

What GIS Technicians Do: A Synthesis of DACUM Job Analyses

John Johnson

Abstract: *The U.S. Department of Labor Employment and Training Administration (DOLETA) has created a new standard occupational classification code for GIS/Geospatial Technician. This entry-level job has long been sought after by graduates of the 164 community college GIS certificate programs currently in operation in the United States. The formal recognition of this job has created an opportunity for these colleges to realign their curricula to meet workforce needs. This study was undertaken by the National Geospatial Technology (GeoTech) Center to assist in this effort to validate the DOLETA's occupation-specific workforce requirements. Validation is performed using the DACUM (Developing A CUrriculum) job-analysis technique, which relies on workers themselves to describe and define their jobs. Building on the strength of this approach, the GeoTech Center developed and applied a meta-analytic technique for consolidating multiple DACUM job analyses into a single national assessment. Using eight GIS technician job analyses from across the country, this assessment identifies 55 common task categories, 35 knowledge and skill categories, and 27 behavior categories that are ranked and documented. This helps to clarify the job responsibilities of GIS technicians and complements the DOLETA's workforce information.*

INTRODUCTION

Who are GIS technicians and what do they do? This is an important question now that the U.S. Department of Labor Employment and Training Administration (DOLETA) has recognized this job title with a new standard industrial classification (SIC) code. DOLETA also identified an associated list of occupation-specific job tasks, interests, work values, wages, and related information (DOLETA 2009). This information can serve as the basis for new job descriptions, curriculum resources for education and training, criteria for inter-institutional program articulation, and requirements for professional certification. However, because it was developed by DOLETA workforce analysts rather than the workers themselves, the information will be most valuable if validated by workforce practitioners.

The National Geospatial Technology Center (GeoTech), funded by the National Science Foundation (NSF) to support community college geospatial programs, conducted an initial validation of this workforce information for GIS technicians. With help from the GIS Certification Institute (GISCI), it developed and applied a meta-analytic technique for consolidating multiple DACUM (Developing A CUrriculum) job analyses into a single national assessment. It includes a summary list of GIS technician job tasks identified and validated entirely by industry practitioners. This assessment helps to authenticate the DOLETA's list of workforce requirements for this job.

GROWING NEED FOR GEOSPATIAL COMPETENCIES

The recent development of the Geospatial Technology Competency Model (GTCM), discussed elsewhere in this issue (DiBiase et al. 2010), was a watershed event for the geospatial industry. It culminated years of effort to develop an industry model frame-

work for geospatial occupations. Of particular interest to many workers and educators alike are the responsibilities associated with newly recognized geospatial job titles (DOLETA 2009). This workforce information can impact salaries, job placement and advancement as well as training and curriculum development activities.

The GTCM consists of a pyramid made up of building blocks of worker competencies. At the bottom or foundation level are personal effectiveness and academic and workforce competencies, followed by industry-wide and industry-sector technical competencies. At the top are the occupation-specific competencies, which have been initially defined by the DOL using its standard occupational review process. While useful as an overview, these competencies tend to be inadequate for developing detailed job descriptions and training materials.

Approximately 164 two-year community colleges offer GIS certificate or degree programs in the United States (NGTC 2010a). Most of these programs are meant to prepare students for jobs as GIS technicians. Despite this shared commitment to geospatial workforce development, few educational content standards are available to guide and coordinate their efforts. The result is an assortment of classes, curriculum, and certificate/degree requirements generating confusion among prospective students as well as their advisers.

The GIS Certification Institute (GISCI) is an independent nonprofit organization formed in 2004 to certify GIS professionals. The lack of identified geospatial workforce competencies was an important factor affecting its pragmatic decision to use a portfolio-based system for certification rather than using a competency-based examination approach. The GISCI recently announced a GISP Certification Update Initiative to reconsider the portfolio-based approach in light of DOLETA's GTCM and related developments, including the results of this study (GISCI 2010).

In 2006, the DOLETA identified the geospatial industry as an important emerging high-growth area for the U.S. economy (DOLETA 2006). In response, it sponsored a study entitled “Defining and Communicating Geospatial Industry Workforce Demand” (GITA and AAG 2006). The resulting project report highlighted the growing demand for geospatial workers and ways to prepare workers to meet it. It also helped to define and clarify the multifaceted geospatial industry and recommended two new standard occupational classifications (SOC): GIS/Geospatial Technician and GIS/Geospatial Analyst. The Department of Labor had previously observed that “occupation titles (in this field) were inadequate” and that “evaluating the competencies in the geospatial technology user community could be of great value in planning training” (DOLETA 2005, 20).

Also in 2006, the University Consortium for Geographic Information Science (UCGIS) and the Association of American Geographers (AAG) published the *Geographic Information Science and Technology (GIS&T) Body of Knowledge*. This document offered “a vision of how higher education should prepare students for success in the variety of professions that rely upon geospatial technologies” (UCGIS 2010). It was designed “to be applicable across the undergraduate, graduate, and postbaccalaureate/professional sectors of the GIS&T educational infrastructure” (UCGIS 2006, 42). Unfortunately for educators, it does not specifically address the competencies required by entry-level GIS technicians who typically seek training at two-year community colleges.

An influential predecessor to the DOLETA’s GTCM was a 2003 report prepared by workforce development specialists at the University of Southern Mississippi (Gaudet et al. 2003b). Although wider in scope, the original Geospatial Technology Competency Model provides less detail about the domain-specific knowledge and skills than does the *Body of Knowledge*. It also specifically avoids referencing job titles and work-oriented tasks because “they can become dated as work undergoes dynamic change” (Gaudet 2003, 23). Instead, it uses role profiles (novice to expert) to classify workers and assign competencies. However, because GIS technicians can take on multiple roles at various levels of expertise (e.g., data acquisition, data management, visualization), this document also falls short of providing the guidance educators need.

Industry associations and firms provide other pieces of the puzzle. For example, URISA has published a guide, “Model GIS Job Descriptions,” which outlines typical job responsibilities for various geospatial occupations, including GIS technicians (URISA 2000). ESRI, a leading GIS software firm, also recently introduced a new technical certification program to validate an individual’s “expertise and knowledge of ESRI software and related technology” (ESRI 2010).

Efforts to define required geospatial worker competencies certainly are not unique to the United States. For example, the European Computer Driving License Foundation, which recently developed an examination-based GIS certification process for the Italian market, has generated interest both regionally and globally. The examination, developed by Laboratorio di Sistemi

Informativi Territoriali Ambientali of Sapienza University of Rome together with Associazione Italiana per l’Informatica ed il Calcolo Automatico, has spawned the creation of at least one popular professional preparation course at Sapienza University (ESRI 2009, 9).

In the United States, the recently completed DOLETA GTCM is mobilizing renewed attention to the need to more clearly define job-related geospatial competencies. Associated with the GTCM are several new geospatial occupations, including that of GIS technician, which are described in DOLETA’s O*NET online occupation clearinghouse. This study aims to validate this occupation description to assure its alignment with current workforce requirements.

DEFINING COMPETENCIES FOR GIS TECHNICIANS

According to the DOLETA, a competency is “the capability of applying or using knowledge, skills, abilities, behaviors, and personal characteristics to successfully perform critical work tasks, specific functions, or operate in a given role or position” (Ennis 2008, 4). The identification of “critical work tasks,” therefore, is an initial step in defining competencies for GIS technicians. These normally are documented through a formal job analysis.

The purpose of a job analysis is to systematically identify the work activities, tasks, responsibilities, knowledge, skills, and abilities required to perform a job. Various job-analysis techniques are available, involving both work-oriented and worker-oriented methods. These include using questionnaires, observation, worker diaries/logs, interviews, focus groups, work records, information searches, and critical incident evaluations (Brannick, Levine, Morgeson 2007). While most rely on various indirect sources for collecting job information, the DACUM job-analysis technique relies directly on the workers themselves to describe and define their jobs.

DACUM JOB ANALYSIS

DACUM is a formal job-analysis technique that has been used worldwide for more than 30 years. It is quick to administer, self-validating, and instills ownership among those who take part in the process (Hartley 1999, 22). The methodology involves a structured one-day to three-day workshop in which a trained DACUM facilitator guides a panel of five to 12 “expert workers” as they systematically describe and define their jobs or occupations. Input from this panel typically is recorded on note cards and arranged as a storyboard in front of the panel. The process relies on a series of brainstorming activities in which participants discuss and reach consensus on a set of specific “tasks” that make up their jobs. These tasks are organized into categories called “duties” and presented, along with associated knowledge, skills, and behaviors, in a summary job profile called a “DACUM research chart” (Norton 1997).

The DACUM methodology defines a task as a statement that concisely describes a work activity in performance terms. It usually

consists of a single action verb, an object that receives the action, and a qualifier, as in “create map template.” Tasks represent the smallest unit of a job activity with a meaningful outcome. They can be assigned and, in a finite amount of time, will result in a product, service, or decision. All tasks consist of two or more steps and can be observed and measured. “Duties,” on the other hand, are more general than tasks and describe a large area of work in performance terms. They also denote clusters of related tasks as in “manage data.” Both tasks and duties avoid reference to “enablers,” such as knowledge, skills, worker behaviors, tools, equipment, and supplies. As the term implies, these enable workers to perform tasks at a specified level of competency (Norton 1997).

A strength of the DACUM methodology is that all job tasks can be linked directly to a panel of expert workers who have been identified by name, title, and organization. Together, these individuals reached a consensus that, as GIS technicians, they are required to perform these job responsibilities. This legitimizes the list of job tasks and effectively eliminates those that are either outdated or performed largely by workers with other job titles.

Of course a particular DACUM panel may not fully represent all workers with a given job title. This may result from the mix of business sectors, worker experience, or personal characteristics on the panel. It also may stem from the fact that certain job tasks are performed by GIS technicians in one region of the country but not in another (e.g., urban versus rural locations) or that job tasks evolve over time. Supporting such critiques are results of Willet’s 1989 study, which compared DACUM findings with those from two other occupational-analysis techniques. Willet found that DACUM identified only 73 percent of the competencies believed to be associated with a particular job, but that the rate was increased to 94 percent when the DACUM results were combined with those from an “information search” analysis. Willet thus recommended that DACUM results be combined with those from an information-search analysis to obtain an adequate list of competencies. However, this proposed solution negates a key strength of DACUM analyses while increasing the likelihood of including extraneous tasks. An alternate approach for obtaining a comprehensive list of job tasks using only DACUM job analyses was therefore developed. This involves using a meta-analytic approach for consolidating multiple DACUM job analyses into a single summary assessment.

A META-ANALYTIC APPROACH FOR CONSOLIDATING MULTIPLE DACUM ANALYSES

While the DACUM job analysis technique has the advantage of being entirely worker-generated, its results can vary somewhat depending on its location, timing, and mix of panel participants. To overcome these limitations and still arrive at an accurate and comprehensive list of job tasks for GIS technicians, the GeoTech Center developed a systematic procedure for combining multiple DACUM research charts into a single meta-analysis.

By definition, “a meta-analysis combines the results of several

studies that address a set of related research hypotheses . . . by identifying a common measure of effect size for which a weighted average might be the output” (Wikipedia 2010). This technique was considered suitable for this work because all DACUM job analyses are conducted in a similar manner. They are directed by trained DACUM facilitators who follow an established set of procedures for collecting job-related information and compiling it into a DACUM research chart. This standardized output format facilitates the grouping of individual DACUM components from multiple job analyses into a single consolidated assessment.

When the present study was undertaken, a total of six DACUM job analyses for GIS technicians previously had been conducted at various U.S. locations. The GeoTech Center then conducted two additional analyses. In total, the eight DACUM analyses combine input from 76 current or former GIS technicians. The results of three of these job analyses also were validated by a survey of local GIS professionals. This increased the number of geospatial professionals providing input into this analysis by an additional 413. Then, with help from industry experts, the results were carefully consolidated into a single summary assessment.

The eight DACUM panels identified a total of 476 job tasks that subsequently were grouped into 55 task categories. These categories, listed in Table 1, are organized according to the number of DACUM panels that contributed to each and by the number of similar tasks aggregated in each category. For example, the two highest-ranked task categories—“Design & create maps” and “Develop/document procedures”—are the only categories identified by all eight panels. “Design & create maps” is listed above “Develop/document procedures” because it includes the greatest number of aggregate related tasks, suggesting a higher level of complexity.

Some of the task categories listed in Table 1 are not mutually exclusive. Task categories generalized from input by some DACUM panels may be subsumed in broader categories identified by others. For example, “join & relate data” is a category identified by only two panels but it also could be included as part of the “conduct geoprocessing” category, which was identified by seven panels.

Also included in Table 1 is information on the importance and perceived learning difficulty of each task category based on the validation survey results. Tasks from three job analyses in California, Illinois, and Georgia were mailed to larger groups of GIS professionals for validation purposes. Respondents rated each task on its importance to the job performance of GIS technicians as well as its perceived learning difficulty. These values were weighted by the number of survey respondents and then combined within each task category. The median value for each task category is included on this table, along with the number of survey responses used to generate it. Because tasks from only three out of the eight job analyses were validated in this manner, not all tasks or task categories have this associated information.

Table 1 shows the combined results from eight DACUM job analyses for GIS technicians. As illustrated in Figure 1, these were conducted at various U.S. locations between 1996 and 2009.

Table 1. Tasks Performed by GIS Technicians Ranked by Consensus among DACUM Panels and Task Complexity

Task Categories	DACUM Panels	Aggregate Related Tasks	Median Importance	Validation Survey		#
				#	Median Learning Difficulty	
Design & create maps (G1)	8	34	medium	846	medium	785
Develop/document procedures (F4)	8	13	medium	296	medium	265
Conduct geoprocessing (D1)	7	26	medium	1,298	medium	1,156
Acquire data (C1)	7	20	medium	471	medium	426
Create/update data (C6)	7	16	high	1,112	medium	1,018
Validate data (C3)	7	14	high	571	medium	502
Collect field data electronically (B2)	7	12	high	594	medium	534
Create reports (G2)	7	9	medium	525	medium	482
Convert data (C9)	7	8	high	356	medium	317
Organize data (C2)	6	15	medium	824	medium	734
Maintain equipment & supplies (F8)	6	15	medium	727	low	624
Import/export data (C5)	6	12	medium	344	medium	303
Participate in conferences/workshops (H2)	6	12	medium	691	low	628
Create/update metadata (C7)	6	11	high	510	medium	448
Provide training (H3)	6	11	medium	434	medium	396
Develop & make presentations (G4)	6	10	medium	434	medium	370
Evaluate data (A6)	6	9	high	272	medium	252
Evaluate data sources (A7)	6	6	high	318	medium	293
Coordinate project activities (F1)	5	14	high	62	high	60
Disseminate products (G5)	5	14	medium	306	medium	277
Georeference data (C8)	5	10	high	773	medium	703
Communicate with others (H1)	5	10	high	321	low	290
Define data requirements (A1)	5	9	medium	213	medium	194
Backup/restore data (C4)	5	7	medium	351	low	311
Attend training (H5)	5	7	medium	484	low	437
Conduct geostatistical analysis (D5)	5	6	medium	218	medium	196
Develop project timeline/schedule (F6)	5	6	medium	173	medium	158
Review job-related information (H9)	5	6	medium	262	medium	238

Table 1. Tasks Performed Continued

Task Categories	DACUM Panels	Aggregate Related Tasks	Median Importance	Validation Survey		#
				#	Median Learning Difficulty	
Develop software applications (E2)	4	13	medium	246	high	225
Design/edit databases (E1)	4	9	high	45	high	44
Maintain software (E5)	4	8	high	38	medium	36
Perform queries (D2)	4	6				
Digitize data (B4)	4	5	high	331	low	301
Geocode data (B5)	4	5	high	380	medium	333
Define software/hardware requirements (E3)	4	5	medium	30	medium	28
Promote/represent GIS (H7)	4	5	medium	151	medium	145
Provide technical support (H8)	4	4	medium	129	medium	118
Prepare/assess cost estimates (F5)	3	7	medium	29	medium	29
Identify client needs/deliverables (F7)	3	7				
Conduct network analysis (D3)	3	6	medium	740	medium	631
Create tables & charts (G3)	3	6	medium	210	medium	192
Optimize database performance (E4)	3	5	medium	281	medium	240
Develop user guides (H4)	3	5	medium	58	high	55
Define feature behavior (A3)	3	4	medium	162	high	144
Conduct image analysis (D4)	3	4	medium	29	high	28
Develop data maintenance schedule (A4)	3	3	high	30	medium	28
COGO legal descriptions (B1)	3	3	medium	254	medium	227
Scan nondigital data (B6)	3	3	medium	305	low	277
Supervise interns (H10)	3	3	medium	112	medium	97
Determine project scope (F2)	3	3	low	173	medium	157
Determine resource requirements (F3)	2	4				
Join & relate data (A2)	2	3	high	436	medium	397
Establish data custodianships (A5)	2	3	medium	47	medium	45
Collect field data manually (B3)	2	3	medium	335	low	284
Acquire professional certification (H6)	2	2	medium	256	medium	225

Task ranking is by number of DACUM panels followed by aggregate number of related tasks.

Task categories are not mutually exclusive. Some categories also may be part of another more general category.

Source: National Geospatial Technology Center, 2010.

At the core of each job analysis was a panel of expert workers, all of whom were either working or had recently worked as GIS technicians or were the immediate supervisors of someone in this position. Approximately 32 percent of panelists were GIS technicians, 23 percent were GIS analysts, 13 percent were GIS specialists, 13 percent were GIS managers, and 8 percent were GIS coordinators. Overall, approximately 65 percent were male and 35 percent were female. More detailed information about these DACUM panels is available on Supplemental Table 3 for this paper at the GeoTech Center Resource Repository (NGTC 2010b).

IDENTIFYING DACUM JOB ANALYSES FOR GIS TECHNICIANS

This meta-analytical process began with a literature search to locate all previously completed DACUM Research Charts for GIS technicians. A total of six were identified that met the minimum requirements for a DACUM job analysis. This means they were conducted by a trained DACUM facilitator over a period of one to three days using a panel of at least five expert workers. As indicated in Figure 1, these were located in Portland, Maine (1996), Aberdeen, Washington (1997), Waco, Texas (2002), Cedar Rapids, Iowa (2002), San Diego, California (2005), and Auburn, WA (2007). Those in Cedar Rapids and San Diego were conducted over two days, while the others were completed in only one day. Results from the San Diego job analysis also were validated by a survey of local GIS professionals.

To improve the reliability of these findings, two additional two-day DACUM job analyses were conducted in areas not previously studied. Using partner colleges within the National Geotech Center, these additional analyses were held at Lake Land College in rural Mattoon, Illinois, and Gainesville State College in urban Atlanta, Georgia. They increased both the regional and professional diversity of this meta-analysis. Their results also were validated by surveys of local GIS professionals.

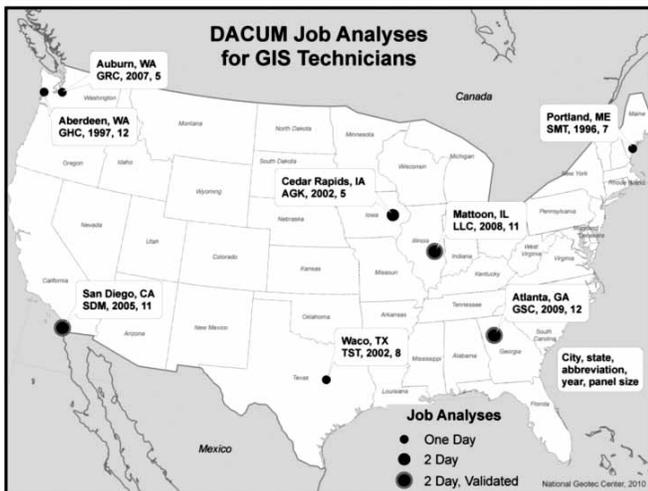


Figure 1. DACUM job analyses for GIS technicians

CREATING TASK CATEGORIES

Information from these eight DACUM job analyses for GIS technicians was collected, entered into a database, and then organized into a common set of tasks, knowledge, skill, and behavior classes. The contents of each class then were organized into categories by topic and, for validation purposes, were shared with GISCI's Core Competency Working Group for its final review and input.

Each of the final 55 task categories listed in Table 1 aggregates between two and 34 tasks included in one or more of the eight DACUM research charts used in this analysis. A detailed listing of all the 476 job tasks aggregated into these 55 task categories is available in Supplemental Table 5 for this paper at the GeoTech Center Resource Repository (NGTC 2010b). Because this table contains a complete listing of all original task statements, it should be relied on to obtain a clear understanding of the meaning and content of each task category.

Consistent with standard DACUM procedures, in which job "tasks" are considered components of job "duties," the task categories identified in this meta-analysis were then generalized into duty categories. These were derived from the original duty classifications listed in Supplemental Table 5 for this paper at the GeoTech Center Resource Repository (NGTC 2010b). Accordingly, the following eight duty categories were identified in this meta-analysis:

Manage Data	Manage Software
Generate Data	Manage Projects
Process Data	Generate Products
Analyze Data	Professional Development

These may be considered the generic duties for which most GIS technicians in the United States are currently responsible. Each of these duty categories contains between five and ten task categories that are listed in Supplemental Table 4 for this paper at the GeoTech Center Resource Repository (NGTC 2010b).

CREATING KNOWLEDGE, SKILL, AND WORKER BEHAVIOR CATEGORIES

In addition to providing job tasks and duties, all eight DACUM panels also generated lists of knowledge, skills, and worker behaviors considered important for GIS technicians to properly perform their jobs. These normally are collected near the end of a DACUM workshop after all duties and job tasks have been properly identified and recorded.

As part of the meta-analytic process, these, too, were grouped into knowledge, skill, and behavior classes and then consolidated into subcategories within each group. This process resulted in 35 knowledge and skill categories containing a total of 230 individual values and 27 behavior categories representing 102 discrete values. A detailed listing of these knowledge and skills and behaviors organized by category is available in Supplemental Table 6 for this paper at the GeoTech Center

Table 2. Priority Knowledge, Skills, and Behaviors for GIS Technicians

Knowledge and Skill Categories	DACUM Panels	Aggregate Related Knowledge and Skills	Validation Survey	
			Median Importance	Responses
Communication: verbal/presentation/writing (2)	8	23	medium	753
Critical thinking/problem solving (10)	7	13	high	318
Organizational (24)	7	11	high	343
Mathematics (geometry, statistics) (23)	7	9	medium	391
Time management (32)	7	7	high	291
Cartography (1)	6	8	medium	416
Computer programming (7)	6	6	medium	280
Computer basics (3)	5	12	medium	311
Computer database (4)	5	12	medium	253
Land divisions, measurements (20)	5	11	medium	511
Photogrammetry/remote sensing (25)	5	8	medium	264
Computer software (8)	5	7	medium	331
Map reading (22)	5	5	high	228
Troubleshooting (33)	5	5	high	238
Industry applications (18)	4	11	medium	264
Data types, transfers & conversions (12)	4	8	high	628
Geography (15)	4	7		
Standards (client, customer, industry) (30)	4	7	medium	594
Coordinate systems, projections (9)	4	6	high	235
Computer keyboarding (5)	4	4	medium	237
Scale (28)	4	4	HIGH	237
Geoprocessing, modeling (16)	3	6	medium	512
Data models (11)	3	5	high	157
Jargon, acronyms (19)	3	4	medium	155
Research (27)	3	4	medium	155
Computer networks (6)	2	4	medium	52
Equipment operation (14)	2	4	medium	155
Engineering drawings (13)	2	3	medium	53
Spatial thinking (29)	2	3	high	156
Units of measure/conversion (34)	2	3	medium	392
GPS (17)	2	2		
Queries & analysis (26)	2	2	medium	224
Web development (35)	1	3		
Legal issues (21)	1	2	medium	136
Teaching (31)	1	1		

Table 2. Priority Knowledge, Continued

Behavior Categories		Aggregate Related Knowledge & Skills	Validation Survey (median) Importance	Responses
Detail-orientated (5)	8	10	high	371
Self-motivated/independent (24)	6	14	high	366
Team player (26)	6	11	high	50
Analytical (2)	6	7	high	366
Punctual/reliable (21)	5	5	high	81
Multitasking (13)	4	4	high	209
Follow procedures (10)	3	5		
Positive attitude (18)	3	4	high	155
Self-improvement (23)	3	4	high	52
Ethical/respectful (9)	3	3	high	236
Industrious, persistent (11)	3	3		
Dress code, etiquette, hygiene (7)	2	3	medium	76
Open-minded (15)	2	3		
Outgoing, friendly (16)	2	3	medium	81
Trustworthy, honesty, integrity (27)	2	3	medium	519
Visionary (28)	2	3		
Adaptable, flexible (1)	2	2	high	52
Common sense (3)	2	2	high	237
Professionalism, maturity (20)	2	2		
Resourceful (22)	2	2	high	285
Sense of humor (25)	2	2	high	548
Networking (interpersonal) (14)	1	2		
Creative (4)	1	1	high	157
Diplomatic (6)	1	1	high	157
Enthusiastic (8)	1	1	high	157
Leadership (12)	1	1		
Patient (17)	1	1		

Ranking is by number of DACUM panels followed by aggregate number of related knowledge, skills, and behaviors.

Categories are not mutually exclusive. Some knowledge, skill, and behavior categories also may be part of another more general category.

Source: National Geospatial Technology Center, 2010.

Resource Repository (NGTC 2010b).

These knowledge, skill, and behavior categories are listed in Table 2, where they have been sorted by the number of DACUM panels represented by each and the aggregate number of values they contain. For example, all eight panels noted GIS technicians should have strong “communication: verbal/presentation/writing” skills and also should be “detail-orientated.” Although some of these categories overlap because of the nature of the data collection and consolidation process, they are useful in describing the traits most valued by industry practitioners in this job.

Also in Table 2 is an indicator of the importance of these categories to the job performance of a GIS technician. This information came from the three job analyses that included post-workshop validation surveys. Values for individual knowledge, skills, and abilities were first weighted by the number of survey respondents and then combined within each category. Listed is the overall median importance value for each category along with the corresponding number of respondents. However, because this represents only a portion of the knowledge, skills and abilities included in this meta-analysis, not all values or categories have been rated.

LIMITATIONS OF THE DACUM JOB ANALYSIS

Limitations of the DACUM job analysis technique include the challenge inherent in getting a representative group of exemplary workers to spend one or more days serving on a DACUM panel. Once there, these participants also may have trouble describing their jobs correctly in terms of duties, tasks, knowledge, skills, and behaviors (Hartley 1999, 12). To minimize this, a significant amount of time often is spent on panel orientation at the beginning of a workshop. Ultimately, however, it is the responsibility of the DACUM facilitator to assist workers in correctly describing and assigning what they do to one or more of these classifications. This, of course, takes time, which is why a minimum of two days often is recommended for a comprehensive DACUM job analysis. Because half the analyses included in this study were conducted in only one day, it is likely that not all of them are complete and that certain tasks may not be described as fully or as accurately as they should be. The effect of this on the final results, however, should be minimal because of the aggregating effect of the meta-analytic process used.

CONCLUSION

This meta-analytic assessment of multiple DACUM job analyses for GIS technicians uses workforce practitioners to identify the principal task categories for this job along with related knowledge, skills, and abilities needed to properly perform them. It was developed by the National GeoTech Center with help from GISCI's Core Competency Working Group as a way to help to validate the job information for GIS/Geospatial Technician developed by the DOLETA as part of its new Geospatial Technology Competency Model.

The study was conducted using a meta-analytic approach for independently identifying and quantifying job tasks performed by GIS technicians. It builds on the underlying strength of the DACUM job analysis technique that uses expert workers to define and document their jobs. Accordingly, all task categories and related knowledge, skill, and behavior categories were independently identified by multiple panels of existing and former GIS technicians and ranked accordingly. The categories include both simple and complex groupings of tasks, knowledge, skills, and abilities considered by GIS technicians to be critical to the successful performance of their jobs. This information will help the National GeoTech Center develop workforce skills and competency resources to guide program development for undergraduate geospatial technology education programs. Following this study, the Center plans to conduct DACUM job analyses for other geospatial occupations, beginning with Remote-Sensing Technician. The meta-analytic assessment introduced here provides a means to consolidate multiple DACUM analyses in a way that preserves the DACUM method's strengths while redressing its potential pitfalls.

About the Author

John Johnson has an undergraduate degree in Geography and master's degrees in Urban and Regional Planning and Business Administration. With more than ten years of experience working as a GIS consultant and educator, he has helped to develop two community college GIS programs and has served on a number of related projects. He currently is working as a DACUM facilitator and curriculum specialist for the National Geospatial Technology Center.

Corresponding Address:
1614 Hawk View Drive
Encinitas, CA 92024
Phone: (760) 889-8606
john@gisws.com

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What GIS Technicians Do: A Synthesis of DACUM Job Analyses

Supplemental Tables

John Johnson, National GeoTech Center

October, 2010



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Table of Contents

Table 3: DACUM Job Analyses for GIS Technician; Panel Information	3
Table 4: Tasks Performed by GIS Technicians; Organized by Duty Categories.....	5
Table 5: Tasks Performed by GIS Technicians; Grouped into Duty & Task Categories.....	7
Table 6: GIS Technician Knowledge, Skills & Worker Behaviors Grouped into Knowledge, Skills & Worker Behavior Categories.....	24

Table 3
DACUM Job Analyses for GIS Technician
Panel Information

Gainesville State College (GSU), Atlanta, GA - January 16-17, 2009

Azar Khani	GIS Specialist III	Fulton County Government
Brannon Schnelle	GIS Analyst	Jordan, Jones & Goulding
Collin Horace	GIS Developer/Analyst	CH2MHILL
Donald I. M. Enderle	GIS Analyst	Photo Science Inc.
Dwight Lanier	GIS/Environmental Science Laboratory Coordinator	Gainesville State College
Eric McRae	Director	Information Technology Outreach Services
Lisa Jackson	Information Analyst III	Center for GIS, Georgia Institute of Technology
Lisbeth Ruiz-Nunez	Regional Resource Info. Coordinator	US Forest Service
Mark Lane	GIS Manager	Hall County Government
Melanie Tabb	GIS Administrator	Gwinnett County
Ron Pate	Registered Land Surveyor	n/a
Tripp Corbin	Vice President GIS	Keck & Wood, Inc.
John Johnson	DACUM Facilitator	GISWS, Encinitas, CA
Carol Kraemer	Recorder	Gainesville State College
Georgia URISA	Validation Survey - 179 Respondents	Web-based survey conducted in March, 2009
National Science Foundation	Sponsor (Advance Technology Education)	

Lake Land College (LLC), Mattoon, IL - November 19-20, 2008

Adam Pfister	GIS Analyst	Archer Daniels Midland Company
Brad McVay	GIS Specialist	Illinois Water Survey
Brooke Ferguson	former GIS Specialist	County Government
Curt Reynolds	GIS Specialist-Technical Manager III-GIS application de	Illinois Department of Transportation
Doug Ratermann	Land Surveyor	Henry, Meisenheimer & Gende, Inc.
Jay Donnelly	GIS Coordinator/Technician	Clinton County GIS Office
Jill Zerrusen	n/a	Effingham County Tax Assessors Office
Kevin McReynolds	GIS Technician	Coles County Regional Planning Commission
Molly & Dennis Godar	Agriculture Consultants	n/a
Roger Reed	Programming-GIS Technician	USDA-Effingham County
Travis Schackmann	CAD/GIS Technician	EJ Water Cooperative
John Johnson	DACUM Facilitator	GISWS, Encinitas, CA
Kay Hanley	Recorder	Lake Land College
Illinois GIS Association	Validation Survey - 89 Respondents	Web-based survey conducted in April, 2009
National Science Foundation	Sponsor (Advance Technology Education)	

Green River Community College (GRC), Auburn, WA - June 12, 2007

Ann Boyd	Lead GIS Analyst	City of Bellevue, WA
Beth Carpenter	Engineering Technician	City of Sammamish Public Works, WA
Blane Moore	GIS Analyst	PACE Engineers Inc., Kirkland, WA
Glenn Brooks	Geographic Information Officer	Northwest Response, Woodinville, WA
Jennifer Recco	Planning Technician	City of Puyallup, WA
Erik Tingelstad	DACUM Facilitator	Highline Community College
Nancy Warren	DACUM Facilitator	Highline Community College

San Diego Mesa College (SDM), San Diego, CA - January 13-14, 2005

Colleen Larsen	GIS/Mapping Specialist II	Engineering, Padre Dam Municipal Water District
David Hulten	GIS Technician	City of Encinitas
Dennis Larson	Senior GIS Technician	Technical Services, San Diego Association of Governments
Drew Dowling	GIS Analyst	SanGIS
Fred McCamic	GIS Analyst	Public Works, County of San Diego
Gina Durizzi	Principal Survey Aid/GIS Coordinator	Engineering Capital Projects, Field Division, City of San Diego
Jason McNeil	GIS Technician II	Information Services, City of Escondido
Lisa Canning	Senior Engineering Aide	Metropolitan Waste Water Division, City of San Diego
Melanie Casey	GIS Analyst	Planning and Land Use, County of San Diego
Nancy Ross	GIS Specialist	Management Information Services, City of Chula Vista
Sue Carnevale	Senior Regional Planner/GIS Analyst	Technical Services, San Diego Association of Governments
John Johnson	DACUM Facilitator	GISWS, Encinitas, CA
Sara Halstead	DACUM Co-facilitator	Employee Training Institute, San Diego, CA
San Diego Regional GIS Council	Validation Survey - 150 Respondents	Mail-in survey conducted April/May, 2005
National Science Foundation	Sponsor (Advance Technology Education)	

Table 3 (cont.)
DACUM Job Analyses for GIS Technician
Panel Information

Texas State Technical College (TST), Waco, TX - August 8, 2002

J. Scott Sires	n/a	Independent Contractor, Richardson, TX
Lisa M. Zygo	n/a	Baylor University, Waco, TX
Maxey Sheppard	n/a	Sheppard Surveying, Abilene, TX
Melinda Polley	n/a	Freese & Nichols, Inc., Grand Prairie, TX
Robert Leathers	n/a	McLennan County 911, Waco, TX
Ronald Carrol	n/a	Ronald Carrol Surveyors, Temple, TX
Van Walker	n/a	Brazos River Authority, Waco, TX
Wayne Tschirhart	n/a	Guadalupe-Blanco River Authority, Seguin, TX
Michael Jones	DACUM Facilitator	IDEAS Center, Waco, TX
Diana Sphar	DACUM Facilitator	IDEAS Center, Waco, TX

AgroKnowledge (AGK), Cedar Rapids, IA - GIS Technician/Analyst - January 14-15, 2002

Aaron Schultz	GPS/GIS Specialist/Analysis	Ecolotree, Inc., North Liberty, IA
Greg Evans	GIS Lab Assistant	Jackson State Community College, Jackson, TN
Michael J. Burke	Vice-President of Operations	Ag Spectrum Co. & The Consulting Company (TCC) Dewitt, IA
Michael Sutton	Lab Technician	SST Development Group, Stillwater, OK
Nicole Koppes	GIS Mapping Specialist	The Consulting Co., Dewitt, IA
Dr. Gaines Miles	DACUM Facilitator	Purdue University
Janie Thomas	Team Leader	
National Science Foundation	Sponsor (Advance Technology Education)	

Grays Harbor College (GHC), Aberdeen, WA - GIS Specialist - April 22, 1997

Andy Wilson	n/a	Rayonier, Inc
Angel Wallen	n/a	Grays Harbor College Central Services
David Condell	n/a	Washington Dept. of Fish & Wildlife
Doc Saul	n/a	Washington Dept. of Fish & Wildlife
Joan Perringe	n/a	Weyhauser Co.
Klas Taylor	n/a	North West Indian Fisheries Conservation
Kyle Bastrp	n/a	Grays Harbor College Central Services
Mark Scott	n/a	The Wellap Alliance
Michael Bishop	n/a	Pacific Co. Public Works Dept.
Mike Stevenson	n/a	Quinalult Dept. of Natural Resources
Robin Nelbac	n/a	Pacific Co. Public Works Dept.
Tlea Tichech	n/a	Grays Harbor Regional Planning Commission
Krista Madan	DACUM Facilitator	
Don Samuelson	Coordinator	
Fred Wood	Recorder	
National Science Foundation	Sponsor (Advance Technology Education)	

Southern Maine Technical College (SMT), Portland, ME - August 6, 1996

Barry Tibbetts	Assessor/GIS Administrator	Town of Kennebunk, Me
Bruce Hyman	n/a	Wilbur Smith Associates, Portland, ME
Doug Flewelling	n/a	University of ME, Orono, ME
Greg Charest	n/a	US EPA New England, Boston, MA
Joel Zimmerman	n/a	New England Water Pollution Control Com., Wilmington, MA
Larry Harwood	GIS Coordinator	ME State Office of GIS, State House Sta#125, Augusta, ME
R. Michael White	Manager, AM/FM/GIS Services	James W. Sewall Company, Old Town, ME
Susan McMaster	DACUM Facilitator & Recorder	McMaster Training Associates, Dalzell, SC
Mary Jane Curran	Assistant Facilitator	Cape Code Community College, West Barnstable, MA
Wes Winterbottom	Assistant Facilitator	Gateway Community Technical College, West Hartford, CT
Robert E. Moore	Assistant Facilitator	New Hampshire Technical College, Stratham, NH
National Science Foundation	Sponsor (Advance Technology Education)	

Source: National Geotech Center, 2010

Table 4
Tasks Performed by GIS Technicians
Organized by Duty Categories

Duty / Task Categories	DACUM Panels	Aggregate Related Tasks	Validation Survey (median)			
			Importance	#	Learning Difficulty	#
A MANAGE DATA						
A1 Define data requirements	5	9	medium	213	medium	194
A2 Join & relate data	2	3	high	436	medium	397
A3 Define feature behavior	3	4	medium	162	high	144
A4 Develop data maintenance schedule	3	3	high	30	medium	28
A5 Establish data custodianships	2	3	medium	47	medium	45
A6 Evaluate data	6	9	high	272	medium	252
A7 Evaluate data sources	6	6	high	318	medium	293
B GENERATE DATA						
B1 COGO legal descriptions	3	3	medium	254	medium	227
B2 Collect field data electronically	7	12	high	594	medium	534
B3 Collect field data manually	2	3	medium	335	low	284
B4 Digitize data	4	5	high	331	low	301
B5 Geocode data	4	5	high	380	medium	333
B6 Scan non-digital data	3	3	medium	305	low	277
C PROCESS DATA						
C1 Acquire data	7	20	medium	471	medium	426
C2 Organize data	6	15	medium	824	medium	734
C3 Validate data	7	14	high	571	medium	502
C4 Back-up/restore data	5	7	medium	351	low	311
C5 Import/Export data	6	12	medium	344	medium	303
C6 Create/update data	7	16	high	1,112	medium	1,018
C7 Create/update metadata	6	11	high	510	medium	448
C8 Georeference data	5	10	high	773	medium	703
C9 Convert data	7	8	high	356	medium	317
D ANALYZE DATA						
D1 Conduct geoprocessing	7	26	medium	1,298	medium	1,156
D2 Perform queries	4	6		<i>n/a</i>		
D3 Conduct network analysis	3	6	medium	740	medium	631
D4 Conduct image analysis	3	4	medium	29	high	28
D5 Conduct geostatistical analysis	5	6	medium	218	medium	196
E MANAGE SOFTWARE						
E1 Design/edit databases	4	9	high	45	high	44
E2 Develop software applications	4	13	medium	246	high	225
E3 Define software/hardware requirements	4	5	medium	30	medium	28
E4 Optimize database performance	3	5	medium	281	medium	240
E5 Maintain software	4	8	high	38	medium	36

Table 4 (cont.)
Tasks Performed by GIS Technicians
Organized by Duty Categories

Duty / Task Categories	DACUM Panels	Aggregate Related Tasks	Validation Survey (median)				
			Importance	#	Learning Difficulty	#	
F MANAGE PROJECTS							
F1	Coordinate project activities	5	14	high	62	high	60
F2	Determine project scope	3	3	low	173	medium	157
F3	Determine resource requirements	2	4		<i>n / a</i>		
F4	Develop/document procedures	8	13	medium	296	medium	265
F5	Prepare/assess cost estimates	3	7	medium	29	medium	29
F6	Develop project timeline/schedule	5	6	medium	173	medium	158
F7	Identify client needs/deliverables	3	7		<i>n / a</i>		
F8	Maintain equipment & supplies	6	15	medium	727	low	624
G GENERATE PRODUCTS							
G1	Design & create maps	8	34	medium	846	medium	785
G2	Create reports	7	9	medium	525	medium	482
G3	Create tables & charts	3	6	medium	210	medium	192
G4	Develop & make presentations	6	10	medium	434	medium	370
G5	Disseminate products	5	14	medium	306	medium	277
H PROFESSIONAL DEVELOPMENT							
H1	Communicate with others	5	10	high	321	low	290
H2	Participate in conferences / workshops	6	12	medium	691	low	628
H3	Provide training	6	11	medium	434	medium	396
H4	Develop user guides	3	5	medium	58	high	55
H5	Attend training	5	7	medium	484	low	437
H6	Acquire professional certification	2	2	medium	256	medium	225
H7	Promote / represent GIS	4	5	medium	151	medium	145
H8	Provide technical support	4	4	medium	129	medium	118
H9	Review job related information	5	6	medium	262	medium	238
H10	Supervise interns	3	3	medium	112	medium	97

Aggregate Related Tasks: Number of tasks from DACUM Panels.

DACUM Panels: Number of DACUM panels that identified tasks within this task category.

Validation Survey: Number of tasks that were subjected to a regional validation survey.

Validation Survey #: Number of validation survey respondents who ranked tasks in this category.

Source: National Geospatial Technology Center, 2010

Table 5
Tasks Performed by GIS Technician
Grouped into Duty & Task Categories

Duty Category / Task Category / Tasks	VALIDATION SURVEY										Actual Duty
	DACUM Panels		Importance: 1 low - 3 high				Learning Difficulty: 1 low - 3 high				
	Name	Size	Mean	Median	Mode	Responses	Mean	Median	Mode	Responses	
A MANAGE DATA											
A1 Define data requirements											
Determine data to be obtained	AGK	5									Define project parameters
Determine appropriate projections	GHC	12									GIS & Remote Sensing Analysis
Determine coverages to be managed	GHC	12									Database Design
Determine data needs / format	GHC	12									Data Acquisition & Development
Determine future uses for completed project data / processes	GHC	12									Project Management
Define data requirements (e.g. domains)	GSC	12	2.09	2.0	2.0	174	2.10	2.0	2.0	158	Gather Data
Define data requirements (C)	SDM	11	2.54	3.0	3.0	39	2.44	2.0	2.0	36	Create / Acquire GIS Data * (3)
Determine resource needs	TST	8									Manage Individual Assignments
Determine future uses for completed projects/databases	TST	8									Manage Individual Assignments
9 tasks	5 panels	48 members	2.17	2.0	2.0	213	2.16	2.0	2.0	194	
A2 Join & relate data											
Join tables (e.g. link, join, relate)	GSC	12	2.54	3.0	3.0	177	1.62	2.0	2.0	162	Manage Data
Perform spatial join	GSC	12	2.51	3.0	3.0	175	1.71	2.0	2.0	161	Manage Data
Join non-spatial data	LLC	12	2.32	2.0	2.0	84	1.62	2.0	2.0	74	Modify Data
3 tasks	2 panels	24 members	2.49	3.0	3.0	436	1.66	2.0	2.0	397	
A3 Define feature behavior											
Create topology for related features (64%) (Adv.)	LLC	12	2.11	2.0	2.0	85	2.32	2.0	2.0	71	Modify Data
Define feature behaviors (e.g. sub-types & domains) (C)	SDM	11	2.25	2.0	2.0	36	2.65	3.0	3.0	34	Create / Acquire GIS Data * (3)
Define feature relationships/behaviors (relate tables, relationship classes)	SDM	11	2.63	3.0	3.0	41	2.67	3.0	3.0	39	Create / Acquire GIS Data * (3)
Build topology.	SMT	11									GIS Techniques
4 tasks	3 panels	34 members	2.27	2.0	2.0	162	2.49	3.0	3.0	144	
A4 Develop data maintenance schedule											
Develop a data maintenance schedule	GHC	12									Maintain & Update Data
Develop data maintenance schedules	SDM	11	2.33	3.0	3.0	30	2.32	2.0	2.0	28	Maintain GIS Data* (1)
Conform to data maintenance schedule	TST	8									Update & Manipulate Data
3 tasks	3 panels	31 members	2.33	3.0	3.0	30	2.32	2.0	2.0	28	
A5 Establish data custodianships											
Establish the data custodianships	GHC	12									Maintain & Update Data
Assign data/database permissions	SDM	11	2.27	2.0	3.0	22	2.23	2.0	2.0	22	Manage GIS Data
Establish data custodianship (C)	SDM	11	2.32	2.0	3.0	25	2.26	2.0	2.0	23	Manage GIS Data
3 tasks	2 panels	23 members	2.30	2.0	3.0	47	2.25	2.0	2.0	45	

Table 5
Tasks Performed by GIS Technician
Grouped into Duty & Task Categories

Duty Category / Task Category / Tasks	VALIDATION SURVEY											Actual Duty
	DACUM Panels		Importance: 1 low - 3 high				Learning Difficulty: 1 low - 3 high					
	Name	Size	Mean	Median	Mode	Responses	Mean	Median	Mode	Responses		
A6 Evaluate data												
Choose data for analysis	AGK	5										Analyze Processed Data
Verify accuracy of imported data	GHC	12										Information Sharing Data Exchange
Verify content and spatial accuracies	GHC	12										Data Acquisition & Development
Evaluate spatial data accuracy	GSC	12	2.49	3.0	3.0	177	2.11	2.0	2.0	157		Process Data
Determine data compatibility (e.g. projections) (E,C)	SDM	11	2.73	3.0	3.0	48	2.47	2.0	2.0	47		Create / Acquire GIS Data * (3)
QA/QC data (E,C) (Create/Acquire GIS Data)	SDM	11	2.87	3.0	3.0	47	2.52	3.0	3.0	48		Create / Acquire GIS Data * (3)
Evaluate data in context of application.	SMT	11										Principles of Geography
Evaluate data quality.	SMT	11										GIS Techniques
Handle data types appropriately	TST	8										Update & Manipulate Data
9 tasks	6 panels	59 members	2.60	3.0	3.0	272	2.26	2.0	2.0	252		
A7 Evaluate data sources												
Evaluate sources	GHC	12										Data Acquisition & Development
Research Data Sources	GRC	5										Create/Maintain Geographic Data Sets
Identify data sources/resources	GSC	12	2.50	3.0	3.0	177	1.88	2.0	2.0	161		Gather Data
Research existing geospatial data	LLC	12	2.31	2.0	2.0	87	1.70	2.0	2.0	79		Collect / Create Data
Research available data (C)	SDM	11	2.67	3.0	3.0	54	2.02	2.0	2.0	53		Create / Acquire GIS Data * (3)
Evaluate data sources	TST	8										Acquire & Develop Data
6 tasks	6 panels	60 members	2.48	3.0	3.0	318	1.86	2.0	2.0	293		
B GENERATE DATA												
B1 COGO legal descriptions												
Digitize data using COGO (e.g. metes & bounds)	GSC	12	2.31	2.0	3.0	164	2.01	2.0	2.0	141		Process Data
COGO (55%)	LLC	12	2.05	2.0	2.0	63	2.24	2.0	2.0	58		Collect / Create Data
COGO legal descriptions (E)	SDM	11	1.96	2.0	1.0	27	2.18	2.0	2.0	28		Create / Acquire GIS Data * (3)
3 tasks	3 panels	35 members	2.21	2.0	3.0	254	2.09	2.0	2.0	227		
B2 Collect field data electronically												
Capture spatial & attribute data	GHC	12										Data Acquisition & Development
Coordinate geodetic control prior to mapping	GHC	12										Data Acquisition & Development
Perform Data Entry (e.g. college GPSdata, collect field data)	GRC	5										Create/Maintain Geographic Data Sets
Collect data using GPS	GSC	12	2.49	3.0	3.0	174	1.66	2.0	2.0	160		Gather Data
Post process GPS data (e.g. differential correction)	GSC	12	2.46	3.0	3.0	173	2.01	2.0	2.0	155		Process Data
Post-process electronically collected field data (73%) (Adv.)	LLC	12	2.25	2.0	2.0	85	1.96	2.0	2.0	75		Modify Data
Electronically collect field spatial data (GPS, Traffic counters, total station, yield monitors)	LLC	12	2.41	3.0	3.0	85	1.85	2.0	2.0	71		Collect / Create Data
Collect field attribute data (E,C)	SDM	11	2.54	3.0	3.0	39	2.00	2.0	2.0	40		Create / Acquire GIS Data * (3)
Collect field location data via GPS (E,C)	SDM	11	2.50	3.0	3.0	38	2.15	2.0	2.0	33		Create / Acquire GIS Data * (3)
Assess current technologies used in data collection.	SMT	11										Data Collection Skills

Table 5
Tasks Performed by GIS Technician
Grouped into Duty & Task Categories

Duty Category / Task Category / Tasks	VALIDATION SURVEY											Actual Duty
	DACUM Panels		Importance: 1 low - 3 high				Learning Difficulty: 1 low - 3 high					
	Name	Size	Mean	Median	Mode	Responses	Mean	Median	Mode	Responses		
Capture spatial and non-spatial data	TST	8									Acquire & Develop Data	
Participate in geodetic control	TST	8									Acquire & Develop Data	
12 tasks	7 panels	71 members	2.44	3.0	3.0	594	1.88	2.0	2.0	534		
B3 Collect field data manually												
Collect data using field sheets	GSC	12	2.31	2.0	2.0	169	1.47	1.0	1.0	148	Gather Data	
Manually collect attribute data in the field (82%)	LLC	12	2.27	2.0	3.0	89	1.61	2.0	2.0	74	Collect / Create Data	
Administer questionnaires (27%)	LLC	12	1.35	1.0	1.0	77	1.47	1.0	1.0	62	Collect / Create Data	
3 tasks	2 panels	24 members	2.08	2.0	2.0	335	1.51	1.0	1.0	284		
B4 Digitize data												
Perform Data Entry (e.g. digitize geographic features, create Auto-Cad)	GRC	5									Create/Maintain Geographic Data Sets	
"Heads-up" digitize data	GSC	12	2.46	3.0	3.0	169	1.56	1.0	1.0	154	Process Data	
Digitize feature geometry	LLC	12	2.52	3.0	3.0	88	1.62	2.0	2.0	78	Collect / Create Data	
Perform tablet digitization (E,C)	SDM	11	1.93	2.0	2.0	30	1.92	2.0	2.0	26	Create / Acquire GIS Data * (3)	
Perform "heads-up" (on-screen) digitization (E,C)	SDM	11	2.64	3.0	3.0	44	2.02	2.0	2.0	43	Create / Acquire GIS Data * (3)	
5 tasks	4 panels	40 members	2.45	3.0	3.0	331	1.67	1.0	1.0	301		
B5 Geocode data												
Perform Geo-coding	GRC	5									Create/Maintain Geographic Data Sets	
Geocode addresses	GSC	12	2.48	3.0	3.0	176	1.84	2.0	2.0	160	Process Data	
Geocode (Adv)	LLC	12	2.27	2.0	2.0	83	1.92	2.0	2.0	71	Collect / Create Data	
Reverse geocode (82%) (Adv)	LLC	12	1.91	2.0	2.0	78	2.10	2.0	2.0	61	Collect / Create Data	
Geocode data (E, C)	SDM	11	2.44	3.0	3.0	43	2.22	2.0	2.0	41	Create / Acquire GIS Data * (3)	
5 tasks	4 panels	40 members	2.31	3.0	3.0	380	1.95	2.0	2.0	333		
B6 Scan non-digital data												
Scan hard copy maps	GSC	12	2.22	2.0	2.0	175	1.26	1.0	1.0	160	Gather Data	
Scan non-digital data (91%)	LLC	12	2.07	2.0	2.0	87	1.36	1.0	1.0	75	Collect / Create Data	
Scan hard copy images (E, C)	SDM	11	2.05	2.0	2.0	43	1.69	2.0	2.0	42	Create Image Data	
3 tasks	3 panels	35 members	2.15	2.0	2.0	305	1.35	1.0	1.0	277		
C PROCESS DATA												
C1 Acquire data												
Obtain agronomic data (e.g. soil test, yield)	AGK	5									Initiate GIS Projects	
Obtain area of interest boundary data	AGK	5									Initiate GIS Projects	
Obtain base map data (e.g. roads, streams, political boundaries, cities)	AGK	5									Initiate GIS Projects	
Obtain climate data (e.g. precipitation, wind, temperature)	AGK	5									Initiate GIS Projects	
Obtain imagery data (e.g. satellite, aerial)	AGK	5									Initiate GIS Projects	
Obtain land use data	AGK	5									Initiate GIS Projects	

Table 5
Tasks Performed by GIS Technician
Grouped into Duty & Task Categories

Duty Category / Task Category / Tasks	DACUM Panels		VALIDATION SURVEY								Actual Duty
	Name	Size	Importance: 1 low - 3 high				Learning Difficulty: 1 low - 3 high				
			Mean	Median	Mode	Responses	Mean	Median	Mode	Responses	
Obtain terrain feature data (e.g. soil type, topography)	AGK	5									Initiate GIS Projects
Coordinate data collection	AGK	5									Define project parameters
Gather data for updates	GHC	12									Maintain & Update Data
Adhere to policies for sharing and receiving data	GHC	12									Information Sharing Data Exchange
Contact data originator for acquisition	GHC	12									Data Acquisition & Development
Acquire Data	GRC	5									Create/Maintain Geographic Data Sets
Acquire existing data (e.g. digital, hard copy)	GSC	12	2.61	3.0	3.0	177	1.72	2.0	2.0	161	Gather Data
Define data collection methods (e.g. GPS, air photo)	GSC	12	2.24	2.0	2.0	177	1.91	2.0	2.0	160	Gather Data
Acquire existing geospatial data	LLC	12	2.43	2.0	3.0	89	1.64	2.0	2.0	78	Collect / Create Data
Purchase new data	SDM	11	1.96	2.0	2.0	28	1.89	2.0	2.0	27	Create / Acquire GIS Data * (3)
Acquire data from originator	TST	8									Acquire & Develop Data
Adhere to P&P for sharing and receiving data	TST	8									Exchange & Share Data
Gather data for updates	TST	8									Update & Manipulate Data
Assist in determining data needs/format	TST	8									Acquire & Develop Data
20 tasks	7 panels	65 members	2.40	2.0	3.0	471	1.79	2.0	2.0	426	
C2 Organize data											
Create directory structure	AGK	5									Initiate GIS Projects
Create naming conventions	AGK	5									Initiate GIS Projects
Normalize data structure (e.g. schema)	GSC	12	2.04	2.0	2.0	171	2.21	2.0	2.0	149	Process Data
Organize digital data (e.g. data library)	GSC	12	2.36	2.0	2.0	174	1.78	2.0	2.0	160	Manage Data
Organize non-digital data	GSC	12	2.15	2.0	2.0	175	1.61	2.0	1.0	161	Manage Data
Categorize data	LLC	12	2.16	2.0	2.0	83	1.61	2.0	2.0	71	Modify Data
Establish file structure (Adv.)	LLC	12	2.04	2.0	2.0	85	1.89	2.0	2.0	73	Maintain Data
Organize files according to Company procedures	LLC	12	2.27	2.0	2.0	88	1.56	2.0	1.0	71	Perform Administrative Responsibilities
Organize file structure (e.g. create directories, perform data & directory housekeeping (C))	SDM	11	2.69	3.0	3.0	48	2.10	2.0	2.0	49	Manage GIS Data
Organize work tasks.	SMT	11									Organizational Skills
Organize written information (i.e., reports, resumes).	SMT	11									Organizational Skills
Make decisions to organize work priorities in light of unexpected contingencies.	SMT	11									Organizational Skills
Organize files.	SMT	11									Organizational Skills
Assist other team members in organizing their work.	SMT	11									Organizational Skills
Perform file management	TST	8									Monitor Hardware/Software Environment
15 tasks	6 panels	59 members	2.20	2.0	2.0	824	1.82	2.0	2.0	734	
C3 Validate data											
Finalize data sets	AGK	5									Analyze Processed Data
Validate agronomic data	AGK	5									Process Spatial Data
Validate boundary data	AGK	5									Process Spatial Data
Determine data consistencies	GHC	12									Database Design

Table 5
Tasks Performed by GIS Technician
Grouped into Duty & Task Categories

Duty Category / Task Category / Tasks	DACUM Panels		VALIDATION SURVEY								Actual Duty	
	Name	Size	Importance: 1 low - 3 high				Learning Difficulty: 1 low - 3 high					
			Mean	Median	Mode	Responses	Mean	Median	Mode	Responses		
Verify that updates are error free	GHC	12										Maintain & Update Data
Ensure Data Quality (Quality Control, Quality Assurance)	GRC	5										Manage Geographic Data Sets
Conduct Ground Truthing	GRC	5										Manage Geographic Data Sets
Validate spatial data (e.g. topology, build, verification)	GSC	12	2.45	3.0	3.0	172	1.97	2.0	2.0	155		Process Data
Validate tabular data	GSC	12	2.47	3.0	3.0	173	1.84	2.0	2.0	154		Process Data
Quality Assurance / Quality Control (Adv.) (Maintain data)	LLC	12	2.43	3.0	3.0	89	2.20	2.0	2.0	75		Maintain Data
Validate data changes (multi-editor environ.) (91%) (Adv.)	LLC	12	2.01	2.0	2.0	84	2.25	2.0	2.0	69		Maintain Data
QA/QC data (E,C) (Maintain GIS Data)	SDM	11	2.83	3.0	3.0	53	2.39	2.0	2.0	49		Maintain GIS Data* (1)
Verify content and spatial accuracies	TST	8										Acquire & Develop Data
Verify accuracy of imported data	TST	8										Exchange & Share Data
14 tasks	7 panels	65 members	2.42	3.0	3.0	571	2.04	2.0	2.0	502		
C4 Back-up/restore data												
Back-up finished project files	AGK	5										Create Usable Products
Back-up raw data	AGK	5										Initiate GIS Projects
Archive data	GSC	12	2.28	2.0	2.0	177	1.54	1.0	1.0	158		Manage Data
Back-up Data	LLC	12	2.12	2.0	2.0	89	1.54	1.0	1.0	69		Maintain Data
Archive / retrieve data (E,C)	SDM	11	2.42	2.0	3.0	48	1.96	2.0	2.0	48		Manage GIS Data
Backup / restore data (E,C)	SDM	11	2.41	2.0	3.0	37	1.97	2.0	2.0	36		Manage GIS Data
Implement database backup procedures	TST	8										Monitor Hardware/Software Environment
7 tasks	5 panels	48 members	2.27	2.0	2.0	351	1.65	1.0	1.0	311		
C5 Import/Export data												
Import obtained data	AGK	5										Process Spatial Data
Export application recommendation files	AGK	5										Create Usable Products
Export data in transferable format	GHC	12										Information Sharing Data Exchange
Import data into existing GIS	GHC	12										Information Sharing Data Exchange
Integrate data from various sources into consistent format	GHC	12										Data Acquisition & Development
Communicate with other database	GHC	12										Database Design
Connect to external data sources (e.g. odbc, GIS servers)	GSC	12	2.43	2.0	3.0	176	1.75	2.0	2.0	158		Gather Data
Export data structures	LLC	12	2.04	2.0	2.0	83	1.68	2.0	2.0	74		Disseminate Data
Import CAD files (82%)	LLC	12	2.14	2.0	2.0	85	1.62	2.0	2.0	71		Modify Data
Bulk load data and transfer formats.	SMT	11										GIS Techniques
Import data into appropriate formats	TST	8										Exchange & Share Data
Export data in transferable format	TST	8										Exchange & Share Data
12 tasks	6 panels	60 members	2.26	2.0	3.0	344	1.70	2.0	2.0	303		

Table 5
Tasks Performed by GIS Technician
Grouped into Duty & Task Categories

Duty Category / Task Category / Tasks	VALIDATION SURVEY											Actual Duty
	DACUM Panels		Importance: 1 low - 3 high				Learning Difficulty: 1 low - 3 high					
	Name	Size	Mean	Median	Mode	Responses	Mean	Median	Mode	Responses		
C6 Create/update data												
Match location points with attributes	AGK	5										Process Spatial Data
Perform spatial and content updates	GHC	12										Maintain & Update Data
Update Existing Data	GRC	5										Create/Maintain Geographic Data Sets
Edit attribute data	GSC	12	2.78	3.0	3.0	176	1.41	1.0	1.0	161		Process Data
Edit spatial data	GSC	12	2.76	3.0	3.0	174	1.58	2.0	1.0	160		Process Data
Post / reconcile edits (e.g. changes)	GSC	12	2.47	3.0	3.0	174	1.72	2.0	2.0	159		Manage Data
Create features	LLC	12	2.74	3.0	3.0	87	1.53	1.0	1.0	80		Collect / Create Data
Edit feature geometry	LLC	12	2.64	3.0	3.0	87	1.81	2.0	2.0	77		Modify Data
Enter data base information	LLC	12	2.58	3.0	3.0	88	1.33	1.0	1.0	79		Collect / Create Data
Update non-spatial data attributes	LLC	12	2.50	3.0	3.0	82	1.45	1.0	1.0	78		Modify Data
Update spatial data attributes	LLC	12	2.59	3.0	3.0	86	1.43	1.0	1.0	77		Modify Data
Edit GIS data(e.g. add, delete, update) (E,C)	SDM	11	2.91	3.0	3.0	54	2.27	2.0	2.0	51		Maintain GIS Data* (1)
Populate GIS feature attributes (E,C)	SDM	11	2.71	3.0	3.0	55	2.02	2.0	2.0	48		Create / Acquire GIS Data * (3)
Refresh/ replace layers (e.g. imagery, thematic layers) (C)	SDM	11	2.49	2.0	2.0	49	2.10	2.0	2.0	48		Maintain GIS Data* (1)
Create subset data	TST	8										Update & Manipulate Data
Perform spatial and content updates	TST	8										Update & Manipulate Data
16 tasks	7 panels	65 members	2.65	3.0	3.0	1,112	1.63	2.0	1.0	1,018		
C7 Create/update metadata												
Create metadata	GHC	12										Data Acquisition & Development
Document spatial and content changes	GHC	12										Document Data
Create and Update Meta Data	GRC	5										Create Technical Documentation
Create / update metadata	GSC	12	2.44	3.0	3.0	176	1.69	2.0	2.0	160		Manage Data
Create metadata	LLC	12	2.22	2.0	2.0	85	1.85	2.0	2.0	71		Collect / Create Data
Update Metadata	LLC	12	2.11	2.0	2.0	85	1.68	2.0	2.0	72		Maintain Data
Publish metadata	LLC	12	1.85	2.0	2.0	82	1.73	2.0	2.0	66		Disseminate Data
Create metadata (E,C)	SDM	11	2.59	3.0	3.0	44	2.09	2.0	2.0	44		Create / Acquire GIS Data * (3)
Update metadata (E,C)	SDM	11	2.50	3.0	3.0	38	1.89	2.0	2.0	35		Maintain GIS Data* (1)
Create and maintain metadata	TST	8										Document Data & Procedures
Initiate metadata process	TST	8										Acquire & Develop Data
11 tasks	6 panels	60 members	2.27	3.0	3.0	510	1.77	2.0	2.0	448		
C8 Georeference data												
Georeference imagery	GHC	12										GIS & Remote Sensing Analysis
Change data's spatial reference	GSC	12	2.55	3.0	3.0	175	1.83	2.0	2.0	161		Process Data
Define data's spatial reference	GSC	12	2.61	3.0	3.0	176	1.83	2.0	2.0	158		Process Data
Georeference data	GSC	12	2.54	3.0	3.0	177	1.88	2.0	2.0	161		Process Data
Transform spatial data (e.g. reprojections)	LLC	12	2.29	2.0	2.0	84	2.03	2.0	2.0	75		Modify Data

Table 5
Tasks Performed by GIS Technician
Grouped into Duty & Task Categories

Duty Category / Task Category / Tasks	VALIDATION SURVEY											Actual Duty
	DACUM Panels		Importance: 1 low - 3 high				Learning Difficulty: 1 low - 3 high					
	Name	Size	Mean	Median	Mode	Responses	Mean	Median	Mode	Responses		
Rectify raster data (e.g. rubbersheeting)	LLC	12	2.20	2.0	2.0	80	2.09	2.0	2.0	69	Modify Data	
Georeference digital imagery (C)	SDM	11	2.29	2.0	2.0	42	2.59	3.0	3.0	41	Create Image Data	
Rectify images (C)	SDM	11	2.36	3.0	3.0	39	2.66	3.0	3.0	38	Create Image Data	
Apply appropriate projections	TST	8									Update & Manipulate Data	
Georeference data	TST	8									Update & Manipulate Data	
10 tasks	5 panels	55 members	2.47	3.0	3.0	773	1.98	2.0	2.0	703		
C9 Convert data												
Convert raw data into format of choice	AGK	5									Process Spatial Data	
Conversion of digital formats - data abstraction (cut, simplify, stretch & fit)	GHC	12									Data Acquisition & Development	
Convert Data Source (e.g. Auto-CAD)	GRC	5									Create/Maintain Geographic Data Sets	
Perform data conversions	GSC	12	2.48	3.0	3.0	176	1.99	2.0	2.0	161	Process Data	
Convert data between formats (e.g. KML, XML, RSS) (Adv.)	LLC	12	1.93	2.0	2.0	80	1.95	2.0	2.0	63	Modify Data	
Convert between data formats (C)	SDM	11	2.57	3.0	3.0	47	2.31	2.0	2.0	45	Maintain GIS Data* (1)	
Perform data conversions (between formats) (E, C)	SDM	11	2.72	3.0	3.0	53	2.31	2.0	2.0	48	Create / Acquire GIS Data * (3)	
Convert data into consistent formats	TST	8									Acquire & Develop Data	
8 tasks	7 panels	65 members	2.40	3.0	3.0	356	2.08	2.0	2.0	317		
D ANALYZE DATA												
D1 Conduct geoprocessing												
Calculate defined yield	AGK	5									Process Spatial Data	
Combine data layers	AGK	5									Analyze Processed Data	
Compare data layers	AGK	5									Analyze Processed Data	
Create recommendation equations	AGK	5									Process Spatial Data	
Interpolate defined yield	AGK	5									Process Spatial Data	
Interpolate point data	AGK	5									Process Spatial Data	
Observe data anomalies	AGK	5									Analyze Processed Data	
Report data anomalies	AGK	5									Analyze Processed Data	
Perform buffer analysis	GHC	12									GIS & Remote Sensing Analysis	
Perform vector/raster overlay analysis	GHC	12									GIS & Remote Sensing Analysis	
Automate Manual Processes (e.g. scripting, modal building)	GRC	5									Create/Maintain/Manage Geographic Data	
Conduct slope analysis	GSC	12	1.80	2.0	2.0	168	2.21	2.0	2.0	145	Analyze Data	
Derive new data (e.g. generate contours from DEM, data generalization)	GSC	12	2.20	2.0	2.0	170	2.24	2.0	2.0	155	Process Data	
Identify service area	GSC	12	2.09	2.0	2.0	175	1.88	2.0	2.0	155	Analyze Data	
Perform proximity analysis	GSC	12	2.05	2.0	2.0	171	1.97	2.0	2.0	153	Analyze Data	
Perform site selection	GSC	12	1.91	2.0	2.0	172	2.10	2.0	2.0	150	Analyze Data	
Perform view shed analysis	GSC	12	1.79	2.0	2.0	157	2.31	2.0	2.0	127	Analyze Data	
Geoprocess data (e.g. clip, buffer, union)	LLC	12	2.52	3.0	3.0	87	1.74	2.0	2.0	77	Modify Data	
Conduct Geoprocessing (e.g. clip, buffering, overlay, run models) (C)	SDM	11	2.81	3.0	3.0	52	2.35	2.0	2.0	51	Spatial/Non-Spatial Analysis (Vector/Raster)	
Create Models (e.g. process & scientific models, flow charts) (C)	SDM	11	2.21	2.0	2.0	29	2.85	3.0	3.0	27	Spatial/Non-Spatial Analysis (Vector/Raster)	

Table 5
Tasks Performed by GIS Technician
Grouped into Duty & Task Categories

Duty Category / Task Category / Tasks	VALIDATION SURVEY										Actual Duty
	DACUM Panels		Importance: 1 low - 3 high				Learning Difficulty: 1 low - 3 high				
	Name	Size	Mean	Median	Mode	Responses	Mean	Median	Mode	Responses	
Interpret Results (C)	SDM	11	2.69	3.0	3.0	39	2.76	3.0	3.0	38	Spatial/Non-Spatial Analysis (Vector/Raster)
Pre-process Data (e.g. generalize, subset) (C)	SDM	11	2.41	2.0	2.0	34	2.29	2.0	2.0	35	Spatial/Non-Spatial Analysis (Vector/Raster)
QA/QC Data (C) (Spatial/Non-Spatial Analysis)	SDM	11	2.80	3.0	3.0	44	2.42	2.0	2.0	43	Spatial/Non-Spatial Analysis (Vector/Raster)
Assess output to determine if output is good.	SMT	11									Computer Skills
Interpret topography (i.e., contour lines).	SMT	11									Principles of Geography
Perform overlay analysis.	SMT	11									GIS Techniques
26 tasks	7 panels	68 members	2.11	2.0	2.0	1,298	2.15	2.0	2.0	1,156	
D2 Perform queries											
Perform spatial database queries	GHC	12									GIS & Remote Sensing Analysis
Create Database Queries	GRC	5									Manage Geographic Data Sets
Respond to Geographic Queries	GRC	5									Conduct Data Analysis
Run Database Queries and Calculations	GRC	5									Conduct Data Analysis
Perform data queries.	SMT	11									Data Model/Data Base Skills
Perform basic spatial queries	TST	8									Update & Manipulate Data
6 tasks	4 panels	36 members									
D3 Conduct network analysis											
Perform network analysis (dynamic segmentation)	GHC	12									GIS & Remote Sensing Analysis
Identify least-cost path	GSC	12	1.78	2.0	1.0	172	2.18	2.0	2.0	148	Analyze Data
Identify shortest route	GSC	12	2.06	2.0	2.0	175	1.90	2.0	2.0	154	Analyze Data
Linear reference data	GSC	12	2.23	2.0	2.0	164	2.03	2.0	2.0	136	Process Data
Model linear networks	GSC	12	1.72	2.0	2.0	163	2.48	3.0	3.0	142	Analyze Data
Perform dynamic segmentation (18%) (Adv.)	LLC	12	1.73	2.0	1.0	66	2.31	2.0	2.0	51	Collect / Create Data
6 tasks	3 panels	36 members	1.93	2.0	2.0	740	2.16	2.0	2.0	631	
D4 Conduct image analysis											
Classify remote sensing data	GHC	12									GIS & Remote Sensing Analysis
Develop orthophotography	GHC	12									GIS & Remote Sensing Analysis
Interpret Imagery	GRC	5									Conduct Data Analysis
Perform image analysis (e.g. classification) (C)	SDM	11	1.90	2.0	1.0	29	2.68	3.0	3.0	28	Create Image Data
4 tasks	3 panels	28 members	1.90	2.0	1.0	29	2.68	3.0	3.0	28	
D5 Conduct geostatistical analysis											
Analyze data statistically	AGK	5									Analyze Processed Data
Perform statistical analysis	GHC	12									GIS & Remote Sensing Analysis
Generate statistical reports	GSC	12	1.97	2.0	2.0	175	2.10	2.0	2.0	155	Analyze Data
Generate statistics (e.g. descriptive, spatial) (C)	SDM	11	2.42	2.0	2.0	43	2.59	3.0	3.0	41	Spatial/Non-Spatial Analysis (Vector/Raster)

Table 5
Tasks Performed by GIS Technician
Grouped into Duty & Task Categories

Duty Category / Task Category / Tasks	VALIDATION SURVEY											Actual Duty
	DACUM Panels		Importance: 1 low - 3 high				Learning Difficulty: 1 low - 3 high					
	Name	Size	Mean	Median	Mode	Responses	Mean	Median	Mode	Responses		
Apply principles of computational geometry.	SMT	11										GIS Techniques
Use random sampling techniques.	SMT	11										Quality Control
6 tasks	5 panels	51 members	2.06	2.0	2.0	218	2.20	2.0	2.0	196		
E MANAGE SOFTWARE												
E1 Design/edit databases												
Create data dictionary	GHC	12										Database Design
Define database fields	GHC	12										Database Design
Define database tables	GHC	12										Database Design
Determine key fields	GHC	12										Database Design
Design Database Structure	GRC	5										Create/Maintain/Manage Geographic Data
Create Database Tables	GRC	5										Manage Geographic Data Sets
Maintain Data Dictionaries	GRC	5										Create Technical Documentation
Develop databases (e.g. define geometry & attributes)(C)	SDM	11	2.67	3.0	3.0	45	2.70	3.0	3.0	44		Create / Acquire GIS Data * (3)
Construct a data base	SMT	11										Data Model/Data Base Skills
9 tasks	4 panels	39 members	2.67	3.0	3.0	45	2.70	3.0	3.0	44		
E2 Develop software applications												
Test application performance	GHC	12										Application Development
Design application	GHC	12										Application Development
Determine programming tools required to develop applications	GHC	12										Application Development
Develop application to simplify and/or standardize procedures	GHC	12										Application Development
Exercise quality control (Application Dev't)	GHC	12										Application Development
Automate Manual Processes	GRC	5										Conduct Data Analysis
Automate repetitive tasks (Adv.)	LLC	12	2.13	2.0	2.0	83	2.28	2.0	2.0	72		Maintain Professional Development
Create scripts (C)	SDM	11	2.31	2.0	3.0	29	2.79	3.0	3.0	28		Spatial/Non-Spatial Analysis (Vector/Raster)
Determine application design format (e.g. platform, language)	SDM	11	2.04	2.0	2.0	23	2.67	3.0	3.0	21		Develop Software Applications
Develop software applications	SDM	11	1.95	2.0	1.0	20	2.67	3.0	3.0	21		Develop Software Applications
QA/QC software applications (e.g. beta test) (C)	SDM	11	2.03	2.0	2.0	32	2.53	3.0	3.0	32		Develop Software Applications
Enhance existing custom applications	SDM	11	1.96	2.0	2.0	24	2.76	3.0	3.0	25		Develop Software Applications
Customize commercial software (C)	SDM	11	2.23	2.0	2.0	35	2.65	3.0	3.0	26		Develop Software Applications
13 tasks	4 panels	40 members	2.11	2.0	2.0	246	2.55	3.0	3.0	225		
E3 Define software/hardware requirements												
Determine hardware /software requirements/ constraints	GHC	12										Data Acquisition & Development
Select database software (performance, usability, cost, manageability, uses, output format)	GHC	12										Database Design
Provide Technology Recommendations	GRC	5										Perform Related Technical Duties
Define user software needs (C)	SDM	11	2.13	2.0	2.0	30	2.43	2.0	3.0	28		Develop Software Applications
Recommend new technologies	TST	8										Monitor Hardware/Software Environment
5 tasks	4 panels	36 members	2.13	2.0	2.0	30	2.43	2.0	3.0	28		

Table 5
Tasks Performed by GIS Technician
Grouped into Duty & Task Categories

Duty Category / Task Category / Tasks	VALIDATION SURVEY											Actual Duty
	DACUM Panels		Importance: 1 low - 3 high				Learning Difficulty: 1 low - 3 high					
	Name	Size	Mean	Median	Mode	Responses	Mean	Median	Mode	Responses		
E4 Optimize database performance												
Optimize database structure (Adv.)	LLC	12	1.90	2.0	2.0	84	2.03	2.0	2.0	71	Maintain Data	
Optimize data file folders (Adv.)	LLC	12	1.89	2.0	2.0	83	1.81	2.0	2.0	70	Maintain Data	
Optimize data files (Adv.)	LLC	12	1.89	2.0	2.0	83	1.84	2.0	2.0	70	Maintain Data	
Conduct database performance tuning (e.g. compress, build stats, index) (C)	SDM	11	2.19	2.0	2.0	31	2.45	3.0	3.0	29	Maintain GIS Data* (1)	
Optimize workstation performance	TST	8									Monitor Hardware/Software Environment	
5 tasks	3 panels	31 members	1.93	2.0	2.0	281	1.96	2.0	2.0	240		
E5 Maintain software												
Support application	GHC	12									Application Development	
Update and maintain application	GHC	12									Application Development	
Maintain Software	GRC	5									Manage Equipment and Supplies	
Install Software (e.g. enhancements, service packs) (C)	SDM	11	2.58	3.0	3.0	38	2.00	2.0	2.0	36	Provide Technical Support*	
Comply with software licensing agreements	TST	8									Monitor Hardware/Software Environment	
Install software upgrades	TST	8									Monitor Hardware/Software Environment	
Maintain workstation security	TST	8									Monitor Hardware/Software Environment	
Recommend software upgrades	TST	8									Monitor Hardware/Software Environment	
8 tasks	4 panels	36 members	2.58	3.0	3.0	38	2.00	2.0	2.0	36		
F MANAGE PROJECTS												
F1 Coordinate project activities												
Make project recommendations	AGK	5									Create Usable Products	
Produce application recommendation files	AGK	5									Create Usable Products	
Conform to policy and standards	GHC	12									Project Management	
Coordinate multiple projects and ongoing activities	GHC	12									Project Management	
Monitor project progress	GHC	12									Project Management	
Verify that project goals were met	GHC	12									Project Management	
Coordinate with Project Team	GRC	5									Perform Project Management	
Coordinate Projects with Stakeholders	GRC	5									Perform Project Management	
Coordinate work with Consultants	GRC	5									Perform Project Management	
Coordinate with Information Technology (IT)	GRC	5									Perform Related Technical Duties	
Coordinate GIS projects (C)	SDM	11	2.61	3.0	3.0	38	2.58	3.0	3.0	36	Perform Administrative Responsibilities	
Maintain contracts (E)	SDM	11	2.25	3.0	3.0	24	2.33	2.0	2.0	24	Perform Administrative Responsibilities	
Coordinate multiple activities	TST	8									Manage Individual Assignments	
Assure QA/QC	TST	8									Manage Individual Assignments	
14 tasks	5 panels	41 members	2.47	3.0	3.0	62	2.48	3.0	3.0	60		

Table 5
Tasks Performed by GIS Technician
Grouped into Duty & Task Categories

Duty Category / Task Category / Tasks	VALIDATION SURVEY										Actual Duty
	DACUM Panels		Importance: 1 low - 3 high				Learning Difficulty: 1 low - 3 high				
	Name	Size	Mean	Median	Mode	Responses	Mean	Median	Mode	Responses	
F2 Determine project scope											
Determine scope of project	GHC	12									Project Management
Develop Project Plan	GRC	5									Perform Project Management
Develop project scope	GSC	12	1.69	1.0	1.0	173	2.29	2.0	2.0	157	Manage Tasks
3 tasks	3 panels	29 members	1.69	1.0	1.0	173	2.29	2.0	2.0	157	
F3 Determine resource requirements											
Allocate internal / external resource needs (equipment, personnel, data)	GHC	12									Project Management
Determine resource needs (equipment, personnel, data)	GHC	12									Project Management
Maintain project resources	TST	8									Manage Individual Assignments
Optimize resources	TST	8									Manage Individual Assignments
4 tasks	2 panels	20 members									
F4 Develop/document procedures											
Establish project standards (e.g. layout & format consistency)	AGK	5									Define project parameters
Produce in-house standardized data documentation	GHC	12									Document Data
Develop policy for sharing data	GHC	12									Information Sharing Data Exchange
Document Project Results	GRC	5									Create Technical Documentation
Document operating procedures	GSC	12	2.30	2.0	2.0	177	1.91	2.0	2.0	161	Manage Tasks
Complete Company documentation	LLC	12	1.96	2.0	2.0	80	1.68	2.0	2.0	68	Perform Administrative Responsibilities
Develop GIS procedures (e.g. to update data)	SDM	11	2.49	3.0	3.0	39	2.33	2.0	2.0	36	Maintain GIS Data* (1)
Document what you have done for next person.	SMT	11									Quality Control
Assess documentation needs	TST	8									Document Data & Procedures
Develop procedural guides	TST	8									Document Data & Procedures
Maintain project documentation	TST	8									Manage Individual Assignments
Conform to policies and standards	TST	8									Manage Individual Assignments
Create documentation	TST	8									Document Data & Procedures
13 tasks	8 panels	76 members	2.23	2.0	2.0	296	1.91	2.0	2.0	265	
F5 Prepare/assess cost estimates											
Assess project costs	GHC	12									Project Management
Budget project	GHC	12									Project Management
Assess acquisition costs	GHC	12									Data Acquisition & Development
Assess maintenance & update cost	GHC	12									Maintain & Update Data
Prepare cost estimates (e.g. time, equipment) (C)	SDM	11	2.14	2.0	2.0	29	2.48	2.0	2.0	29	Perform Administrative Responsibilities
Obtain data acquisition cost quotes	TST	8									Acquire & Develop Data
Meet project budget	TST	8									Manage Individual Assignments
7 tasks	3 panels	31 members	2.14	2.0	2.0	29	2.48	2.0	2.0	29	

Table 5
Tasks Performed by GIS Technician
Grouped into Duty & Task Categories

Duty Category / Task Category / Tasks	VALIDATION SURVEY										Actual Duty
	DACUM Panels		Importance: 1 low - 3 high				Learning Difficulty: 1 low - 3 high				
	Name	Size	Mean	Median	Mode	Responses	Mean	Median	Mode	Responses	
F6 Develop project timeline/schedule											
Determine project timeline	AGK	5									Define project parameters
Develop project timetables	GHC	12									Project Management
Estimate Task Schedule	GRC	5									Perform Project Management
Prioritize Work Load	GRC	5									Perform Related Technical Duties
Develop project schedule	GSC	12	1.75	2.0	1.0	173	2.24	2.0	2.0	158	Manage Tasks
Conform to project timetables	TST	8									Manage Individual Assignments
6 tasks	5 panels	42 members	1.75	2.0	1.0	173	2.24	2.0	2.0	158	
F7 Identify client needs/deliverables											
Determine project needs	AGK	5									Define project parameters
Assess client need	GHC	12									Document Data
Assess client needs	GHC	12									Application Development
Assist in defining deliverables (maps, reports,...)	GHC	12									Database Design
Define deliverables	GHC	12									Project Management
Gather User Requirements	GRC	5									Fulfill Map/Data Requests, Perform Proj Mgm
Respond to Public Records Request	GRC	5									Perform Related Technical Duties
7 tasks	3 panels	22 members									
F8 Maintain equipment & supplies											
Request equipment & supplies (e.g. hardware, software)	AGK	5									Define project parameters
Maintain inventory of supplies	GHC	12									Paper Mapping Design & Development
Maintain Plotters and Printers	GRC	5									Manage Equipment and Supplies
Order Supplies	GRC	5									Manage Equipment and Supplies
Schedule Equipment	GRC	5									Manage Equipment and Supplies
Maintain Hardware	GRC	5									Manage Equipment and Supplies
Maintain GPS & field equipment (digital camera, laser range finder, DMI)	GSC	12	2.48	3.0	3.0	170	1.66	2.0	2.0	152	Manage Equipment
Maintain plotter / printer	GSC	12	2.26	2.0	2.0	174	1.48	1.0	1.0	155	Manage Equipment
Maintain scanner	GSC	12	2.13	2.0	2.0	174	1.49	1.0	1.0	152	Manage Equipment
Maintain Vehicle	GSC	12	1.70	2.0	1.0	168	1.44	1.0	1.0	128	Manage Equipment
Maintain equipment/ supplies) (E,C)	SDM	11	2.37	2.0	2.0	41	1.78	2.0	2.0	37	Perform Administrative Responsibilities
Comply with hardware maintenance agreements	TST	8									Monitor Hardware/Software Environment
Cooperate in using shared equipment	TST	8									Monitor Hardware/Software Environment
Monitor supplies inventories	TST	8									Monitor Hardware/Software Environment
Comply with company P&P	TST	8									Monitor Hardware/Software Environment
15 tasks	6 panels	53 members	2.16	2.0	2.0	727	1.54	1.0	1.0	624	

Table 5
Tasks Performed by GIS Technician
Grouped into Duty & Task Categories

Duty Category / Task Category / Tasks	VALIDATION SURVEY										Actual Duty
	DACUM Panels		Importance: 1 low - 3 high				Learning Difficulty: 1 low - 3 high				
	Name	Size	Mean	Median	Mode	Responses	Mean	Median	Mode	Responses	
G GENERATE PRODUCTS											
G1 Design & create maps											
Make project maps	AGK	5									Create Usable Products
Define purpose and use of maps	GHC	12									Paper Mapping Design & Development
Determine appropriate fonts and colors	GHC	12									Paper Mapping Design & Development
Determine appropriate scale	GHC	12									Paper Mapping Design & Development
Recognize cartographic conventions	GHC	12									Paper Mapping Design & Development
Design layout	GHC	12									Paper Mapping Design & Development
Select proper media/output device	GHC	12									Paper Mapping Design & Development
Acknowledge contributors	GHC	12									Paper Mapping Design & Development
Design Maps	GRC	5									Fulfill Map/Data Requests
Design Cartographic Elements	GRC	5									Fulfill Map/Data Requests
Create Maps	GRC	5									Fulfill Map/Data Requests
Perform Graphic Design	GRC	5									Fulfill Map/Data Requests
Plot Map	GRC	5									Fulfill Map/Data Requests
Create reference maps (e.g. streets)	GSC	12	2.66	3.0	3.0	176	1.59	2.0	1.0	162	Generate Deliverables
Create thematic maps (e.g. zoning)	GSC	12	2.65	3.0	3.0	175	1.63	2.0	2.0	162	Generate Deliverables
Create interactive maps (82%) (Adv.)	LLC	12	2.04	2.0	2.0	81	2.36	2.0	3.0	74	Disseminate Data
Create static maps	LLC	12	2.38	2.0	2.0	86	1.59	2.0	2.0	79	Disseminate Data
Design map layouts	LLC	12	2.34	2.0	3.0	89	1.73	2.0	2.0	79	Disseminate Data
Create map series templates	LLC	12	1.99	2.0	2.0	84	1.97	2.0	2.0	76	Disseminate Data
Create map templates (C)	SDM	11	2.38	2.0	3.0	47	2.29	2.0	2.0	48	Develop Software Applications
Create maps (E,C)	SDM	11	2.93	3.0	3.0	59	2.33	2.0	2.0	58	Generate Products*(hard copy, electronic)
Create graphic items (e.g. logos, headers, posters, exhibits) (E,C)	SDM	11	2.31	2.0	2.0	49	2.11	2.0	2.0	47	Generate Products*(hard copy, electronic)
Conceptualize scale.	SMT	11									Principles of Geography
Calculate scale transformations.	SMT	11									Cartographic Skills
Use appropriate symbology.	SMT	11									Cartographic Skills
Resolve spatial conflicts.	SMT	11									Cartographic Skills
Interpret maps.	SMT	11									Principles of Geography
Acknowledge contributors and copyrights	TST	8									Develop & Design Map Displays
Adhere to purpose and use of maps	TST	8									Develop & Design Map Displays
Apply cartographic conventions	TST	8									Develop & Design Map Displays
Design layout	TST	8									Develop & Design Map Displays
Determine appropriate scale and projection	TST	8									Develop & Design Map Displays
Determine appropriate symbology	TST	8									Develop & Design Map Displays
Select proper media/output device	TST	8									Develop & Design Map Displays
34 tasks	8 panels	76 members	2.45	2.0	3.0	846	1.85	2.0	2.0	785	

Table 5
Tasks Performed by GIS Technician
Grouped into Duty & Task Categories

Duty Category / Task Category / Tasks	VALIDATION SURVEY											Actual Duty
	DACUM Panels		Importance: 1 low - 3 high				Learning Difficulty: 1 low - 3 high					
	Name	Size	Mean	Median	Mode	Responses	Mean	Median	Mode	Responses		
G2 Create reports												
Generate field reports e.g. budget, input quantities	AGK	5										Create Usable Products
Report Results	GHC	12										GIS & Remote Sensing Analysis
Create Database Reports	GRC	5										Manage Geographic Data Sets
Create data analysis reports (e.g. tables, charts)	GSC	12	2.36	2.0	3.0	176	1.85	2.0	2.0	162		Generate Deliverables
Create project status report	GSC	12	2.18	2.0	2.0	176	1.76	2.0	2.0	160		Manage Tasks
Create reports (91%)	LLC	12	1.98	2.0	2.0	88	1.76	2.0	2.0	74		Disseminate Data
Create analysis reports (E,C)	SDM	11	2.48	3.0	3.0	44	2.53	3.0	3.0	43		Generate Products*(hard copy, electronic)
Write informational reports (e.g. progress, technical, procedural, recommendations) (C)	SDM	11	2.41	2.0	3.0	41	2.37	2.0	2.0	43		Perform Administrative Responsibilities
Report results	TST	8										Update & Manipulate Data
9 tasks	7 panels	65 members	2.25	2.0	2.0	525	1.91	2.0	2.0	482		
G3 Create tables & charts												
Create Database Tables	GRC	5										Create/Maintain Geographic Data Sets
Create Mail Lists	GRC	5										Fulfill Map/Data Requests
Create charts (82%)	LLC	12	1.90	2.0	2.0	86	1.73	2.0	2.0	74		Disseminate Data
Create charts (E,C)	SDM	11	2.31	2.0	2.0	39	2.16	2.0	2.0	38		Generate Products*(hard copy, electronic)
Create tables (E,C)	SDM	11	2.58	3.0	3.0	48	2.16	2.0	2.0	45		Generate Products*(hard copy, electronic)
Generate mailing labels (E,C)	SDM	11	2.05	2.0	2.0	37	1.80	2.0	2.0	35		Generate Products*(hard copy, electronic)
6 tasks	3 panels	28 members	2.16	2.0	2.0	210	1.93	2.0	2.0	192		
G4 Develop & make presentations												
Create project presentation(s)	AGK	5										Create Usable Products
Present completed products	AGK	5										Create Usable Products
Provide information presentations for users	GHC	12										Training & Education
Create Presentation Materials	GRC	5										Participate in Training and Outreach
Give Informational Presentations	GRC	5										Participate in Training and Outreach
Create Presentation Materials	GRC	5										Fulfill Map/Data Requests
Develop presentations	GSC	12	2.02	2.0	2.0	174	2.01	2.0	2.0	159		Generate Deliverables
Create animation (e.g. 3D, 4D)	GSC	12	1.46	1.0	1.0	174	2.40	2.0	3.0	139		Generate Deliverables
Present project summary	LLC	12	1.92	2.0	2.0	86	1.89	2.0	2.0	72		Disseminate Data
Provide information presentations	TST	8										Pursue Professional Development
10 tasks	6 panels	54 members	1.78	2.0	2.0	434	2.13	2.0	2.0	370		
G5 Disseminate products												
Disseminate documentation where appropriate	GHC	12										Document Data
Disseminate information through a web site	GHC	12										Training & Education
Manage Web Content	GRC	5										Perform Related Technical Duties
Publish Map Products	GRC	5										Fulfill Map/Data Requests

Table 5
Tasks Performed by GIS Technician
Grouped into Duty & Task Categories

Duty Category / Task Category / Tasks	VALIDATION SURVEY											Actual Duty
	DACUM Panels		Importance: 1 low - 3 high				Learning Difficulty: 1 low - 3 high					
	Name	Size	Mean	Median	Mode	Responses	Mean	Median	Mode	Responses		
Load/Burn Data onto Media	GRC	5									Fulfill Map/Data Requests	
Deliver Maps and Data	GRC	5									Fulfill Map/Data Requests	
Publish digital spatial information (CD, DVD)	LLC	12	1.98	2.0	2.0	84	1.49	1.0	1.0	73	Disseminate Data	
Publish spatial information on-line	LLC	12	1.81	2.0	2.0	85	2.07	2.0	2.0	70		
Distribute data according to organizational policy (E,C)	SDM	11	2.30	2.0	3.0	37	1.92	2.0	2.0	36	Manage GIS Data	
Distribute digital products (E,C)	SDM	11	2.51	3.0	3.0	47	2.00	2.0	2.0	46	Generate Products*(hard copy, electronic)	
Distribute hard copy products (E,C)	SDM	11	2.60	3.0	3.0	53	1.94	2.0	2.0	52	Generate Products*(hard copy, electronic)	
Produce deliverables	TST	8									Manage Individual Assignments	
Disseminate information via Internet	TST	8									Exchange & Share Data	
Disseminate documentation	TST	8									Document Data & Procedures	
14 tasks	5 panels	48 members	2.16	2.0	2.0	306	1.86	2.0	2.0	277		
H PROFESSIONAL DEVELOPMENT												
H1 Communicate with others												
Let users & data custodians know that updates are completed	GHC	12									Maintain & Update Data	
Communicate with peers	GHC	12									GIS & Remote Sensing Analysis	
Communicate with clients	LLC	12	2.33	2.0	3.0	86	1.61	2.0	1.0	77	Perform Administrative Responsibilities	
Communicate with co-workers	LLC	12	2.66	3.0	3.0	88	1.34	1.0	1.0	77	Perform Administrative Responsibilities	
Interact with co-workers	LLC	12	2.71	3.0	3.0	87	1.39	1.0	1.0	77	Maintain Professional Development	
Correspond with others (e.g. email, mail, phone) (C)	SDM	11	2.80	3.0	3.0	60	1.85	2.0	2.0	59	Perform Administrative Responsibilities	
Communicate quality control problems to other team members.	SMT	11									Quality Control	
Present ideas clearly and concisely.	SMT	11									Communication Skills/Teamwork	
Communicate with peers	TST	8									Manage Individual Assignments	
Inform data users and custodians of update completion	TST	8									Update & Manipulate Data	
10 tasks	5 panels	54 members	2.61	3.0	3.0	321	1.53	1.0	1.0	290		
H2 Participate in conferences / workshops												
Visit trade shows	AGK	5									Expand Professional Knowledge & Skills	
Network with industry professionals	AGK	5									Expand Professional Knowledge & Skills	
Participate in User Groups	GRC	5									Participate in Training and Outreach	
Participate in workshops & conferences	GSC	12	2.35	2.0	2.0	176	1.39	1.0	1.0	160	Professional Development	
Attend User Conferences	LLC	12	2.07	2.0	2.0	87	1.41	1.0	1.0	76	Maintain Professional Development	
Participate in job related workshops	LLC	12	2.25	2.0	2.0	87	1.38	1.0	1.0	79	Maintain Professional Development	
Present at User Conferences (55%) (Adv.)	LLC	12	1.56	1.0	1.0	81	2.16	2.0	2.0	73	Maintain Professional Development	
Network with other job related professionals	LLC	12	2.26	2.0	2.0	87	1.54	1.0	1.0	78	Maintain Professional Development	
Participate in job related professional organizations	LLC	12	2.30	2.0	2.0	86	1.35	1.0	1.0	78	Maintain Professional Development	
Participate in professional conferences (oral, posters, publish/ submit articles) (E,C)	SDM	11	2.07	2.0	2.0	41	2.21	2.0	2.0	38	Pursue Professional Development	
Participate in GIS user groups (E,C)	SDM	11	2.24	2.0	2.0	46	1.70	2.0	2.0	46	Pursue Professional Development	
Participate in professional organizations	TST	8									Pursue Professional Development	
12 tasks	6 panels	53 members	2.17	2.0	2.0	691	1.57	1.0	1.0	628		

Table 5
Tasks Performed by GIS Technician
Grouped into Duty & Task Categories

Duty Category / Task Category / Tasks	VALIDATION SURVEY											Actual Duty
	DACUM Panels		Importance: 1 low - 3 high				Learning Difficulty: 1 low - 3 high					
	Name	Size	Mean	Median	Mode	Responses	Mean	Median	Mode	Responses		
H3 Provide training												
Train co-workers	AGK	5										Expand Professional Knowledge & Skills
Assess level of user's knowledge and needs and train accordingly	GHC	12										Training & Education
Establish and maintain remote training sites	GHC	12										Training & Education
Provide post training support	GHC	12										Training & Education
Organize Staff/Department Training	GRC	5										Participate in Training and Outreach
Train Other Staff	GRC	5										Participate in Training and Outreach
Cross-training (e.g. mentoring, coaching)	GSC	12	2.14	2.0	2.0	174	1.88	2.0	2.0	156		Professional Development
Provide training	GSC	12	1.78	2.0	2.0	176	2.26	2.0	2.0	158		Generate Deliverables
Cross-train within organization (C)	SDM	11	2.38	3.0	3.0	45	2.26	2.0	2.0	43		Pursue Professional Development
Train GIS end-user(s) (C)	SDM	11	2.49	3.0	3.0	39	2.51	3.0	3.0	39		Provide Technical Support*
Participate in peer training	TST	8										Pursue Professional Development
11 tasks	6 panels	53 members	2.05	2.0	2.0	434	2.13	2.0	2.0	396		
H4 Develop user guides												
Develop training applications and course materials	GHC	12										Training & Education
Develop users guides	GHC	12										Training & Education
Build help files	SDM	11	1.88	2.0	1.0	25	2.38	2.0	2.0	24		Develop Software Applications
Write Technical Guides (C)	SDM	11	2.00	2.0	2.0	33	2.55	3.0	3.0	31		Provide Technical Support*
Create "read me" files	TST	8										Exchange & Share Data
5 tasks	3 panels	31 members	1.95	2.0	2.0	58	2.48	3.0	3.0	55		
H5 Attend training												
Seek additional training	AGK	5										Expand Professional Knowledge & Skills
Evaluate personal performance	AGK	5										Expand Professional Knowledge & Skills
Attend training	GSC	12	2.52	3.0	3.0	177	1.38	1.0	1.0	161		Professional Development
Conduct self-assessment	GSC	12	2.13	2.0	2.0	176	1.76	2.0	2.0	153		Professional Development
Complete job related classes (online / classroom)	LLC	12	2.21	2.0	2.0	85	1.51	1.0	1.0	76		Maintain Professional Development
Take advanced training courses (e.g. technical training & education courses) (C)	SDM	11	2.59	3.0	3.0	46	2.11	2.0	2.0	47		Pursue Professional Development
Maintain technical proficiency	TST	8										Pursue Professional Development
7 tasks	5 panels	48 members	2.33	2.0	2.0	484	1.61	1.0	1.0	437		
H6 Acquire professional certification												
Obtain professional certification (e.g. GISP, ASPRS)	GSC	12	2.11	2.0	2.0	175	2.35	2.0	2.0	154		Professional Development
Acquire GIS Certification (45%)	LLC	12	1.86	2.0	2.0	81	2.34	2.0	3.0	71		Maintain Professional Development
2 tasks	2 panels	24 members	2.03	2.0	2.0	256	2.35	2.0	2.0	225		

Table 5
Tasks Performed by GIS Technician
Grouped into Duty & Task Categories

Duty Category / Task Category / Tasks	VALIDATION SURVEY										Actual Duty
	DACUM Panels		Importance: 1 low - 3 high				Learning Difficulty: 1 low - 3 high				
	Name	Size	Mean	Median	Mode	Responses	Mean	Median	Mode	Responses	
H7 Promote / represent GIS											
Promote GIS uses	GHC	12									Training & Education
Educate and Promote GIS Capabilities	GRC	5									Participate in Training and Outreach
Perform Community outreach	LLC	12	1.60	2.0	1.0	83	1.82	2.0	2.0	73	Maintain Professional Development
Participate in public relations activities (E,C)	SDM	11	1.97	2.0	2.0	31	1.94	2.0	2.0	31	Perform Administrative Responsibilities
Represent GIS at meetings (committees, user groups, organizational conferences) (E,C)	SDM	11	2.30	2.0	2.0	37	2.05	2.0	2.0	41	Perform Administrative Responsibilities
5 tasks	4 panels	40 members	1.85	2.0	1.0	151	1.91	2.0	2.0	145	
H8 Provide technical support											
Provide Technical Support	GRC	5									Perform Related Technical Duties
Provide technical support for users (Adv.)	LLC	12	2.28	2.0	2.0	86	2.01	2.0	2.0	76	Disseminate Data
Resolve user technical problems (C)	SDM	11	2.49	3.0	3.0	43	2.69	3.0	3.0	42	Provide Technical Support*
Troubleshoot hardware/software problems	TST	8									Monitor Hardware/Software Environment
4 tasks	4 panels	36 members	2.35	2.0	2.0	129	2.25	2.0	2.0	118	
H9 Review job related information											
Explore new process techniques	AGK	5									Expand Professional Knowledge & Skills
Review industry publications	AGK	5									Expand Professional Knowledge & Skills
Research GIS Technology Trends	GRC	5									Perform Related Technical Duties
Research current/emerging trends (e.g. publications, on-line)	GSC	12	2.13	2.0	2.0	175	1.58	2.0	1.0	160	Professional Development
View job related information (e.g. blogs, news feeds, print publications, forums)	LLC	12	2.00	2.0	2.0	87	1.19	1.0	1.0	78	Maintain Professional Development
Read trade publications	TST	8									Pursue Professional Development
6 tasks	5 panels	42 members	2.09	2.0	2.0	262	1.45	2.0	1.0	238	
H10 Supervise interns											
Participate in Hiring and Supervisory Activities	GRC	5									Perform Related Technical Duties
Supervise interns (82%) (Adv.)	LLC	12	1.69	2.0	1.0	84	2.07	2.0	2.0	69	Perform Administrative Responsibilities
Supervise Interns (C)	SDM	11	2.11	2.0	2.0	28	2.36	2.0	2.0	28	Perform Administrative Responsibilities
3 tasks	3 panels	28 members	1.79	2.0	1.0	112	2.15	2.0	2.0	97	

Source: National Geotech Center, 2010

Table 6
GIS Technician Knowledge, Skills & Worker Behaviors
Grouped into Knowledge, Skill & Worker Behavior Categories

Knowledge & Skill Categories / Knowledge & Skills	DACUM Panels		VALIDATION SURVEY			
	Name	Size	Importance: 1 low - 3 high			
			Mean	Median	Mode	Responses
1 Cartography						
Cartographic principles/theory	GRC	5				
Cartographic license	GSC	12	1.88	2.0	2.0	134
Create map book	GSC	12	2.12	2.0	2.0	153
Cartographic design	LLC	12	2.38	2.0	2.0	76
Cartographic Design	SDM	11	2.81	3.0	3.0	53
Demonstrate map design and layout.	SMT	11				
Demonstrate graphic design skills.	SMT	11				
Cartography	TST	8				
8 knowledge & skills	6 panels	59 members	2.18	2.0	2.0	416
2 Communication: verbal/presentation/writing						
Communication skills (verbal & written)	AGK	5				
People skills (public relations, communication)	AGK	5				
Communication skills	GHC	12				
Communication skills -oral	GRC	5				
Communication skills -written, email	GRC	5				
Verbal & written communication	GSC	12	2.57	3.0	3.0	156
Graphing & reporting	GSC	12	2.13	2.0	2.0	156
Verbal communication	LLC	12	2.56	3.0	3.0	81
Communication	LLC	12	2.58	3.0	3.0	81
Technical writing	LLC	12	1.95	2.0	2.0	74
Printing legibly	SDM	11	2.29	2.0	3.0	52
Technical writing	SDM	11	2.35	2.0	2.0	51
Oral Communication	SDM	11	2.75	3.0	3.0	51
Presentation	SDM	11	2.41	2.0	3.0	51
Demonstrate technical writing skills.	SMT	11				
Demonstrate oral communication skills (individual, group, team, client presentatio	SMT	11				
Demonstrate active listening skills.	SMT	11				
Demonstrate initiative in communicating ideas.	SMT	11				
Demonstrate negotiation skills.	SMT	11				
Demonstrate ability to research information.	SMT	11				
Communication skills (writing, reading)	TST	8				
Good written and verbal interpersonal communication skills	TST	8				
Business skills	TST	8				
23 knowledge & skills	8 panels	76 members	2.39	2.0	3.0	753
3 Computer basics						
Computer skills (above average)	AGK	5				
Operating systems	GHC	12				
Burn to disk	GSC	12	2.24	2.0	2.0	157
FTP site	GSC	12	2.21	2.0	2.0	154
Demonstrate knowledge of basic computer concepts and terms.	SMT	11				
Use basic operating system commands.	SMT	11				
Define and differentiate among computer terms related to networks.	SMT	11				
Apply basic concepts of hardware storage.	SMT	11				
Demonstrate knowledge of graphical user interface environ-ment (i.e., Windows).	SMT	11				
Use Internet, ftp, e mail, computer faxes.	SMT	11				
Computer skills	TST	8				
Internet skills, esp. data collection and attribution	TST	8				
12 knowledge & skills	5 panels	48 members	2.23	2.0	2.0	311
4 Computer database						
Computer Science-database design	GHC	12				
Computer Science-information management	GHC	12				
Digital file management	GHC	12				
Database development	GRC	5				

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Knowledge & Skill Categories / Knowledge & Skills	DACUM Panels		VALIDATION SURVEY			
	Name	Size	Importance: 1 low - 3 high			
			Mean	Median	Mode	Responses
Database administration	GRC	5				
Experience with relational databases	GRC	5				
Data custodianship	LLC	12	2.18	2.0	2.0	72
Database structure	LLC	12	2.43	2.0	2.0	79
Data exchange procedures	SDM	11	2.33	2.0	3.0	51
Security restrictions on data	SDM	11	2.43	3.0	3.0	51
Relational database design,	TST	8				
file management	TST	8				
12 knowledge & skills	5 panels	48 members	2.34	2.0	2.0	253
5 Computer keyboarding						
Data entry	AGK	5				
Typing	GSC	12	2.03	2.0	2.0	157
Keyboarding	LLC	12	2.15	2.0	2.0	80
Demonstrate keyboarding skills.	SMT	11				
4 knowledge & skills	4 panels	40 members	2.07	2.0	2.0	237
6 Computer networks						
Networking systems	GHC	12				
Windows networks	GHC	12				
Computer networking	GHC	12				
Computer, Network configuration	SDM	11	2.12	2.0	2.0	52
4 knowledge & skills	2 panels	23 members	2.12	2.0	2.0	52
7 Computer programming						
Experience with computer programming concepts	GRC	5				
Basic scripting (SQL, VB, HTML, Python, ASP, CSS, Query)	GSC	12	1.89	2.0	2.0	152
Programming	LLC	12	1.78	2.0	2.0	76
Programming languages (VBA)	SDM	11	2.02	2.0	2.0	52
Apply basic programming principles (SQL statements, Boolean logic, macros).	SMT	11				
programming	TST	8				
6 knowledge & skills	6 panels	59 members	1.88	2.0	2.0	280
8 Computer software						
Geography-competency in software	GHC	12				
Legacy technology	GSC	12	1.68	2.0	2.0	133
Modify user interface	GSC	12	1.68	2.0	2.0	147
End user Web applications	SDM	11	2.55	3.0	3.0	51
Use software applications.	SMT	11				
Use various platforms.	SMT	11				
GIS software	TST	8				
7 knowledge & skills	5 panels	54 members	1.81	2.0	2.0	331
9 Coordinate systems, projections						
map datum, geoid	GRC	5				
Coordinate systems	GRC	5				
projections	GRC	5				
Spatial projections	GSC	12	2.61	3.0	3.0	156
Coordinate systems Projections	LLC	12	2.56	3.0	3.0	79
Recognize projections.	SMT	11				
6 knowledge & skills	4 panels	40 members	2.59	3.0	3.0	235
10 Critical thinking/Problem Solving						
Critical thinking	AGK	5				
Problem solving skills	GHC	12				
"Think Outside the Box", "See the big picture"	GRC	5				
Analytical thinker	GRC	5				

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	Name	Size	Importance: 1 low - 3 high			
			Mean	Median	Mode	Responses
Critical thinking	GRC	5				
Problem solve	GRC	5				
Solution-orientated	GRC	5				
Problem solving	GSC	12	2.70	3.0	3.0	157
Critical thinking	LLC	12	2.51	3.0	3.0	80
Problem solving	LLC	12	2.65	3.0	3.0	81
Recognize and define problem(s).	SMT	11				
Break problem into manageable parts.	SMT	11				
Problem solving skills	TST	8				
13 knowledge & skills	7 panels	65 members	2.64	3.0	3.0	318
11 Data models						
Raster / Vector	GSC	12	2.54	3.0	3.0	157
Recognize raster and vector models.	SMT	11				
Differentiate between raster space and real space.	SMT	11				
Conceptualize model of reality.	SMT	11				
Raster and vector data	TST	8				
5 knowledge & skills	3 panels	31 members	2.54	3.0	3.0	157
12 Data types, transfers & conversions						
Data transfer	AGK	5				
File transfer	GRC	5				
Adding data to a project (GIS, CAD)	GSC	12	2.74	3.0	3.0	157
Export formats, properties; settings	GSC	12	2.46	3.0	3.0	157
File types (SHP, GDB, Coverage, CAD, DGN, TXT, IMG, TIF, SID, Flash, PDF, GeoPDF, e00, PkZIP, RAR, TAR)	GSC	12	2.62	3.0	3.0	157
Data sources	GSC	12	2.52	3.0	3.0	157
Data collection and format conversion	TST	8				
Data manipulation (spatial, non-spatial)	TST	8				
8 knowledge & skills	4 panels	30 members	2.58	3.0	3.0	628
13 Engineering drawings						
Engineering-CAD	GHC	12				
Engineering-COGO	GHC	12				
Reading engineering-grade plans	SDM	11	2.23	2.0	3.0	53
3 knowledge & skills	2 panels	23 members	2.23	2.0	3.0	53
14 Equipment operation						
Application equipment capabilities/limitations	AGK	5				
Technical operating	AGK	5				
Understanding of equipment interactions	AGK	5				
Plotter operation	GSC	12	2.32	2.0	2.0	155
4 knowledge & skills	2 panels	17 members	2.32	2.0	2.0	155
15 Geography						
Geography-census	GHC	12				
Geography-transportation	GHC	12				
Geography-urban planning	GHC	12				
Geography-Cartography	GHC	12				
Geographic principles	GRC	5				
Apply principles of geography.	SMT	11				
Geography	TST	8				
7 knowledge & skills	4 panels	36 members	n / a			
16 Geoprocessing, modeling						
Create TIN model	GSC	12	1.70	2.0	2.0	132
Creating models	GSC	12	1.98	2.0	2.0	152

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Knowledge & Skill Categories / Knowledge & Skills	DACUM Panels		VALIDATION SURVEY			
	Name	Size	Importance: 1 low - 3 high			
			Mean	Median	Mode	Responses
Geoprocessing methods	GSC	12	2.53	3.0	3.0	155
Contour mapping	LLC	12	2.14	2.0	2.0	73
Evaluate a physical model.	SMT	11				
Explain how a data model works.	SMT	11				
6 knowledge & skills	3 Panels	35 members	2.10	2.0	2.0	512
17 GPS						
Global GPS system	GRC	5				
Global Positioning System (GPS)	TST	8				
2 knowledge & skills	2 panels	13 members			n / a	
18 Industry applications						
Fisheries	GHC	12				
Forestry basics/survey	GHC	12				
Geology	GHC	12				
Wildlife	GHC	12				
Engineering-survey	GHC	12				
Related Industries	GSC	12	1.90	2.0	2.0	154
Variable Rate Technology (VRT)	LLC	12	1.54	1.0	1.0	37
Drafting	LLC	12	1.74	2.0	2.0	73
Explain how GIS can be used in various real world applications.	SMT	11				
Identify applications of GIS technology.	SMT	11				
Demonstrate fundamental drafting skills.	SMT	11				
11 knowledge & skills	4 panels	47 members	1.80	2.0	2.0	264
19 Jargon, acronyms						
Jargon	GHC	12				
Platform shop talk	GHC	12				
Industry jargon	GSC	12	2.32	2.0	2.0	155
Technical terminology	TST	8				
4 knowledge & skills	3 panels	32 members	2.32	2.0	2.0	155
20 Land divisions, measurements						
Basic survey principles	GRC	5				
Interpret legal descriptions	GRC	5				
Plats & deeds	GSC	12	2.26	2.0	2.0	152
Land measurements	LLC	12	2.23	2.0	2.0	77
Land descriptions	LLC	12	2.18	2.0	2.0	77
Land divisions	LLC	12	2.21	2.0	2.0	76
Legal descriptions	LLC	12	2.14	2.0	2.0	76
Land surveying	SDM	11	1.81	2.0	2.0	53
basics of surveying	TST	8				
Coordinate geometry (COGO)	TST	8				
Cadastral data	TST	8				
11 knowledge & skills	5 panels	48 members	2.17	2.0	2.0	511
21 Legal issues						
Copyright laws	LLC	12	2.10	2.0	2.0	72
OSHA requirements	LLC	12	1.48	1.0	1.0	64
2 knowledge & skills	1 panels	12 members	1.81	2.0	2.0	136
22 Map reading						
Map interpretation	GRC	5				
Map reading	GSC	12	2.79	3.0	3.0	157
Cadastral	LLC	12	2.32	2.0	2.0	71

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Knowledge & Skill Categories / Knowledge & Skills	DACUM Panels		VALIDATION SURVEY			
	Name	Size	Importance: 1 low - 3 high			
			Mean	Median	Mode	Responses
Conceptualize images in 3 D.	SMT	11				
Good color sensitivity helpful	TST	8				
5 knowledge & skills	5 panels	48 members	2.64	3.0	3.0	228
23 Mathematics (geometry, statistics)						
Statistics	AGK	5				
Statistics	GHC	12				
Statistics	GRC	5				
Mathematics (geometry, statistics, trigonometry, algebra)	GSC	12	1.97	2.0	2.0	156
Mathematics	LLC	12	2.13	2.0	2.0	80
Geometry	SDM	11	2.32	2.0	2.0	53
Mathematics	SDM	11	2.38	2.0	2.0	50
Statistics	SDM	11	2.12	2.0	2.0	52
statistics	TST	8				
9 knowledge & skills	7 panels	65 members	2.12	2.0	2.0	391
24 Organizational						
Organized	GHC	12				
Organized	GRC	5				
Organizational	GSC	12	2.56	3.0	3.0	157
Organization	LLC	12	2.62	3.0	3.0	81
Organizational	SDM	11	2.81	3.0	3.0	53
Organized	SDM	11	2.90	3.0	3.0	52
Demonstrate neatness.	SMT	11				
Demonstrate file management skills.	SMT	11				
Interpret and implement procedures methodically.	SMT	11				
Demonstrate ability to maintain focus and be consistent.	SMT	11				
Organizational skills	TST	8				
11 knowledge & skills	7 panels	71 members	2.66	3.0	3.0	343
25 Photogrammetry/Remote Sensing						
Geography-photogrammetry	GHC	12				
Geography-remote sensing	GHC	12				
Basic remote sensing theory	GRC	5				
Photogrammetry	LLC	12	1.90	2.0	2.0	70
Remote sensing	LLC	12	1.91	2.0	2.0	74
Thermal imaging	LLC	12	1.50	1.0	1.0	66
Photogrammetry	SDM	11	1.87	2.0	2.0	54
Remote sensing	TST	8				
8 knowledge & skills	5 panels	48 members	1.80	2.0	2.0	264
26 Queries & analysis						
Interpolation	GSC	12	1.95	2.0	2.0	143
Query (spatial/attribute)	LLC	12	2.49	3.0	3.0	81
2 knowledge & skills	2 panels	24 members	2.15	2.0	2.0	224
27 Research						
Research techniques	LLC	12	2.19	2.0	2.0	78
Scientific methods	LLC	12	1.90	2.0	2.0	77
Research technical support	GHC	12				
Demonstrate ability to research information.	SMT	11				
4 knowledge & skills	3 panels	35 members	2.05	2.0	2.0	155
28 Scale						
Scale	GRC	5				
Map scale	GSC	12	2.64	3.0	3.0	157
Scale	LLC	12	2.60	3.0	3.0	80

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	Name	Size	Importance: 1 low - 3 high			
			Mean	Median	Mode	Responses
Demonstrate appropriate scale for message.	SMT	11				
4 knowledge & skills	4 panels	40 members	2.63	3.0	3.0	237
29 Spatial Thinking						
Spatial awareness	GSC	12	2.67	3.0	3.0	156
Demonstrate spatial intelligence.	SMT	11				
Recognize spatial inconsistencies.	SMT	11				
3 knowledge & skills	2 panels	23 members	2.67	3.0	3.0	156
30 Standards (client, customer, industry)						
Understand national documentation standards	GHC	12				
technological standards	GRC	5				
Client/company standards	GSC	12	2.59	3.0	3.0	153
GIS Industry standards	GSC	12	2.39	2.0	3.0	155
Naming conventions	GSC	12	2.37	2.0	2.0	156
“ISO 9000” standards	LLC	12	1.73	2.0	1.0	51
Quality control & assurance procedures	LLC	12	2.67	3.0	3.0	79
7 knowledge & skills	4 panels	41 members	2.42	2.0	3.0	594
31 Teaching						
Teaching skills	GRC	5				
1 knowledge & skills	1 panels	5 members			n / a	
32 Time management						
Time management	AGK	5				
Diversified task - time management	GHC	12				
Time management skills	GRC	5				
Time management	GSC	12	2.63	3.0	3.0	157
Time management	LLC	12	2.62	3.0	3.0	81
Time Management	SDM	11	2.89	3.0	3.0	53
Time management skills	TST	8				
7 knowledge & skills	7 panels	65 members	2.67	3.0	3.0	291
33 Troubleshooting						
Troubleshooting	AGK	5				
Geography-navigation/trouble shooting	GHC	12				
Troubleshooting	GSC	12	2.61	3.0	3.0	157
Troubleshooting	LLC	12	2.60	3.0	3.0	81
Troubleshooting skills	TST	8				
5 knowledge & skills	5 panels	49 members	2.61	3.0	3.0	238
34 Units of measure/conversion						
Unit conversions	GSC	12	2.25	2.0	2.0	156
Units of measure	GSC	12	2.56	3.0	3.0	157
Unit conversions	LLC	12	2.13	2.0	2.0	79
3 knowledge & skills	2 panels	24 members	2.35	2.0	2.0	392
35 Web development						
Web development	GRC	5				
Web content management	GRC	5				
Relevant domain knowledge	GRC	5				
3 knowledge & skills	1 panels	5 members			n / a	
1 Adaptable, flexible						
Adaptable, Flexible	GRC	5				
Adaptability	SDM	11	2.88	3.0	3.0	52
2 worker behaviors	2 panels	16 members	2.88	3.0	3.0	52

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	Name	Size	Importance: 1 low - 3 high			
			Mean	Median	Mode	Responses
2 Analytical						
Analytical	AGK	5				
Analytical	GHC	12				
Analytical	GSC	12	2.56	3.0	3.0	156
Logical, intelligent	GSC	12	2.62	3.0	3.0	157
Analytical	SDM	11	2.79	3.0	3.0	53
Interpret technical information (i.e., manuals and CD Rom)	SMT	11				
Analytical, detail oriented	TST	8				
7 worker behaviors	6 panels	59 members	2.62	3.0	3.0	366
3 Common sense						
Common sense	GSC	12	2.69	3.0	3.0	157
Common sense	LLC	12	2.63	3.0	3.0	80
2 worker behaviors	2 panels	24 members	2.67	3.0	3.0	237
4 Creative						
Creativity	GSC	12	2.50	3.0	3.0	157
1 worker behaviors	1 panels	12 members	2.50	3.0	3.0	157
5 Detail orientated						
Attentive to detail	AGK	5				
Observant	AGK	5				
Detail orientated	GHC	12				
Attention to detail	GRC	5				
Detail orientated	GSC	12	2.71	3.0	3.0	157
Accuracy & precision	LLC	12	2.73	3.0	3.0	81
Detail oriented	LLC	12	2.60	3.0	3.0	81
Detail-oriented	SDM	11	2.83	3.0	3.0	52
Check work.	SMT	11				
Thoroughness	TST	8				
10 worker behaviors	8 panels	76 members	2.71	3.0	3.0	371
6 Diplomatic						
Diplomatic, tactful	GSC	12	2.45	3.0	3.0	157
1 worker behaviors	1 panels	12 members	2.45	3.0	3.0	157
7 Dress Code, etiquette, hygiene						
Hygienic	GRC	5				
Use appropriate office etiquette	GRC	5				
Dress code	LLC	12	1.66	2.0	2.0	76
3 worker behaviors	2 panels	17 members	1.66	2.0	2.0	76
8 Enthusiastic						
Enthusiastic	GSC	12	2.62	3.0	3.0	157
1 worker behaviors	1 panels	12 members	2.62	3.0	3.0	157
9 Ethical / respectful						
Respectful of others	GRC	5				
Ethical	GSC	12	2.73	3.0	3.0	156
Ethical behavior (integrity)	LLC	12	2.68	3.0	3.0	80
3 worker behaviors	3 panels	29 members	2.71	3.0	3.0	236
10 Follow procedures						
follow procedures	GRC	5				
Recognize the importance of following procedures.	SMT	11				
Follow technical procedures.	SMT	11				

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	Name	Size	Importance: 1 low - 3 high			
			Mean	Median	Mode	Responses
Demonstrate data entry and digitizing skills.	SMT	11				
Understanding of copyright laws and standards	TST	8				
5 worker behaviors	3 panels	24 members				n / a
11 Industrious, persistent						
Industrious	AGK	5				
Demonstrate ability to be persistent at collecting data.	SMT	11				
Persistence	TST	8				
3 worker behaviors	3 panels	24 members				n / a
12 Leadership						
Leadership skills	GRC	5				
1 worker behaviors	1 panels	5 members				n / a
13 Multi-tasking						
Ability to multi-task	GRC	5				
Multi-tasking	GSC	12	2.62	3.0	3.0	157
Multi-tasking	SDM	11	2.88	3.0	3.0	52
Able to multi-task, set work priorities	TST	8				
4 worker behaviors	4 panels	36 members	2.68	3.0	3.0	209
14 Networking (interpersonal)						
Network with peers	GRC	5				
Participate outside of office (e.g. within user groups)	GRC	5				
2 worker behaviors	1 panels	5 members				n / a
15 Open minded						
Open-minded	AGK	5				
Open-minded	GRC	5				
Open to new tasks, assignments, ideas	GRC	5				
3 worker behaviors	2 panels	10 members				n / a
16 Outgoing, friendly						
People skills	GRC	5				
Easy-going	GRC	5				
Outgoing (friendly)	LLC	12	2.27	2.0	2.0	81
3 worker behaviors	2 panels	17 members	2.27	2.0	2.0	81
17 Paitent						
Patient	AGK	5				
1 worker behaviors	1 panels	5 members				n / a
18 Positive attitude						
Attitude	GHC	12				
Positive attitude	GHC	12				
Can-do, positive attitude	GRC	5				
Positive attitude	GSC	12	2.69	3.0	3.0	155
4 worker behaviors	3 panels	29 members	2.69	3.0	3.0	155
19 Pride						
pride in work	GRC	5				
1 worker behaviors	1 panels	5 members				n / a
20 Professionalism, maturity						
Professionalism	LLC	12	2.60	3.0	3.0	81
maturity	TST	8				
2 worker behaviors	2 panels	20 members	2.60	3.0	3.0	81

Table 6
GIS Technician Knowledge, Skills & Worker Behaviors
Grouped into Knowledge, Skill & Worker Behavior Categories

Knowledge & Skill Categories / Knowledge & Skills	DACUM Panels		VALIDATION SURVEY			
	Name	Size	Importance: 1 low - 3 high			
			Mean	Median	Mode	Responses
21 Punctual / reliable						
Consistent	AGK	5				
Reliable - punctual	GHC	12				
Punctuality	GSC	12	2.46	3.0	3.0	155
Punctuality	LLC	12	2.37	2.0	2.0	78
Punctual	SDM	11	2.63	3.0	3.0	52
	5 worker behaviors	5 panels 52 members	2.47	3.0	3.0	285
22 Resourceful						
Resourcefulness	SDM	11	2.90	3.0	3.0	52
Resourceful	TST	8				
	2 worker behaviors	2 panels 19 members	2.90	3.0	3.0	52
23 Self improvement						
Ability to learn	GRC	5				
Self-improvement	GSC	12	2.61	3.0	3.0	157
Willingness to learn	GSC	12	2.87	3.0	3.0	157
Willingness to learn	SDM	11	2.92	3.0	3.0	52
	4 worker behaviors	3 panels 28 members	2.76	3.0	3.0	366
24 Self motivated / independent						
Independent worker	GHC	12				
Motivated	GHC	12				
Self-starter	GHC	12				
Self-starter	GRC	5				
Self-initiated learner	GRC	5				
Can work independently	GRC	5				
Independent	GSC	12	2.44	2.0	3.0	154
Self-motivated	GSC	12	2.73	3.0	3.0	157
Self motivation	LLC	12	2.62	3.0	3.0	81
Ability to work independently	SDM	11	2.91	3.0	3.0	53
Self-disciplined	SDM	11	2.88	3.0	3.0	52
Self-motivated	SDM	11	2.92	3.0	3.0	51
Self-starter, independent worker motivated	TST	8				
	14 worker behaviors	6 panels 60 members	2.68	3.0	3.0	548
25 Sense of humor						
Good sense of humor	GRC	5				
Sense of humor	SDM	11	2.50	3.0	3.0	50
	2 worker behaviors	2 panels 16 members	2.50	3.0	3.0	50
26 Team Player						
Team player	GHC	12				
Team building	GRC	5				
Team participation	GRC	5				
Can work in team	GRC	5				
Interpersonal	GSC	12	2.40	2.0	2.0	155
Networking	GSC	12	2.25	2.0	2.0	155
Team player	GSC	12	2.65	3.0	3.0	156
Team Player	SDM	11	2.83	3.0	3.0	53
Demonstrate ability to work in a team as a member and/or leader.	SMT	11				
Recognize roles of others in team and cooperate to get job done.	SMT	11				
Team worker	TST	8				
	11 worker behaviors	6 panels 59 members	2.47	2.0	2.0	519

Table 6
GIS Technician Knowledge, Skills & Worker Behaviors
Grouped into Knowledge, Skill & Worker Behavior Categories

Knowledge & Skill Categories / Knowledge & Skills	DACUM Panels		VALIDATION SURVEY			
	Name	Size	Importance: 1 low - 3 high			
			Mean	Median	Mode	Responses
27 Trustworthy, honesty, integrity						
Trustworthy with confidential information	AGK	5				
Honesty	TST	8				
Integrity	TST	8				
3 worker behaviors	2 panels	13 members			n / a	
28 Visionary						
Divine - all knowing	GHC	12				
Abstract thinker (outside the box)	GSC	12	2.27	2.0	2.0	156
Visionary	GSC	12	2.07	2.0	2.0	155
3 worker behaviors	2 panels	24 members	2.17	2.0	2.0	311

Source: National Geospatial Technology Center, 2010