Missouri
Department
of Transportation

MoDOT

Pete K. Rahn, Director

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

October 26, 2007

Dear Consultant:

The Missouri Highways and Transportation Commission is requesting the services of a surveying consulting firm to provide control survey on the lists of projects provided on the attached scope of services. The projects are scattered over the entire state with some being large corridor projects with at least 10 miles in length.

Please limit your letter of interest to no more then 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 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. Two consultants will be selected, one to perform the work for each list of projects. Any firm unable to provide services on one of the projects per specific list will not be considered to provide services on any of the listed projects. Please specify if you are interested in either or both of the lists.

Any firm unable to provide services on one of the projects listed will not be considered to provide services on any of the listed 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 9, 2007 to the address listed below.

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

You may also submit letters of interest by fax to (573) 526-4535 or E-mail at Alexa.Mitchell@modot.mo.gov. 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 Alexa Mitchell at (573) 751-6591.

Sincerely,

Dave Nichols
Director of Project Development

am/gt
Attachments
cc: Ms. Kathy Harvey – de

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	Length +/- mi	Elevation (ft) (Photo Scale)	Description of Project/Special Conditions
J3P0426	Marion	61/24	4.8	1:3000	N/O Rte 61/24 int. to Ralls Co Line
J3P0427	Ralls	61	6	1:3000	Marion Co Line to S/O Rte M (need 2 alternates flown)
J3P0417	Audrain	54	3.8	1:3000	From Rte D to 0.7 W/O Rte JJ
J3P0418B	Audrain	54	10.8	1:3000	From 0.7 W/O Rte JJ to Rte O
J3P0418C	Audrain	54	7.5	1:3000	From Rte O to Rte 19
J3P0418	Audrain	54	8.7	1:3000	From Rte 19 to Ralls Co. Line
J3P0419	Ralls	54	3.6	1:3000	From Audrain Co Line to Pike Co. Line
J3P0420	Pike	54	13	1:3000	From Ralls Co. Line to Rte 61
J6S1718	St. Louis	100	9.7	1:3000	Rte 100 from Rte 61 to Big Bend Blvd.

TABLE II-2
WESTERN MAPPING PROJECT LOCATIONS

Job #	County	Rte	Length +/- mi	Elevation (ft) (Photo Scale)	Description of Project/Special Conditions
J2P0483	Adair	63	15.5	1:3000	Kirksville Bypass (3 optional alignments)
J2P0412	Adair	11	1	1:3000	Bridge improvements
J2S0787	Livingston	V	1	1:3000	Bridge improvements
J4P2152	Platte	92	1	1:3000	Bridge replacement (K0754)
J4P2211	Jackson	50	1.5	1:3000	US 50 / Bynum Intersection, Lone Jack
J8P0595C	Stone	13	6	1:3000	1.26 mi. S/O Rte 76 S. Junction (near Branson West) to Kimberling City bridge.

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

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) **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.

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.

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

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.

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. 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.

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.

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) All coordinates shall be based on the State Plane Coordinate System, North American Datum (NAD) of 1983 (1997) in the appropriate zone.

8) 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 =
(easting – 820,208.3333) *0.00000000045 * (easting – 820,208.3333) + 0.9999333 = 393,700

Central Zone =
(easting – 1,640,416.6665) *0.00000000045 * (easting – 1,640,416.6665) + 0.9999333 = 393,700

West Zone =
(easting – 2,788,708.3331) *0.00000000045 * (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 = 20909689
[20909689 = (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.

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 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 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 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. .

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.

2) **MoDOT Survey Report.** A MoDOT survey project report for each project. See Appendix A, Item 4.

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 contact prints from film aerial camera with the photo control and north arrow graphically depicted on the front of the photo and a description of the point(s) printed on the back of the photo.

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

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 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, 2008.**

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 contact prints from film aerial camera with a north arrow and the photo control graphically depicted on the front of the photo and a description of the point(s) and a reference to the corresponding field book printed on the back of the photo.

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