

## Chapter 12 Survey Documentation and Submittals

### 12-1. General

This chapter provides guidance on survey documentation, such as field notes, deliverables, metadata, and final submittal reports generated for a topographic survey project, such as a site survey, control survey, hydrographic survey, or construction measurement and payment survey. Generally, a project report is prepared for every major surveying project; in particular, those projects involving new work. Less formal letter reports will usually suffice for routine or repetitive construction surveys. Contract survey specifications will indicate when a formal report is required. This narrative report should describe all salient events and procedures involved in the project. The report will outline all submittals or deliverables attached with the report, to include: raw data files (GPS, data collector), coordinate files, design files (\*.dgn), ESRI shape files, sheet index files, hard-copy drawings, quantity take-off computations, etc. In addition, any QC and/or QA procedures should be described. If real property surveys are involved requiring filing in local jurisdictions, then appropriate licensing certifications must be made on the submitted drawings. FEMA or FAA certifications will require survey reports to be submitted in that agency's format.

### 12-2. Final Survey Report Format--Civil Works

A standardized report format should be used for all major survey projects--especially those for planned design and construction. A project report submitted in a consistent format provides essential background information to the design engineer. The following outline may be used for guidance in preparing a survey report on a topographic survey.

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#### Outline for Survey Report Submittals

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##### **Section 1: General Project Description**

Overview of the project including location, purpose, and parties involved.

##### **Section 2: Background**

Reason for project (more detailed description) and more specific location description including a map. Accuracy and deliverables should be discussed in this section. Attach or include a copy of the original Scope of Work prepared by the originator. Add funding information if applicable.

##### **Section 3: Project Planning**

How the project was planned including but not limited to: reconnaissance results; control establishment; datums; DGPS method(s) selected; topographic survey techniques; feature and attribute standards selected.

##### **Section 4: Data Collection**

Overview of how data was collected including but not limited to: Equipment used (make and model); data collection method(s) and/or techniques used; control points used; amount of data collected; number of crews and personnel per crew; how long the data collection took; data processing/error checking performed in field.

##### **Section 5: Primary Control Data Processing**

How the control data processing was performed including but not limited to process followed.

Subsection 5-1: Total station Traversing--adjustment software, results, closures, final adjustment results and coordinate listings.

Subsection 5.2: GPS Control Surveys & Baseline Processing--Software used; baseline processing results (summary); reprocessed baselines and reason for; parameters for baseline processing (elevation mask, type of ephemeris used); summary results or loop closures (if applicable).

Subsection 5.3: Combined GPS, Total Station, Differential Leveling Network Adjustments---Software used; results of unconstrained adjustment, minimal constrained adjustment, and fully constrained adjustment; summary of weights used, general statistics.

**Section 6: Project Summary and Conclusion**

This section shall include overall results of the processing, products produced, listing of deliverables being submitted, list of metadata files submitted, overall accuracy of the data collection (based on results from data processing section), problems encountered during data collection and data processing, recommendations for future data collection efforts of this type or in this area (lessons learned).

**Section 7: Output and Reports from Software**

This section shall include the detailed reports and output from software packages used during the data processing. This section might have multiple subsections--e.g., one for each step in the processing that has output that is critical in evaluating results.

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**12-3. Final Survey Report Format--Military**

FM 3-34.331 recommends the following format be utilized for final project reports involving military facilities. The guidance and report outline is excerpted from FM 3-34.331.

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An end-of-project report is used to inform the commander and the customer that the project has been completed. The results of the project will generally be listed on DA Form 1962. Copies of DA Form 1959, map overlays, and other graphics may be included. The report should be broken down into readily identifiable numbered and titled paragraphs, as follows:

- Paragraph 1. References. A complete listing of all orders, letters, project directives, and memorandums for record (MFRs) concerning the project. Normally, the other reports will not be listed as references.
  - Paragraph 2. Personnel. The name and rank of all personnel participating in the project. The inclusive dates of their involvement should also be listed. This paragraph can be further broken down as follows:
    - Field-crew personnel from the parent unit.
    - Visiting or inspecting personnel (the unit or office should also be included).
    - Local officials directly involved in the project.
  - Paragraph 3. Objective. The specific mission statement.
  - Paragraph 4. Discussion. A detailed discussion of exactly what transpired during the conduct of the project. Specific dates and details should be included. The milestone objectives outlined in the recon report should be discussed. Indicate whether the project was kept on schedule, or fully explain the reasons for falling behind schedule.
  - Paragraph 5. Problem Areas. Specific problem areas and the solutions to the problems. This information becomes a historical record to be used for future planning purposes. Technical information will be included in the narrative and graphic sections of the recon report.
  - Paragraph 6. Funding. All fund citations and a total of all funds expended. The ISVT and recon reports are the sources for this information. Copies of all travel vouchers and other expenses should be included.
  - Paragraph 7. Work Hours. The total number of expended work hours (broken down by rank). A composite of all progress reports should be included.
  - Paragraph 8. Conclusions and Recommendations. Cite specific conclusions and recommendations.
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Examples of final survey reports submitted by an AE contractor and Corps in-house staff are included in the application projects in some of the appendices to this manual. Although these reports do not conform to the above formats, they do include the same general information.



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PARTY: CFC TECHNOLOGIES, INC JOB# 7322 9-23-04  
KEN CORNER - P.C., NOTES, TI PC E WARM  
PAIGE MELANCON - PROJECT MANAGER  
ERIC QUIRK - CAD / INST / ROD  
SAM ALLEMAN - MULTI-BEAM OPERATOR  
BILL BERGEN - USACE CONSULTANT  
DAVID ROBAR - USACE ASST. CHIEF OF SURVEY

KEY WEST, FLORIDA  
US ARMY CORPS OF ENGINEERS  
JACKSONVILLE DISTRICT  
DREDGING 34-FOOT PROJECT  
MAIN SHIP CHANNEL, CUT-A, CUT-B, CUT-C  
& TRUMAN HARBOR  
CONST. CONTRACT NO. DACW17-03-C-0001  
DREDGE CONTRACTOR - BEAN-STY.  
SUB-CONTRACT TO JOHNSON-MCADAMS  
CONTRACT NO. DACW17-01-D-0003  
TASK ORDER: 20 SURVEY NO. 04-030

TI: SOKKA BEO AUTOMATIC LEVEL, LEICA 500 GPS RTK  
SYSTEM w/ CARLSON DATA COLLECTOR

HORIZ DATUM: NAD '83                      ZONE: FLORIDA EAST  
VERTICAL DATUM: MLLW                      UNITS: FEET US  
- EPOCH 1960 - 1978 (LEVELS)  
RTK = NAVD '88                              236

Figure 12-2. Sample Title Page in a field survey book (Jacksonville District)

d. *Page setup.* The first page of each entry should contain (at the top left side of the page) the name of the installation or project location, a specific project title, and the type of work being done. At the top of the right half of the right half of the page, record the actual date of the survey, weather conditions, type and serial number of instruments used, members of the crew and their assignment, map or field book references, and

other remarks as necessary for a complete understanding of the survey. Pages are numbered on the right hand page only.

*e. Corrections.* No erasures should be made in the field book. If errors are made, they will be crossed through and the corrections will be entered ensuring that the original data remains legible. No figure should be written over the top of another-- nor should any figure be erased. If a whole page is in error, the complete page will be lined or crossed through and the word "VOID" will be written in large letters diagonally across the page. An explanation of the error, and a cross-reference will be entered on the voided page showing the book and page number where the correct information may be found. At the end of each day of work, the field notes shall be signed and dated by the individual responsible for the work.

*f. Data collector.* If a data collector is used, the basic setup information (station description, HI, sketch, etc.) needs to be recorded in the field book. This information is used to document the sequence of the survey. Sketches are added in the field book as needed to supplement the data collector and aid the CADD technician with the planimetric features. On some critical projects (e.g., boundary location, construction payment surveys, etc.) it may be prudent to duplicate digitally recorded data in the field book as it is observed. The requirement for such duplicative recording will depend on the nature of the project, including factors such as potential contract disputes and claims, boundary encroachments, etc.

*g. References.* When it is necessary to copy information from another field book or other source, a note will be made which clearly states that the information was copied and the source from which it came. If the notes are a continuation from another field book, a description will be written in the field book to the effect "NOTES CONTINUED FROM BK XXXX PAGE XX." A similar description (e.g., CONTINUED IN BOOK XXXX FROM PAGE XX) will be written on the last page of each section of notes if those notes are to be continued either in another book or on another page that is not adjacent to the current page.

*h. Sketches.* Sketches are absolutely essential on many site plan surveys, especially if complex utility details are involved. The sketch should show all the details, dimensions, and explanatory notes required. The sketch should be written on a whole page whenever possible. If necessary, multiple pages with the sketch divided equally among the pages should be used if the sketch has too many details to be shown on one page.

*i. Digital photos.* Sketches and other data may be supplemented by digital photos taken in the field. Photos are often useful of permanent control monuments occupied, utility access covers/boxes, utility identification signs, sample vegetation and tree cover, culverts, bridges, towers, etc. References to digital photos should be made in the field book or data collector.

*j. Descriptive project data.* Field book records must contain sufficient descriptive notes so that the survey can be easily reconstructed by different personnel or at any later point in time. Thus, it is important to describe the starting horizontal and vertical control points and their coordinate values. Problems or control discrepancies should be clearly noted in the field book. Sketches of traverse or level routes should be drawn in the field book. Instruments used should be identified. All the forgoing applies whether or not a data collector system is used. Figure 12-3 below depicts a portion of a field book that describes the initial base station set up parameters for a RTK survey. Such basic information is critical in the event the subsequent RTK survey data is questioned.

*k. Project archives.* In general, a separate field book should be initiated for each design or construction project. Field books should be copied or scanned as soon as possible after the field work is completed. The original book should be submitted with the deliverables for permanent retention by the District office.

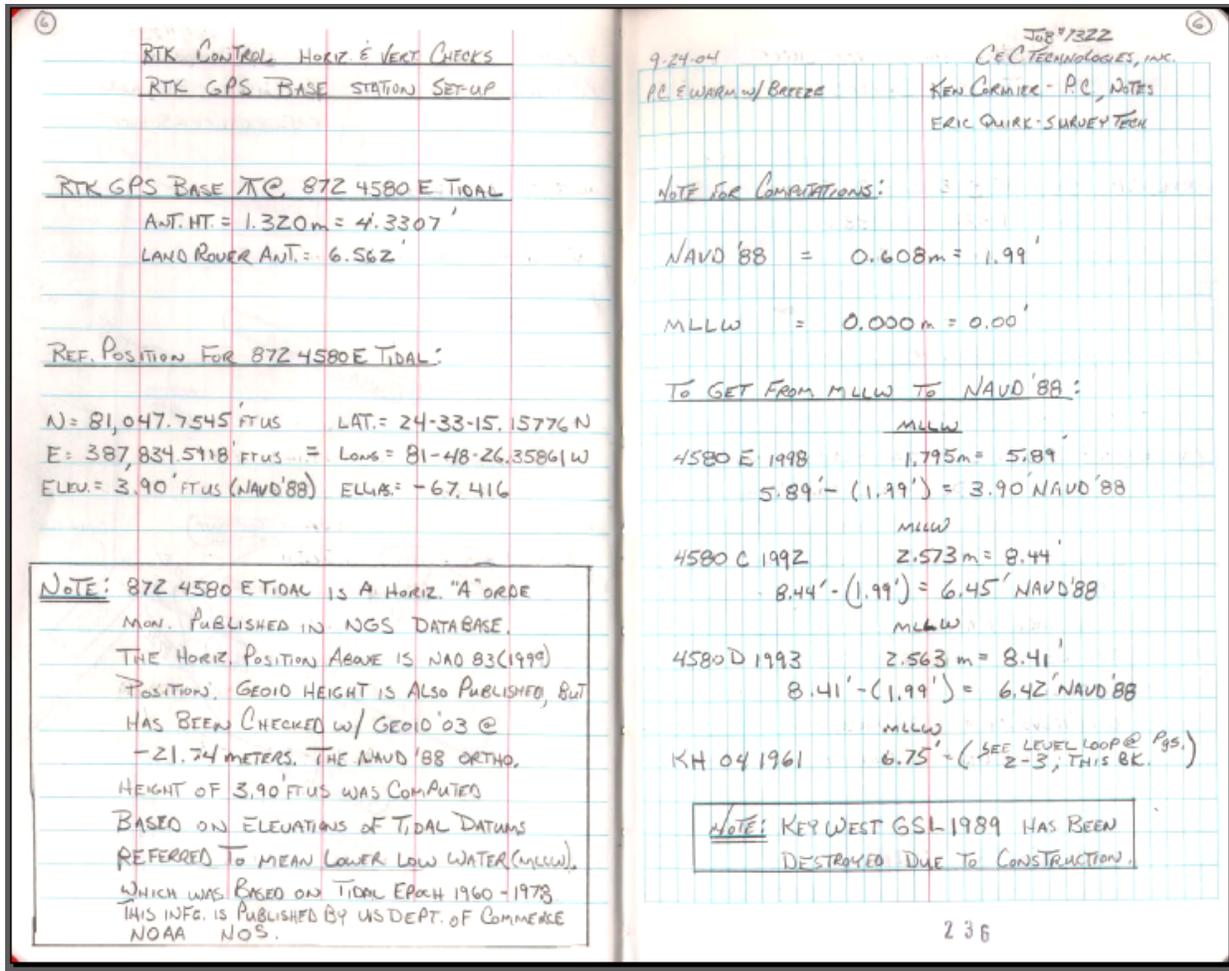


Figure 12-3. RTK reference notes in a field survey book (Jacksonville District--C&C Technologies, Inc.)

### 12-5. Sample Topographic Survey Field Book Notes

There is no set format for topographic field notes. The amount of detail required in the field book will depend on the nature of the project. When a data collector is used with a total station or RTK, then only minimal file referencing data is needed in the field book, as illustrated in Figure 12-4 below.

"Topo"				08-23-02		34
File: ARK-1-DCG - DATA Collection						
PT. #	CODE	ROD				
Ne PT. #9 (mu=5.58)						
BS PT. #10	00000	5.31			ELEV	
101	CHK-IN	5.31			ERRORS	-0.001
① 23	2703	5.27	TURN			
102	CHK-IN	5.31	N. E.		ELEV	
					ERRORS	+0.003 +0.009 +0.001
Ne PT. #23 (mu=5.36)						
BS PT. #9	0000-00	5.50			ELEV	
103	CHK-IN	5.50			ERRORS	-0.002
104	2706	6.10				
105	2706	6.10				
106-151	0801	6.10	Line # 1			
152-166	1801	6.10	Line # 2			
167-201	1910	6.10	Line # 3			
202-205	1801	6.10	Line # 4			
206-213	1801	6.10	Line # 5			
214-215	1601	6.10	Line # 6			
216-239	3001	6.10				
240-261	1802	6.10				
262-	3000	6.10				
263	1601	6.10				
264-267	1801	6.10	Line # 7			

= AB-7 = 0+00	3/4" Iron Rod
= AB-8 = 4+56 1/2	3/4" Iron Rod
= PT. #10 = AB-8 = 4+56 1/2	3/4" Iron Rod
= AB-7-1	Hub Stake
= PT. #10 = AB-8 = 4+56 1/2	3/4" Iron Rod
= AB-7-1	Hub Stake
= AB-7 = 0+00	3/4" Iron Rod
= PT. #9 = AB-7 = 0+00	" "
ROD IN TOP OF CONC. ON LT BANK DOWNSTREAM WALL OF STRUCTURE	
ROD IN TOP OF CONC. ON RT BANK DOWNSTREAM WALL OF STRUCTURE	
Edge of Sigs Road ON TOP of RIP RAP	
Edge of RIP RAP	
Waters Edge	
Edge Rip Rap	
Edge Rip Rap	
Invert Round Culvert 36" Round Iron Pipe	
Nat. Ground on DIRT	
Station Rip Rap	
Top Drop Inlet 2 1/2 X 2 1/2	
Invert 24" Round Conc. Pipe	
Edge Rip Rap	

Figure 12-4. Topographic survey notes referencing data collector shots (Vicksburg District)

When topographic observations are manually recorded, a variety of field book formats may be used. The particular format selected will depend on the note keeper's preferences, the type of project, densification method (radial, cross-sections, or linear profiles), type of instrument, and amount of descriptor data required for individual shots. The surveying texts listed in Appendix A provide examples of topographic survey notes—particularly Kavanagh 1997 and many of the state DOT manuals. Some representative examples of topographic field notes are shown on the following Figures 12-5 through 12-8.

⊕ Profile - Road A 10/20/85

Sta.	+	HI	-	Elev.	Adj. Elev.		(27)
TBM#3	11.80	189.68			171.88	TBM#3 is nail in roof of 24" water pipe, set in June 1975 - Book 42-12	
13+00			9.40				
13+89			4.96				
13+96			4.60				
14+00			4.40			X-SEC. # 3B	
14+49			2.11				
TP			1.03	182.65	182.66		
	9.94	192.52					
15+00			8.61			X-SEC. # 4	
15+19			7.66				
16+00			3.38			X-SEC. # 5	
16+47			0.88				
TBM#4			0.81	191.78	191.80	TBM#4 is RP spike set in pavement, Set June 1975 - Book 42-12	
	11.45	203.75					
17+00			8.87			SAMPLE NOTES - PROFILE ON EXISTING PAVEMENT.	
18+00			3.80				

Figure 12-5. Sample notes from a road profile survey--setting elevations on intermediate stations

X-SECTION STA 0+00 L-8 10  
13 SEPT 87

RANGE	+	HI	-	ROD	ELEV		
	4.00	14.00			10.00	"FCSJ-2120" (PUBLISHED NGVD 1929)	
200				3.9		B/L AND TOP OF LEVEE	
25				6.0		SLOPE	
30				8.0		BREAK	
34				9.9		SLOPE	
50				10.0		SLOPE	
75				12.5		SLOPE	
300				14.5		SLOPE	
			13.55		0.45	T.P. (2x2 HUB)	
	3.55	4.00					
17.5				3.6		TOE OF LEVEE	
1.50				3.6		MARSH (GRASS + WATER)	
1.25				3.6		MARSH (GRASS + WATER)	
			2.25		1.75	"FCSJ-2119" (PUBLISHED ELEV 1.74)	

Figure 12-6. Sample notes from a levee cross-section survey

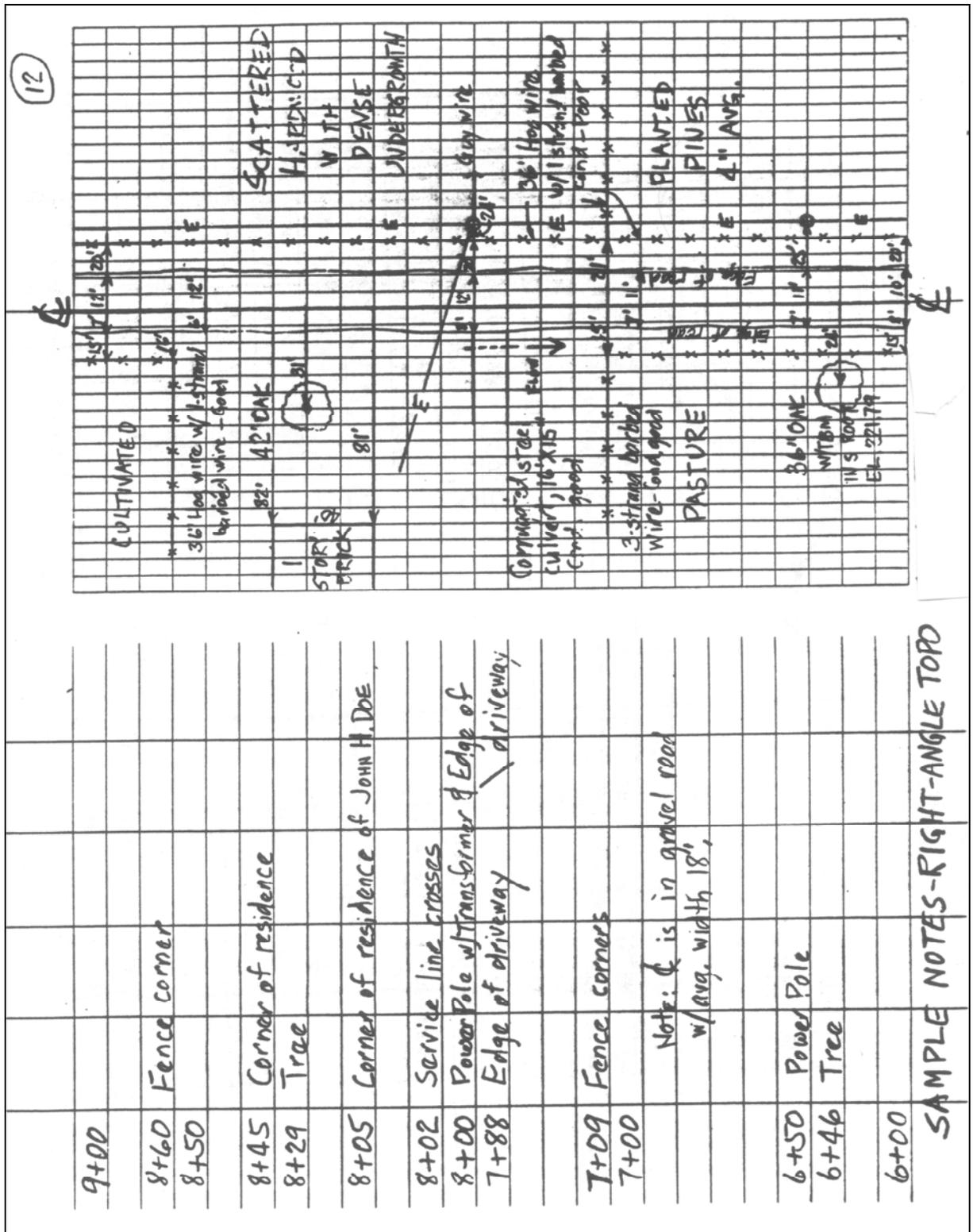


Figure 12-7. Notes from a right-angle topographic survey along a road centerline

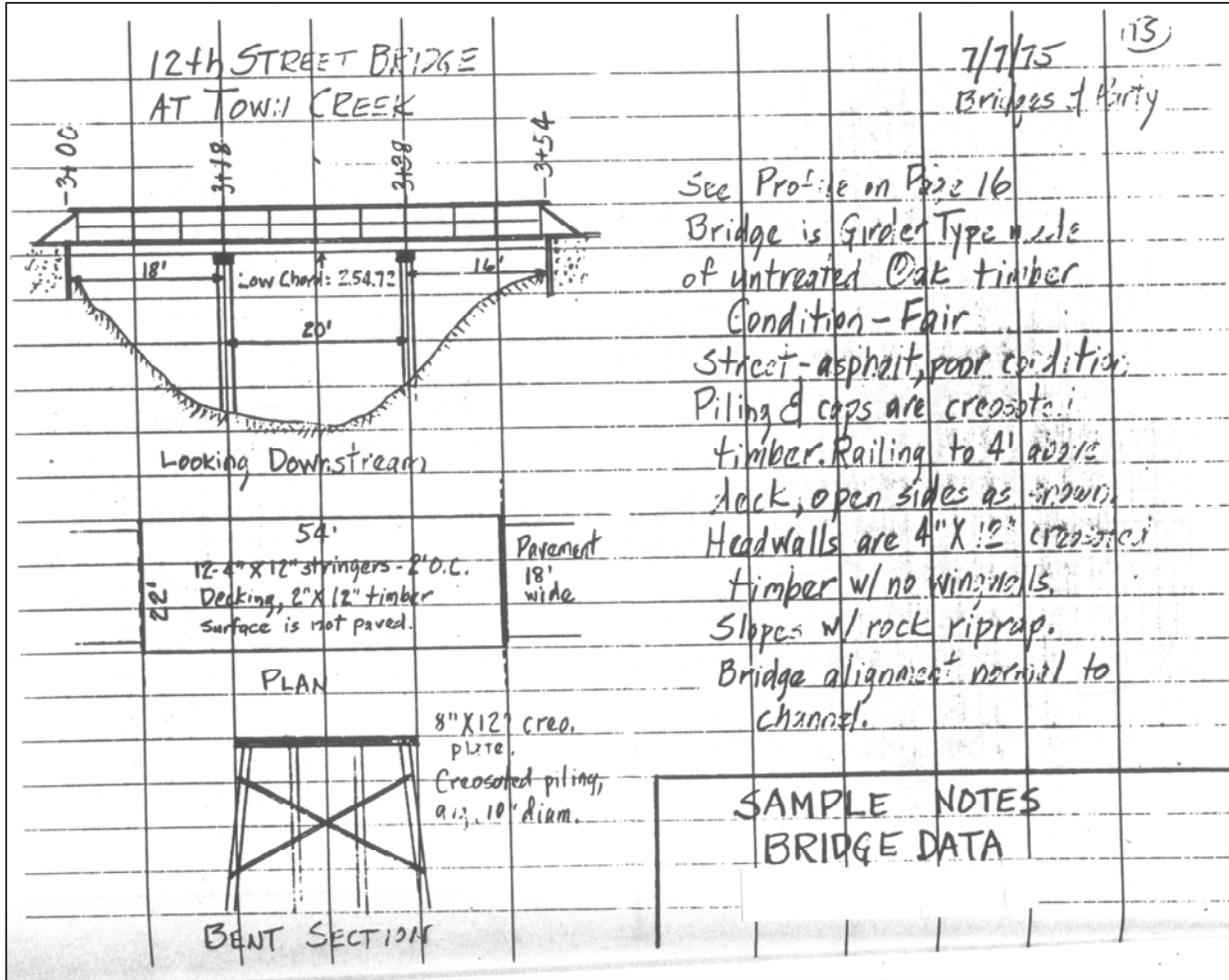


Figure 12-8. Sample notes from a bridge survey

## 12-6. Monument Descriptions

A description of the point occupied shall be made in the field notes. This description shall include the type of monument, its general location, and the type of material the point is set in. A sketch of the location of the point relative to existing physical features and reference ties shall be made and included in the notes. If a horizontal control line is used, a sketch of it shall be made and included in the notes. This sketch does not need to draw to scale, but it should include the relative position of one point to the next and the basic control used. Alternatively, DA Form 1959 (Description and Recovery of Horizontal Control Station) may be used to record descriptions of permanent control monuments. A sample DA Form 1959 is shown at Figure 3-1 in Chapter 3. Optionally, a digital photo or "rubbing" of a monument may be obtained and submitted.

## 12-7. Standardized Coordinate File Coding (New Orleans District)

This section describes a coding scheme used by New Orleans District that is intended to define the general parameters associated with a survey project. This coding format is a mandatory submittal item for AE contractors performing surveys in New Orleans District. These code records are inserted into the ASCII coordinate file produced by the data collector and were developed for general USACE topo survey requirements. These records are used when importing the data into a GIS to create the required Metadata file. Additional codes may need to be developed to suit particular applications. All code records will begin with a “ # ” in column 1, and are limited to 80 characters (4 for the code, 1 space, and 75 for text). All comment records will begin with a “;” in column 1, and are also limited to 80 characters. The submitted file is in chronological order thus the code records will define the attributes of the records that follow. If the field data collection was completed in 7 days, the file would contain 7 #H02 records. Each would be placed at the beginning of the data collected on that day in indicate that the following records were collected on that date.

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### INDEX OF RECORD CODES

- |   |  |
|---|--|
| #B01 - Coordinates and station of baseline PI.  | #H11 - Page number of field book specified by previous #H10 code on which the following information is recorded. |
| #B00 - Name of ASCII coordinate file that contains the survey data.   | #H12 - Combined scale factor.  |
| #BC1 - Coordinates and station of point of curve for curve #1.  | #H20 - Title of survey job. The survey title is limited to 75 characters per record.                             |
| #BT1 - Coordinates and station of point of tangent for curve #1.  | #H21-H29 - Continuation of survey job title.   |
| #BI2 - Coordinates of point of intersection for curve #2.   | #H30 - Reserved for any comments about the survey job. The comments are limited to 75 characters per record.     |
| #C01 - Party Chief.   | #H31-H99 - Continuation of comments about the survey job.  |
| #C02 - Instrument Man.  | #I01 - Instrument.   |
| #C03 - Rodman.  | #I02 - Serial number.  |
| #G01 - Staff gage code number supplied by USCOE.  | #M01-M99 - Description of miscellaneous survey points that follow.   |
| #G02 - Name of gage.  | #P01 - The profile segment's beginning x-y coordinates and stationing.   |
| #G03 - Water surface elevation as read on gage.   | #P03 - Time of profile. Only needed if elevations of points are relative to prorated water surface.              |
| #G04 - Time (1423) of gage reading based on 24 hr clock.  | #P04 - Prorated water surface elevation used for elevation of points in profile.                                 |
| #G10-G99 - Descriptions and or comments are limited to 75 characters per record.  | #T01 - Name of temporary benchmark (TBM).  |
| #H01 - Standard DOS file name of ASCII file which contains the survey data. More than one file is allowed per survey job. | #T02 - Given elevation of TBM.   |
| #H02 - Date (MM/DD/YY) on which the following information was obtained.   | #T05 - Condition of TBM.   |
| #H03 - Order (accuracy) of survey. (1,2,3..AA).   | #T06 - Found elevation of TBM.   |
| #H04 - Horizontal datum on which the survey is referenced. (NAD-1927, NAD-1983, WGS-84,...).                              | #T10-T99 - Description of TBM.   |
| #H05 - Job number of survey. (YY-JJJ).  | #X01 - The range line definition which contains the end point coordinates, station, and name of the range.       |
| #H06 - Unit of linear measure (FT, MT, MI, ...).  | #X02 - Range code or index number.   |
| #H07 - Map projection. Use standard list of projection codes (1702, 1703, ...).   | #X03 - Time of cross-section. Only needed if elevations of points are relative to prorated water surface.        |
| #H08 - Location of survey such as nearest town, river, channel, basin. More than one location is allowed per survey.      | #X04 - Prorated water surface elevation used for elevation of points in cross-section.                           |
| #H09 - Survey firm or organization.   | #W01 - Temperature.  |
| #H10 - Index number of survey field book in which the following information is recorded.                                  |  |

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#W02 - Pressure.  
#W03 - Humidity.  
#W04 - Cloud conditions  
(0-10%: clear  
10-50%: scattered

50-90%: broken  
90-100%: obscured)  
#W05 - Wind speed.  
#W06 - Wind direction  
(N,S,E,W,NE,NW,SE,SW)

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*a. Survey job parameters.* Header records are required to describe the survey job parameters such as Horizontal Datum, Units of Measure, Survey Date, Job Location, Survey Firm, etc. #H20 thru #H29 are reserved for job title. #H30 to #H99 are reserved for any comments about the survey job. Survey field book and page numbers shall be indicated on the #H12 and #H13 records. This allows for an easy reference to original field data.

#H01 - Standard DOS file name of ASCII file which contains the survey data. More than one file is allowed per survey job.  
#H02 - Date (MM/DD/YY) on which the following information was obtained.  
#H03 - Order (accuracy) of survey. (1,2,3..AA).  
#H04 - Horizontal datum on which the survey is referenced. (NAD-1927, NAD-1983, WGS-84,...).  
#H05 - Job number of survey. (YY-JJJ).  
#H06 - Unit of linear measure (FT, MT, MI, ...).  
#H07 - Map projection. Use standard list of projection codes (1702, 1703, ...).  
#H08 - Location of survey such as nearest town, river, channel, basin. More than one location is allowed per survey.  
#H09 - Survey firm or organization.  
#H10 - Index number of survey field book in which the following information is recorded.  
#H11 - Page number of field book specified by previous #H10 code on which the following information is recorded.  
#H12 - Combined scale factor.  
#H20 - Title of survey job. The survey title is limited to 75 characters per record.  
#H21-#H29 - Continuation of survey job title.  
#H30 - Reserved for any comments about the survey job. The comments are limited to 75 characters per record.  
#H31-#H99 - Continuation of comments about the survey job.

*b. Vertical control.* All control points whether found or established must be described by control code records. Vertical control records are required to define the parameters such as Vertical Datum, Benchmark Name, Epoch, etc., used to determine the survey point elevations. These records are required at the beginning of a file and where the vertical parameters change such as when a different benchmark is used, a code is inserted to describe the mark.

#V01 - Name of permanent benchmark (PBM).  
#V02 - Given elevation of PBM.  
#V03 - Epoch (date of adjustment).  
#V05 - Condition of PBM.  
#V06 - Found elevation of PBM.  
#V07 - Horizontal Position of PBM. (Northing, Easting or DDMMSS.SSSSS, DDDMMSS.SSSSS)  
#V09 - Vertical adjustment (adjustment value to apply to following records).  
#V10-#V99 - Description of PBM.

*c. Temporary benchmarks (TBM).* All TBMs used whether established or found must be defined with TBM records. The primary benchmark used to set the TBM will be assumed to be the previous #V01 record (V-Records). The date set will come from the last "H02" record. #T10 through #T99 are used for description of mark.

#T01 - Name of temporary benchmark (TBM).  
#T02 - Given elevation of TBM.

#T05 - Condition of TBM.  
#T06 - Found elevation of TBM.  
#T10-#T99 - Description of TBM.

*d. Baseline parameters.* These records describe the reference baseline. If a baseline listing is available, the user may include the file name in the #B00 record. Each baseline PI is defined by its coordinates, station number, and PI name. Curve data are defined by #BC, #BI, and #BT records. These records define the coordinates, and station number of the Point of Curve, Point of Intersection, and Point of Tangent respectively.

#B00 - Name of ASCII coordinate file that contains the baseline data.  
#B01 - Coordinates and station of baseline PI. (Northing, Easting, Station, PI)  
#BC1 - Coordinates and station of point of curve for curve #1.  
#BT1 - Coordinates and station of point of tangent for curve #1.  
#BI1 - Coordinates of point of intersection for curve #1.

*e. Survey crew members.* Gage records are required each time a gage is read.

#C01 - Party Chief.  
#C02 - Instrument Man.  
#C03 - Rodman.

*f. Water surface elevation.* Gage records are required each time a gage is read.

#G01 - Staff gage code number supplied by USACE.  
#G02 - Name of gage.  
#G03 - Water surface elevation as read on gage.  
#G04 - Time (1423) of gage reading based on 24 hr clock.  
#G10-#G99 - Gage descriptions and or comments

*g. Instrument records.* These records are required to document the equipment used--Total Station, GPS Receiver, Level, etc.

#I01 - Instrument.  
#I02 - Serial number.

*h. Miscellaneous records.* These records are required on miscellaneous shots. The record will contain a general description of the points that follow.

(M-RECORDS -- example)  
#M01 Borehole locations at the south end of the ammo  
#M02 plant located in the U.S. Army Reserve Complex  
#M03 in Corn Bayou, La., near the WABPL.  
#M01-M99 - Description of miscellaneous survey points that follow.

*i. Profile parameters.* Each reach of profile must be preceded by a #P01 record. If the profile contains sounding data controlled by a gage, a #P03 (time) and #P04 (elevation) record must be included showing the interpolated water surface elevation.

#P01 - The profile segment's beginning x-y coordinates and stationing.  
#P03 - Time of profile. Only needed if elevations of points are relative to prorated water surface.  
#P04 - Prorated water surface elevation used for elevation of points in profile.

*j. Cross-section parameters.* Each cross-section must be preceded by a #X01 record. If the section contains sounding data controlled by a gage, a #X03 (time) and #X04 (elevation) record must be included showing the interpolated water surface elevation.

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- #X01 - The range line definition which contains the end point coordinates, station, and name of the range.
- #X02 - Range code or index number.
- #X03 - Time of cross-section. Only needed if elevations of points are relative to prorated water surface.
- #X04 - Prorated water surface elevation used for elevation of points in cross-section.

*k. Weather parameters.* Observed weather conditions as directed in scope of work.

- #W01 - Temperature.
- #W02 - Pressure.
- #W03 - Humidity.
- #W04 - Cloud conditions  
(0-10%: clear  
10-50%: scattered  
50-90%: broken  
90-100%: obscured)
- #W05 - Wind speed.
- #W06 - Wind direction (N,S,E,W,NE,NW,SE,SW)

*l. Standardized Coding of Data Set Records (New Orleans District).* A data set is defined as a cross section, a profile, or a group of topo shots. A data set begins with the #M, #P, or #X code records. For example a cross section data set begins with the #X records and is terminated by any #M, #P, or #X record. In the following example, the section at station 740+60.00 includes points 14 through 36.

---

```
#X013662575.472 513846.972 3663420.478 514783.249 74068.00 U-038
14,513846.972800,3662575.472400,25.177800,CLL
15,513851.730690,3662579.729793,24.790555,FSC
16,513854.771424,3662582.450114,23.607343,CON
17,513861.896190,3662588.617533,20.473465,CON
18,513869.537809,3662595.353421,17.172052,CON
19,513870.695011,3662596.667041,16.935937,FST
20,513885.651015,3662609.886094,17.604381,GRN
21,513897.436845,3662620.505040,17.054901,FL
22,513908.146804,3662629.967624,17.636607,GRN
28,514012.307919,3662723.237411,18.174412,GRN
29,514030.276254,3662739.133536,18.048303,GRN
30,514045.890994,3662753.505709,17.817666,GRN
31,514053.518645,3662760.498189,17.489915,TBK
32,514056.229181,3662763.379132,15.895516,RAP
33,514062.253261,3662768.735739,12.501015,RAP
34,514068.531708,3662774.720419,8.722339,RAP
35,514073.817554,3662777.983519,4.021107,RAP
36,514076.573300,3662782.391800,2.350900,WE
#X01 3662546.513 513869.121 3663402.044 514818.226 74032.00 U-038A
37,513869.121300,3662546.513300,24.810400,CLL
38,513874.846108,3662551.522557,24.355463,FSC
39,513877.284808,3662553.713072,23.223493,CON
40,513884.216098,3662559.999895,20.291534,CON
41,513891.230399,3662566.338795,17.194674,CON
42,513892.695782,3662567.524053,16.967491,FST
43,513908.060337,3662581.755554,17.467846,GRN
44,513918.193497,3662590.318394,17.270104,FL
45,513931.191766,3662602.314157,17.485274,GRN
```

---

*m. Sample Set of Encoded Records from a Topographic Survey (New Orleans District).* The following archival data was created for a survey of a power line near Algiers, LA. This dataset was

generated by the AE contractor as part of his survey deliverable. The same dataset is then used to create a metadata file shown in a subsequent section.

---

```
#H01 04024LRP.EM
#H02 01-07-04
#H03 3
#H04 NAD83
#H05 04024
#H06 USFEET
#H07 1702
#H08 NEAR ALGIERS, LA.
#H09 CHUSTZ SURVEYING INC.
#H10 040012
#H11 1-75
#H12 1.0
#H20 FIELD DATA RE-COLLECTION OF CHALMETTE POWERLINE
#H30 W912P8-04-D-0001
#H31 Task Order 7
;
;
;-----VERTICAL CONTROL INFORMATION -----
;
#V01 Q 196
#V02 6.77
#V03 1996
#V04 LWRP 1993
#V05 Good
#V06 N/A
#V07 29-55-31 89-59-06
#V10 THE PID FOR THIS PBM IS AT0483
#V11 AS PER THE SCOPE OF WORK FOR THIS PROJECT, PBM Q 196
#V12 WAS TO BE USED FOR THE VERTICAL CONTROL ON THIS PROJECT
#V13 NOTE: THIS FILE HAS BEEN CORRECTED TO THE LWRP 1993 VALUES
#V14 BY ADDING 0.15 FT TO THE NAVD88 ELEVATION TO BRING IT TO
#V15 NGVD29, THEN SUBTRACTING THE LWRP 1993 VALUE OF 0.9 AS
#V16 PROVIDED IN THE SCOPE OF WORK TOTAL CORRECTION TO NAVD88
#V17 WIRE ELEVATION IS (-) 0.65 FT
;
;
;-----TEMPORARY BENCK MARKS-----
;
;
; ELEVATIONS WERE ESTABLISHED ON SEVERAL CONTROL POINTS
; BUT NO ACTUAL TBMS WERE ESTABLISHED ON THE PROJECT
;
;-----FIELD PERSONNEL-----
;
#C01 LEE HINES
#C01 MATHEW DELHOMME
#C02 JOHN TEMPLETON
#C03 ROGER GROS
#C03 GREGERY GROS
;
;-----EQUIPMENT-----
```

```
#E01 TOTAL STATION
#E02 LEICA T-1010
#E03 370556
;
#E01 LEVEL
#E02 TOPCON ATG3
#E03 5F6344
;
;
;-----WEATHER-----
;
;
#W01 64 F
#W02 30.5 inHg
#W03 40%
#W04 PARTLY CLOUDY
#W05 10-15 MPH
#W06 WNW
;
; NOTE: ADDITIONAL WEATHER RECORDS ARE IN THE FIELD BOOKS
```

## 12-8. Creating Metadata for Topographic Surveys

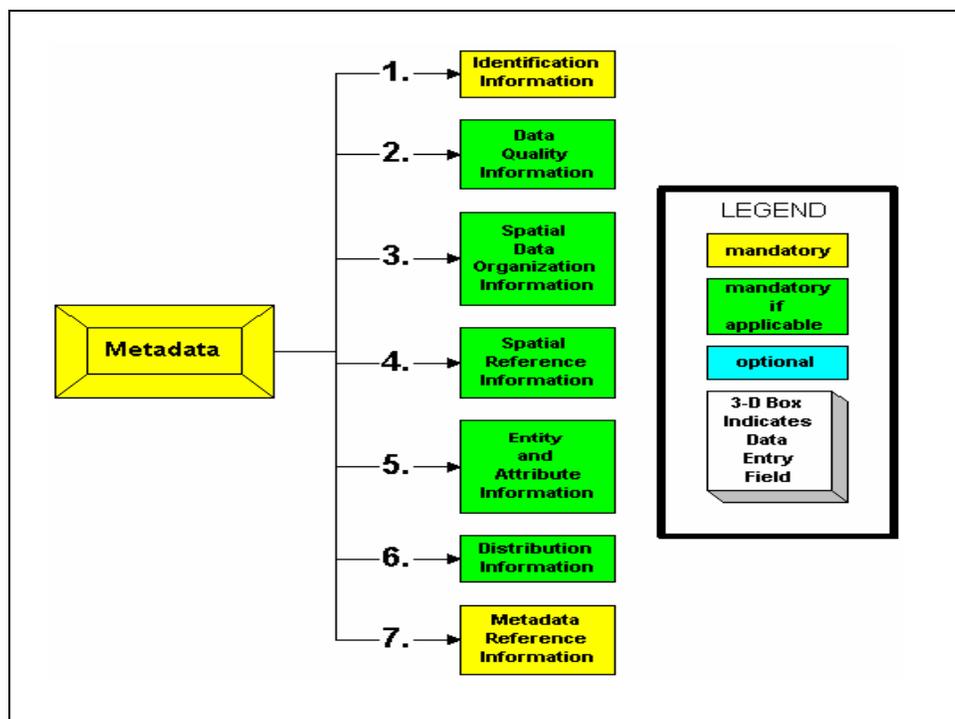


Figure 12-9. Mandatory and optional metadata fields

Metadata records should be created for topographic survey projects. The file structure is outlined in Figure 12-9 above. Only fields 1 and 7 are mandatory--2 through 6 are optional. Corps metadata policy and procedural references are contained in ER 1110-1-8156 (Policies, Guidance, and Requirements for Geospatial Data and Systems) and EM 1110-1-2909 (*Geospatial Data and Systems*). The following is a sample metadata file generated from the previously described New Orleans District power line survey.

---

Identification\_Information:

Citation:

Citation\_Information:

Originator: New Orleans District, U.S. Army Corps of Engineers

Publication\_Date: JANUARY 6, 7, 15 and 16, 2004

Title: FIELD DATA RE-COLLECTION OF CHALMETTE POWERLINE

Publication\_Information

Publication\_Place: New Orleans, LA

Publisher: New Orleans District, U.S. Army Corps of Engineers

Online\_Linkage:

<NONE>

Online\_Linkage:

<NONE>

Description:

Abstract:

Resurvey of the Entergy power line crossing located at Mississippi River mile 89.2 AHP. The power lines were raised to facilitate the navigation of large cruise liners to the Port of New Orleans. The power lines were surveyed at a 75-foot interval and referenced to PBM Q-196 (AT0483). Note: this file has been corrected to the LWRP 1993 values by adding 0.15 ft to the NAVD88 elevation to bring it to NGVD29, then subtracting the LWRP 1993 value of 0.9 as provided in the scope of work.

Total correction to NAVD88 wire elevation is (-) 0.65 ft

Horizontal positions were relative to the levee marker survey traverse on the NAD83 datum.

Surveys were performed to document the elevations of the high tension

Purpose:

The power lines were hanging too low for the new cruise ship to safely cross under without striking. Documentation was required by the utility company and the cruise lines to determine the margin of safety under the raised wires.

Time\_Period\_of\_Content:

Time\_Period\_Information:

Single\_Date/Time:

Calendar\_Date: JANUARY 6, 7, 15 and 16, 2004

Currentness\_Reference: publication date

Status:

Progress: Complete

Maintenance\_and\_Update\_Frequency: Daily.

Spatial\_Domain:

Bounding\_Coordinates:

West\_Bounding\_Coordinate: 3709150.07

East\_Bounding\_Coordinate: 3709460.65

North\_Bounding\_Coordinate: 523258.07

South\_Bounding\_Coordinate: 520243.34

Keywords:

Theme:

Theme\_Keyword\_Thesaurus: none

Theme\_Keyword: Boundaries

Theme\_Keyword: Hydrography

Theme\_Keyword: Topography

Place:

Place\_Keyword\_Thesaurus: none

Place\_Keyword: New Orleans

Place\_Keyword: Louisiana

Place\_Keyword: NEAR ALGIERS, LA.  
Temporal:  
Temporal\_Keyword\_Thesaurus: None  
Temporal\_Keyword: JANUARY 6, 7, 15 and 16, 2004

Access\_Constraints:  
None.

Use\_Constraints:  
This survey information is accurate as of the date of publication. Topographic-Hydrographic survey data is subject to change rapidly due to several factors including but not limited to dredging activity and natural shoaling scouring processes. The U. S. Army Corps of Engineers accepts no responsibility for changes in the conditions which develop after the date of publication. This information is intended for the internal use of the U. S. Army Corps of Engineers and it is being provided for external use as a public service. This agency accepts no responsibility for errors or omissions contained in this data. The accuracy of this data is therefore not guaranteed, and prudent surveyors or mariners should not rely solely upon it.

Point\_of\_Contact:

Contact\_Information:  
Contact\_Person\_Primary:  
Contact\_Person: Mark W. Huber  
Contact\_Address:  
Address\_Type: mailing address  
Address:  
U.S. Army Corps of Engineers  
New Orleans District  
Survey Section  
CEMVN-ED-SS  
P.O. Box 60267  
City: New Orleans  
State\_or\_Province: LA  
Postal\_Code: 70160-0267  
Country: USA  
Contact\_Voice\_Telephone: (504) 862-1852  
Contact\_Facsimile\_Telephone: (504) 862-1850  
Contact\_Electronic\_Mail\_Address: mark.w.huber@MVN02.usace.army.mil

Data\_Quality\_Information:

Logical\_Consistency\_Report:  
The quality of data collected is consistent between dates and vessels collection information.

Completeness\_Report:

The listed surveys represent complete collection for this date.

Positional\_Accuracy:

Horizontal\_Positional\_Accuracy:  
Horizontal\_Positional\_Accuracy\_Report:  
Hydrographic Survey Data collected via DGPS and XY accuracy is +/- 3 feet.  
Topographic Data is Third Order Class II

Lineage:

Source\_Information  
Source\_Citation:

Citation\_Information:

Originator: New Orleans District.  
Publication\_Date: Unpublished material  
Title: No title, data not formally published,  
hard copy is avail  
Geospatial\_Data\_Presentation\_Form: ASCII File  
Publication\_Information:  
Publication\_Place: n/a  
Publisher: n/a  
Other\_Citation\_Details: n/a

Type\_of\_Source\_Media: paper

Source\_Time\_Period\_of\_Content:

Time\_Period\_Information:

Single\_Date/Time:

Calendar\_Date: JANUARY 6, 7, 15 and 16, 2004

Source\_Currentness\_Reference: ground condition

Source\_Citation\_Abbreviation:

Not avail.

Source\_Contribution:

Not avail.

Process\_Step:

Process\_Description:

Hydrosurveys are collected via DGPS. Topographic  
surveys are typically collected with total stations.

Source\_Used\_Citation\_Abbreviation: N/A

Source\_Used\_Citation\_Abbreviation: N/A

Process\_Date: JANUARY 6, 7, 15 and 16, 2004

Source\_Produced\_Citation\_Abbreviation:

N/A

Process\_Contact:

Contact\_Information:

Contact\_Person\_Primary:

Contact\_Person: Ronald W. King

Contact\_Address:

Address\_Type: mailing address

Address:

U.S. Army Corps of Engineers  
New Orleans District  
Survey Section  
CEMVN-ED-SS  
P.O. Box 60267

City: New Orleans

State\_or\_Province: LA

Postal\_Code: 70160-0267

Country: USA

Contact\_Voice\_Telephone: (504) 862-1853

Contact\_Facsimile\_Telephone: (504) 862-1850

Contact\_Electronic\_Mail\_Address:

ronald.w.king@MVN02.usace.army.mil

Spatial\_Data\_Organization\_Information:

Indirect\_Spatial\_Reference:

Filename: 04024LRP.em

This survey data is presented in an ASCII XYZ coordinate file.

Direct\_Spatial\_Reference\_Method: Vector

Spatial\_Reference\_Information:

Horizontal\_Coordinate\_System\_Definition:

State Plane:

Zone: 1702

Unit\_of\_Measure: USFEET

Entity\_and\_Attribute\_Information:

Overview\_Description:

Entity\_and\_Attribute\_Overview:

The data attributes consist of soundings, depth curves (soundings), and obstructions.

Entity\_and\_Attribute\_Detail\_Citation:

not req'd.

Distribution\_Information:

Distributor:

Contact\_Information:

Contact\_Person\_Primary:

Contact\_Person: Ronald W. King

Contact\_Address:

Address\_Type: mailing address

Address:

U.S. Army Corps of Engineers

New Orleans District

Survey Section

CEMVN-ED-SS

P.O. Box 60267

City: New Orleans

State\_or\_Province: LA

Postal\_Code: 70160-0267

Country: USA

Contact\_Voice\_Telephone: (504) 862-1853

Contact\_Facsimile\_Telephone: (504) 862-1850

Contact\_Electronic\_Mail\_Address: ronald.w.king@MVN02.usace.army.mil

Resource\_Description: not applicable

Distribution\_Liability:

The Government furnishes this data and the recipient accepts and uses it with the express understanding that the United States Government makes no warranties, expressed, or implied, concerning the accuracy, completeness, reliability, usability, or suitability for any particular purpose of the information and data furnished. The United States shall be under no liability whatsoever to any person by reason of any use made thereof. This data belongs to the Government. Therefore, the recipient further agrees not to represent this data to anyone as other than Government provided data. The recipient may not transfer this data to others without also transferring this disclaimer.

Standard\_Order\_Process:

Digital\_Form:

Digital\_Transfer\_Information:

Format\_Name: EM

Format\_Information\_Content: ASCII XYZ Format

Transfer\_Size: 0.500 megabytes

Digital\_Transfer\_Option:

Online\_Option:  
  Computer\_Contact\_Information:  
    Network\_Address:  
      Network\_Resource\_Name:  
        <NONE>  
    Online\_Computer\_and\_Operating\_System:  
      Windows NT Server running Netscape WWW Server  
Offline\_Option:  
  Offline\_Media: 3.5 inch diskette  
  Recording\_Format: DOS for diskette  
Fees: Labor and media fees will be charged for requests for off-line data

Metadata\_Reference\_Information:

Metadata\_Date: JANUARY 6, 7, 15 and 16, 2004

Metadata\_Contact:

  Contact\_Information:

    Contact\_Person\_Primary:

      Contact\_Person: Mark W. Huber

    Contact\_Address:

      Address\_Type: mailing address

      Address:

        U.S. Army Corps of Engineers

        New Orleans District

        Survey Section

        CEMVN-ED-SS

        P.O. Box 60267

    City: New Orleans

    State\_or\_Province: LA

    Postal\_Code: 70160-0267

    Country: USA

    Contact\_Voice\_Telephone: (504) 862-1852

    Contact\_Facsimile\_Telephone: (504) 862-1850

    Contact\_Electronic\_Mail\_Address: mark.w.huber@MVN02.usace.army.mil

Metadata\_Standard\_Name:

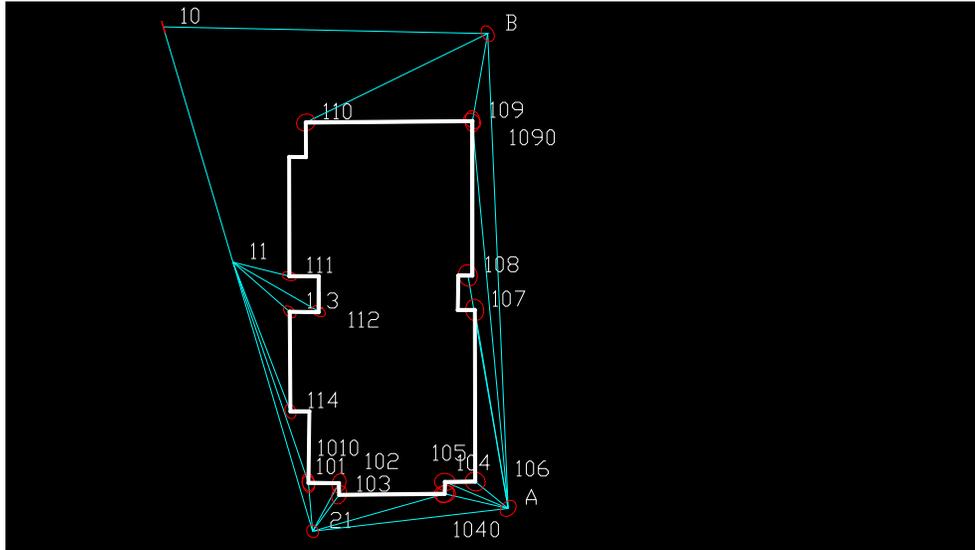
  FGDC Content Standards for Digital Geospatial Metadata

Metadata\_Standard\_Version: 19940608

---

## 12-9. Sample Submittal of Feature Data Accuracy

Some software will provide estimated accuracies of located features. These accuracies are usually based on a priori estimates, unless connected (redundant) adjustment statistics are available. Figure 12-10 below depicts a topographic survey with estimated feature accuracies indicated by error ellipses.



**Figure 12-10. Error ellipses indicating horizontal feature accuracy on shots to building corners. Error estimates are relative to closed traverse from Point “10” which was constrained. Errors logically increase with distance from Point “10.”**

### 12-10. Deliverable QA Checklist

The following list may be used for verifying receipt of deliverables and as a QA check on submitted data.

- GPS network sketch
- Control diagram
- GPS raw data along with field observation log sheets filled out in field with all information and sketches
  - Traverse sketches
  - Level line sketches
  - Raw data and computation files with horizontal and vertical abstracts
  - GPS baseline reduction reports
  - Traverse adjustments
  - Level line adjustments
  - Free and constrained adjustment reports (combined observations)
  - Field survey books (original) containing daily record of survey observations
  - Scanned field survey books (in Adobe Acrobat PDF format, one field book per file)
  - Detail sketches of utilities and other planimetric features
  - ASCII file containing all reduced coordinate data in X-Y-Z format
  - DGN, DTM, and ESRI files
  - Advance hard-copy plots (2 sets)
  - Metadata files (\*.gen and \*.met files)
  - Final Survey Report (narrative format following outline earlier in this chapter)

### 12-11. Mandatory Criteria

Preparation and submittal of metadata, as described in paragraph 12-10, is mandatory.