

Specialty Structuring Based on Task Modules Semantically Linked to Knowledge Domain Lexicons

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Background

The Job Structuring Technology (JST) project has the goal of targeting specific occupational areas and evaluating a series of scenarios to optimize force structuring by 1) promoting a rational distribution of knowledge, skill and ability (KSA) requirements; 2) providing a career-perspective for technical and managerial training; and 3) evaluating the impact of manpower deployment alternatives on mission readiness. One of the most challenging research objectives has been to develop a methodology for automatically proposing and evaluating possible specialty structuring scenarios which span more than one career field. This problem is being addressed by using Mission-Essential Modules (MEMs) as basic building blocks and Knowledge Domain Lexicons (KDLs) as cross-career ladder bridges.

Mission-Essential Modules

Mission-Essential Modules are Task Co-performance Modules (TCM) that have been identified as "high-drivers" by Subject Matter Experts (SMEs) in the Job/Mission Phase of a given JST study. Task Co-performance Modules have been routinely produced in the Air Force Occupational Measurement Squadron (AFOMS) occupational analysis program since 1988. Each Air Force Specialty (AFS) is typically subdivided into approximately 20 to 80 TCMs. Though the TCMs have not been used internally by AFOMS, they have been exported in their raw form to other applications for use (such as the Training Decision System, TDS; Job-Linked Assessment Procedures, J-LAP; and Tailored Task List System, TTLS). These other application areas have consistently modified modules to suit their own requirements and hence, the anticipated "common basis" for job definition has been eroded. The semantic (KDL-based) method reported here is one of the two active methods being explored by the JST project to improve the multi-use stability of TCMs. The other method (not reported here) is based on survey data and uses Experience Profiles (job descriptions for increasing time in service) to subdivide large modules.

The transition of a TCM to a MEM is a multi-step process. Each TCM assumes an independent identity with a growing number of data element profiles. These data elements include, at a minimum: original AFSC, TCM, Task Statements, and Task-Level Data. In addition to that basic set, other profiles may be added, most importantly Knowledge Domain Lexicon (KDLs) profiles. As explained below, a KDL profile is a series of Strength Of Association (SOA) values which measures a module's affinity to a selected set of dimensions.

Because the target of the semantic matching is a TCM that is drawn from a standard Comprehensive Occupational Data Analysis Programs (CODAP) task list, it is known that the content is focused and well-structured for separating verbs and nouns. From other research, it has become clear that in looking for Knowledge, Skills, and Abilities in CODAP text, that the nouns carry the lion's share of knowledge content while the verbs address skills and abilities. Nearly 200 CODAP task lists have been processed which describe Air Force jobs and the frequency of all tokens are on file. Each AFS task list has been processed and separated into

two parts: the verb-phrase-only file and the arbitrary token file (including verbs, adverbs, nouns, adjectives but not articles or prepositions). As both knowledge and skills must be trained and mastery achieved, the arbitrary token file represents the best definition of general "KNOWLEDGE" load or training requirement of the TCM.

Domains

A goal of job structuring is to explore possible options in defining the boundaries of career fields - i.e., sets of jobs which span a career from entry at apprentice level to retirement at the upper superintendent level. If individuals could be taught all things for all jobs, only one career field would be required -- but that is clearly not the case. Given that separations into different "fields" are appropriate, one would be wise to identify higher level sets of related career fields. A higher level set might identify common aptitude constellations (for recruitment), or common training and/or experiences (for training and assignment), or operationally-related assignments (for mission accomplishment). These broad categories of work would serve to handle modeling and allocation issues at the highest levels. A set of jobs or career fields with some common bond is called a "domain." Domains are important to the Job Structuring Technology system because they define global parameters for the process by identifying sets of jobs which may or may not be considered for consolidation. Two jobs within a domain may be combined, while two jobs in different domains may NOT be combined.

Knowledge Domain Lexicon

A key instrument in measuring cross-field similarity is the Knowledge Domain Lexicon. Knowledge Domain Lexicons (KDLs) are sets of tokens (non-common words and phrases) which have been found to be associated with the specified domain. The KDL methodology is necessary because the terminology used within an AFS may be specialized to a degree and hence similarity with other AFSs may be clouded without some bridge. To bridge this problem, EXTERNAL domain-area lexicons are built to bring together related AFSs. Lexicons may be built up either by: 1) reviewing published documented sources (regulations, classification standards), 2) inspecting occupational survey data (keywords from job descriptions, entire task modules), or 3) "notional" means (drawn from the experience of individuals such as Subject Matter Experts (SMEs) or veteran occupational analysts). Though the goal is bridging job areas, typically lexicons are built-up within existing jobs and only at the end of the process are they merged into a single domain profile. The job level lexicons are kept on file so that other types of domains may be defined, if desired.

Domain Sets

In most analyses, several related domains need to be considered together, as a set. For this level of analysis, the term "domain set" is used. Initial KDLs are denoted "nominal" and contain words which would be used in the target jobs. When KDLs are collected into Domain Sets, each KDL can be refined to include only those tokens which DIFFERENTIATE its own domain. These processed KDLs are called "refined" or "distilled" lexicons and are used to quickly classify TCMs. One chooses a domain set to expedite the purpose of the restructuring exercise at hand. For example one type of domain set is the one which separates jobs by the four skill-aptitude requirement areas (i.e., four domains in the set.) The Air Force's four aptitude areas are: Mechanical, Administrative, General, and Electronic (the MAGE profile). These are composite scores derived from combinations of subscores on the Armed Services Vocational Aptitude Battery (ASVAB). A potential enlistee's aptitude can be measured for these aptitude areas prior to enlistment and hence ensure the force is receiving the required talent. Another example of a set of domains is the current AFSC (Air Force Specialty Code) structure implemented 1 November 1993: Operations, Logistics, Support, Medical, Professional, Acquisition & Financial, Office of Special Investigations, Special Duty Identifiers, and Reporting Identifiers). The previous AFSC structure contained about 240 AFSC titles organized under about 50 "career field" labels -- a domain set which was more personnel and training oriented. All are valid viewpoints.

A First Application

This paper employed a strawman, "notional," set of domains which includes: Aerospace, Medical, and Civil Engineering with one generic module for Administration (Supervision, Training, Forms Management, Security, Safety, Planning, Organizing, Directing, and Implementing). For applications in which the domains are very broad, the term "SuperLex" has been adopted. The Administration lexicon created for this effort spanned numerous AFSs and represented a job requirement across all technical boundaries and hence was deemed a SuperLex along with the Aerospace, Medical, and Civil Engineering lexicons.

The Results

For the JST project, the backbone of the Knowledge Domain Lexicons was drawn from the Office of Personnel Management (OPM) Classification Standards for Wage Grade (WG) and General Schedule (GS) federal service jobs and in some cases, the Dictionary of Occupational Titles (DOT). Although the backbone was drawn from these sources, actual task-level statements from the military service are used in the task modules. One concern was whether or not the civilian job descriptions would use enough of the same language to allow the Semantic Assisted Analysis Techniques (SAATs) to detect matches between KDLs and the Task Co-performance Modules (TCMs). Of course the answer was "no," the OPM descriptions were not detailed enough to be used "as is," but they provided the necessary "notional springboard" which could be augmented in a stepwise refinement/expansion process (by adding in new tokens from military task modules) to produce a uniquely effective, multi-level taxonomy.

Initial attempts to match KDLs derived from each and every individual WG or GS job against target TCMs demonstrated problems with varying levels of detail covered in different subject matter areas. The most notable problem was that the KDL for the Medical area included more supervisory and management words than other subject matter areas. Hence, for every supervisory module in all of the military career fields, "Medical" was identified as the most relevant domain. That problem was resolved by creating a proper "Supervision/Administration" SuperLex by using tokens from the task modules from the most administrative AFSs (Information Management and Personnel). Also, "super domain" lexicons were made for the three active subject matter areas automated thus far (Aerospace [AERO], Civil Engineering [CIVENG/CivE/CE], and Medical [MED]). These three SuperLexes were used with the Supervision/Administration SuperLex for the first test application which follows.

So, on the second iteration of the KDL computations, instead of matching against hundreds of WG/GS jobs, each TCM was matched against a set of four SuperLexes - aerospace, civil engineering, medical, and supervision/administration. For each SuperLex in the set, a Strength of Association (SOA) measure was computed. Each TCM's data element profile was augmented to include the SOA value for each SuperLex. A TCM is declared to belong to the domain with the highest "Strength Of Association (SOA)" measure found in its profile. After a TCM is declared to belong to a given domain, SOAs are computed for subordinate KDL profiles in order to provide further subclassifications. The metric, "Strength Of Association (SOA)", is currently computed as the percent of all token occurrences in a task module that are accounted for by tokens in the Knowledge Domain Lexicon. A problem with the SOA metric was noticed in analyzing AFSCs with shreds (e.g., 452X1ABC where the "A", "B", and "C" represent distinct sub-jobs or "shreds"). Because the shreds perform different areas of work, the entire AFS task list is not appropriate. Shred "A", for example, may do the first four supervisory duties, one maintenance management duty, one general aircraft duty (known as cross-utilization-tasks), and one or two duties specific to the shred. The same is true of the "B" and "C" shreds. If this fact is not addressed, TCMs (which are computed with the full AFS sample) may be associated with shreds which do not actually perform that work or, at most, assist in performing that work on occasion. With this in mind, it becomes apparent that future iterations should include either screening of entire TCMs for shred appropriateness, or the SOA metric should be amended to differentially weight lexicon tokens by frequency of occurrence and/or modify the frequency weights of TCM tokens to reflect Percent Members Performing (PMP) and/or Percent Time Spent (PTS) by members of the target shred.

This methodology shows great promise in the present study which covers 673 TCMS in 20 diverse AFSs ranging from Antenna Specialists through Medical Laboratory Specialists. The following table summarizes the results for these AFSs by showing the number of modules automatically allocated to each SuperLex by the KDL SOA profiles. Note that the table originally showed only the Number of TCMS assigned to each category and that was found to be misleading because modules varied so much in size. To show a more realistic measure of the proportion of the an AFS task list associated with a specific domain area, the number of characters or "bytes" required for the task statements are shown in addition to the number of TCMS:

AFSC ¹	Title	Supv TCMS	Supv Title Bytes	Aero TCMS	Aero Title Bytes	CivE TCMS	CivE Title Bytes	Med TCMS	Med Title Bytes
361X0	Antenna Systems	6	14,907	28	26,673	11	8,530	0	0
361X1	Communication Cable Sys	11	11,940	18	21,691	5	5,302	0	0
452X1ABC	F-15 Avionics	12	11,002	10	16,498	0	0	0	0
452X2ABC	F-16 Avionics	3	10,048	13	37,604	1	660	1	658
452X3ABC	F/FB-111 Avionics	10	9,548	18	21,766	0	0	0	0
455X2	Communications & Navigation	20	13,325	47	42,124	0	0	0	0
552X0	Structural	15	15,492	19	20,027	24	25,448	3	2,648
602X0	Passenger/Household Goods	48	40,035	8	7,335	8	6,735	1	730
603X0	Vehicle Op/Dispatcher	16	18,202	6	6,006	2	1,151	0	0
702X0	Information Management	30	25,376	0	0	0	0	0	0
902X0	Medical Service	15	14,780	1	1,763	0	0	21	24,130
905X0	Pharmacy	16	12,366	0	0	0	0	11	11,724
914X0	Mental Health	12	13,833	1	768	0	0	27	26,863
924X0	Medical Laboratory	16	13,772	6	4,277	1	679	31	29,936

¹Note that AFSC notation shown is the AFSC structure that was in use when the task lists were constructed and the data collected. Occupational surveys typically take about two years from inception to data reporting. As the AFSC revision occurred 1 November 1993, tasks lists and data sets just now becoming available will reflect the impact of the revision and should be labeled with the new AFSC structure.

On this second iteration an in depth analysis was performed on the Structural AFS. This AFS was chosen because the Civil Engineering lexicon was not complete when these tests were made and any "misses" could be used to target the missing areas. Second, the Structural AFS contains, historically, a diverse number of jobs such as Carpenter, Mason, Plumber, Roofer, Sheet Metal Worker, etc. What follows are examples of the top rated TCMS drawn from the Structural AFS and declared to be in the four major domains: Civil Engineering, Supervision, Medical, and Aerospace. Each example shows two TCMS. For each TCM, the task statements in the TCM are shown followed by four lines reporting (in descending order) the SOA values for each SuperLex in the domain set.

Example 1: TCMs with Highest Civil Engineering SOA values.

```
===== Top Rated Module in CIVENG
01 P0667 APPLY SEALANTS TO BLOCK OR BRICK CONSTRUCTION
01 P0671 CLEAN MORTAR STAINS FROM BRICK SURFACES WITH ACID
01 P0672 CLEAN MORTAR STAINS FROM BRICK SURFACES WITH MATERIALS OTHER
02 THAN ACID
01 P0673 CLEAN MORTAR STAINS ON TILE AND BLOCK SURFACES
01 P0706 REPLACE CRACKED OR DAMAGED BLOCK, BRICK, OR STRUCTURAL TILES
01 P0707 REPOINT BLOCK, STRUCTURAL TILE, OR BRICK MORTAR JOINTS
01 P0708 RESEAL BLOCK, STRUCTURAL TILE, OR BRICK MORTAR JOINTS
01 M Module: 0001 CS0001 Stage 383: PS0002 450 to 456
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45.19 CIVENG.TX1
17.04 AEROSPAC.TX1
04.44 MEDICAL.TX1
02.22 SUPER.TX1

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===== Second rated Module
01 K0475 INSTALL OR REPLACE POCKET SLIDING DOORS
01 K0481 INSTALL OR REPLACE SLATE ROOFING
01 K0495 INSTALL OR REPLACE WATER TABLES
01 K0497 INSTALL OR REPLACE WOODEN DROP SIDING
01 X0502 INSTALL OR REPLACE WOODEN SIDING SHINGLES
01 K0505 LAY OUT CORNICES
01 M Module: 0051 CS0001 Stage 326: PS0002 304 to 309
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38.67 CIVENG.TX1
28.00 AEROSPAC.TX1
20.00 MEDICAL.TX1
02.67 SUPER.TX1

Shown above are the two TCMs which had the highest SOA values for the Civil Engineering SuperLex. As one might expect, the use of block or brick tends to distinguish the first TCM from the Aerospace and Medical areas.

Example 2: TCMs with Highest Supervision SOA values.

```
===== Top Rated Module in SUPER ==
01 D0075 ADMINISTER TESTS
01 D0076 ANNOTATE AF FORMS 1095 (TRAINING ACTIONS REQUIRED)
01 D0077 ANNOTATE AF FORMS 1096 (CDC STATUS RECORD)
01 D0078 ANNOTATE AF FORMS 1098 (SPECIAL TASK CERTIFICATION AND
02 RECURRING TRAINING)
01 D0079 ANNOTATE AF FORMS 797 (JOB QUALIFICATION STANDARD
02 CONTINUATION SHEET)
01 D0082 COMPLETE AF FORMS 803 (REPORT OF TASK EVALUATIONS)
01 D0103 SCORE TESTS
01 D0104 VERIFY CDC ENROLLMENT OF PERSONNEL
01 M Module: 0046 CS0001 Stage 216: PS0002 818 to 825
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53.97 SUPER.TX1
19.05 AEROSPAC.TX1
18.25 MEDICAL.TX1
00.79 CIVENG.TX1

===== Second Rated Module =====

01 A0013 DRAFT BUDGET REQUIREMENTS
 01 B0023 CONDUCT HIRING INTERVIEWS
 01 B0024 CONDUCT STAFF MEETINGS
 01 B0030 DRAFT OR REVISE CIVILIAN POSITION DESCRIPTIONS
 01 B0031 DRAFT OR REVISE MILITARY JOB DESCRIPTIONS
 01 C0049 EVALUATE BUDGET REQUIREMENTS
 01 C0072 WRITE CIVILIAN PERFORMANCE APPRAISALS
 01 M Module: 0024 CS0001 Stage 248: PS0002 803 to 809

43.59 SUPER.TX1
 24.36 MEDICAL.TX1
 08.97 AEROSPAC.TX1
 01.28 CIVENG.TX1

Although these TCMs are from the Structural AFS (552X0), standard supervision responsibilities still arise.

Example 3: TCMs with Highest Medical SOA values.

===== Top Rated Module in Medical

01 B0025 CORRECT SAFETY HAZARDS
 01 C0065 IDENTIFY SAFETY HAZARDS
 01 C0070 REPORT SAFETY HAZARDS
 01 E0108 ANNOTATE AF FORMS 1800 (OPERATOR'S INSPECTION GUIDE AND
 02 TROUBLE REPORT (GENERAL PURPOSE VEHICLES))
 01 F0140 COMPLETE AF FORMS 1297 (TEMPORARY ISSUE RECEIPT)
 01 M Module: 0023 CS0001 Stage 329: PS0002 692 to 696

28.40 MEDICAL.TX1
 25.93 SUPER.TX1
 14.81 AEROSPAC.TX1
 04.94 CIVENG.TX1

===== Third Rated Module in Medical

01 Y0951 ASSEMBLE AM-2 MATTING FOR RAPID RUNWAY REPAIRS
 01 Y0960 DON OR DOFF CHEMICAL WARFARE PERSONAL PROTECTIVE CLOTHING
 01 Y0962 ERECT CAMOUFLAGE NETTING
 01 Y0963 ERECT HARDBACK TENTS
 01 Y0965 ERECT TENTS, OTHER THAN HARDBACK TENTS
 01 Y0971 FIRE M-16 RIFLES FOR QUALIFICATION
 01 Y0973 IDENTIFY AND REPORT SUSPECTED UNEXPLODED ORDNANCES
 01 Y0975 IDENTIFY CHEMICAL WARFARE AGENTS
 01 Y0990 MAINTAIN M17 GAS MASKS
 01 Y0991 MAINTAIN PERSONAL DOCUMENTATION SUCH AS SHOT RECORDS, DOG
 02 TAGS, OR MILITARY IDENTIFICATION (ID) TAGS
 01 Y1012 PERFORM CAMOUFLAGING PROCEDURES
 01 Y1014 PERFORM CAMP SECURITY
 01 Y1031 PRACTICE COMSEC OR OPSEC DURING CONTINGENCY EXERCISES OR
 02 OPERATIONS
 01 Y1035 PRACTICE FIRST AID LIFESAVING TECHNIQUES
 01 Y1036 PRACTICE PERSONAL HYGIENE TECHNIQUES UNDER FIELD CONDITIONS
 01 Y1041 PREPARE PERSONAL CLOTHING AND EQUIPMENT FOR DEPLOYMENT
 01 Y1052 TEAR DOWN, INSPECT, CLEAN, AND REASSEMBLE M-16 RIFLES
 01 M Module: 0005 CS0001 Stage 370: PS0002 1 to 17

20.93 MEDICAL.TX1
 18.99 SUPER.TX1
 18.60 AEROSPAC.TX1
 05.43 CIVENG.TX1

Although these TCMs are from the Structural AFS (552X0), there does seem to be a valid concern with medical or health issues.

Example 4: TCMs with Highest Aerospace SOA values.

```
===== Top Rating Module in Aerospace
01 Y1008 OPERATE WALK IN REFRIGERATION BOXES
01 Y1009 OPERATE WATER PURIFICATION UNITS
01 Y1044 RELOCATE AIRCRAFT ARRESTING SYSTEMS
01 Y1045 RELOCATE AIRCRAFT MOBILE ARRESTING SYSTEMS (MASS)
01 Y1046 REMOVE AIRCRAFT ARRESTING SYSTEMS, OTHER THAN MASS
01 M Module: 0025 CS0001 Stage 365: PS0002 1032 to 1036

44.93 AEROSPAC.TX1
10.14 MEDICAL.TX1
08.70 CIVENG.TX1
05.80 SUPER.TX1
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===== Second Module in Aerospace
01 V0878 INSTALL OR REINFORCE BEARING PILES ON LOADING DOCKS, BOAT
02 DOCKS, OR WHARVES
01 V0879 INSTALL OR REINFORCE BRACINGS ON LOADING DOCKS, BOAT DOCKS,
02 OR WHARVES
01 V0880 INSTALL OR REINFORCE DECKING ON LOADING DOCKS, BOAT DOCKS,
02 OR WHARVES
01 V0881 INSTALL OR REINFORCE FENDER BOARDS ON LOADING DOCKS, BOAT
02 DOCKS, OR WHARVES
01 V0891 REMOVE OR REPLACE DECKING ON LOADING DOCKS, BOAT DOCKS, OR
02 WHARVES
01 V0892 REMOVE OR REPLACE FENDER BOARDS ON LOADING DOCKS, BOAT
02 DOCKS, OR WHARVES
01 M Module: 0031 CS0001 Stage 325: PS0002 958 to 963

34.64 AEROSPAC.TX1
24.84 CIVENG.TX1
05.23 MEDICAL.TX1
03.92 SUPER.TX1
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While the first TCM above at least mentions aircraft, the second TCMs looks very little like an Aerospace concern. The linkage there must have been on the verbs rather than the noun phrases. The Aerospace SuperLex caused great confusion with AFS (552X0, Structural). This is due, in part, to the fact that all metal-working jobs were assigned to the Aerospace SuperLex. Civil Engineering does, however, cover some aspects of metal work, and its domain profile will be amended accordingly as the Civil Engineering domain is completed. Note that at the time of the computer runs (6 October 1995), only one third of the Civil Engineering jobs were loaded which demonstrates how robust the methodology is.

Conclusions

The Knowledge Domain Lexicon (KDL) method was useful in quickly classifying 673 diverse TCMs for input to the JST system. While only the first two iterations have been completed with notional sets of job dimensions, results are very promising. The next step may be to create KDL sets using the high-level digit of AFS as a job domain. This can be done with both the older AFS definitions and the new AFS structure as implemented on 1 November 1993. This new AFS structure is targeted more firmly at the concept of the Air Force "Mission" as opposed to the older system which focused on technical training considerations. While both approaches have their merits, interacting them simultaneously may provide the very insight needed to accomplish the JST objective of having a flexible perspective for restructuring.

STRUCTUR Domain Lexicon

ADHESIVE
 ADJUST
 AGGREGATE
 AIRHAMMER
 ALTER
 AND
 ANTI-GLARE
 APPLY
 AREA
 ARTIFICIAL
 ASBESTOS
 ASPHALT
 AUTOMOTIVE
 BANANA
 BASEBOARD
 BASIN
 BEAM
 BEVEL
 BLOCK
 BOARD
 BOILER
 BREAKER
 BRICK
 BUILD
 BUILT-UP
 CARPET
 CEILING
 CEMENT
 CHIMNEY
 CHIPPING
 CHISEL
 CINDER
 COLD
 COMMON
 COMPOSITION
 CONCRETE
 CONSTRUCT
 CORNICE
 COTTA
 COVERER
 COVERING
 CURB
 CURE
 CUSHION
 CUSIONS
 CUT
 CUTTER
 DECK
 DECKING
 DETERMINE
 DIRT
 DITCH
 DOOR
 DOUBLE
 DRAIN
 DRAINAGE
 DRILL
 DUMP
 EDGE
 EXPANSION
 FABRICATE
 FACE
 FAMILY
 FELT
 FILL
 FINISH
 FINISHER
 FINISHING

FIREBRICK
 FIREPLACE
 FIT
 FLASHING
 FLOAT
 FLOOR
 FORM
 FOUNDATION
 FRICTION
 GLASS
 GLAZED
 GLAZIER
 GLAZING
 GRAVEL
 GRIND
 GROUND
 GUARD
 GUN
 GUTTER
 GYPSUM
 HAMMER
 HARD
 HEAT
 HEATINGADJUSTING
 HOD
 HOE
 HOIST
 HOLE
 HOT
 INSTALL
 INSTALLING
 INSULATING
 JACK
 JOINT
 JOIST
 KETTLE
 KNIFE
 LATEX
 LATH
 LAY
 LEAK
 LEVEL
 LEX
 LINOLEUM
 LOCATE
 LOT
 MACHINE
 MAINTAIN
 MANHOLE
 MARGIN
 MASON
 MASONRY
 MATERIAL
 MATTING
 MEASURE
 METAL
 METHOD
 MIX
 MIXER
 MOLDED
 MOLDING
 MOP
 MORTAR
 MUD
 NAIL
 NAILPULLER
 NATURAL
 NOTCHED

OIL-ASPHALT
 OPERATE
 OUT
 PACK
 PANEL
 PARKING
 PARTITION
 PATCH
 PATIO
 PAVEMENT
 PAVING
 PICKAX
 PIPE
 PLACE
 PLAN
 PLASTER
 PLASTERER
 PLASTERING
 PLASTIC
 PLATE
 PNEUMATIC
 POINTED
 POLISH
 POUR
 PREPARE
 PRYBAR
 PULLER
 PUMP
 RAISE
 RAKE
 RAMP
 REMOVE
 REPAIR
 REPLACE
 RESIN
 RIG
 ROAD
 ROLL
 ROLLER
 ROOF
 ROOFING
 RUBBER
 RULER
 RUNNING
 RUNWAY
 SAFETY
 SAND
 SANDER
 SAW
 SCALER
 SCISSORS
 SCREED
 SCRIBE
 SEAL
 SEALER
 SELECT
 SEQUENCES
 SET
 SETTER
 SETTING
 SHAPE
 SHEATHING
 SHINGLE
 SHOVEL
 SIDEWALK
 SIDING
 SINGLE
 SKYLIGHT

SLAG
 SLATE
 SNIP
 SOLDER
 SOLIDIFIED
 SPRAYER
 SPREAD
 SPREADER
 SQUARE
 STEP
 STONE
 STRAIGHT
 STRUCTUR
 STRUCTURAL
 STRUCTURE
 STUCCO
 SUBSURFACE
 SURFACE
 T-SQUARE
 TAMPER
 TAMPING
 TANK
 TAPE
 TEMPERED
 TERRA
 TILE
 TOOL
 TRACE
 TRIM
 TROWEL
 TRUCK
 TURBINE
 USE
 VALLEY
 VALVE
 VENTILATOR
 VENTS
 VIBRATOR
 VINYL
 WALK
 WALKWAY
 WALL
 WG-3602
 WG-3602-08CEMENT
 WG-3603
 WG-3603-08MASONRY
 WG-3603-10MASON
 WG-3604
 WG-3604-10TILE
 WG-3605
 WG-3606-07ROOFER
 WG-3606-09ROOFER
 WG-3609-09FLOOR
 WG-3610
 WG-3611
 WG-3653
 WG-3653-05ASPHALT
 WG-3653-07ASPHALT
 WG3605-09
 WHILE
 WINDOW
 WINDSHIELD
 WOOD
 WORK
 WORKER
 WORKING