NC STATE UNIVERSITY

O*NET® Tools and Technology:

A Synopsis of Data Development Procedures

Prepared by:

Erich C. Dierdorff, Ph.D.
Donald W. Drewes, Ph.D.
Jennifer J. Norton, M.S.

Submitted to:
National Center for O*NET Development
Raleigh, NC

March 21, 2006

Table of Contents

List of Tables

Overview

This report provides a brief description of the development of O*NET® database information pertaining to "tools and technology" (T2). Machines, equipment, and tools have long been recognized as important components of the O*NET Content Model. Changes in the contemporary workplace create the need to capture data regarding software systems and information technology that are important to occupational performance. Thus, the primary focus of T2 development is to collect occupational information regarding various machines, equipment, tools, and software for presentation as supplemental data within the O*NET database. Special emphasis is placed on cutting-edge technologies and emerging workplace practices. These occupational data will be valuable for a wide range of O*NET applications such as workforce development, employee training, and vocational and career guidance.

The T2 data in the O*NET database are simultaneously generic and specific. They are specific in that they are described in the "language" of the occupation, industry, or field. Thus, T2 data can function as carriers of information specific to an individual occupation. At the same time, T2 data are organized by linking them to generic classifications in a standardized taxonomy entitled the *United Nations Standard Products and Services Code* (UNSPSC: for more details see www.unspsc.org). This taxonomic organization provides a non-duplicative, common language for classifying T2 data, allowing for comparisons of T2 data across multiple occupations. In essence, by possessing both generic and specific attributes, the same tool or technology for an occupation can serve multiple end-user purposes.

Important to note is that T2 entries are tools or technologies that are essential to the performance of an occupational role. In other words, T2 data are those items necessary to carry out central functions required by an occupational incumbent's work role and responsibilities. In addition to being essential to occupational performance, T2 items must have an expectation of a training requirement that ranges from a minimum of at least some on-the-job training, initial supervision, or "demonstration of use," to more formal training or vocational education. Additional information and examples of T2 data, as well as descriptions of the UNSPSC system, are provided later in this report.

This report will provide brief summaries of the following areas pertaining to T2 development:

- terminology useful for understanding the T2 project and the nature of T2 data;
- procedural development of the T2 project;
- general process steps of the T2 project;
- major activities within each project step;
- interventions for ensuring quality; and,
- descriptions of the current T2 data, including summary statistics.

T2 Terminology

Key terms and descriptions relevant to the T2 project and data are presented in the table below.

Table 1: T2 Terminology and Descriptions

Term	Description
T2 Objects	Specific tools or technology essential to occupational incumbents for performing their work roles. These are termed "examples" in the O*NET OnLine system.
Tools	"Tools" are generally comprised of machines, equipment, and tools
Technology	"Technology" generally includes information technology and software
UNSPSC Commodity	Product/service (i.e., noun) that corresponds to the most molecular level of the United Nations Standard Products and Services Code (UNSPSC) taxonomy
UNSPSC Class	Product/service (i.e., noun) that corresponds to the next "higher" level of the UNSPSC taxonomy above Commodities
Collection Stage	Initial stage of project work that focuses on capturing essential T2 objects for occupations
Classification Stage	Stage in which collected T2 objects are linked to UNSPSC taxonomy
Compilation Stage	Stage in which collected and classified T2 objects are compiled for O*NET database use

Procedural Development

An extensive proof-of-concept study was conducted to fully develop and test the procedures used for the current T2 effort. During this study a sample of 33 occupations was processed and more than 3000 individual T2 objects were collected. Sample occupations included some from information technology, healthcare and medical-related occupations, and pure "knowledge work" such as Statisticians, and varied substantially in the occupational use and relevancy of machines, equipment, tools, and software. The purpose of this proof-of-concept study was three-fold:

- to provide a testing ground for various data collection procedures concerning T2 information;
- to assess the viability of the Internet as the primary source of quality T2 information; and,
- to evaluate the efficacy of the UNSPSC taxonomy for organizing and classifying T2 information.

Although specific data collection procedures utilizing Internet-based sources have proven valuable for other O*NET data (e.g., occupational tasks), it was important to specifically assess the viability of these existing procedures and sources for T2 information. The knowledge and experience gained from developing standardized data collection procedures during these previous projects was found to significantly support the current T2 data collection effort. Established data collection methods, as well as the substantial knowledge base of previous Internet-based sources, provided quality occupational information. The results of the proof-of-concept study led to several procedural development conclusions. Three major conclusions are presented below.

First, the viability of websites as sources of high quality T2 information was supported. Examples of Internet-based sources typically used for T2 information include occupation information systems (OIS), career information systems (CIS), vocational information websites, job postings, professional association websites, competency listings, and education/training curricula. Evidence of the validity of the T2 data collected from such sources was also supported. This evidence was gained through comparisons to hardcopy publications (e.g., textbooks), as well as by asking subject matter experts to review and validate collected T2 data.

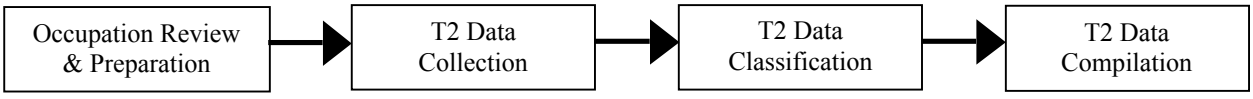
A second conclusion supported the use of project analysts trained in proper Internet searching procedures and possessing a strong background in occupational analysis. These analyst characteristics greatly enhanced the quality and efficiency of T2 procedures. All project analysts involved in the T2 project underwent specific training, which used both classroom instruction and web-based learning. This training included topics such as Internet data collection, occupational analysis, project protocols, and standard operating procedures.

A third conclusion confirmed the importance and efficacy of a taxonomic approach to organizing T2 information. Such an approach makes collected T2 information more comprehensible and congruent with other occupational data within the O*NET Content Model. Use of the UNSPSC system was found to be suitable for these purposes.

Findings from the proof-of-concept study were incorporated into the development of procedures subsequently used to produce the current T2 data. A summary description of these procedures is presented in the following section.

General T2 Procedure and Major Activities

Based upon the lessons learned during the proof-of-concept study, the following general procedure was designed and implemented to collect, organize, and present T2 information. This procedure occurs across four major steps shown in the figure below. Each of these steps is briefly described in the ensuing paragraphs.



Step 1: Occupation Review and Preparation

The primary purpose of this step is to familiarize project analysts with the occupation for which T2 data are to be collected. This process involves several activities, including:

- reviewing existing occupational information contained within the O*NET system so that occupational context, content, and differentiation are clearly understood,

- studying existing task information for the occupation in question in order to clearly develop a concept of the work activities performed and the types of tools and technology likely to be needed for such activities, and,

- reviewing industry or general field of study sources to clarify understanding of occupational activities that could involve tools and technology.

For each targeted occupation, project analysts conduct the following tasks in this general sequence:

1. Review overall occupational information within O*NET system (e.g., occupational description, lay titles, required skills, etc.).

2. Review the occupation's task listing for tasks that involve the use of T2 objects.

   - T2 objects explicitly listed within tasks are recorded for verification during subsequent data collection.
   - T2 objects implied by the performance of the tasks are noted by analysts to guide and support subsequent data collection.

3. Compare the target occupation to similar occupations in O*NET to further understanding of occupational differentiation.

4. Review existing T2 object lists for similar occupations, when available.

As an example, consider the conduct of the above activities for the target occupation of Registered Nurses. First, the occupational description and lay titles are reviewed:

> *Assess patient health problems and needs, develop and implement nursing care plans, and maintain medical records. Administer nursing care to ill, injured, convalescent, or disabled patients. May advise patients on health maintenance and disease prevention or provide case management. Licensing or registration required. Includes advance practice nurses such as: nurse practitioners, clinical nurse specialists, certified nurse midwives, and certified registered nurse anesthetists. Advanced practice nursing is practiced by RNs who have specialized formal, post-basic education and who function in highly autonomous and specialized roles.*
>
> *Sample of reported job titles: RN (Registered Nurse), Staff Nurse, Staff RN (Staff Registered Nurse), Charge Nurse, OR RN (Operating Room Registered Nurse), Clinical Nurse, Oncology RN (Oncology Registered Nurse), Relief Charge Nurse, CCU Nurse (Cardiac Care Unit Nurse), CCU Nurse (Coronary Care Unit Nurse)*

Second, the task list is reviewed for explicitly stated T2 objects, as well as those implied by the performance of a given task. Below are two examples of tasks that imply the use of T2 objects. Examples of potential T2 objects derived from the task performance implications are shown in parentheses.

> Record patients' medical information and vital signs. (Electronic blood pressure monitors; Cardiac monitors)
>
> Maintain accurate, detailed reports and records. (Electronic medical record EMR software; Personal computers)

Third, the information for Registered Nurses is compared to other nursing occupations in O*NET. This information is used to determine points of differentiation that might affect specific T2 usage. For example, information for Licensed Practical and Vocational Nurses would be reviewed:

> *Care for ill, injured, convalescent, or disabled persons in hospitals, nursing homes, clinics, private homes, group homes, and similar institutions. May work under the supervision of a registered nurse. Licensing required.*
>
> *Sample of reported job titles: LPN (Licensed Practical Nurse), Charge Nurse, Clinic Nurse, Office Nurse*

Finally, other nursing and/or medical-related occupations that have previously been researched are reviewed to determine if there are T2 objects that may also apply to the target occupation. Potential T2 objects are noted and incorporated in subsequent data collection activities.

Step 2: T2 Data Collection

The purpose of this step is to locate and capture essential T2 objects using Internet-based sources (e.g., career websites, job postings, professional association websites, university curricula, etc.).

Searching for T2 objects. Internet searching follows both a general search strategy and a more focused strategy developed specifically for the target occupation. The general search strategy is conducted first and involves using specific occupational keywords (e.g., occupation's title) combined with other search terms such as "technology" or "equipment." This strategy also involves visits to websites such as professional associations, which may have detailed information about educational and occupational requirements. Following the general search is a more focused search strategy that is based upon information gathered during Step 1, such as T2 object usage that was either explicitly stated in tasks or implied by task performance.

Both searching strategies include targeted searching, using search engines such as Google®. Emphasis is placed on using keywords related to the occupation to search in a way that will elicit complete but succinct results sets, as well as on making specific visits to websites found to be productive for similar occupations. Internet-based sources must be reputable, reliable, and valid in order to be used as providers of T2 information. Efforts are made to ensure that search sites include quality websites such as occupation information systems, career information systems,

professional association and education websites, degree and certification descriptions, governmental job specifications, and trade journals.

Also included in the search process is a directed effort to capture new and emerging T2 objects – items that may be coming into use for a given occupation in conjunction with technological advancements. For example, in medical-related occupations, robotic surgery is becoming more prevalent. Thus, devices such as robotic arms are added to T2 object listings. These objects are often easily identified through more focused research of particular occupational procedures, as information about new activities required to perform a given procedure and the technology linked to these activities is obtained through careful Internet searching.

Collecting T2 objects. As T2-related items are located on Internet-based sources, they are evaluated in order to determine whether or not they should be captured as T2 objects. In general, these evaluative decisions are meant to err on the side of inclusion. Thus, questionable T2-related items that may not have obvious reasons for exclusion are generally retained at this point, with the supposition that further searching will confirm or disconfirm inclusion. For example, an item such as "surgical drill" could appear on a list of objects used in a nursing setting. Further research would be needed to determine whether the nurses do, in fact, use such drills, or whether they are merely equipment present in an operating room setting and are actually used only by surgeons. However, all T2-related items must meet several minimum inclusion criteria in order to be deemed essential T2 objects. These criteria are below.

- Evidence must be provided to link T2 objects to the target occupation, meaning that the objects must be found in a context that makes clear they are used by an occupational incumbent for whom the objects are being sought. For example, simply having a list of surgical instruments is insufficient for determination that these instruments are actually used by Registered Nurses.

- The Internet-based source must provide quality information. For example, university curricula are considered quality sources, whereas "web logs" (blogs) are not.

- Use of T2 objects must have an expectation of some form of training, which could range from a minimum of on-the-job training, initial supervision, or "demonstration of use," to more formal training or vocational education.

- T2 objects must not be material, such as paint or glue, but in fact tools or technology.

Because the linkage of T2 objects to specific occupations is infrequently provided by existing occupational information sources, it is unusual to find pre-existing lists of tools and technology neatly organized or directly associated with a given occupation. Instead, analysts must assemble T2 object listings from sources that present activity-related descriptions. For example, when researching T2 information for an Emergency Medical Technician, an analyst would note that incumbents might insert intravenous lines, and would then locate descriptions of intravenous line insertion procedures (from an on-line training manual, for example) in order to determine the specific types of equipment used in this core work role activity.

Overall data collection process. In general, searching and collecting activities are iterative and cyclical. All sources providing T2 objects are specifically recorded using their "uniform resource locators" (URLs). Analysts continue to pursue search and collection activities for a target occupation until:

1. all avenues have been exhausted;
2. only redundant information is provided; and,
3. all relevant occupational tasks that entail T2 object usage have been represented.

Points 1 and 2 above are determined to have been reached when all relevant search terms have been used, and when search result sets continue to produce the same websites and T2 object results on a repeated basis.

It is important to note that a wide net is cast during data collection. Thus, many T2 objects may be subsequently excluded but are still retained at this point, given that they meet the inclusion criteria. The overarching rationale for such inclusiveness stems from the belief that it is better to capture too many T2 objects and then eliminate irrelevant T2 objects during the ensuing project steps (i.e., classification or compilation) than it is to overlook or fail to capture T2 objects that are occupationally important.

As an example of the searching and collection activities, consider again the occupation of Registered Nurses. The following paragraphs illustrate the outcomes of searching and collection activities and the impact of applying the inclusion criteria.

First, analysts begin the search process, starting with prime websites such as nursing associations, community college curricula, hospital job descriptions, and competency listings that often describe pieces of equipment or types of tools.

For Registered Nurses, T2-related items such as those shown below would be captured as T2 objects, as each clearly meets the four inclusion criteria.

> fetal monitors, arterial line catheters, defibrillators, and endotracheal ET tubes

Erring on inclusion, T2-related items that appear essential but initially lack clear evidentiary support, such as "surgical drapes," would be retained pending further investigation. In the case of surgical drapes, this item would be retained as a T2 object because further research would provide evidence that, in fact, there is a specific training procedure surrounding the use of this object.

T2-related items such as bandages, IV solutions, and medications would not be captured as T2 objects because they would be deemed as material, not tools or technology.

Data collection continues until search efforts provide only redundant information and all core activities of an occupation that necessitate the use of tools and technology are represented in the T2 object listing. An additional round of data collection often occurs in conjunction with the classification process (see Step 3 below). However, this supplemental data collection is extremely focused and generally performed on a case-by-case basis in order to gather T2

information for particular underrepresented occupational activities in need of additional T2 representation.

An important final point is that the searching and collection process is very much generative and emergent. In other words, to be most effective the process uses a "whole is greater than the sum of the parts" approach. For the holistic picture to emerge – or for the entire T2 object list to be compiled – hundreds of specific pieces of T2-related information from individual websites are collected and compiled to create the final T2 object list. Using the Registered Nurses example, it may be that one website mentions a procedure frequently conducted by incumbents. To locate T2-related information relevant to the conduct of this procedure, however, descriptions of the procedure often must be found in order to determine the requisite T2 objects involved. Moreover, the website describing the specific procedure will frequently describe or allude to other standard procedures and thus, these procedures must be researched as well. In short, analysts must engage in multi-directional and emergent search activities to most effectively locate and capture essential T2 objects for target occupations.

Step 3: T2 Data Classification

The purpose of this step is to organize all collected T2 objects into a taxonomic structure. To accomplish this, T2 objects are classified according to the UNSPSC system. This system contains over 18,000 non-duplicative entries and is organized into four levels of specificity (from most specific to least): Commodity, Class, Family, and Segment. For more details regarding the UNSPSC, see the organization's website (www.unspsc.org).

Classification facilitates a standardized and common language for T2 information. Importantly, this organization allows for cross-occupational comparisons of T2 objects and is congruent with other generic O*NET database information (e.g., skills). For example, several occupations use T2 objects pertaining to graphical software; however, the specific graphical software used by each occupation's incumbents will vary. Below are some examples of this object-level variability and how classification functions to create a common language. Note that each of these T2 objects is classified to the single UNSPSC Commodity of "Graphics or photo imaging software."

- *Aldus FreeHand* used by Cartographers and Photogrammetrists
- *Adobe Illustrator* used by Market Research Analysts
- *Harvard Graphics software* used by Biological Technicians
- *Ulead PhotoImpact* used by Desktop Publishers

Analysts are first presented with an occupation's T2 object listing generated during data collection. Often comprised of more than 100 T2 objects, these listings must be closely reviewed so that items can be matched to entries within the taxonomic structure and so that any redundant items can be removed. The classification process is standardized. In order for T2 objects to be

classified, they must be evaluated one at a time. This process involves answering the following questions for each T2 object:

- *Is the object clearly recognizable (i.e., what does the object represent)?* If not immediately apparent, further research is conducted to investigate what the object in question represents and whether or not it is

  - an individual T2 object and not part of a greater set of objects (e.g., "breathing assistance equipment," describes a collection of objects that includes oxygen masks, nebulizers, nasal cannulae, and oxygen regulators).
  - clearly related to the target occupation and not included in error.
  - spelled correctly and not just a misspelling of another item already in the object list (e.g., Intraaortic balloon pumps is the correct object; it is possible that an object such as "inter-aortic balloon pumps" may have been collected).
  - not a synonym for another object in the list; a case in which further research must be done to determine which synonym is the preferred term.
  - a generic name and not a brand name, if the object is tool-related (e.g., Air hammer versus Coleman PowerMate).

- *Does the object clearly meet the inclusion criteria?* Further research is performed as necessary and decisions are made based on occupational context as well as procedural information provided by Internet-based sources. Thus, latex gloves might well be retained as an essential T2 object in occupations involving hazardous materials, as such gloves require some training regarding their use by incumbents on the job and are essential in such occupations.

- *Has this object been classified before?* Prior to searching the UNSPSC system for a viable classification of a given T2 object, previous classifications are reviewed to check whether or not the object has an existing and applicable classification link. An archival file (data dictionary) listing all previously collected and classified T2 objects is used for this purpose. If no prior classifications exist or existing classifications are non-applicable (i.e., different occupational usage), analysts then search the UNSPSC system for a viable classification.

- *How should the object be classified to the UNSPSC?* When no prior classifications exist or existing classifications are non-applicable, analysts search the UNSPSC taxonomy for viable classifications.

Classifying T2 objects to the UNSPSC. Direct matches of T2 objects to UNSPSC entries at the Commodity level (see T2 Terminology for details) are first sought through keyword searching. Any T2 object judged to be a member of an existing UNSPSC Commodity entry is then assigned the name and code of the UNSPSC Commodity.

If a direct match to a UNSPSC Commodity is not found, T2 object synonyms are tried and relevant UNSPSC entries at the Class level are examined in order to determine the best fit. In addition, project analysts may research specific UNSPSC Commodities to determine whether or

not they are the best match for the T2 object in question. Analysts continue this process until all objects within an occupation's listing are classified.

Flagged for review are any T2 objects that cannot be clearly identified, or for which inclusion criteria are debatable, or for which there are no readily apparent matches in the UNSPSC. These objects are specifically addressed through project team discussions and resolutions provided by team consensus. In cases where there is insufficient evidence for T2 object inclusion (e.g., object appears on only one website, its purpose is obscure, or it is not easily linked to occupational tasks) the object is eliminated from the occupation's listing. Casting a wide net is the strategy of the data collection stage, whereas the classification stage is designed for line-by-line, careful evaluations aimed at producing T2 object listings with both content and face validity. It should be noted that information technology (IT) professionals provided further assistance in developing classification strategies for software and computer language T2 objects.

Table 2 displays examples of T2 objects and their classifications to the UNSPSC taxonomy.

Table 2: Examples of T2 Objects and Classifications

T2 Object	UNSPSC Commodity	UNSPSC Class
AdRelevance software	Data base reporting software	Data management and query software
C++	Object or component oriented development software	Development software
ESRI ArcView	Map creation software	Information exchange software
Altimeters	Height gauges	Length and thickness and distance measuring instruments
Radionucleide dose calibrators	Medical radiation dosimeters	Medical radiation detection or monitoring products
Doppler vascular equipment	Cardiac ultrasound or doppler or echo units or cardioscopes	Medical ultrasound and doppler and echo imaging products
Sigmoid equipment	Flexible endoscopes or accessories or related products	Endoscopes and accessories and related products
Goniometers	Goniometers	Medical exam size measuring devices
Cholangiocath catheters	Surgical or endoscopic catheters or catheterization kits or drainage bags	Surgical support supplies
Cloudberry Wireless Automatic Vehicle Location	Mobile location based services software	Information exchange software
eMoneyAdvisor AdvisorPlatform	Customer relationship management CRM software	Data management and query software

Step 4: T2 Data Compilation

The purpose of this final step is twofold: (1) to provide a final quality control review to ensure consistency, quality, and accuracy of T2 data and, (2) to build the necessary T2 database files for use in the O*NET system.

By this final step, all T2 objects have been verified in terms of meeting inclusion criteria and have been assigned appropriate taxonomic classification. The resulting T2 object listings are then reviewed to verify conformity to a set of style guidelines meant to ensure consistency. Any T2 objects not meeting the guidelines are revised. Classifications are reviewed to ensure accuracy. Spellings of software names and any other potentially problematic language issues are checked and confirmed. At this time, the core activities for each occupation are again reviewed to make certain that those requiring tools and technology for performance are represented by the collected T2 objects. Data are then delivered to a project oversight team, which conducts a supplementary review. Automated routines are utilized to provide final verification of style and classifications. Any additional questions are addressed and style changes or classification issues are discussed and resolved.

Interventions for Ensuring Quality

To ensure that project activities produce valuable outcomes the quality of T2 information is verified and enhanced in three ways:

1. project activities are designed to facilitate efficiency and effectiveness,
2. support tools are provided to project staff to improve consistency, and,
3. control points are placed through the overall process to verify and correct for quality.

Procedural Design

A prominent procedural design feature that facilitates efficiency and effectiveness is the separation of project activities into sequential stages. For any given occupation, steps 1 (occupation review and preparation) and 2 (data collection), discussed above, are performed as a single initial stage of work. Once these steps are completed, the next stage of activities involves step 3 (classification). The primary rationale for staged separation is to allow project analysts to better focus on the different activities requisite to each step. In other words, analysts can then more effectively develop the frame of mind for a given project stage (e.g., data collection or classification). The requisite activities for data collection and data classification are very complex and multifaceted. Thus, designing the procedure to allow analysts to center their attention on a fixed set of project activities is beneficial.

Another procedural design feature is the “batching” of occupational assignments. Here, occupations to be researched for T2 information are assigned to analysts in batches, based upon their similarities. For example, one analyst may be assigned a group of healthcare-related occupations, while another will be assigned a batch of information technology-related

occupations. Such batching promotes familiarity with the occupational area and context (e.g., industry), as well as allowing analysts to develop specific knowledge about T2 usage within a given occupational niche.

Support Tools

Two primary tools are used to support project activities and enhance the consistency of T2 information. The first tool is a style guide that provides rules for formatting, presentation, and style of T2 information. All T2 objects must adhere to these guidelines and violations are identified and immediately corrected. This tool is used during data collection, data classification, and data compilation. Thus, the use of the guidelines promotes standardization and consistency of T2 information across occupations.

The second tool utilized to enhance consistency is the aforementioned "data dictionary," an archival file that contains all previously collected and classified T2 objects. The data dictionary is used primarily during data classification. Analysts use the dictionary to ensure that T2 objects previously captured and classified are again correctly and consistently classified. This tool ensures that objects are classified similarly across myriad occupations.

Quality Control Points

According to quality experts such as Juran and Deming, quality control activities should be built throughout a given system's processes, rather than merely occurring as a final step. Toward this end, several quality control points occur across major project steps. In addition to multiple application points, quality control activities utilize multiple methods including manual reviews, automated reviews, and third party reviews. These points are presented below in relation to their respective project step.

- Step 1: Occupation Review and Preparation

  - Analysts are required to review occupational task lists for both explicit and implied references to T2 usage, which increases the breadth and accuracy of subsequent searches.
  - Analysts are required to review occupational information for related or similar occupations.

- Step 2: T2 Data Collection

  - Captured T2 objects are revised to adhere to stylistic guidelines.
  - Websites used are evaluated to determine that they contain objective and valid content, and are not merely expressions of a single individual's opinions.
  - Collected T2 objects are briefly reviewed by another team member in order to detect obvious errors of omission and/or inclusion. Note that this review is not meant to be exhaustive, but merely provide feedback and guidance.

- Step 3: T2 Data Classification

  - During classification, T2 objects are again checked for adherence to stylistic guidelines.
  - Difficult to classify T2 objects are flagged and subjected to team discussion for resolution.
  - A sample of classifications is reviewed by senior project staff. Questionable classifications are identified, discussed with the respective analyst, and a final classification decision made.

- Step 4: T2 Data Compilation

  - T2 data are compiled into a central file and a final review is conducted in two waves. First, project analysts review all T2 objects and identify any potential errors. Second, senior project personnel address and resolve potential errors. Senior personnel also perform a line-by-line review of approximately 75% of the T2 data.
  - T2 data are subjected to automated routines that verify spelling, consistent classification, and/or other database conventions (e.g., proper UNSPSC numeric code assignments, capitalization, etc.)
  - Prior to final publication of T2 data, an additional review using both manual and automated procedures is conducted by the project oversight team at the National Center for O*NET Development.

T2 Data Descriptions and Summary Statistics

As previously discussed, T2 data provide multiple levels of detail. At the most specific level of detail are T2 objects ("examples" on O*NET OnLine). These T2 data are often in the language of the occupation and can include specific products, as well. For example, technology-related objects will frequently be commercially available products, such as various software packages. For such T2 objects, the vendor and proprietary names are included in the entry (e.g., Microsoft Access, Oracle PeopleSoft, Kronos Workforce Timekeeper, Adobe Illustrator). Substantial effort is made to accurately reflect this proprietary information; however, product vendors frequently change due to mergers or acquisitions, selling commercial rights, or even through changing names of product lines of legacy software. Tool-related T2 objects (e.g., fluorescence spectrophotometers, dynamometers, autoclaves, global positioning system GPS devices) do not carry vendor information, because this information is less central to the objects.

T2 objects are organized using the UNSPSC taxonomy. This initial organization occurs at the highest level of detail in the UNSPSC system, UNSPSC Commodities. These Commodity entries can be seen as generic descriptors of T2 data, similar to the relationship between generalized work activities (GWA) and tasks. Thus, theses entries are useful for cross-occupational comparisons. Some examples of Commodity entries include enterprise resource planning ERP software, accounting software, materials requirements planning logistics and supply chain software, global positioning system receivers, medical magnetic resonance imaging MRI scanners, and infrared spectrometers.

Commodity entries are also the organizing force for presentation of T2 information in the O*NET OnLine system. Here, samples of these entries are shown in bold format, followed by several specific T2 objects as examples. Although transparent to end-users of O*NET OnLine, T2 data are also organized by three other UNSPSC classes of increasing generality (Class, Family, and Segment).

The initial T2 database contains tools and technology information spanning 156 occupations. A total of 14,633 T2 objects were collected across these occupations. On average, there are approximately 94 T2 objects per occupation, classified into approximately 53 Commodities and 26 Classes. Of the 14,633 T2 objects, roughly 44% (5318 objects) are technology-related. Table 3 below shows overall cumulative statistics for total T2 objects, tool-related T2 objects, and technology-related T2 objects.

Table 3: Cumulative Statistics for 156 Occupations

T2 Data Type	Mean	Standard Deviation	Minimum [a]	Maximum
Total T2 Objects	93.80	56.23	13	282
Total T2 Generic Titles (Commodity-level)	52.57	36.80	9	158
Total T2 Generic Titles (Class-level)	25.78	16.62	5	78
Tool Objects	59.71	56.06	3	255
Tool Generic Titles (Commodity-level)	42.30	38.39	3	144
Tool Generic Titles (Class-level)	20.33	17.27	1	74
Technology Objects	34.09	33.59	0	177
Technology Generic Titles (Commodity-level)	10.27	7.13	0	37
Technology Generic Titles (Class-level)	5.44	2.74	0	13

[a] There were 2 of the 156 occupations for which no technology-related objects were collected (Helpers-Pipelayers, Plumbers, Pipefitters, and Steamfitters; Construction Laborers)

More specific frequency statistics regarding T2 data for each of the 156 occupations are provided on pages 19-30. Presented first, Table 4 displays total T2 object frequencies by occupation and classification (pages 19-24). Next, Table 5 also displays T2 objects frequencies by occupation, but presents additional frequencies by tool versus technology and classification (pages 24-30).

Conclusion

This report provides a brief description of the procedural development of O*NET database information pertaining tools and technology. Among the topics discussed in this report were T2 project and data terminology, general process steps and major activities undertaken during the

project, and various quality control interventions. Examples were also provided to illustrate the results and decision points of different project activities. The T2 data file for the 156 occupations treated during this present project effort, as well as additional supportive information (e.g., listing of occupations, T2 data file descriptions, fact sheet, etc.) may be found on the O*NET Consortium website (www.onetcenter.org/supplemental.html).

Table 4: T2 Object Frequencies by Occupation and Classification

O*NET-SOC Code	Title	T2 Objects	Cumulative Totals	
			UNSPSC Commodities	UNSPSC Classes
11-2011.00	Advertising and Promotions Managers	40	22	10
11-2021.00	Marketing Managers	31	21	9
11-3021.00	Computer and Information Systems Managers	89	52	20
11-3031.01	Treasurers, Controllers, and Chief Financial Officers	40	16	7
11-3031.02	Financial Managers, Branch or Department	25	18	9
11-3040.00	Human Resources Managers	43	17	11
11-3051.00	Industrial Production Managers	36	21	9
11-3071.00	Transportation, Storage, and Distribution Managers	49	25	13
11-9021.00	Construction Managers	35	20	9
11-9041.00	Engineering Managers	32	20	8
11-9051.00	Food Service Managers	29	16	9
11-9111.00	Medical and Health Services Managers	43	24	11
13-1031.01	Claims Examiners, Property and Casualty Insurance	50	14	9
13-1031.02	Insurance Adjusters, Examiners, and Investigators	66	15	10
13-1051.00	Cost Estimators	27	12	7
13-2011.01	Accountants	109	21	10
13-2011.02	Auditors	70	13	7
13-2021.01	Assessors	59	16	10
13-2021.02	Appraisers, Real Estate	65	16	10
13-2041.00	Credit Analysts	32	11	8
13-2051.00	Financial Analysts	113	15	7
13-2052.00	Personal Financial Advisors	92	17	8
13-2072.00	Loan Officers	69	14	8
13-2082.00	Tax Preparers	38	17	8
15-1021.00	Computer Programmers	142	26	10
15-1031.00	Computer Software Engineers, Applications	156	31	13
15-1032.00	Computer Software Engineers, Systems Software	185	36	15
15-1041.00	Computer Support Specialists	51	34	16

O*NET-SOC Code	Title	Cumulative Totals		
		T2 Objects	UNSPSC Commodities	UNSPSC Classes
15-1051.00	Computer Systems Analysts	138	36	14
15-1061.00	Database Administrators	87	33	13
15-1071.00	Network and Computer Systems Administrators	100	40	18
15-1071.01	Computer Security Specialists	73	26	13
15-1081.00	Network Systems and Data Communications Analysts	98	40	18
17-1011.00	Architects (except landscape and naval)	65	37	20
17-1021.00	Cartographers and Photogrammetrists	85	43	21
17-1022.00	Surveyors	91	42	26
17-2031.00	Biomedical Engineers	232	120	61
17-2071.00	Electrical Engineers	156	61	30
17-2081.00	Environmental Engineers	147	90	45
17-2111.01	Industrial Safety and Health Engineers	102	46	26
17-2111.02	Fire-Prevention and Protection Engineers	68	24	17
17-2111.03	Product Safety Engineers	78	52	25
17-2112.00	Industrial Engineers	129	59	31
17-2141.00	Mechanical Engineers	130	58	32
17-3011.01	Architectural Drafters	54	26	13
17-3011.02	Civil Drafters	50	25	12
17-3013.00	Mechanical Drafters	54	25	11
17-3023.01	Electronics Engineering Technicians	77	64	32
17-3023.03	Electrical Engineering Technicians	91	71	34
17-3025.00	Environmental Engineering Technicians	240	158	65
17-3031.01	Surveying Technicians	120	53	32
17-3031.02	Mapping Technicians	79	34	13
19-1021.00	Biochemists and Biophysicists	238	131	66
19-1042.00	Medical Scientists, Except Epidemiologists	130	96	43
19-2031.00	Chemists	222	143	54
19-2041.00	Environmental Scientists and Specialists, Including Health	143	69	33
19-2042.00	Geoscientists, Except Hydrologists and Geographers	282	123	66

O*NET-SOC Code	Title	Cumulative Totals		
		T2 Objects	UNSPSC Commodities	UNSPSC Classes
19-2043.00	Hydrologists	217	74	45
19-3021.00	Market Research Analysts	89	33	11
19-3022.00	Survey Researchers	92	25	10
19-3051.00	Urban and Regional Planners	71	26	12
19-4021.00	Biological Technicians	106	76	42
19-4091.00	Environmental Science and Protection Technicians, Including Health	119	64	36
19-4093.00	Forest and Conservation Technicians	154	92	50
21-1011.00	Substance Abuse and Behavioral Disorder Counselors	31	14	7
23-2011.00	Paralegals and Legal Assistants	77	24	9
29-1051.00	Pharmacists	55	43	32
29-1071.00	Physician Assistants	101	87	62
29-1111.00	Registered Nurses	192	149	78
29-1122.00	Occupational Therapists	72	56	34
29-1123.00	Physical Therapists	118	86	38
29-1126.00	Respiratory Therapists	70	59	27
29-2011.00	Medical and Clinical Laboratory Technologists	123	88	45
29-2012.00	Medical and Clinical Laboratory Technicians	104	76	41
29-2021.00	Dental Hygienists	72	45	29
29-2031.00	Cardiovascular Technologists and Technicians	139	81	41
29-2034.01	Radiologic Technologists	76	47	25
29-2034.02	Radiologic Technicians	56	31	16
29-2041.00	Emergency Medical Technicians and Paramedics	117	79	41
29-2052.00	Pharmacy Technicians	54	40	28
29-2055.00	Surgical Technologists	146	89	51
29-2061.00	Licensed Practical and Licensed Vocational Nurses	130	87	53
29-2071.00	Medical Records and Health Information Technicians	96	41	23
31-1011.00	Home Health Aides	32	31	22
31-2022.00	Physical Therapists Aides	21	20	12
31-9091.00	Dental Assistants	113	71	29

O*NET-SOC Code	Title	Cumulative Totals		
		T2 Objects	UNSPSC Commodities	UNSPSC Classes
31-9092.00	Medical Assistants	85	78	47
35-1012.00	First-line Supervisors/Managers of Food Preparation and Serving Workers	36	16	9
35-2014.00	Restaurant Cooks	33	25	7
35-2021.00	Food Preparation Workers	56	38	7
35-3011.00	Bartenders	60	25	13
35-3021.00	Combined Food Preparation and Serving Workers, Including Fast Food	56	39	12
35-3031.00	Waiters and Waitresses	19	9	8
39-6031.00	Flight Attendants	48	34	23
41-1011.00	First-Line Supervisors of Retail Sales Workers	74	26	16
41-2011.00	Cashiers, Except Gaming	24	18	14
41-2021.00	Counter and Rental Clerks	19	19	13
41-2031.00	Retail Salespersons	62	23	17
41-4012.00	Sales Representatives, Wholesale and Manufacturing, Except Technical and	43	17	7
41-9022.00	Real Estate Sales Agents	82	33	15
43-3011.00	Bill and Account Collectors	27	15	10
43-3031.00	Bookkeeping, Accounting, and Auditing Clerks	64	17	11
43-3071.00	Tellers	35	28	17
43-4051.00	Customer Service Representatives	38	17	10
43-4081.00	Hotel, Motel and Resort Desk Clerks	13	10	5
43-5032.00	Dispatchers, Except Police, Fire, and Ambulance	39	26	16
43-5061.00	Production, Planning, and Expediting Clerks	61	15	7
43-5071.00	Shipping, Receiving, and Traffic Clerks	41	17	13
43-9031.00	Desktop Publishers	74	26	12
47-2031.01	Construction Carpenters	132	70	36
47-2031.02	Rough Carpenters	97	59	33
47-2041.00	Carpet Installers	84	37	25
47-2051.00	Cement Masons and Concrete Finishers	148	61	35
47-2061.00	Construction Laborers	174	125	60
47-2073.00	Operating Engineers and Other Construction Equipment Operators	148	109	47

O*NET-SOC Code	Title	Cumulative Totals		
		T2 Objects	UNSPSC Commodities	UNSPSC Classes
47-2081.00	Drywall and Ceiling Tile Installers	71	44	25
47-2111.00	Electricians	178	111	44
47-2131.00	Insulation Workers, Floor, Ceiling, and Wall	38	29	19
47-2132.00	Insulation Workers, Mechanical	37	29	20
47-2141.00	Painters, Construction and Maintenance	102	63	33
47-2151.00	Pipelayers	90	71	32
47-2152.01	Pipefitters and Steamfitters	154	100	40
47-2152.02	Plumbers	203	106	49
47-2181.00	Roofers	149	71	42
47-3013.00	Helpers-Electricians	137	102	36
47-3015.00	Helpers-Pipelayers, Plumbers, Pipefitters, and Steamfitters	255	130	49
47-4011.00	Construction and Building Inspectors	121	89	38
47-4041.00	Hazardous Materials Removal Workers	129	95	50
47-4051.00	Highway Maintenance Workers	146	108	48
49-1011.00	First-line Supervisors/Managers of Mechanics, Installers, and Repairers	29	21	11
49-2094.00	Electrical and Electronics Repairers, Commercial and Industrial Equipment	148	119	46
49-2096.00	Electronic Equipment Installers and Repairers for Motor Vehicles	42	31	15
49-3011.00	Aircraft Mechanics and Service Technicians	165	117	47
49-3021.00	Automotive Body and Related Repairers	130	88	41
49-3022.00	Auto Glass Installers and Repairers	59	45	25
49-3023.01	Automotive Master Mechanics	224	148	60
49-3023.02	Automotive Specialty Technicians	198	135	54
49-3031.00	Bus and Truck Mechanics and Diesel Engine Specialists	117	88	39
49-3042.00	Mobile Heavy Equipment Mechanics, Except Engines	141	106	43
49-3093.00	Tire Repairers and Changers	83	50	27
49-9021.01	Heating, Air Conditioning and Refrigeration Mechanics and Installers	141	106	42
49-9041.00	Industrial Machinery Mechanics	163	126	50
51-1011.00	First-line Supervisors/Managers of Production and Operating Workers	47	22	13
51-4011.00	Computer-controlled Machine Tool Operators, Metal and Plastic	114	48	23

O*NET-SOC Code	Title	Cumulative Totals		
		T2 Objects	UNSPSC Commodities	UNSPSC Classes
51-4041.00	Machinists	185	106	37
51-4121.01	Welders, Production	103	84	39
51-4121.02	Welders and Cutters	115	87	41
51-4121.03	Welder-Fitters	117	90	42
51-4121.04	Solderers	45	39	23
51-4121.05	Brazers	43	39	23
51-8031.00	Water and Liquid Waste Treatment Plant and System Operators	91	60	24
53-2011.00	Airline Pilots, Copilots, and Flight Engineers	90	34	19
53-3032.00	Truck Drivers, Heavy and Tractor-Trailer	33	26	15
53-3033.00	Truck Drivers, Light or Delivery Services	20	18	14
53-3041.00	Taxi Drivers and Chauffeurs	30	20	11
53-7051.00	Industrial Truck and Tractor Operators	60	29	13

Table 5: Tool versus Technology Objects by Occupation and Classification

O*NET-SOC Code	Title	Tools			Technology		
		T2 Objects	UNSPSC Commodities	UNSPSC Classes	T2 Objects	UNSPSC Commodities	UNSPSC Classes
11-2011.00	Advertising and Promotions Managers	6	6	2	34	16	8
11-2021.00	Marketing Managers	6	6	2	25	15	7
11-3021.00	Computer and Information Systems Managers	21	15	7	68	37	13
11-3031.01	Treasurers, Controllers, and Chief Financial Officers	6	6	2	34	10	5
11-3031.02	Financial Managers, Branch or Department	7	7	3	18	11	6
11-3040.00	Human Resources Managers	4	4	2	39	13	9
11-3051.00	Industrial Production Managers	6	6	2	30	15	7
11-3071.00	Transportation, Storage, and Distribution Managers	9	8	6	40	17	7
11-9021.00	Construction Managers	4	4	2	31	16	7

		Tools			Technology		
O*NET-SOC Code	Title	T2 Objects	UNSPSC Commodities	UNSPSC Classes	T2 Objects	UNSPSC Commodities	UNSPSC Classes
11-9041.00	Engineering Managers	6	6	2	26	14	6
11-9051.00	Food Service Managers	4	4	3	25	12	6
11-9111.00	Medical and Health Services Managers	4	4	2	39	20	9
13-1031.01	Claims Examiners, Property and Casualty Insurance	6	6	2	44	8	7
13-1031.02	Insurance Adjusters, Examiners, and Investigators	8	4	3	58	11	7
13-1051.00	Cost Estimators	6	6	2	21	6	5
13-2011.01	Accountants	7	7	3	102	14	7
13-2011.02	Auditors	7	7	3	63	6	4
13-2021.01	Assessors	13	5	3	46	11	7
13-2021.02	Appraisers, Real Estate	14	6	4	51	10	6
13-2041.00	Credit Analysts	5	5	3	27	6	5
13-2051.00	Financial Analysts	6	6	2	107	9	5
13-2052.00	Personal Financial Advisors	6	6	2	86	11	6
13-2072.00	Loan Officers	6	6	2	63	8	6
13-2082.00	Tax Preparers	3	3	2	35	14	6
15-1021.00	Computer Programmers	4	3	1	138	23	9
15-1031.00	Computer Software Engineers, Applications	7	6	2	149	25	11
15-1032.00	Computer Software Engineers, Systems Software	8	6	2	177	30	13
15-1041.00	Computer Support Specialists	9	9	5	42	25	11
15-1051.00	Computer Systems Analysts	4	4	1	134	32	13
15-1061.00	Database Administrators	6	6	2	81	27	11
15-1071.00	Network and Computer Systems Administrators	18	12	6	82	28	12
15-1071.01	Computer Security Specialists	6	5	2	67	21	11
15-1081.00	Network Systems and Data Communications Analysts	23	12	5	75	28	13
17-1011.00	Architects (except landscape and naval)	25	20	12	40	17	8
17-1021.00	Cartographers and Photogrammetrists	40	28	14	45	15	7
17-1022.00	Surveyors	57	30	17	34	12	9
17-2031.00	Biomedical Engineers	140	100	55	92	20	6
17-2071.00	Electrical Engineers	79	48	25	77	13	5
17-2081.00	Environmental Engineers	100	77	40	47	13	5

		Tools			Technology		
O*NET-SOC Code	Title	T2 Objects	UNSPSC Commodities	UNSPSC Classes	T2 Objects	UNSPSC Commodities	UNSPSC Classes
17-2111.01	Industrial Safety and Health Engineers	56	34	19	46	12	7
17-2111.02	Fire-Prevention and Protection Engineers	30	21	15	38	3	2
17-2111.03	Product Safety Engineers	52	40	19	26	12	6
17-2112.00	Industrial Engineers	46	43	27	83	16	4
17-2141.00	Mechanical Engineers	72	43	26	58	15	6
17-3011.01	Architectural Drafters	23	16	8	31	10	5
17-3011.02	Civil Drafters	21	15	7	29	10	5
17-3013.00	Mechanical Drafters	23	16	7	31	9	4
17-3023.01	Electronics Engineering Technicians	56	53	25	21	11	7
17-3023.03	Electrical Engineering Technicians	65	57	26	26	14	8
17-3025.00	Environmental Engineering Technicians	175	140	57	65	18	8
17-3031.01	Surveying Technicians	70	42	26	50	11	6
17-3031.02	Mapping Technicians	18	17	6	61	17	7
19-1021.00	Biochemists and Biophysicists	168	116	58	70	15	8
19-1042.00	Medical Scientists, Except Epidemiologists	109	89	39	21	7	4
19-2031.00	Chemists	155	125	46	67	18	8
19-2041.00	Environmental Scientists and Specialists, Including Health	83	53	26	60	16	7
19-2042.00	Geoscientists, Except Hydrologists and Geographers	153	109	58	129	14	8
19-2043.00	Hydrologists	72	58	38	145	16	7
19-3021.00	Market Research Analysts	6	6	2	83	27	9
19-3022.00	Survey Researchers	7	7	3	85	18	7
19-3051.00	Urban and Regional Planners	4	4	3	67	22	9
19-4021.00	Biological Technicians	76	66	36	30	10	6
19-4091.00	Environmental Science and Protection Technicians, Including Health	91	53	29	28	11	7
19-4093.00	Forest and Conservation Technicians	115	80	44	39	12	6
21-1011.00	Substance Abuse and Behavioral Disorder Counselors	5	5	2	26	9	5
23-2011.00	Paralegals and Legal Assistants	6	5	2	71	19	7
29-1051.00	Pharmacists	40	34	25	15	9	7
29-1071.00	Physician Assistants	94	81	57	7	6	5
29-1111.00	Registered Nurses	178	144	74	14	5	4

O*NET-SOC Code	Title	Tools			Technology		
		T2 Objects	UNSPSC Commodities	UNSPSC Classes	T2 Objects	UNSPSC Commodities	UNSPSC Classes
29-1122.00	Occupational Therapists	46	43	26	26	13	8
29-1123.00	Physical Therapists	107	77	32	11	9	6
29-1126.00	Respiratory Therapists	62	51	23	8	8	4
29-2011.00	Medical and Clinical Laboratory Technologists	104	80	40	19	8	5
29-2012.00	Medical and Clinical Laboratory Technicians	85	68	36	19	8	5
29-2021.00	Dental Hygienists	58	37	23	14	8	6
29-2031.00	Cardiovascular Technologists and Technicians	126	75	37	13	6	4
29-2034.01	Radiologic Technologists	64	42	22	12	5	3
29-2034.02	Radiologic Technicians	44	26	13	12	5	3
29-2041.00	Emergency Medical Technicians and Paramedics	101	76	39	16	3	2
29-2052.00	Pharmacy Technicians	42	33	24	12	7	4
29-2055.00	Surgical Technologists	135	82	46	11	7	5
29-2061.00	Licensed Practical and Licensed Vocational Nurses	120	81	49	10	6	4
29-2071.00	Medical Records and Health Information Technicians	24	21	13	72	20	10
31-1011.00	Home Health Aides	29	28	19	3	3	3
31-2022.00	Physical Therapists Aides	17	16	10	4	4	2
31-9091.00	Dental Assistants	104	64	23	9	7	6
31-9092.00	Medical Assistants	73	67	40	12	11	7
35-1012.00	First-line Supervisors/Managers of Food Preparation and Serving Workers	14	9	5	22	7	4
35-2014.00	Restaurant Cooks	28	21	5	5	4	2
35-2021.00	Food Preparation Workers	45	37	6	11	1	1
35-3011.00	Bartenders	50	22	10	10	3	3
35-3021.00	Combined Food Preparation and Serving Workers, Including Fast Food	47	37	10	9	2	2
35-3031.00	Waiters and Waitresses	10	8	7	9	1	1
39-6031.00	Flight Attendants	42	32	21	6	2	2
41-1011.00	First-Line Supervisors of Retail Sales Workers	19	15	10	55	11	6
41-2011.00	Cashiers, Except Gaming	18	14	11	6	4	3
41-2021.00	Counter and Rental Clerks	16	16	10	3	3	3
41-2031.00	Retail Salespersons	18	17	12	44	6	5

		Tools			Technology		
O*NET-SOC Code	Title	T2 Objects	UNSPSC Commodities	UNSPSC Classes	T2 Objects	UNSPSC Commodities	UNSPSC Classes
41-4012.00	Sales Representatives, Wholesale and Manufacturing, Except Technical and Scientific Products	4	4	2	39	13	5
41-9022.00	Real Estate Sales Agents	9	8	5	73	25	10
43-3011.00	Bill and Account Collectors	5	4	3	22	11	7
43-3031.00	Bookkeeping, Accounting, and Auditing Clerks	6	6	5	58	11	6
43-3071.00	Tellers	22	18	10	13	10	7
43-4051.00	Customer Service Representatives	10	8	4	28	9	6
43-4081.00	Hotel, Motel and Resort Desk Clerks	8	8	3	5	2	2
43-5032.00	Dispatchers, Except Police, Fire, and Ambulance	16	12	8	23	14	8
43-5061.00	Production, Planning, and Expediting Clerks	4	4	2	57	11	5
43-5071.00	Shipping, Receiving, and Traffic Clerks	11	8	6	30	9	7
43-9031.00	Desktop Publishers	5	5	3	69	21	9
47-2031.01	Construction Carpenters	116	61	30	16	9	6
47-2031.02	Rough Carpenters	92	54	29	5	5	4
47-2041.00	Carpet Installers	71	34	22	13	3	3
47-2051.00	Cement Masons and Concrete Finishers	136	57	31	12	4	4
47-2061.00	Construction Laborers	174	125	60	0	0	0
47-2073.00	Operating Engineers and Other Construction Equipment Operators	146	107	45	2	2	2
47-2081.00	Drywall and Ceiling Tile Installers	61	38	21	10	6	4
47-2111.00	Electricians	156	103	39	22	8	5
47-2131.00	Insulation Workers, Floor, Ceiling, and Wall	34	27	17	4	2	2
47-2132.00	Insulation Workers, Mechanical	33	27	18	4	2	2
47-2141.00	Painters, Construction and Maintenance	91	56	28	11	7	5
47-2151.00	Pipelayers	88	69	31	2	2	1
47-2152.01	Pipefitters and Steamfitters	140	93	35	14	7	5
47-2152.02	Plumbers	170	96	43	33	10	6
47-2181.00	Roofers	134	64	38	15	7	4
47-3013.00	Helpers-Electricians	135	100	35	2	2	1
47-3015.00	Helpers-Pipelayers, Plumbers, Pipefitters, and Steamfitters	255	130	49	0	0	0
47-4011.00	Construction and Building Inspectors	96	75	31	25	14	7

		Tools			Technology		
O*NET-SOC Code	Title	T2 Objects	UNSPSC Commodities	UNSPSC Classes	T2 Objects	UNSPSC Commodities	UNSPSC Classes
47-4041.00	Hazardous Materials Removal Workers	123	90	47	6	5	3
47-4051.00	Highway Maintenance Workers	137	101	43	9	7	5
49-1011.00	First-line Supervisors/Managers of Mechanics, Installers, and Repairers	6	6	4	23	15	7
49-2094.00	Electrical and Electronics Repairers, Commercial and Industrial Equipment	134	108	39	14	11	7
49-2096.00	Electronic Equipment Installers and Repairers for Motor Vehicles	34	27	12	8	4	3
49-3011.00	Aircraft Mechanics and Service Technicians	148	108	43	17	9	4
49-3021.00	Automotive Body and Related Repairers	118	82	36	12	6	5
49-3022.00	Auto Glass Installers and Repairers	56	43	23	3	2	2
49-3023.01	Automotive Master Mechanics	208	141	55	16	7	5
49-3023.02	Automotive Specialty Technicians	182	128	49	16	7	5
49-3031.00	Bus and Truck Mechanics and Diesel Engine Specialists	114	85	36	3	3	3
49-3042.00	Mobile Heavy Equipment Mechanics, Except Engines	138	103	40	3	3	3
49-3093.00	Tire Repairers and Changers	80	48	25	3	2	2
49-9021.01	Heating, Air Conditioning and Refrigeration Mechanics and Installers	128	97	38	13	9	4
49-9041.00	Industrial Machinery Mechanics	154	118	46	9	8	4
51-1011.00	First-line Supervisors/Managers of Production and Operating Workers	9	9	7	38	13	6
51-4011.00	Computer-controlled Machine Tool Operators, Metal and Plastic	66	37	18	48	11	5
51-4041.00	Machinists	165	96	33	20	10	4
51-4121.01	Welders, Production	101	82	37	2	2	2
51-4121.02	Welders and Cutters	114	86	40	1	1	1
51-4121.03	Welder-Fitters	114	87	40	3	3	2
51-4121.04	Solderers	43	38	22	2	1	1
51-4121.05	Brazers	41	38	22	2	1	1
51-8031.00	Water and Liquid Waste Treatment Plant and System Operators	82	55	20	9	5	4
53-2011.00	Airline Pilots, Copilots, and Flight Engineers	72	28	15	18	6	4

		Tools			Technology		
O*NET-SOC Code	Title	T2 Objects	UNSPSC Commodities	UNSPSC Classes	T2 Objects	UNSPSC Commodities	UNSPSC Classes
53-3032.00	Truck Drivers, Heavy and Tractor-Trailer	27	23	12	6	3	3
53-3033.00	Truck Drivers, Light or Delivery Services	13	13	9	7	5	5
53-3041.00	Taxi Drivers and Chauffeurs	18	18	9	12	2	2
53-7051.00	Industrial Truck and Tractor Operators	49	27	12	11	2	1