.00000000045 * (\text{easting} - 2,788,708.3331) + 0.9999412 = 393,700$

- b. Elevation Factor. is determined by dividing the ellipsoid radius by the ellipsoid radius plus the mean elevation for the project.

Elevation Factor = $\frac{20909689}{[20909689 + (\text{elevation in feet} - 100.065)]}$

- c. Grid Factor. is the result of multiplying the Elevation Factor by the Scale Factor of the centroid point of the project.



CONTROL SURVEY SCOPE OF SERVICES

Grid Factor = Elevation factor X Scale factor

- d. Projection Factor. is the reciprocal of the grid factor

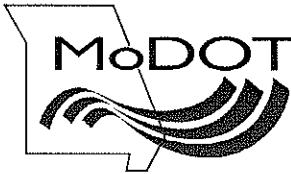
Projection Factor = 1 / Grid factor

11) Types of Control Points:

- a. Primary Control. A Primary Control Survey Network (PCSN) consisting of semi-permanent, intervisible, control point pair(s) (5/8 x 12-15 inch iron pin with center punch or chiseled X-cut set below the ground surface) will be set and referenced at each site. One intervisible control point pair will be established for approximately each mile of alignment. A constrained least squares adjustment shall be made for all the points that comprise the PCSN. If a single project exceeds twenty (20) miles in length, a supplemental control tie to the NSRS shall be made at the approximate midpoint.

The survey report shall include a summary of closures and accuracies for the PCSN. A minimum of three (3) reference ties to recoverable accessories will be made for each control station. The control station is to be described in such manner as to facilitate navigation and recovery of its location. Only static or rapid-static GPS procedures are permitted for this survey type.

- b. Photo Control Points (target/photo-identifiables). The Consultant will plan and establish horizontal and vertical photo control points required for the topographic mapping. Pins will be recessed for targets that are not located on a paved surface. The elevation of both the target and the pin will be reported. With the ground elevation going to the .CTL file and the pin elevation going to the .REC file. The accuracies shall be sufficient to support the topographic mapping requirements. Photo-identifiable control points can be used to supplement the ground control. These points include, but are not limited to; utility poles, corners of concrete structures, painted stripes, manhole covers, etc. Photo control points will not be referenced. RTK GPS survey procedures are permitted for this survey type.
- c. Field Check Points. Random supplemental checkpoints at varying offsets from centerline will be obtained by the Consultant, resulting in approximately ten (10) points per mile of



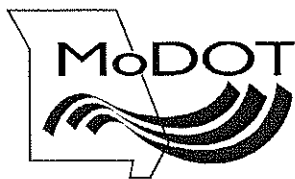
CONTROL SURVEY SCOPE OF SERVICES

alignment. The points must be inside the mapping corridor limits. The accuracies shall be sufficient to support horizontal and vertical accuracy checks of the topographic mapping. The supplemental control points will not be referenced. RTK survey procedures are approved for this survey type.

- 12) **Valley Sections Survey.** The Consultant shall perform a Valley Sections survey for the project when requested. This survey will ensure precise positions of the valley sections as graphically marked and indicated on the Commission provided map files.

The survey shall comply with the following specifications. If any portion of the survey does not comply with these specifications, a written report substantiating the material variances for the specification with the responsible surveyor's signature is required. The Commission reserves the right to disallow variation.

- a. Section Survey. All section should be established from the primary control of the project. The required degree of accuracy shall be 1:20,000 for distance and six (6) seconds for angular. The consultant is responsible for obtaining at least this degree of accuracy, through the proper adjustment and care of instruments, equipment, and the method of making measurements. The valley sections are tied to the survey centerline and extend to at least five (5) ft. (2 m) above the extreme high water elevation on each side of the section. The stationing along the valley section is established in the same direction across the valley as the survey centerline stationing. The type of ground cover must be indicated to assist office personnel in the establishment of Manning's "n" value.
- b. Extreme High Water Elevations. are obtained for each of the valley sections. The location and elevation of the high water elevations are included in the survey notes while the location is tied to the survey centerline or base lines. The best procedure is to obtain information from local residents and then confirm this information by observation. Quite often local residents may exaggerate, or the high water elevation remembered by them will be far beyond the flood frequency to which the structure is to be designed. Particular care is exercised in obtaining this information since it is used as the basis for laying out the proposed structure. If any doubt exists as to high water marks



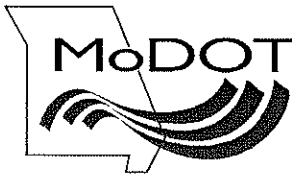
CONTROL SURVEY SCOPE OF SERVICES

reported to the survey party, give location and elevation of all such marks and in every case give dates of occurrence.

VI. SPECIFICATIONS FOR SURVEY DELIVERABLES

The Consultant shall provide to the Commission the following items:

- 1) Three ASCII coordinate files all containing the primary control, photo control and check points for the project survey. These files are:
 - a. Ground Elevations. The photogrammetric control file. A file listing control positions by point number, X,Y, and Z values in project units. These values are referenced to the Missouri Coordinate System of 1983, zone name Zone, in an ASCII file format. The file will be named J#####.ctl with specifications for file setup in Appendix A, Item 1
 - b. Pin Elevations. The survey control file. A file listing control positions by point number, X, Y, and Z values in project units referenced to the Missouri Coordinate System of 1983, Zone name Zone, with X and Y values modified by the projection factor. This ASCII formatted file will be named J#####.rec with specifications for file setup in Appendix A, Item 2.
 - c. The Geodetic Control File. A file containing latitude and longitude information for all control points named J#####.txt with file format listed in appendix A, Item, 3. All OPUS solution sheets and/or data sheets from post processed static GPS sessions, calculations for grid and projection factor including the centroid point, mean elevation and the final grid and projection factor will also be listed in this file.
 - d. The Valley Section Coordinate File. A file containing the primary control, section location points, and check points for the section surveys. All section location points shall be coded as 755 with a –BS added to the beginning point of each section and a –ES to represent the ending point for that section. This ASCII formatted file will be named J#####.nvs with specifications for file setup in Appendix A, Item 5.
- 2) **MoDOT Survey Report**: A MoDOT survey project report for each project. See Appendix A, Item 4.



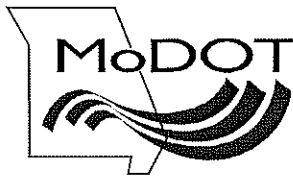
CONTROL SURVEY SCOPE OF SERVICES

- 3) Copies of all intervisible control survey pair station descriptions along with all benchmark descriptions and field ties. A sketch of each point shall be provided showing the relative location of field ties to the point being referenced.
- 4) The Consultant shall provide a letter certifying that the below mentioned surveying specifications have been achieved for this project. The letter shall document the relative positional accuracies in parts per million, the confidence level in percent, and the post adjustment residual values in centimeters that were achieved on this project. If any portion of the survey does not comply with these specifications, a written report substantiating the material variances from the specifications with the responsible surveyor's signature is required. The Commission reserves the right to disallow variations.

The survey report documents proof of these specifications:

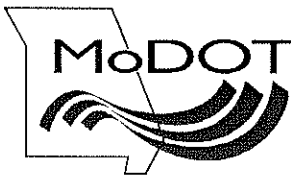
- a. Fixed preprocess baseline solutions.
 - b. Control station relative positional accuracies of 10 ppm in relation to adjacent stations at the 95% confidence level.
 - c. Post adjustment residual values < 3 cm in any dimension for control stations.
 - d. A map of no greater than 1:24,000 scale (USGS Topography map) with all survey control points plotted and labeled on hardcopy, digital or both.
- 5) The Consultant shall provide a set of prints with the photo control and north arrow graphically depicted on the front of the print and a description of the point(s) printed on the back of the print.
 - 6) The Consultant shall furnish the files on CD ROM format. All submittals shall consist of two CD ROMs, one shall be labeled "working set" and one set labeled "archive set". In addition, the CD ROMs shall contain a text file describing the contents including project name, file names, Consultant's name and the date of submittal. This file shall be named contents.txt and be located in the root directory of the disk.

VII. ACCEPTANCE OF COMPLETED WORK



CONTROL SURVEY SCOPE OF SERVICES

- 1) The Consultant shall submit all completed work promptly to allow time for proper review. Work reviewed and found in accordance with the specifications shall be considered to constitute "satisfactorily completed and accepted work"
- 2) The Missouri Department of Transportation will determine which work is in accordance with these specifications and represents acceptable work. Failure to produce acceptable work as specified, and after the Consultant has exercised the right to verify the quality of the work will cause the following:
 - a. The Missouri Department of Transportation may reject that portion of the work and the Consultant will accept a hundred (100) percent reduction in payment, at the agreement price, for the affected portions of work.
 - b. In the event that some work is found to be unacceptable in accordance with the specifications, and reworking is deemed necessary, the Consultant agrees that it shall complete such work without expense to the Missouri Department of Transportation, even though final payment may have been received. The Consultant must give immediate attention to these changes so there will be a minimum delay. The above and foregoing is not to be construed as a limitation of the Missouri Department of Transportation right to seek recovery of damages for negligence on the part of the Consultant.
- 3) **Return of Source Data.** The Consultant shall return to the Commission all of the provided source data, including all aerial photographs and maps
- 4) **Data Quality.** The Consultant shall be responsible for the professional quality, technical accuracy and the coordination of data, documents and other services furnished for this project.
- 5) **Additional Services.** The Commission reserves the right to request additional work beyond the scope of services addressed in this document. In this event, a supplemental agreement shall be executed and approved prior to the performance of additional services. Changes in compensation will be addressed in the supplemental agreement.
- 6) **Documentation.** The consultant shall provide any documentation necessary to explain, support and clarify the procedures used for data



CONTROL SURVEY SCOPE OF SERVICES

development. The Consultant shall be available to the Commission to discuss and interpret provided data.

- 7) **Data Ownership.** All data and documents prepared in performance of this Scope of Services shall be delivered to and become the property of the Commission upon suspension, abandonment, cancellation, termination, or completion of the Consultant's service.

VIII. SCHEDULE AND DELIVERY

- 1) **Schedule.** Projects that have targeted ground control points must be coordinated with the placing of targets and the photo mission so that a minimum of time will elapse between targeting and photography. MoDOT will identify priority sites needing final reports for mapping. The Consultant will continuously prosecute the work and survey deliverables shall be submitted to MoDOT as they are completed. The time of completion for all of the work addressed in these documents shall be **JULY 1, 2009.**

- 2) **Extensions.** The Commission will grant time extensions for unavoidable delays beyond the control of the Consultant. Requests for extensions of time shall be in writing by the Consultant, before plans are due, stating fully the reasons for the request.

- 3) **Materials to be delivered:**

- a. A set of prints with a north arrow and the photo control graphically depicted on the front of the print and a description of the point(s) and a reference to the corresponding field book printed on the back of the print.

Example:

Station # _____

Book _____ Page _____

Desc. of point _____

Ground Elev. _____

- b. Survey reports and sketches.

- 4) All material shall be delivered to:

Missouri Department of Transportation
P.O. Box 270
200 Harrison St.



Jefferson City MO 56102
Attention: Photogrammetry

CONTROL SURVEY SCOPE OF SERVICES



APPENDIX A

1. **Example of File Format for the Photogrammetric Control File.** This file is described in the Specifications for Control Survey Deliverables Section of the Scope of Services.

This file lists control positions by point number, X, Y, and Z values in project units. These values are referenced to the Missouri Coordinate System of 1983, Zone name Zone, in an ASCII file format with the following column assignments.

Columnized Feature	Point #	X Coordinate	Y Coordinate	Elevation	
Column #'s	1 – 3	5 – 15	17 – 27	29 – 36	

The file is space delimited.

```
801 2822698.048 1049380.027 879.890
802 2822109.962 1046386.240 833.220
803 2824745.770 1047848.664 866.570
804 2827979.396 1045633.469 807.810
805 2830295.248 1046379.796 767.000
806 2832731.880 1045946.490 770.860
807 2833973.971 1045530.297 823.210
808 2834925.754 1045765.585 785.850
809 2840304.352 1044862.477 872.640
810 2841701.376 1044426.162 894.570
811 2844038.780 1045215.527 918.880
812 2844065.693 1044044.473 914.890
813 2846978.128 1043812.817 924.270
814 2849221.801 1043268.513 946.570
815 2851956.658 1042880.686 974.720
816 2853466.225 1041758.320 934.200
817 2855618.327 1041573.120 946.820
818 2857946.557 1043634.129 892.230
819 2857249.308 1040920.208 939.330
901 .000 .000 883.130
903 .000 .000 759.860
904 .000 .000 832.470
```



2. **Example of File Format for the Survey Control File.** This file is described in the Specifications for Control Survey Deliverables Section of the Scope of Services.

This file lists control positions by point number, X, Y, and Z values in project units. These values are referenced to the Missouri Coordinate System of 1983, Zone name Zone and modified by the projection factor. This is an ASCII file format with the following column assignments.

Columnized Feature	Point #	X Coordinate	Y Coordinate	Elevation	
Column #'s	1 – 5	7 – 21	22 – 36	38 – 49	

The file is comma delimited. Spaces are needed before decimal with trailing zeros after decimal to five places.

```
801, 2822698.04800, 1049380.02700, 879.89000,  
802, 2822109.96200, 1046386.24000, 833.22000,  
803, 2824745.77000, 1047848.66400, 866.57000,  
804, 2827979.39600, 1045633.46900, 807.81000,  
805, 2830295.24800, 1046379.79600, 767.00000,  
806, 2832731.88000, 1045946.49000, 770.86000,  
807, 2833973.97100, 1045530.29700, 823.21000,  
808, 2834925.75400, 1045765.58500, 785.85000,  
809, 2840304.35200, 1044862.47700, 872.64000,  
810, 2841701.37600, 1044426.16200, 894.57000,  
811, 2844038.78000, 1045215.52700, 918.88000,  
812, 2844065.69300, 1044044.47300, 914.89000,  
813, 2846978.12800, 1043812.81700, 924.27000,  
814, 2849221.80100, 1043268.51300, 946.57000,  
815, 2851956.65800, 1042880.68600, 974.72000,  
816, 2853466.22500, 1041758.32000, 934.20000,  
817, 2855618.32700, 1041573.12000, 946.82000,  
818, 2857946.55700, 1043634.12900, 892.23000,  
819, 2857249.30800, 1040920.20800, 939.33000,  
901, 0.00000, 0.00000, 883.13000,  
903, 0.00000, 0.00000, 759.86000,  
904, 0.00000, 0.00000, 832.47000,
```



3. **Example of File Format for the Geodetic Control File.** This file is described in the Specifications for Control Survey Deliverables Section of the Scope of Services.

A file containing latitude and longitude information for all control points.

Columnized Feature	Point #	Name of Station	Geodetic Position	Map Coordinates	Scale & Convergence
Column #'s	1 – 8	10 – 24	30 – 48	52 – 62	65 – 80

MISSOURI COORDINATE SYSTEM OF 1983

CAMDEN RTE. 54
JOB # 5P347
OSAGE BEACH BY PASS WEST TO
RTE. KK TO GLAIZE BRIDGE

PROJECTION FACTOR 1.0001041
GRID FACTOR .9998959
Zone = Missouri Central

POINT	NAME	LATITUDE & LONGITUDE	STATE PLANE (FEET)	CONVERGENCE
239		N 38°07'33.666917" N W 92°41'14.262069" E	834741.3171 446123.0874	- 0°06'56.2857"
240		N 38°07'19.125203" N W 92°41'35.040821" E	833273.8370 444459.6998	- 0°07'09.0759"
241		N 38°07'17.505657" N W 92°41'32.972773" E	833109.6780 444624.6167	- 0°07'07.7949"
242		N 38°05'53.679786" N W 92°40'42.072381" E	824622.6549 448675.7757	- 0°06'36.1670"
243		N 38°05'57.349493" N W 92°40'37.844930" E	824993.1943 449014.4065	- 0°06'33.5675"

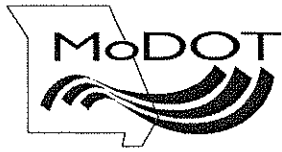


4. **Example of GPS Report Files.** These files contain information reporting the observation, adjustment and analysis details of GPS measurements. These reports illustrate the survey's compliance to the Control Survey Specifications of the Scope of Service.

The files document proof of these specifications:

- Fixed* preprocess baseline solutions.
- Preprocessed ratios between variances generated in the integer search > two (2).
- Reference variances < ten (10).
- Control station relative positional accuracies of 10 ppm in relation to adjacent stations at the 95% confidence level.
- Post-adjustment residual values < 3 cm in any dimension for control stations

From Station	To Station	Solution Type	Slope Distance (meters)	Ratio	Reference Variance	From Ant. Ht. (meas. meters)	To Ant. Ht. (meas. meters)
1 1 GRS CA01	803	iono free fixed	1050.358	47.8	0.720	1.468	1.574
2 1 GRS CA01	801	iono free fixed	1113.209	48.3	0.695	1.468	1.569
3 1 GRS CA01	802	iono free fixed	894.368	28.1	1.695	1.468	1.520
4 802	803	iono free fixed	161.246	37.4	1.671	1.520	1.574
5 802	801	iono free fixed	234.541	45.1	1.393	1.520	1.569
6 803	801	iono free fixed	150.591	73.6	0.517	1.574	1.569
7 803	802	iono free fixed	759.694	15.4	1.177	1.574	1.520



5. Example of Valley Section coordinate file. This file is described in the Specifications for Control Survey Deliverables Section of the Scope of Services.

This file lists section location points by point code, X, Y, and Z values in project units. These values are referenced to the Missouri Coordinate System of 1983, Zone name Zone. This is an ASCII file format with the following column assignments.

Columnized Feature	Point #	X Coordinate	Y Coordinate	Elevation	Code	Linking Code	Comment
Column #'s	1 – 5	7 – 21	22 – 36	38 – 49	51 – 54	56 – 59	61 – 100
2001	1493733.6037	1680412.0330	1046.9031	755	-BS		South End of Valley Section
2002	1493734.8938	1680589.1186	1046.6232	755			
2003	1493734.3449	1680849.4171	1046.8231	755			
2004	1493733.0785	1680640.0107	1049.1831	755			
2005	1493736.4857	1680297.0907	1056.4631	755			
2006	1493730.8658	1680463.1365	1043.8632	755			
2007	1493739.7600	1681003.6282	1036.3031	755			
2008	1493729.1805	1681020.3111	1032.8231	755			
2009	1493732.6212	1680772.7421	1044.7432	755			
2010	1493735.5559	1681115.1527	1012.8632	755			
2011	1493729.9020	1681034.6798	1029.9832	755			
2012	1493731.1692	1680354.5509	1051.8231	755			
2013	1493729.7146	1680900.4171	1046.0231	755			
2014	1493731.1667	1680760.1757	1046.1432	755			
2015	1493729.5378	1680725.5532	1048.5831	755			
2016	1493728.0645	1680324.7744	1055.1831	755	-ES		North End of Valley Section
2017	1493736.6366	1681045.0101	1028.3431	755	-BS		West End of Valley Section
2018	1493732.2524	1680422.7118	1045.7831	755			
2019	1493728.5201	1680498.0051	1043.8231	755			
2020	1493737.6257	1680864.7977	1046.9431	755	-ES		East End of Valley Section
2021	1493729.4129	1680376.6705	1049.9431	101			
2022	1493732.6091	1680337.0953	1053.5032	102			
2023	1493736.6573	1680553.5910	1044.1432	103			
2024	1493733.7694	1681138.7330	1007.7031	104			
2025	1493738.8081	1680531.5129	1042.3832	105			
2026	1493731.6096	1680607.1505	1048.4231	106			
2027	1493733.5886	1680659.7624	1049.7432	107			
2028	1493733.8626	1680947.7051	1042.4631	108			
2029	1493730.5960	1681053.7462	1026.9031	109			
2030	1493733.7689	1681078.3643	1021.3031	110			
2031	1493737.3482	1680399.6171	1047.5431	111			
2032	1493731.2640	1680450.6210	1044.1831	301			
2033	1493731.1776	1680709.2456	1049.4631	302			
2034	1493733.7812	1680828.1086	1046.5431	303			
2035	1493736.1656	1680812.5292	1045.5831	304			
2036	1493730.4846	1681065.9005	1023.7831	305			
2037	1493735.1396	1680966.8297	1040.7831	306			
2038	1493729.3275	1680688.7999	1050.5032	307			
2039	1493729.6920	1681157.3570	1004.1031	308			
2040	1493735.5161	1680513.6674	1042.8231	309			
2041	1493736.1545	1681125.3292	1011.3431	310			
2042	1493735.3617	1680787.1784	1044.5431	311			
2043	1493740.3307	1680800.8345	1044.2231	312			

