

County of Orange
Resources & Development Management Department
Geomatics / Land Information Systems Division

GENERAL SPECIFICATIONS
FOR
PHOTOGRAMMETRY CONTRACTS



Prepared By:
Raymond L. Mathe, County Surveyor

July 2007

**ORANGE COUNTY SURVEYOR
GENERAL SPECIFICATIONS FOR PHOTOGRAMMETRY
JULY, 2007**

PREFACE

Any photogrammetric projects performed for the County of Orange, Resources & Development Management Department (RDMD), Geomatics Division shall be in accordance with the specifications contained herein. This shall include Section A – Technical Specifications and the Appendices as well as any special provisions/list of deliverable provided for a specific project within the scope of work (SOW).

**ORANGE COUNTY SURVEYOR
GENERAL SPECIFICATIONS FOR PHOTOGRAMMETRY
JULY, 2007**

TABLE OF CONTENTS

| | |
|---|-----------|
| A. TECHNICAL SPECIFICATIONS SECTION | 1 |
| A.1. DIGITAL MAPPING CAMERA..... | 1 |
| A.2. FILM - BASED CAMERA | 1 |
| A.3. PHOTOGRAPHY | 1 |
| A.4. FLIGHT PLAN | 2 |
| A.5. DIGITAL IMAGERY..... | 2 |
| A.6. FILM..... | 3 |
| A.7. CONTACT PRINTS | 4 |
| A.8. INSTRUMENTATION | 4 |
| A.9. AERIAL TRIANGULATION | 4 |
| A.10. ORTHOPHOTOGRAPHY | 5 |
| A.11. DIGITAL TERRAIN MODEL - LIDAR OPTION | 5 |
| A.12. DIGITAL ORTHOPHOTOGRAPHY..... | 6 |
| A.13. RECTIFIED PHOTOGRAPHY | 8 |
| A.14. PHOTO-INDEX..... | 8 |
| A.15. PREPARATION OF TOPOGRAPHIC MAP PRODUCTS..... | 8 |
| A.16. TESTING AND INSPECTION OF MAPS | 14 |
| APPENDICES | 16 |
| A. STANDARD LIST OF DELIVERABLES | 17 |
| B. DIGITAL MAPPING – FEATURES/SYMBOLS LIST & CELL LIBRARY DESCRIPTIONS | 18 |
| C. CADD LIBRARY - FEATURES/SYMBOLS LIST | 20 |
| D. INDEX SHEET | 21 |
| E. SHEET LAYOUT | 22 |

A. TECHNICAL SPECIFICATIONS SECTION

A.1. DIGITAL MAPPING CAMERA

- A.1.1.A digital mapping camera with the USGS **factory accepted camera certificate** can be considered for photogrammetric services, being based on the frame sensor technology. The front-end electronics shall have signal conditioning, analog-to-digital conversion, charged coupled device (CCD) timing, and processing, integrated inside the digital mapping camera module.
- A.1.2. To ensure ridged image geometry, the digital mapping camera will employ a CCD frame matrix sensor technology.
- A.1.3.The digital mapping camera must incorporate an electronic Forward Motion Compensation (FMC), for acquiring a fully blur-free image for large scale mapping.
- A.1.4.The digital mapping camera shall have a T-AS adaptor ring kit and T-AS gyro stabilized suspension mount to compensate for the roll, pitch, and yaw of the aircraft. There shall be no influences from airspeed or sudden aircraft movements.
- A.1.5.The characteristics of this camera are to be suitable for use with analytical/digital plotting instruments.
- A.1.6.When the USGS supplies the factory acceptance certificate and calibration report, it must be supplied to the County.
- A.1.7.Definition must be such as to yield a RMS error of pointing during inner orientation of a figure commensurate with that established by the instrument manufacturer. This figure should not exceed 6 microns.

A.2. FILM – BASED CAMERA

- A.2.1.A calibrated, 153 mm focal length, precision Aerial survey camera similar to the LEICA RC20/30 or ZEISS RMK TOP, must be used for all aerial photographic work.
- A.2.2.The characteristics of this camera are to be suitable for use with analytical/digital plotting instruments. Such camera shall be equipped with FMC.
- A.2.3.The most recent calibration certificate, not more than three years old, is to be submitted to the County prior to photography. The certificate, from the USGS or other competent optical testing laboratory, must prove that the camera and magazine combination are compatible with all contract requirements.
- A.2.4.When the USGS supplies both a standard and SMAC calibration report, both must be supplied to the County.
- A.2.5.The fiducial marks must be clearly imaged and show uniform intensity when scanned for digital orthophoto purposes.
- A.2.6.Definition must be such as to yield a RMS error of pointing during inner orientation of a figure commensurate with that established by the instrument manufacturer. This figure should not exceed 6 microns.
- A.2.7.The film platen shall not deviate from the true plane by more than 13 microns.
- A.2.8.Any filter used shall be parallel to the lens within 10 seconds.
- A.2.9.The symmetric radial distortion as measured within the 40 degree half field angle is not to exceed 5 microns at any point.

A.3. PHOTOGRAPHY

- A.3.1.All aerial photography shall be color and stereoscopic unless otherwise specified in the SOW. If GPS positioning is to be utilized, each frame will coincide with numbering scheme of the AirBorne Global Positioning System (AB/GPS) and Inertial Measurement Unit (IMU) positional data, i.e. Omega, phi, kappa, x, y, z.

- A.3.2. Real time image quality check and review should be possible while in the air when utilizing a digital camera.
- A.3.3. When the digital mapping camera technology is employed, the CCD built into the full-framed sensors, with Forward Motion Compensation, shall output 12-bit per pixel radiometric resolution per square pixel footprint.
- A.3.4. The optical axis of the camera must be within 3 degrees of the vertical during exposure for standard mapping. Additionally, when the photography is being collected for the purpose of digital orthophotos, the tilt between two consecutive exposures shall not exceed 4 degrees.
- A.3.5. The atmospheric conditions must be such that skies are clear of smoke, clouds and haze, such that well-defined images can be obtained.
- A.3.6. The photography shall be captured between the hours of 10am and 2pm when shadows due to buildings and topographical relief are at a minimum. These times may be exceeded to allow for seasonal changes, with the prior permission of the County Surveyor.
- A.3.7. The photographic imagery shall be taken so as to prevent appreciable image movement at the instant of exposure. Exposure and processing shall be such that the negatives will be of high quality showing the demarcation of planimetric and topographic features discernible at the required scale.
- A.3.8. Crab is not to exceed 3 degrees; either between any two consecutive exposures or relative to the flight line.
- A.3.9. The aircraft and camera combination shall be such that no lens of any kind is inserted between the camera and the object space. This does not refer to a filter designed to be used with the camera.
- A.3.10. The photographic density as measured must lie between the values of 0.6 and 1.2 whenever the imagery is to be used to produce digital orthophotos.
- A.3.11. Overlap – Standard Mapping.
- A.3.11.1. Forward overlap shall average 60% +/- 5%. An overlap of less than 55% will be cause for rejection of the photography.
- A.3.11.2. Side lap shall average 30% +/- 5%. An overlap of less than 25% will be cause for rejection of the photography.
- A.3.11.3. The mapping area (neat model), must not lie closer than 15 mm to the edge of the photograph.

A.4. FLIGHT PLAN

- A.4.1. At the time of proposal for any project, A/E shall prepare a flight plan showing each flight line with the flying height above mean ground elevation, direction of flight of each line, model layout and dimensions, outline of the area to be photographed, north point and the positions of all required ground control points. Approval of this flight plan by County Surveyor is required prior to commencing the photographic mission.
- A.4.2. A/E shall show on an inset, the position of the data panel when the camera is positioned in the aircraft with respect to the direction of flight.
- A.4.3. Flight lines are to extend beyond the project boundary by two exposures/digital frames at each end of the flight line.
- A.4.4. Ground Control. The County will generally provide the necessary ground control for all aerial projects. If, for some reason the A/E is required to provide this service, the process A/E shall follow will be detailed in the SOW.

A.5. DIGITAL IMAGERY

- A.5.1. All digital imagery captured, and the flight metadata, shall be processed to create and store standard, open image formats for immediate “ready to use” into analytical/digital photogrammetric instruments.

- A.5.2. Digital imagery will be compatible with existing software in digital photogrammetric workstations, no camera-specific software adaptations will be required due to the central projected imagery of the frame-based technology, as compared to the line sensor cameras, i.e. Push broom.
- A.5.3. Postprocessing software shall offer the end user a wide variety of different output formats (B/W, RGB, CIR, and 4 channel TIFF).
- A.5.4. Each frame will be electronically dodged, tone-balanced and carefully prepared for mosaicking.
- A.5.5. The twelve-bit per pixel radiometric resolution shall optimize exposure sensitivity to be recorded on the CCD even in bright or dark exposures due to reflections, shadowing, or cloud cover.
- A.5.6. All direct digital imagery shall be prepared and ready, and most importantly tiled at the County's specifications, for direct production of all types of mapping and image analysis, using the central-perspective geometry currently employed by all commercial photogrammetric systems.

A.6. FILM

- A.6.1. The manufacturer's recommended environmental storage conditions are to be followed by the A/E while the film is under his control. Extremes in temperature and humidity are to be avoided. Film must be handled by A/E with care.
 - A.6.1.1. Finger marks on, and stretching of the film during processing and subsequent winding are to be avoided by application of due care and appropriate techniques. Chemical stains will also be cause for rejection.
 - A.6.1.2. Scratch marks are a major source of rejection of photography when used for digital orthophoto production. These must be minimized to the fullest extent possible. Pressure irregularities are probably the main source that must be monitored.
 - A.6.1.3. The negatives shall be free from static marks and blemishes, shall have uniform color tone, and shall have the proper degree of contrast for all details to show clearly in the dark-tone areas and high-light areas as well as in the half-tones between the dark and the high light.
- A.6.2. The film used shall be of a stable based material.
 - A.6.2.1. Estar (or equivalent) based film, must be used for all photography.
- A.6.3. All negatives, diapositives and prints are to be numbered and have the following information edited in letters four millimeters high, on the northernmost or westernmost edge, whichever approximates closest to the line of flight:
 - A.6.3.1. Lettering is to be located within 7 mm of the edge of the photograph.
 - A.6.3.2. Flight line and exposure number in the right hand corner. With the numbering to increase in the direction of flight.
 - A.6.3.3. Date in the left-hand corner.
 - A.6.3.4. Scale and project name in the center.
- A.6.4. Diapositives. The 25 cm by 25 cm diapositives (preferably film, not glass) used by A/E for the project shall be submitted to the County with the preliminary digital files, or other preliminary deliverables, and shall include the transfer points, if applicable. The data panel must not be trimmed from the diapositives.
- A.6.5. Film Deliverables:
 - A.6.5.1. Summary of the aerial mission which includes:

- A.6.5.1.1. Shutter speed.
- A.6.5.1.2. Beginning and end times of photography (PST).
- A.6.5.1.3. Film type and emulsion number.
- A.6.5.1.4. Relative aperture setting.
- A.6.5.1.5. Filter, if used.
- A.6.5.1.6. Flying height above mean ground elevation for each strip.

A.6.5.2. One set of original film negatives shall be delivered in a proper film canister.

A.6.5.3. One set of diapositives protected by appropriate plastic sleeves.

A.7. CONTACT PRINTS

A.7.1. One set of contact prints shall be produced in color (unless otherwise specified in the SOW) from the 23 cm by 23 cm vertical negatives and shall be printed on commercial grade, plastic coated photographic paper and made without mask.

A.7.1.1. The set of contact prints is to be left untrimmed, in order to retain the data strip, which will contain the chronometer, camera number and altimeter information. Untrimmed prints shall be 25 cm by 25 cm.

A.7.1.1.1. All ground control shall be shown on this untrimmed set of contact prints in a neat and legible fashion.

A.7.1.1.2. Photo ID points must be pricked through, the point circled on the reverse side and the sketch drawn around this point. A north point shall always be included.

A.7.2. Prints shall be of uniform color and density and shall be of such a degree of contrast that all details of the negatives will show clearly, both in the shadows and highlights, as well as in the half tones.

A.7.3. All contact printout delivered shall be arranged in order by flight lines as shown on the photo-index. The western or northern edge of each contact print shall show a numeral abbreviation of the month, day and year of exposure of the negative together with the project name, approximate scale of the photograph, as well as the strip and exposure number. The exposure number is to increase in the direction of the flight. The camera serial number is also to be included on the prints.

A.7.4. The back of each contact print shall have inked or stamped the name and address of the A/E.

A.7.5. All prints shall be delivered in a smooth and flat condition. Whenever possible, the container used to transport the prints shall be of the same type used by the photographic paper manufacturer.

A.8. INSTRUMENTATION

A.8.1. All instruments used for compiling data must be analytical/digital instruments. Analog instruments fitted with encoders, are unacceptable and may not be used for any phase of the project.

A.8.2. The maximum C factor that may be utilized for calculating permissible flying height may not exceed 2500 or the figure quoted by the manufacture, whichever is the lower.

A.8.3. A printout showing the date and results of the most recent calibration tests, and factory acceptance documents accepted by the USGS, must be supplied with the initial set of deliverables submitted for checking. This refers to the standard tests recommended by the manufacturer.

A.9. AERIAL TRIANGULATION

A.9.1. Aerial Triangulation (bridging) may be utilized to densify the ground control along a strip or perimeter of a block, in order to fully control each individual model.

A.9.2. The use of ABGPS/IMU system may support the aerial triangulation system by providing the highly accurate exterior orientation parameters from survey beginning to improve the quality and reliability of the orientation results.

A.9.3. The A/E shall determine whether project circumstances require full ground control aerial triangulation. Airborne GPS may be utilized upon approval by the County.

A.9.4. The tie/pass points may be either pre-marks, pug points or well-defined points of detail.

A.9.5. Deliverables

A.9.5.1. Digital deliverables will include the final output consisting of the adjusted coordinate-values, residuals and accuracy analysis.

A.9.5.2. The coordinates must also be supplied as an ASCII file on a CD or DVD.

A.9.5.3. All pug and photo ID points must be circled on the diapositives as well as the set of contact prints on which the control has been marked.

A.9.6. Errors:

A.9.6.1. Independent check points shall be to within 18 microns RMS in X & Y, and 20 microns RMS in Z.

A.9.6.2. Check points will constitute predetermined points of detail (generally pre-marks), of which the coordinates have been determined by the County, but not supplied to the A/E, for which the A/E must supply coordinates as part of the Aerial Triangulation.

A.9.6.3. For tie points (between strips), the error shall not exceed 15 microns in X & Y, and 20 microns in Z.

A.9.6.4. The maximum error shall not exceed 2.5 times the RMS error of block or strip adjustment output showing final coordinate values and error residuals. A/E must supply a description of the program used, adequate for interpreting and assessing the quality of the results supplied to the County.

A.9.6.5. Softcopy procedures must be submitted in writing and pre-approved by County Surveyor prior to commencing work.

A.10. ORTHOPHOTOGRAPHY

Orthophotos will be created from vertical photographs using differential rectification to eliminate image displacements due to photographic tilt and relief. All orthophotographic maps shall conform to standard mapping practices. This shall include, but is not limited to; grid ticks, grid coordinates, all street names and flood control facility names and facility numbers, names of all major features as shown on the USGS quadrangle maps. These requirements are outlined in more detail under Section A.15 Preparation of Topographic Map Products.

A.11. DIGITAL TERRAIN MODEL used for orthorectification- LiDAR Option

A.11.1. The digital terrain model and specified datasets shall be the building blocks for removing the perspective related distortions in the aerial photography. The consultant will then determine which areas would require additional breaklines and spot heights (minimum/maximum z) for updating the existing digital surface.

A.11.2. The digital terrain surface that the consultant will produce shall be tested against the surface project control points and the coordinate data. Any difference will be verified and edited if necessary to ensure the integrity of the surface within project accuracy requirement.

A.11.3. A calibrated LiDAR sensor shall be used that is similar to the OPTECH Gemini 167, and could be used for all terrain extraction and then input/ filtered with terrain return signatures, capable of operating at 167 kHz laser rep rates from altitudes up to 2 kilometer.

- A.11.4. The LiDAR sensor shall be able to take advantage of the latest multipulse technology, with the capability to record returns after a subsequent laser shot. The laser should be able to keep firing while pulses are in flight to the receiver. The LiDAR sensor must have capability to capture 4 range measurements for each pulse.
- A.11.5. The signal strength limit of the LiDAR sensor shall define the maximum operating altitude, due to the fact that this limit is never reached since the timing limit occurs at the lower altitude.
- A.11.6. The aircraft trajectory shall be computed using GPS software to tie in the air and ground GPS and ensuring solutions computed from the different ground stations compare. IMU data shall be processed in to refine the trajectory with the aircraft's attitude information.
- A.11.7. After successful field collection, data and all field notes shall be processed and verified. All GPS vectors will have achieved fixed-integer solutions and the processed GPS solution from all the different ground stations match up.
- A.11.8. The IMU data shall be processed to verify and validate all roll, pitch, heading, trajectory, and offsets measurements.
- A.11.9. The resultant data shall be independently compared against a number of ground control points collected by ground survey.
- A.11.10. The Horizontal accuracy should be calculated at $1/11,000 \times \text{altitude}$; + 1 sigma, with the Vertical/ Elevation accuracies reaching 5-10 cm; + 1 sigma
- A.11.11. Where LiDAR surface data is unavailable, the consultant shall perform auto-correlation to extract the terrain surface using the complex stereo pixel matching algorithms. The terrain model review processes will promote the production of a continuous surface with no mismatches, overlaps or underlaps and most efficient loading and storage of surface data in a spatial database.
- A.11.12. Validation of the terrain surface within a stereo viewer is mandatory and expected to ensure surface integrity across all the project area.
- A.11.13. Any surface data not within the tolerance of the specified projects scale will be removed, and replaced with accurate data.

A.12. DIGITAL ORTHOPHOTOGRAPHY

Digital orthophotography shall be provided on a CD, DVD, external hard drive, or storage media as agreed upon by the County Surveyor. Unless otherwise specified in the SOW, the data will be seamless.

- A.12.1. Digital Orthophoto files including DTM files will conform to standard mapping practices and standards as far as practicable. These are outlined more fully in Section A.15. Preparation of Topographic Map Products.
- A.12.2. Information to be shown in each vector file shall include:
 - A.12.2.1. Grid ticks as specified.
 - A.12.2.2. Grid ticks abutting the neat border lines.
 - A.12.2.3. Grid coordinate values printed along the grid line. This implies that the text for the Y coordinate will be read while the map is oriented to north.
 - A.12.2.4. All street names.
 - A.12.2.5. Flood control facility names and facility numbers.
 - A.12.2.6. Names of all major features shown on USGS Quadrangle maps.
 - A.12.2.7. Contour lines when specified in the SOW.
 - A.12.2.7.1. Contour lines must be edited so as not to run through buildings and heavy growth except for mapping scales that are less than 1:1000 (i.e. 1:2000).
 - A.12.2.8. Legend

- A.12.2.8.1. The legend shall be in accordance with Appendix D, pertaining to sheet layout, north point, bar scale, scale, sheet numbers, project name, date of photography, A/E's stamp, signature and company name and address.
- A.12.2.8.2. The legend and border data must be submitted in MicroStation SE format, in accordance with the specified levels, colors, etc, as shown in Appendix D.
- A.12.2.8.3. The legend and sheet layout is subject to approval by the County Surveyor and must be submitted for approval prior to finalizing and printing the final sheets.

A.12.3. Digital File Format.

- A.12.3.1. Raster data and DTM files are to be submitted on CD, DVD, external hard drive, or storage media as agreed upon by the County Surveyor..
- A.12.3.2. Raster files are to be supplied in GeoTIFF file format, capable of interfacing with the County's Intergraph IRAS and GeoMedia software.
- A.12.3.3. The diapositives will be scanned at a pixel size of less than half the required ground resolution to allow for re-sampling.
- A.12.3.4. Re-sampling may only be used to produce a coarser resolution. For example, 0.25 m ground resolution from 0.125 m resolution scanning.
- A.12.3.5. DTM data created for orthophotography must be in accordance with Section A.15 Preparation of Topographic Map Products.

A.12.4. For hard copy deliverables, the plotter must be capable of resolving a single pixel at map scale. In other words, a plotter with a maximum resolution of 200 microns should not be used to produce an orthophoto from a scan of 25 microns, re-sampled to 100 microns.

- A.12.4.1. Example: Photography, scanned at 25 microns or better (down to 7 microns) and re-sampled to 100 microns would require a plotter with a minimum resolution better than 10 lp/mm (10 line pairs per millimeter).

A.12.5. Digital Orthophoto Tile Specifications

- A.12.5.1. Digital Orthophotographs shall, when requested in the SOW, be delivered in conformance with a pre-defined square grid. The grid is based upon uniform metric NAD83 tiles as defined by the following table:

| MAP SCALE | HORIZ. ACCUR. | PHOTO SCALE | GREY PIXEL RES | COLOR PIXEL RES | SQUARE TILE SIZE |
|-------------------|---------------|--------------------|----------------|-----------------|------------------|
| 1:500 | ±30 cm | 1:2500 to 1:5000 | N/A | 12.5cm | 250m |
| 1:1000 | ±60 cm | 1:5000 to 1:12000 | 12.5cm | 25cm | 500m |
| 1:2000 | ±1.2 m | 1:12000 to 1:24000 | 25cm | 50cm | 1000m |
| 1:5000 | ±3 m | 1:24000 to 1:50000 | 50cm | 1m | 2000m |
| Greater than 5000 | ±3 m | 1:24000 to 1:50000 | 1m | 1m + | 4000m |

A.12.6. Accuracy Requirements for Digital Orthophoto Mapping

A.12.6.1. Planimetric coordinate accuracy requirement (ground X or Y in meters) for well-defined points. Computed RMS errors between the X, Y coordinates of a point on the map, as determined by a check survey, must not exceed the limiting RMS error as shown in the following table:

Limiting RMS error

| MAP SCALE | DIGITAL | HARDCOPY |
|-----------|---------|----------|
| 1 : 500 | 0.20 | 0.30 |
| 1 : 1000 | 0.40 | 0.60 |
| 1 : 2000 | 0.80 | 1.20 |
| 1 : 5000 | 2.00 | 3.00 |

A.12.6.2. Discrepancies between the X, Y coordinates of a point on the map, as determined by the check survey that exceed three times the RMS error, shall be interpreted as blunders and shall be corrected by the A/E.

A.13. RECTIFIED PHOTOGRAPHY

Rectified photography must scale within 5% of ground distance between control points, as supplied by the County.

A.14. PHOTO-INDEX

A photo-index map for each set of contact prints shall be prepared by photographing to a reduced scale, a stapled assembly of contact prints made from each vertical negative carefully laid to match corresponding images and clearly showing the photograph numbers. A north arrow, approximate scale and appropriate title shall be shown on the photo-index map, along with the A/E name and address, date of photography, camera make and focal length. The photo-index map shall be produced in black and white on matte or semi-matte paper unless otherwise specified in the SOW. When considered necessary, to accurately identify the specific photographs, the photo numbers shall be inked in alongside each photo.

A.15. PREPARATION OF TOPOGRAPHIC MAP PRODUCTS

A.15.1. General Information for both Digital and Hard Copy Products.

A.15.1.1. The following applies to both the design files and the final mylars.

A.15.1.1.1. The final mylars shall be plotted from the final design files.

A.15.1.1.2. All required information shall conform to standard mapping practice, read in conjunction with this section and the appendices.

A.15.1.1.3. Features to be captured at various scales are defined in Appendix B, C, and E.

A.15.1.1.4. Names of all public roads, streets and freeways shall be shown and shall conform to the names shown on current index maps on file in the office of the Orange County Surveyor.

A.15.1.1.5. Names of all railroads and topographic features (canyons, ravines, streams, washes, peaks, etc.) which are shown on the USGS quadrangles shall be shown.

A.15.1.1.6. Label all public buildings; this information may be extracted from Thomas Brothers Maps. The County will verify the accuracy of this information. Any buildings or features to be labeled that are not detailed within these General Specifications will be noted in the SOW.

A.15.1.1.7. Features captured such as brush, trails, etc. that are not easily identifiable, shall be labeled.

A.15.1.1.8. All compiled digital data must be captured on the stereo/digital plotter. Compilation/digitizing of data remote from the stereo plotter is not permitted.

A.15.1.2. Grid Lines/Ticks

A.15.1.2.1. Grid lines or ticks, as specified in the SOW, shall be placed in the design files and at an interval of 200 mm on the final map sheet.

A.15.1.2.2. A minimum of 4 grid points are to be placed on any one map sheet.

A.15.1.2.3. A grid line is to be placed at the intersection of each grid with the neat border, which is located 50 mm from the sheet edges and 25 mm from the legend.

A.15.1.2.4. The coordinate grid values will be in units of tens and must include values of the nearest 100 meter grid whenever possible.

A.15.1.2.5. The coordinate value for each grid shall be neatly labeled on all four sides of each map sheet, along the extension of the grid line, between the neat border and the outer border located 25 mm from the sheet edge.

A.15.1.3. Map Sheets

A.15.1.3.1. Adjoining map sheets will have butt joins.

A.15.1.3.2. The neat mapping area is to be bordered.

A.15.1.3.3. The sheet size shall be 24" x 36" unless otherwise specified.

A.15.1.4. Contours

A.15.1.4.1. The following table represents the minimum map scale that may be used with the selected contour interval:

| Map Scale | Contour Interval | | Grid Ticks | |
|-----------|------------------|--------------|------------|--------|
| | Index | Intermediate | On Map | Scaled |
| 1:200 | 1 m | 0.25 m | 100 mm | 20 m |
| 1:500 | 2 m | 0.5 m | 100 mm | 50 m |
| 1:1000 | 5 m | 1 m | 100 mm | 100 m |
| 1:2000 | 10 m | 2 m | 100 mm | 200 m |
| 1:5000 | 25 m | 5 m | 100 mm | 500 m |

A.15.1.4.2. The suggested maximum enlargement factor between photo negative and map product is 8 for standard line maps and 6 for digital orthophotos.

A.15.1.4.3. Index contours shall be of heavier weight and shall be labeled in tiers on general slopes intervals not to exceed 200 mm.

A.15.1.4.4. Labeling of contours should be so placed that the elevation of any contour is readily discernible and so that text can be read from the bottom or from the right side of the map sheet.

- A.15.1.4.5. Intermediate contours shall be omitted when the lines fall closer than 2 mm apart, provided that all contours at the top and bottom of slope changes are shown, unless their exclusion is specifically requested by the Orange County Surveyor.
- A.15.1.4.6. The center of the text (contour value) shall align with the contour line and be center/center justified.
- A.15.1.4.7. The gap between contour value and contour line is not to exceed 5 mm.
- A.15.1.4.8. All contour line must be trimmed at the edge of any structure, to within one UOR (Unit of Resolution) except for mapping scales smaller than 1:1000 (i.e. 1:2000).
- A.15.1.4.9. All contour lines must be aesthetically acceptable and be smoothed by use of a smoothing routine as part of the contour interpolation package, when deemed necessary.
- A.15.1.5. Spot Elevations
 - A.15.1.5.1. Spot elevations determined photogrammetrically, shall be shown for all peaks, road intersections, saddles, and bottom of depressions or wherever interpolation of contours would incorrectly represent land form.
 - A.15.1.5.2. Spot elevations shall be included, where contour lines are more than 50 mm apart, as plotted on the map, along flow lines of all drainage courses, at inlets and outlets of culverts and at major angle points in drainage courses, at 25 mm intervals on the map sheet.
 - A.15.1.5.3. A graphic X shall mark the spot elevation. The elevation shall be to the nearest 0.1 feet (0.01 meter) and be shown next to the symbol according to standard mapping procedures.
- A.15.1.6. Scope of Work (SOW)
 - A.15.1.6.1. The SOW for a specific project will outline special features to be captured, (if any). These features, if not normally visible at the scale requested, will be targeted or painted by the County Surveyor.
 - A.15.1.6.2. Additional survey data, such as structure notes, R/W or other cadastral data, cross section elevations, etc. may be given to A/E to be incorporated into the photogrammetric data. Format for delivery of this additional data will be negotiated with the A/E prior to submittal of data.
 - A.15.1.6.3. Photogrammetric firms not having a Professional Land Surveyor on their staff to sign their plans, when cadastral data is to be added to the plans in terms of A.15.1.6.2 above, shall arrange for this responsibility to be delegated to the County Surveyor.
- A.15.1.7. Cross Sections
 - A.15.1.7.1. If cross sections are required, the profile interval and point spacing will be outlined in the SOW. A/E will deliver data in the required format.
 - A.15.1.7.2. The horizontal and vertical scale of the cross section plots will be defined in the SOW.
 - A.15.1.7.3. A printout and ASCII file of all cross sections, showing as a minimum; each station with its corresponding out, and elevations, will be required whenever cross sections are requested in the SOW.
 - A.15.1.7.4. The sheet size of 8 1/2" x 11" is to be used. Alternatively, multiple sections may be plotted on the large format sheets.
- A.15.1.8. Title and Certification

- A.15.1.8.1. A title block shall be placed on each map sheet of the topographic maps. (See Appendix D for details).
- A.15.1.8.2. All final mylars will be dated, signed and sealed either by a California licensed Professional Land Surveyor, a certified Photogrammetrist or a Civil Engineer (authorized to practice surveying in California), certifying as to the accuracy of the map. This certification will also be a part of the title block.
- A.15.1.8.3. The title of the project will be as agreed upon with the Orange County Surveyor.

A.15.1.9. Accuracy Requirements

The Orange County accuracy requirements are based on the ASPRS Accuracy Standards for large-scale maps.

A.15.1.9.1. Grid Lines and Control Monuments

A.15.1.9.1.1. Digital: No error permissible. Grid lines and control monuments will have exact UOR values in the design files.

A.15.1.9.1.2. Hardcopy: 0.2 mm at map scale.

A.15.1.9.2. Planimetric coordinate accuracy requirement (ground X or Y in meters) for well defined points (limiting RMS error, meters on the ground):

| Map Scale | Digital Line Mapping | Hardcopy |
|-----------|----------------------|----------|
| 1 : 200 | 0.03 | 0.05 |
| 1 : 500 | 0.07 | 0.125 |
| 1 : 1000 | 0.15 | 0.25 |
| 1 : 2000 | 0.30 | 0.50 |
| 1 : 5000 | 0.75 | 1.25 |

Note: The accuracy requirement for hardcopy maps is consistent with the ASPRS Standard for Class 1 map accuracy.

A.15.1.9.3. Height Data: Vertical map accuracy is defined as the RMS error in elevation in terms of the project's elevation datum.

| | Well Defined (limiting RMS) | Obscured Vegetation |
|---------------|-----------------------------|---------------------|
| Contours | 0.33 contour | 0.33 height of veg. |
| Spot elev. | 0.20 contour | N/A |
| Terrain model | 0.40 contour | 0.40 height of veg. |

Note: Digital representation will be exact coordinate representation of height data.

- A.15.1.9.4. Terrain model criteria pertain to discrepancies derived from points interpolated from the plane of the relevant triangles at random locations of data acquired by the check survey.
- A.15.1.9.5. The accuracy requirement for contours and spot elevations in well-defined areas is consistent with the ASPRS Standard for Class 1 map accuracy.
- A.15.1.9.6. Discrepancies between the X, Y, or Z coordinates of a point on the map, as determined by the check survey, that exceed three times the RMS error, shall be interpreted as blunders and shall be corrected by the A/E.

A.15.2. Deliverables: Digital Products.

A.15.2.1. General Information. The County of Orange, Resources & Development Management Department utilizes an Intergraph System for mapping and engineering design applications and requires delivery of photogrammetrically acquired data in digital form. The digital data shall be supplied on CD, DVD, external hard drive, or storage media as agreed upon by the County Surveyor.

A.15.2.1.1. All data (Planimetric and Hypsographic) captured in the photogrammetric plotter shall have a "Z" value derived from stereo compilation. The format shall be compatible with MicroStation.

A.15.2.1.2. The general DTM data grid interval used by the A/E is to be supplied at the time of the first preliminary digital deliverable.

A.15.2.1.3. Appendix B defines the graphical attributes for each type of feature, i.e. level, line weight, line style, color, pattern, cell name, font, text width, text height, pattern deltas, and symbol, as appropriate, for the type of feature.

A.15.2.1.4. To enable the A/E to meet the specifications of the County, the following files and documents will be provided by the County along with these specifications: MicroStation 3-D Seed File, cell library, font library, and color table.

A.15.2.1.5. The County provided NAD83Z (3~D) seed file must be used for all design file deliverables.

A.15.2.1.6. Data collected by photogrammetric surveys will not require any data base linkages of any kind and will only consist of graphic data.

A.15.2.1.7. Contiguous elements shall have a common unit of resolution (UOR) coordinate.

A.15.2.2. Files to be Delivered.

Two sets of files covering the mapping area will be delivered as well as an Index File and an ASCII File.

A.15.2.2.1. Border and Grid File

One design file will be delivered for each map sheet. File will contain the sheet border and grid for that particular sheet. Each map sheet will have attached as reference files the relevant files containing planimetric, contour and spot height data.

A.15.2.2.2. Planimetric Data Files.

The files containing planimetric data will be model rather than sheet based, one model per file. There is no maximum file size. (For checking purposes by the County). When clipping models, ensure that no features are deleted.

A.15.2.2.3. TIN Data

Digital terrain model data is required in a TIN (Triangulated Irregular Network) Form.

A.15.2.2.3.1. The triangles from the TIN files will be represented as MicroStation closed shapes, i.e. Element type 6 and delivered in a design file format (.DGN).

A.15.2.2.3.2. The A/E shall submit TIN data merged into as few files as possible.

A.15.2.2.3.3. The triangles on the border of each file will have common UOR values with triangles in adjoining files where applicable. Duplicate triangles in adjoining files are unacceptable.

A.15.2.2.3.4. Polygons defining areas of the terrain model which are unreliable due to terrain being obscured in photography shall be delineated as closed shapes. There should be no other data in these files.

A.15.2.2.3.5. All points outside the neat TIN limits, such as control points and random Spot heights, must be deleted from that particular file. Terrain model must indicate the actual terrain unaffected by structures, e.g. bridges, etc.

A.15.2.2.4. DTM Data.

DTM FILE SPECIFICATIONS

| FEATURE | LEVEL | WT | CO | LS | FONT | ELEMENT TYPE |
|--------------|-------|----|----|----|------|------------------|
| Breaklines | 1 | 0 | 1 | 0 | | Line(string)/arc |
| Mass Points | 2 | 0 | 2 | | 4 | Text |
| Spot Points | 2 | 0 | 2 | | 4 | Text |
| Edge | 7 | 0 | 6 | 1 | | Linestring |
| Obscure Area | 8 | 0 | 0 | 3 | | Linestring |

A.15.2.2.4.1. Breaklines - represent linear ridge, valley, grade breaks and edge of material features.

A.15.2.2.4.2. Mass Points - point elevations.

A.15.2.2.4.3. Spot Points - local high/low point elevations.

A.15.2.2.4.4. Edge - this is a breakline that prevents triangulation beyond the extent of the survey site.

A.15.2.2.4.5. Obscure Area - this is a breakline that surrounds an internal area where triangulation would create an invalid representation of the surface.

A.15.2.2.4.6. This Digital Terrain Model file is to be a MicroStation SE compatible 3-Dimensional design file. The vertices of the elements contained therein are to correspond with the appropriate State Plane Coordinates using the seed design file provided. This file is not to be confused with Intergraph's InRoads DTM file format. These files need not be model-based.

A.15.2.2.5. Tin Files.

A.15.2.2.5.1. Tin Files, to run under Inroads V7.x and MicroStation SE, must also be supplied. These files need not be model based.

A.15.2.2.6. Contour Data Files

A.15.2.2.6.1. These files will be either sheet based or in a composite model format, and contain the smoothed contours derived from the .TIN files.

A.15.2.2.7. ASCII Files

A.15.2.2.7.1. ASCII Format Files containing the point data used in developing the DTM files are required.

A.15.2.2.7.2. Each type of source data collected will be delivered in a separate file: contour lines, point elevations, breaklines, etc.

A.15.2.2.7.3. Files will be delivered on CD, DVD, external hard drive, or storage media as agreed upon by the County Surveyor.

A.15.2.2.8. Index File

An index file covering the entire project will be provided as shown in Appendix D. This file will delineate the mapping boundary as well as each map sheet.

A.15.3. Deliverables: Topographic Mapping/Hard Copies

A.15.3.1. General

A.15.3.1.1. After thorough review, A/E shall submit the digital data files, prepared as described above, and will be plotted and checked by the County. After checking the quality and accuracy of the digital data files, the County will submit a letter of correction to the A/E. The final mylars will be produced by direct plotting of data provided in the Intergraph design files after all requested corrections have been made.

A.15.3.1.2. Within the SOW, the contour map shall mean the original final mylars amended to meet the general specifications contained herein. The contour interval and scale of the final mylars shall be as directed in the SOW. The sheet orientation of the final map sheets shall be as agreed upon with the County prior to commencing compilation.

A.15.3.2. Information to be shown on the Topographic Map.

A.15.3.2.1. The general information to be shown on the final mylars shall conform to standard map practices and shall follow the SOW, as well as the information contained in the appendices. A map sheet index of the entire project shall be placed on each map at miniature scale and shall be properly oriented. The index map shall show the boundary of the total area mapped and shall show the outline of all map sheets of the project with the sheet number of each map indicated. The specific map sheet on which the index map is placed shall be cross-hatched. Sheets shall be arranged so that the lowest numbered map sheet is always to the south or to the west.

A.15.3.3. Sheet Quality

A.15.3.3.1. The final mylars shall be compiled on film with a thickness of not less than 0.1 mm having a polyester base. The material shall have a thermal stability such that the maximum dimensional change shall not exceed 0.00002 mm per millimeter per degree Celsius. It shall have a hygroscopic stability such that the maximum dimensional change shall not exceed 0.00001 mm per millimeter per percent relative humidity. The differences in dimensional changes for the two directions shall not exceed one-fourth the larger value. Stick on labels are not acceptable.

A.15.3.4. Composite Map

A.15.3.4.1. Two single composite map mylar sheets will be required for any project consisting of more than one map sheet. The composite will either be a photographic reduction or a computer plot to a reduced scale, of all maps and will be submitted on a single sheet of mylar at the largest scale possible. In cases of strip mapping, the strip may be cut into segments in order to more easily accommodate the composite map on a single sheet. To ensure legibility, intermediate (minor) contours may be omitted.

A.16. TESTING AND INSPECTION OF MAPS

A.16.1. All contractual items will be delivered by the A/E within the time frame agreed to with the County Surveyor. The A/E will deliver one model before proceeding with the remainder of the preliminary products. The County will check this model and notify A/E if significant revisions are necessary.

A.16.2. The County reserves the right to inspect any and all phases of the work at any time during the progress of the work.

A.16.3. Map sheets will be tested and inspected after delivery by the A/E and will be accepted or rejected within 30 calendar days or a reasonable length of time depending on the size of the project. This time period is allowed for each contracted item submitted and shall commence when each requested item has been delivered.

A.16.4. The A/E shall, at his own expense, correct and submit final digital data files and create final mylar maps. Final products shall comply with the specified accuracy and be delivered to the County within 15 calendar

days of A/E's receipt of correction letter. All corrections requested by the County will be verified against the final digital files and final mylars.

- A.16.5. Completeness of detail will be observed by a thorough inspection. Accuracy of planimetric features may be tested by field surveys.
- A.16.6. The accuracy of contours may be tested by the profile method, or by any other method at the discretion of the County.
- A.16.7. The accuracy of the DTM will be tested by acquiring elevations of random points by field survey or similar means and comparing them with values interpolated off the DTM.
- A.16.8. The cost of testing and inspecting each map sheet prior to initial acceptance or rejection shall be borne by the County. Before accepting any previously rejected digital file or final mylar, the County may re-test the digital file or final mylar. Should the re-submitted information fail to comply with the SOW, the cost of re-testing required to prove that the digital file or final mylar meets the SOW shall be assessed against the A/E, provided, however, that the charges so assessed shall not exceed \$100 per file or mylar for each additional test after each rejection. Such assessments against the A/E will be deducted from any monies due him.
- A.16.9. Field Edit. When there is any question relating to the planimetry, topography or any other feature of the map, it shall be the responsibility of the A/E to perform such field edits as are necessary to correctly map that which is on the ground, unless specifically stated otherwise in the SOW.

APPENDICES

A. STANDARD LIST OF DELIVERABLES

B. DIGITAL MAPPING – FEATURES/SYMBOLS LIST & CELL LIBRARY DESCRIPTIONS

C. CAD LIBRARY - FEATURES/SYMBOLS LIST

D. INDEX SHEET

E. SHEET LAYOUT

**COUNTY OF ORANGE
GENERAL SPECIFICATIONS FOR PHOTOGRAMMETRY CONTRACTS
STANDARD LIST OF DELIVERABLES**

ANALYTICAL ORTHOPHOTOGRAPHY

| | |
|-------------------------|-----------------------|
| PROJECT NAME: | EXAMPLE PROJECT |
| LIMITS: | SEE PDF FILE ATTACHED |
| DIGITAL ORTHO SCALE: | 1"=40' |
| CONTOUR INTERVAL: | 2' CI |
| PHOTOGRAPHY: | COLOR |
| PHOTO SCALE | 1"=500' |
| PIXEL GROUND RESOLUTION | 0.25' |

| DELIVERABLES | REQUIRED | COST | DELIVERY SCHEDULE |
|--|-----------------|-------------|--------------------------|
| 1. Flying (Mobilization) | | \$ - | |
| a. Digital Camera Images | ✓ | \$ - | |
| b. Contact Prints (1 set/color) | ✓ | \$ - | |
| c. Color Photo Plot (1 set) | ✓ | \$ - | |
| d. Camera Calibration Certificate | ✓ | \$ - | |
| e. AirborneGPS / IMU | ✓ | \$ - | |
| 2. Analytical Aerotriangulation (Adjustment Printout) | ✓ | \$ - | |
| 3. Computer Processing of Digital Data: | | \$ - | |
| a. DGN Files | ✓ | \$ - | |
| b. TIFFWorld OR GeoTIFF Raster files | ✓ | \$ - | |
| c. Border and Grid | ✓ | \$ - | |
| d. Planimetric Data and annotation of street names | ✓ | \$ - | |
| e. Contour Data (.dgn) | ✓ | \$ - | |
| f. ASCII Files of Source Data(DTM) | ✓ | \$ - | |
| g. Index File - Sheet Layout | ✓ | \$ - | |
| 4. Composite map (2 sets) scale: 1'=100' (signed) | ✓ | \$ - | |
| 5. Overview Raster file, 1' resol. | ✓ | \$ - | |
| 6. Color Oblique Shot | | \$ - | |
| TOTAL | | \$ - | |

*Delivery Schedule is total calendar days from A/E's receipt of authorization to proceed or photo control (if required).

SUBCONTRACTORS % OF WORK: N/A

FIRM USED PHOTO FIRM, INC.
John Doe

12/28/2007
DATE

SIGNATURE

COUNTY OF ORANGE
GENERAL SPECIFICATIONS FOR PHOTOGRAMMETRY CONTRACTS
FEATURE/SYMBOL LIST

APPENDIX B

| <u>Layer Name</u> | <u>Description</u> | <u>SurveyV8.cel Name</u> | <u>Font 96 Character</u> | <u>Dgn Level</u> | <u>Color.tbl Color</u> | <u>Line Style</u> | <u>Line Weight</u> |
|-------------------|----------------------------------|--------------------------|--------------------------|------------------|------------------------|-------------------|--------------------|
| ANCHOR | Guywire Post | ANCHOR | w | 49 | 104 | 0 | 0 |
| BLDDEC | Building Deck | | | 46 | 69 | 0 | 0 |
| BLDLIN | Building Outline | BLDLIN | | 46 | 71 | 0 | 0 |
| BRIDGE | Bridge Deck | | | 27 | 95 | 0 | 0 |
| BUSHRW | Bush Row | BUSHRW | | 45 | 9 | 0 | 0 |
| CANPAT | Patio or Canopy | | | 46 | 38 | 0 | 0 |
| CATBAS | Catch Basin | | | 46 | 144 | 0 | 0 |
| CONLAB | Contour Label | | | 1 | 0 | 0 | 2 |
| CONLIN | Edge of Concrete | | | 27 | 39 | 0 | 2 |
| CURDIK | Curb, Dike, or Berm | | | 25 | 56 | 0 | 0 |
| DIRTRD | Dirt Road | | | 27 | 7 | 5 | 0 |
| DRIVWY | Driveway | | | 27 | 32 | 1 | 0 |
| EDEASP | Edge of Asphalt | EDEASP | | 27 | 4 | 0 | 0 |
| EDGTRS | Edge of Travelway | | | 27 | 68 | 0 | 0 |
| ELTBOX | Electrical Box | ELTBOX | v | 57 | 153 | 0 | 0 |
| ELTTWR | Electrical Tower | | ! | 57 | 160 | 1 | 0 |
| FENCLI | Fence Line | FENCLI | | 47 | 52 | 0 | 1 |
| FIRHYD | Fire Hydrant | FIRHYD | F | 48 | 36 | 0 | 0 |
| FLOWLI | Flowline | | | 36 | 33 | 6 | 0 |
| GATE | Gate | GATE | G | 48 | 45 | 0 | 0 |
| GUARRL | Guard Rails | GUARRL | | 47 | 0 | 0 | 1 |
| HCONT | Horiz Contol Points | HCONT | 3 | 55 | 147 | 0 | 0 |
| HEADWL | Headwall -top | | | 35 | 123 | 0 | 0 |
| HVCONT | Horiz and Vert Contol Points | HCONT | 1 | 55 | 147 | 0 | 0 |
| INDCONT | Index Contours | | | 3 | 3 | 0 | 2 |
| INDDPC | Index Depression Contours | | | 3 | 3 | 0 | 2 |
| INTCOB | Obscured Intermediate Contours | | | 2 | 2 | 3 | 2 |
| INTCON | Intermediate Contours | | | 2 | 2 | 0 | 0 |
| INTDPC | Intermediate Depression Contours | | | 2 | 2 | 0 | 0 |
| INXCOB | Obscured Index Contours | | | 3 | 3 | 3 | 2 |
| LABELS | Text Labels | | | 46 | 89 | 0 | 0 |
| LANSTP | Striping | | | 27 | 68 | 3 | 0 |
| LIGPOL | Light Pole-single | LIGPOL | L | 49 | 71 | 0 | 0 |
| MANHOL | Manhole | MANHOL | P | 57 | 104 | 0 | 0 |
| MASWAL | Masonary Wall | MASWAL | | 47 | 3 | 0 | 1 |
| MITREE | Middle Size Tree | MITREE | A | 45 | 74 | 0 | 0 |



























































COUNTY OF ORANGE
GENERAL SPECIFICATIONS FOR PHOTOGRAMMETRY CONTRACTS
FEATURE/SYMBOL LIST

APPENDIX B

| <u>Layer Name</u> | <u>Description</u> | <u>SurveyV8.cel Name</u> | <u>Font 96 Character</u> | <u>Dgn Level</u> | <u>Color.tbl Color</u> | <u>Line Style</u> | <u>Line Weight</u> |
|-------------------|---------------------------|--------------------------|--------------------------|------------------|------------------------|-------------------|--------------------|
| PATREE | Tree - palm | PATREE | q | 45 | 157 | 0 | 0 |
| PIPRLI | Pipeline | | | 56 | 0 | 0 | 0 |
| POST | Post | POST | H | 48 | 0 | 0 | 0 |
| RAILRD | Railrd Track | RAILRD | | 47 | 1 | 0 | 1 |
| RETWAL | Retaining Wall | RETWAL | | 47 | 0 | 0 | 0 |
| RIPRAP | RIP RAP | RIPRAP | | 36 | 95 | 0 | 0 |
| ROCKS | Rocks | ROCKS | | 36 | 6 | 0 | 0 |
| SHTLAY | Sheet Layout | | | 62 | 64 | 0 | 0 |
| SIGNS | One Leg Sign | SIGNS | 9 | 48 | 120 | 0 | 0 |
| SPOT | Spot Height | | | 59 | 174 | 0 | 0 |
| STAIRS | Stairs | | | 46 | 165 | 0 | 0 |
| SWPOOL | Swimming Pool | | | 27 | 199 | 0 | 0 |
| TANKS | Tank | | | 46 | 191 | 0 | 0 |
| TICK | Grid Tick | TICK | | 1 | 240 | 0 | 0 |
| TREBRU | Tree Row | TREBRU | | 45 | 0 | 0 | 0 |
| UNKLIN | Outline of Unknown Object | | | 48 | 76 | 0 | 0 |
| UNKOBJ | Unknown Object | UNKOBJ | + | 48 | 148 | 0 | 0 |
| UTIPOL | Utility Pole | UTIPOL | U | 49 | 78 | 0 | 0 |
| VALVE | Valve | VALVE | Q | 48 | 10 | 0 | 0 |
| VCONT | Vertical Control Point | VCONT | 5 | 55 | 3 | 0 | 0 |
| WATLINE | Water Line (wet area) | | | 36 | 7 | 7 | 0 |
| WATMET | Water Meter | WATMET | n | 57 | 98 | 0 | 0 |

APPENDIX C

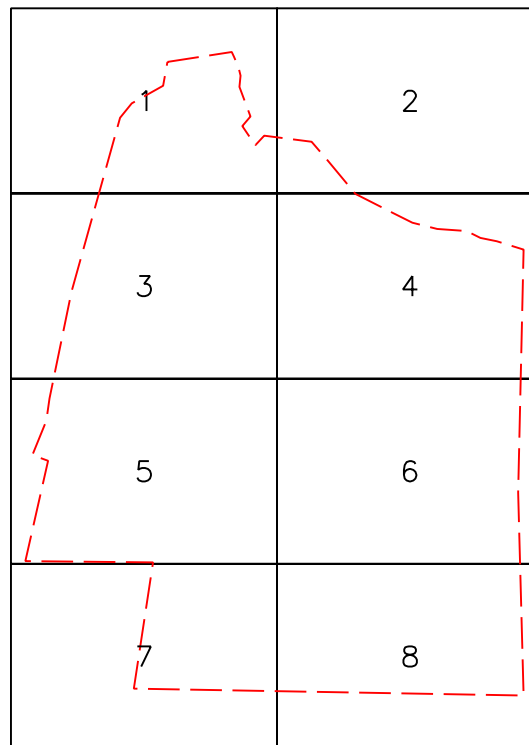
COUNTY OF ORANGE GENERAL SPECIFICATIONS FOR PHOTOGRAMMETRY CONTRACTS CAD LIBRARY - FEATURES/SYMBOLS LIST

| LAYER NAME | DESCRIPTION | LAYER NAME | DESCRIPTION |
|------------|--|------------|--|
| ANCHOR |  GUYWIRE POST | INTDPC |  OBSCURED INTERMEDIATE CONTOURS |
| BLDDEC |  BUILDING DECK | LABELS |  TEXT LABELS |
| BLDLIN |  BUILDING OUTLINE | LANSTP |  LANE STRIPING |
| BRIDGE |  BRIDGE | LIGPOL |  LIGHT POLE |
| BUSHRW |  BUSH - SHRUB ROW | MANHOL |  MANHOLE |
| CANPAT |  CANOPY OR PATIO | MASWAL |  MASONRY WALL |
| CATBAS |  CATCH BASIN / DRAINAGE INLET | MITREE |  MIDDLE SIZE TREE |
| CONLAB |  CONTOUR LABEL | PATREE |  PALM TREE |
| CONLIN |  EDGE OF CONCRETE | PIPELI |  PIPELINE |
| CURDIK |  CURB, DIKE OR BERM | POST |  POST |
| DIRTRD |  EDGE OF DIRT ROAD | RAILRD |  RAILROAD |
| DRIVWY |  EDGE OF DRIVEWAY | RETWAL |  RETAINING WALL |
| EDEASP |  EDGE OF ASPHALT | RIPRAP |  RIP RAP |
| EDGTRS |  EDGE OF TRAVELWAY | ROCKS |  ROCKS |
| ELTBOX |  ELECTRICAL BOX | SHTLAY |  SHEET LAY OUT |
| ELTTWR |  ELECTRICAL TOWER | SIGNS |  ONE LEG SIGN |
| FENCLI |  FENCE LINE | SPOT |  SPOT ELEVATIONS |
| FIRHYD |  FIRE HYDRANT | STAIRS |  STAIRS |
| FLOWLI |  FLOWLINE | SWPOOL |  SWIMMING POOL |
| GATE |  GATE | TICK |  GRID TICK |
| GUARRL |  GUARD RAIL | TANKS |  TANKS |
| HEADWL |  HEADWALL | TREBRU |  EDGE OF BRUSH OR TREE LINES |
| HCONT |  HORIZONTAL CONTROL POINTS | UNKLIN |  OUTLINE OF UNKNOWN OBJECT |
| HVCONT |  HORIZONTAL AND VERTICAL CONTROL POINTS | UNKOBJ |  UNKNOWN OBJECT |
| INDCONT |  INDEX CONTOURS | UTIPOL |  UTILITY POLE |
| INDDPC |  INDEX DEPRESSION CONTOURS | VERCON |  VERTICAL CONTROL POINT |
| INXCOB |  OBSCURED INDEX CONTOURS | VALVE |  VALVE |
| INTCON |  INTERMEDIATE CONTOURS | WATLINE |  WATER LINE (WET AREA) |
| INTCOB |  INTERMEDIATE DEPRESSION CONTOURS | WATMET |  WATER METER |

COUNTY OF ORANGE GENERAL SPECIFICATIONS FOR PHOTOGRAMMETRY CONTRACTS SHEET LAYOUT



| LAYER NAME | DESCRIPTION |
|------------|--|
| ANCHOR | OUTWIRE POST |
| BLDECK | BUILDING DECK |
| BLDLM | BUILDING OUTLINE |
| BRDGE | BRIDGE |
| BUSHRW | BUSH - SHRUB ROW |
| CANPAT | CANOPY OR PATIO |
| CATBAS | CATCH BASIN / DRAINAGE INLET |
| CONLAB | CONTOUR LABEL |
| CONLN | EDGE OF CONCRETE |
| CURDK | CURB, DKE OR BERM |
| DRTRD | EDGE OF DIRT ROAD |
| DRVWP | EDGE OF DRIVEWAY |
| EDCASP | EDGE OF ASPHALT |
| EDGTRS | EDGE OF TRAVELWAY |
| ELTBOX | ELECTRICAL BOX |
| ELTTWR | ELECTRICAL TOWER |
| FENCELI | FENCE LINE |
| FRHYD | FIRE HYDRANT |
| FLOWLI | FLOWLINE |
| GATE | GATE |
| GUARRL | GUARD RAIL |
| HEADWL | HEADWALL |
| HCONT | HORIZONTAL CONTROL POINTS |
| HYCONT | HORIZONTAL AND VERTICAL CONTROL POINTS |
| INDCNT | INDEX CONTOURS |
| INDDPC | INDEX DEPRESSION CONTOURS |
| INDCOB | OBSCURED INDEX CONTOURS |
| INTCON | INTERMEDIATE CONTOURS |
| INTCOB | INTERMEDIATE DEPRESSION CONTOURS |
| INTOPC | OBSCURED INTERMEDIATE CONTOURS |
| LABELS | TEXT LABELS |
| LANSIP | LANE STRIPING |
| LIGPOL | LIGHT POLE |
| MANHOL | MANHOLE |
| MASWAL | MASONRY WALL |
| MTREE | MIDDLE SIZE TREE |
| PATREE | PALM TREE |
| PPCLI | PIPELINE |
| POST | POST |
| RAILRD | RAILROAD |
| RETWAL | RETAINING WALL |
| RPRAP | RIP RAP |
| ROCKS | ROCKS |
| SHTLAY | SHEET LAY OUT |
| SGHS | ONE LEG SIGN |
| SPOT | SPOT ELEVATIONS |
| STARS | STARS |
| SWPOOL | SWIMMING POOL |
| TCK | GRD TCK |
| TANKS | TANKS |
| TREBRU | EDGE OF BRUSH OR TREE LINES |
| UNKNLN | OUTLINE OF UNKNOWN OBJECT |
| UNKOBJ | UNKNOWN OBJECT |
| UTPOL | UTILITY POLE |
| VERCON | VERTICAL CONTROL POINT |
| VALVE | VALVE |
| WATLNE | WATER LINE (WET AREA) |
| WATMET | WATER METER |



NOTE:

COORDINATES SHOWN ARE BASED ON THE CALIFORNIA COORDINATE SYSTEM (CCS83) ZONE VI 1983 NORTH AMERICAN DATUM (NAD 83) EPOCH AS DESCRIBED IN THE FINAL SURVEY REPORT. ELEVATIONS ARE BASED ON THE NATIONAL GEODETIC VERTICAL DATUM 1929 (NGVD29). DCS 1995 ADJUSTMENT AS DESCRIBED IN THE FINAL SURVEY REPORT. ALL UNITS ARE U. S. SURVEY FEET.

ORANGE COUNTY
SURVEYORS & DEVELOPMENT MANAGEMENT CONSULTANTS
12270 Avenida Arroyo
City, State 92637-3458
Tel: 949-959-4444 Fax: 949-959-4333

COMPANY NAME HERE
12270 Avenida Arroyo
City, State 92637-3458
Tel: 949-959-4444 Fax: 949-959-4333
THIS MAP HAS BEEN PRODUCED BY ME OR UNDER MY DIRECTION IN CONFORMANCE WITH THE REQUIREMENTS OF THE PROFESSIONAL LAND SURVEYORS ACT AT THE REQUEST OF THE ORANGE COUNTY SURVEYOR IN 04-20-07.

PLS NAME HERE LIC # PLS 9999
EXPIRATION DATE (12-31-2009)



PHOTO SCALE: 1"=350' (1:4200)
HT. ABOVE TERRAIN: 2'00"
PHOTO DATE: 2-28-06
CAMERA: RC-30
FOCAL LENGTH: 153.56mm
CONTRACTOR: CONTRACTOR NAME HERE
PHOTOGRAPHY: COMPANY NAME HERE
SCANNING: COMPANY NAME HERE
AERIAL TRIANGULATION: COMPANY NAME HERE
GROUND CONTROL: COUNTY OF ORANGE

PROJECT NAME HERE

LAYOUT SHEET

NO SCALE

