NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

NCHRP REPORT 450

Transportation Research Thesaurus and User's Guide

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Research Sponsored by the American Association of State Highway and Transportation Officials
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NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

Systematic, well-designed research provides the most effective approach to the solution of many problems facing highway administrators and engineers. Often, highway problems are of local interest and can best be studied by highway departments individually or in cooperation with their state universities and others. However, the accelerating growth of highway transportation develops increasingly complex problems of wide interest to highway authorities. These problems are best studied through a coordinated program of cooperative research.

In recognition of these needs, the highway administrators of the American Association of State Highway and Transportation Officials initiated in 1962 an objective national highway research program employing modern scientific techniques. This program is supported on a continuing basis by funds from participating member states of the Association and it receives the full cooperation and support of the Federal Highway Administration, United States Department of Transportation.

The Transportation Research Board of the National Research Council was requested by the Association to administer the research program because of the Board's recognized objectivity and understanding of modern research practices. The Board is uniquely suited for this purpose as it maintains an extensive committee structure from which authorities on any highway transportation subject may be drawn; it possesses avenues of communications and cooperation with federal, state and local governmental agencies, universities, and industry; its relationship to the National Research Council is an insurance of objectivity; it maintains a full-time research correlation staff of specialists in highway transportation matters to bring the findings of research directly to those who are in a position to use them.

The program is developed on the basis of research needs identified by chief administrators of the highway and transportation departments and by committees of AASHTO. Each year, specific areas of research needs to be included in the program are proposed to the National Research Council and the Board by the American Association of State Highway and Transportation Officials. Research projects to fulfill these needs are defined by the Board, and qualified research agencies are selected from those that have submitted proposals. Administration and surveillance of research contracts are the responsibilities of the National Research Council and the Transportation Research Board.

The needs for highway research are many, and the National Cooperative Highway Research Program can make significant contributions to the solution of highway transportation problems of mutual concern to many responsible groups. The program, however, is intended to complement rather than to substitute for or duplicate other highway research programs.

Note: The Transportation Research Board, the National Research Council, the Federal Highway Administration, the American Association of State Highway and Transportation Officials, and the individual states participating in the National Cooperative Highway Research Program do not endorse products or manufacturers. Trade or manufacturers' names appear herein solely because they are considered essential to the object of this report.

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NOTICE

The project that is the subject of this report was a part of the National Cooperative Highway Research Program conducted by the Transportation Research Board with the approval of the Governing Board of the National Research Council. Such approval reflects the Governing Board's judgment that the program concerned is of national importance and appropriate with respect to both the purposes and resources of the National Research Council.

The members of the technical committee selected to monitor this project and to review this report were chosen for recognized scholarly competence and with due consideration for the balance of disciplines appropriate to the project. The opinions and conclusions expressed or implied are those of the research agency that performed the research, and, while they have been accepted as appropriate by the technical committee, they are not necessarily those of the Transportation Research Board, the National Research Council, the American Association of State Highway and Transportation Officials, or the Federal Highway Administration, U.S. Department of Transportation.

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FOREWORD

By Staff
Transportation Research Board

This report describes the Transportation Research Thesaurus, which is included as a CD-ROM. It also describes how the thesaurus should be used when developing index terms for a publication. The report will be useful to indexers and other readers who are interested in a deeper understanding of the thesaurus.

Tremendous volumes of information are currently being generated for the planning, design, operation, maintenance, and administration of transportation systems in the United States and abroad. This information, which ranges from specific engineering data to research summaries, is regularly used by federal, state, and local agencies; universities; and other organizations. Storage and retrieval systems have been created to manage and provide access to this information.

Retrieval of information on a specific subject is based on language. If the vocabularies of people assigning indexing terms and those seeking the information are not consistent, searchers will miss needed items and retrieve unwanted information. For example, searching for the word "plants" may yield results on both vegetation and industrial facilities. The entry term "transitways" alone may not provide information on "high-occupancy vehicle lanes." Local differences in terminology can limit search results. For example, "guardrail" is the commonly used term for a type of roadside barrier, but some states use the term "guiderail." Alternative terminology becomes an even bigger issue when an international perspective is taken on information resources. Such difficulties are inherent in any language-based system, but the creation of a thesaurus minimizes the problem. A thesaurus is a controlled vocabulary arranged in a known order in which equivalent, homographic, hierarchical, and associative relationships among terms are clearly displayed and identified by standardized, reciprocal relationship indicators. Its purposes are to promote consistency in the indexing of documents and to facilitate searching by linking entry terms with definitions.

NCHRP Project 20-32 developed a comprehensive transportation research thesaurus and software to access the thesaurus. TRB has adopted the thesaurus as the official list from which Transportation Research Information Services (TRIS) indexing terms, or descriptors, are selected. Under NCHRP Project 20-32(2), CDB Enterprises, Inc., reviewed the index terms currently used in TRIS, updated the terms in the thesaurus by working extensively with TRIS indexers, and facilitated the conversion of all TRIS records to use the new thesaurus terms. CDB Enterprises also improved the access software. The revised thesaurus and access software are included on a CD-ROM packaged with this report. TRB staff members are using the thesaurus to index new TRIS records.

This report describes the development and structure of the thesaurus. It provides training material for readers desiring to use the thesaurus to choose index terms for a document and provides information helpful to those maintaining the thesaurus. The report will also be useful to people who regularly search TRIS, because a fuller understanding of the thesaurus will result in more productive searches. Plans are being made to build a search utility based on the thesaurus into the on-line version of TRIS to benefit casual searchers.

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AUTHOR ACKNOWLEDGMENTS

The Transportation Research Thesaurus (TRT) was developed under the National Cooperative Highway Research Program (NCHRP), Projects 20-32 and 20-32(2), administered by the Transportation Research Board (TRB) and sponsored by the American Association of State Highway and Transportation Officials (AASHTO), in cooperation with the Federal Highway Administration, U.S. Department of Transportation.

The Project Team—which consisted of David Batty (Principal Investigator), Michael Kleiber, Paul Rosenberg, and Mary Roy—wishes to acknowledge the helpful comments and suggestions of the many members of the transportation community who participated in the review and testing process.

The Project Team also wishes to acknowledge, specifically, the help and support of the following individuals:

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The Project Team will appreciate and welcome comments and suggestions on this edition of the TRT. Please see Section K for detailed contact information.

A INTRODUCTION TO THE TRANSPORTATION RESEARCH THESAURUS (TRT)

A.1 Developmental Background of the TRT

It is not uncommon today for a database to contain records collected and indexed over a span of 50 years, using multiple indexing languages (or, indeed, none at all). Over time, the working language of a discipline changes and, eventually, reaches the point where a new, consistent indexing language is needed. This situation is often exacerbated by the fact that databases frequently are formed by combining records from many databases, indexed by many institutions, using many indexing languages. Some consequences of this are the inconsistent use of different terms to describe the same concept, the use of excessively precoordinated terms, and the misuse of identifiers and place names as subject descriptors.

Such was the case for the Transportation Research Information Services (TRIS), an on-line database operated and maintained by the Transportation Research Board (TRB) of the National Research Council. TRB and its Information Services Committee recognized the need for a new indexing language that reflected the current vocabulary of transportation research.

In December 1993, a contract was awarded under the National Cooperative Highway Research Program (NCHRP) to CDB Enterprises, Inc., for the development of a new language for transportation research to be used primarily with TRIS and secondarily as a general transportation thesaurus. CDB Enterprises, Inc., assembled a Thesaurus Project Team of lexicographers and database experts (David Batty and Paul Rosenberg) and subject experts (Michael Kleiber and Mary Roy).

The precursor of TRIS was the Highway Research Information Services (HRIS), which went into service in 1967 with a database of 26,000 records having a common, if unstructured, vocabulary. Two years later, HRIS became TRIS, with coverage extended to all modes of transportation. International highway coverage was accomplished cooperatively through the inclusion of records from what was then International Road Research Documentation (ITRD). Coverage of the maritime, rail and urban transit modes began, with separate funding and separate vocabularies, until funding dwindled and the rail and maritime databases were suspended; but records of these subfiles remained in TRIS. To make TRIS more mode inclusive, TRB agreed in 1985 to load records from the transportation libraries at Northwestern University and the University of California, Berkeley, into TLIB, a new subfile of TRIS. TLIB records contain exploded subject headings from the Library of Congress (assigned at the Institute of Transportation Studies Library [ITS], University of California, Berkeley) and the Northwestern University Transportation Library subject headings. TRIS descriptors are added to records from the ITS Library.

When work began on the new transportation thesaurus, TRIS contained four active subfiles (HRIS, ITRD, TLIB, and the Urban Mass Transportation Research Information Services

[UMTRIS]) and four relatively inactive subfiles (the Air Transportation Research Information Services [ATRIS], the Highway Safety Literature [HSL], the Maritime Research Information Services [MRIS], and the Railroad Research Information Services [RRIS]). Of the active subfiles, HRIS and UMTRIS shared a common vocabulary; ITRD used its own descriptors; and TLIB used two independent and separate subject authority files. There was also, and is, a Research in Progress file of FHWA- and FTA-sponsored research. This file is not under vocabulary control; the descriptors are assigned by researchers and/or sponsors.

Before the thesaurus project began, the TRIS database contained 386,845 records that were indexed by 70,416 postable terms. These terms had been reduced to 16,425 terms by the following mechanical methods: eliminating all terms used fewer than ten times, removing extraneous punctuation, and normalizing plural forms as far as could be done mechanically with a simple algorithm. This list of 16,425 terms served as the basic vocabulary resource for the new thesaurus, supplemented where necessary by the full list of 70,416 terms used to index TRIS.

The Project Team drew many additional terms from other vocabulary sources, including other thesauri, glossaries, manuals, and dictionaries. Of the 8,593 postable terms in the first edition of the new thesaurus, 2,991 were new terms.

In other words, the TRT development reduced an original unorganized vocabulary of over 70,000 terms, via a mechanically reduced vocabulary of 16,425 terms, to a basic vocabulary of 8,593 terms. Of these, 5,602 terms came from the original vocabulary, and 2,991 were new terms, for new concepts and new technology. The lead-in vocabulary, derived from terms not selected as preferred terms from the original TRIS list, and other contributed terms added 1,863 references. There were also 244 scope notes of varied length.

Note: The TRIS database is now approaching the half-million mark, and, as of May 2000, the latest edition of the TRT contains 8,915 postable terms, 1,975 references, and 254 scope notes.

The thesaurus project originally called for delivery of the thesaurus in printed form. During the project, it was decided, with the approval of the review panel, to provide the thesaurus in electronic form instead. The Project Team had used CDB Enterprises proprietary software to develop the TRT, so the thesaurus already existed in electronic form. Another proprietary software package available from Information Designs Limited was modified specifically for use in viewing the TRT electronically. The proprietary software is copyrighted, but the versions modified for the TRT are unrestricted and may be distributed freely. Among other advantages, the electronic version allows much wider distribution than would be feasible in printed form. The printed form, with all of its displays, would require about 2,000 pages.

The TRT has been issued in several revisions and formats since its initial publication (floppy disks, CD-ROM, Internet). The TRT is in the public domain and is distributed by TRB. See Section K for further information.

A.2 Lexicographical Background of the TRT

The TRT was developed using the internationally recognized process of **facet analysis**. The method of thesaurus maintenance described in Section E is also based on facet analysis.

A facet is a group of terms that share a principal characteristic. The terms may share other characteristics, but only one characteristic is chosen as the principal characteristic.

> For example, WOOD, NYLON, STEEL, COPPER, and WOOL all share the characteristic of being MATERIALS, whatever other characteristics some of them may share, like COMBUSTIBILITY. The terms constitute the beginnings of a MATERIALS facet. AUTOMOBILES, BOATS, and AIRCRAFT belong to a VEHICLES facet. Sometimes, the terms in a facet can be divided into subfacets by secondary characteristics: Within the MATERIALS facet, WOOD and WOOL are ORGANIC MATERIALS; STEEL and COPPER are METALS; and NYLON is a PLASTIC.

Facet analysis involves the identification of these independent clusters of terms within the thesaurus vocabulary. The facet analysis process requires basically two steps.

First, from a substantial sample of the source material (documents, existing index vocabularies, and expert knowledge), a raw vocabulary is collected into sets or clusters of terms that have a basic semantic or functional affinity. These clusters are analyzed to identify the facets and perhaps subfacets that, as far as possible, are independent of each other. The name of each facet (e.g., MATERIALS) is considered as a Top Term, and the facet is the hierarchical arrangement of terms subordinate to it.

The second step is to allocate as many terms as possible from the source vocabularies into the facets identified in the first step. This is an iterative process, in which some terms seem at first to belong nowhere or in several places. Such terms are put aside temporarily until the array of facets is validated; indeed, these hard-to-assign terms are often very significant in the validation process by helping to redefine the orientation of the facets so as to be able to accommodate these terms. This process also helps to validate the Top Terms.

Any hierarchy of terms needs a mechanism to preserve the order and level of subordination of its contents and to represent the terms themselves by a set of unique, unambiguous codes that can link the hierarchical order to alphabetical orders or graphic displays. The notational codes in the TRT use the Roman alphabet: a capital letter to indicate the facet or Top Term, and lowercase letters for the detail of the hierarchy.

Notational codes can be used effectively very early in thesaurus development to allocate terms to facets and to indicate their current location in the facet hierarchy. They allow efficient manipulation of large numbers of terms and the application of software programs to perform tasks like ensuring that references reciprocate (i.e., that every synonym or Use For [UF] reference refers to the preferred term, that every Broader Term [BT] reference has a corresponding Narrower Term [NT] reference, and that every Related Term [RT] reference has a corresponding RT reference from the term referred to). The codes also facilitate the manipulation of terms to produce listings of the whole thesaurus in a variety of orders and formats and to produce the final thesaurus showing all the relationships (UF, BT, NT, RT, etc.). Notational codes also facilitate searching by allowing the user to broaden or narrow a search efficiently.

Facet analysis organizes the terms into smaller, related groups, so each group of terms can be examined more easily and efficiently for consistency, order, hierarchical relationships, relationships to other groups, and the acceptability of the language used in the terms. Facet analysis also provides for the orderly designation of relationships between the terms. It eliminates the need to assign BT and NT relationships intuitively, which cannot be done within large vocabularies without risking omissions, circular relationships, and other errors.

The faceted approach is also useful for its flexibility in dealing with the addition of new terms and new relationships. Because each facet can stand alone, changes can usually be made easily in a facet at any time without disturbing the rest of the thesaurus.

A further benefit of the faceted approach becomes apparent during the use of the thesaurus: it is easier for an indexer or searcher to understand a set of hierarchically organized facets as a conceptual map, which shows the precise level and set of associations of a term.

Although software can be used to ensure the integrity of the structure of hierarchies and references between them, to generate printed and on-screen displays of different thesaurus formats, and even to display the thesaurus for point-and-shoot allocation of terms in on-line indexing, the process of facet analysis and the construction and maintenance of a thesaurus are essentially intellectual endeavors.

B PURPOSE AND SCOPE OF THE TRT

The main purpose of a thesaurus is to provide a common language between the providers and the users of information.

The TRT is intended primarily to provide a structured index language for information contained in TRIS. Secondarily, the TRT is offered as a general transportation thesaurus for use by other information services for researchers, managers, and users in the transportation field.

The TRT is designed to support descriptor-based and/or free-text searches in on-line systems, with either user-originated or mediator-negotiated inquiries.

The TRT contains all subjects related to the general field of transportation, including air, land, sea, and space modes. The intention has been to cover all areas, but with special attention to ground transportation.

Although the TRT is a monolingual thesaurus, based primarily on American usage of the English language, a serious effort has been made to include cross-references from commonly used British terms and spellings that differ from American usage.

The TRT does not, however, include **identifiers**. Identifiers are formal names of government agencies, organizations, persons, computer files, and even places (though names of places are a special kind of identifier). As a general rule, identifiers are not included in thesauri because the number and variety of identifiers are highly unpredictable and because many identifiers are used for only a brief period of time (jargon). For example, there are over 100 variations of the name of the E.I. duPont de Nemours Company.

The Project Team recommends that separate authority lists should be used to control identifiers. Published authority lists are available from appropriate information agencies (e.g., for geographic terms, United States Board of Geographic Names, or the Library of Congress Authority File). See Section F for more information on the use of proper names.

In a very few cases, an identifier has been included in the TRT (e.g., TERZAGHI'S RULES, where the identifier has become common usage).

C STRUCTURE OF THE TRT

The TRT consists of an organized group of hierarchies, called facets. Each facet has a Top Term (e.g., TESTING). The Top Term is also the name of the facet. Each facet contains terms that are closely related and subordinate to the Top Term.

The TRT conforms to the National Information Standards Organization's (NISO's) American National Standard, which is described in *Guidelines for the Construction, Format, and Management of Monolingual Thesauri* (Bethesda, MD: NISO Press, 1994 [ANSI/NISO Z39.19-1993]).

C.1 Facet Structure

Each term in the TRT is assigned a unique notational code (using letters from the Roman alphabet) that expresses at a glance the hierarchy (facet) to which the term belongs and the location of the term within the facet.

C.1.1 Facet Outline

Each facet is represented by a capitalized letter of the alphabet:

A	TRANSPORTATION
B	TRANSPORTATION OPERATIONS
C	MANAGEMENT AND ORGANIZATION
D	COMMUNICATION AND CONTROL
E	PLANNING AND DESIGN
F	CONSTRUCTION AND MAINTENANCE
G	TESTING
H	SAFETY AND SECURITY
J	ENVIRONMENT
K	ECONOMIC AND SOCIAL FACTORS
M	PERSONS AND PERSONAL CHARACTERISTICS
N	ORGANIZATIONS
P	FACILITIES
Q	VEHICLES AND EQUIPMENT
R	MATERIALS
S	PHYSICAL PHENOMENA
T	DISCIPLINES
U	MATHEMATICS
V	AREAS AND REGIONS
W	TIME
X	INFORMATION ORGANIZATION

Levels within a hierarchy are represented by lowercase letters of the alphabet. The notational code reflects the position of a term within a hierarchy. Portions of the hierarchy for two facets (T: DISCIPLINES and H: SAFETY AND SECURITY) are shown as follows. Note the gaps in the notational codes that allow for the addition of other terms in the future.

T	DISCIPLINES
Tp	Science
Tpd	Biology
Tpdb	Biophysics
Tpdbb	Bioacoustics
Tpdbd	Biodynamics
Tpdbk	Biokinematics

H	SAFETY AND SECURITY
Ha	Safety
Haa	Transportation safety
Haaa	Aviation safety
...	etc.
Haap	Pipeline safety
Haar	Railroad safety
Haat	Traffic safety
...	etc.
Haau	Transit safety
Haav	Vehicle safety
...	etc.
Hac	Construction safety
Hap	Production safety
Haq	Occupational safety
Har	School safety
Harp	School patrols
Has	Safety factors
Hasv	Visibility
...	etc.
Hau	Safety engineering
Haw	Safety programs
...	etc.
Hax	Countermeasures
Hay	Risk assessment
Hb	Accidents
...	etc.

C.1.2 Facet Summaries

Facet A: TRANSPORTATION

Facet A contains the names of the modes and submodes of transportation. The actual activities, facilities, materials, and persons associated with transportation modes are listed in other appropriate facets.

Facet B: TRANSPORTATION OPERATIONS

Facet B covers the activity of freight, passenger, or distribution operations, including traffic operations and management. It is based on carrier, shipper, or traveler activities: routing, scheduling, dispatching, carrier selection, loading, demand, and so forth.

Facet C: MANAGEMENT AND ORGANIZATION

Facet C covers the activities of organizations (businesses, industries, governments or associations). These activities include management, education and training, finance, marketing, logistics, insurance, production, policy, law and legislation, and industry structure.

Facet D: COMMUNICATION AND CONTROL

Facet D covers communication and control systems and devices with specific applications for these systems and devices in transportation (such as traffic and driver detection/monitoring). Major elements include traffic control, navigation, automated vehicle control, detection and identification systems and devices, communication systems and devices, and intelligent transportation systems.

Facet E: PLANNING AND DESIGN

Facet E is concerned with all aspects of planning and design and contains activity-oriented terms. The emphasis is on activities associated with civil engineering.

Facet F: CONSTRUCTION AND MAINTENANCE

Facet F covers all aspects of construction and maintenance as activities, with emphasis on civil engineering activities, although also including other construction and maintenance activities of interest to transportation, such as metal working. The terms for entities and parts of entities associated with construction and maintenance appear in their own facets.

Facet G: TESTING

Facet G includes procedures, processes, and equipment involved in the measurement, analysis, and inspection of materials, equipment, and structures.

Facet H: SAFETY AND SECURITY

Facet H covers the broad area of safety and security (accidents and their causes, vehicle safety testing, injuries, medical assistance, rescue operations, and law enforcement, including crimes, police functions, and police activities).

Facet J: ENVIRONMENT

Facet J covers the influence of the natural world on both humankind and constructed facilities, environmental issues concerning the impact of humankind on the natural world and means to ameliorate that impact, and natural resources and energy issues focusing on consumption and conservation.

Facet K: ECONOMIC AND SOCIAL FACTORS

Facet K covers the social and economic factors that affect transportation activities, including such topics as costs and benefits, economic and social indicators, and supply and demand.

Facet M: PERSONS AND PERSONAL CHARACTERISTICS

Facet M includes terms for persons and groups of persons, organized by intrinsic characteristics, such as age, gender, and racial and ethnic background; by physical and mental characteristics; by behavioral characteristics; and by occupation and function (including travel and business functions). This facet also contains a section on human physical and psychological characteristics and a section on human anatomy.

Facet N: ORGANIZATIONS

Facet N includes general terms for types of organizations, businesses, and industrial establishments, including the transportation sector. It does not include the names of specific organizations (which are identifiers and may be handled outside this thesaurus in a separate name authority file—see Section F for more information on proper names).

Facet P: FACILITIES

Facet P is concerned with facilities and structures, with special reference to transportation facilities. It contains several classes of specialized facilities (underground facilities, excavations, embankments, bridges, and culverts) and a large group of terms covering transportation facilities. This group of terms is organized by mode of transportation and includes terms related to such facilities as airports, ports, roads and pavements, railroad track and rail, and terminals. The section on types of structure is organized by both building system and use (such as testing laboratories) and includes the structural parts of buildings (foundations, joints, structural supports, etc.). It also includes terminology covering water supply and distribution structures and electric supply structures.

Facet Q: VEHICLES AND EQUIPMENT

Facet Q contains terminology for both vehicles and equipment. Vehicle terms include types of guided and unguided land, air, and sea vehicles and craft; dynamics and characteristics of vehicles; and vehicle components. Equipment terms are organized in two sections: EQUIPMENT BY ATTRIBUTES for equipment with similar characteristics (e.g., acoustic equipment) and EQUIPMENT BY END USE.

Facet R: MATERIALS

Facet R contains two main sections:

CLASSES OF MATERIALS: States of matter, chemical elements, chemicals, naturally occurring materials (rocks, soils, water, petroleum), fuels, and building materials. Building materials are organized by their basic properties (ceramic, composite, metal, organic, hydrocarbon-based, plastic, etc.), by their function (abrasives, fasteners, sorbents, etc.), and by their end use (structural, electronic, transportation, etc.).

PROPERTIES OF MATERIALS: The acoustic, chemical, electrical, mechanical, optical, physical, physicochemical, and thermal properties of materials.

Facet S: PHYSICAL PHENOMENA

Facet S covers the phenomena associated with acoustics, electricity, electromagnetism, mechanics, optics, nuclear energy, and thermodynamics. The largest of these divisions is MECHANICS, which contains the phenomena of direct impact on transportation facilities and materials, including deformation, failure, fatigue, loads, forces, flow, waves, stresses and dynamics.

Facet T: DISCIPLINES

Facet T contains the names and the general levels of division of disciplines and fields of study that are related to transportation. Specific aspects associated with a particular discipline or field of study, such as activities, facilities, materials, and techniques, are listed in other facets.

Facet U: MATHEMATICS

Facet U covers the general principles of mathematics and mathematical methods, models, and relations. It includes the terminology of algebra, arithmetic, mathematical analysis, topology, and geometry. It also includes a large group of terms covering statistical analysis and methodology.

Facet V: AREAS AND REGIONS

Facet V contains terminology specific to areas of the earth, general surface and water features, and socioeconomic regions. It does not contain the names of specific countries, cities, or geographic features (which are identifiers and may be handled outside this thesaurus in a separate name authority file—see Section F for more information on proper names).

Facet W: TIME

Facet W contains descriptors for chronological time and for other aspects and conditions of time, such as periodicity.

Facet X: INFORMATION ORGANIZATION

Facet X contains terms for the activities, tools, and forms of information activity and management. Its major subdivisions include information management, information activities, information dissemination, and types of printed and machine-readable materials.

C.2 Terms

C.2.1 Postable/Nonpostable Terms

The terms/descriptors displayed in the TRT are either **postable** (intended for use in indexing or searching) or **nonpostable** (commonly called USE references, or lead-in vocabulary). Nonpostable terms are usually synonyms, quasi-synonyms, or terms deemed to be too specific for inclusion as postable terms and for which a more general term has been designated the appropriate postable term. In the Alphabetical view of the TRT, postable terms are followed by their notational code, whereas nonpostable terms are followed by "use" and the notational code of the designated postable term and an equal "=" sign. In the Hierarchy view of the TRT, a ">" symbol following a notation indicates a related term in another facet. The true notations for these related terms follow the term within parentheses.

C.2.2 Qualifiers

Some terms appear more than once in the TRT and need an indication of their context. The context is shown by adding a **qualifier** in parentheses. Qualifiers are added in the following situations:

1) The word or phrase has two or more meanings, none of which predominates:

Kadmq	EQUILIBRIUM (ECONOMICS)
Smuf	EQUILIBRIUM (MECHANICS)
Dche	EQUILIBRIUM (SYSTEMS)

2) The word or phrase has more than one meaning, but one predominates:

Jfn	NOISE
Dsmrn	NOISE (COMMUNICATIONS)

3) The word or phrase has two or more meanings, none of which predominates; however, only one of those terms is in the TRT:

Mxku	ADAPTATION (PSYCHOLOGY)

This term is qualified so that its use is restricted to the psychological phenomenon; if indexers wish to use ADAPTATION in another specific context, they will need to qualify it, as with ADAPTATION (GENETICS), and propose it as a candidate term (see Section E.3.1).

C.2.3 Precoordinated Terms

The TRT includes a limited number of precoordinated terms (i.e., phrases in which two separate thesaurus terms are linked to make a composite term). Limiting the use of precoordinated terms reduces the size of the vocabulary and facilitates the work of indexers and searchers.

In the working vocabulary previously used for indexing TRIS, the word DESIGN occurred 199 times as a phrase in which it was linked with another term (e.g., CULVERT DESIGN). In the TRT, the word DESIGN occurs in only about 30 precoordinated terms in common use (e.g., HIGHWAY DESIGN, PAVEMENT DESIGN, and VEHICLE DESIGN), a reduction of precoordination by 85 percent. (In the TRT, the concept CULVERT DESIGN would be represented by the two terms CULVERTS and DESIGN.)

C.3 Reference Structure

One of the important functions of a thesaurus is to show the interrelatedness of the terms used. As recommended by the NISO guidelines for monolingual thesauri, the TRT shows the following relationships and references:

SN **Scope Note** gives a brief indication of the scope of the term or refers to other sections of the TRT for similar terms in other contexts. SNs are included only for ambiguous terms; SNs are not intended to provide dictionary- or glossary-type definitions.

UF **Use For** lists synonyms or similar terms that are not to be used as index terms. For example, TRANSPORT is shown as a UF term under TRANSPORTATION in the TRT. This means that the term TRANSPORTATION should be used for indexing or searching instead of the term TRANSPORT.

BT **Broader Term** indicates the more general term that is one level higher in the hierarchy.

NT **Narrower Term** lists all postable terms that are one level lower in the hierarchy.

RT **Related Term** indicates another postable term related to the original term. RTs can be of two kinds.

> The first and most common kind of RT is to (and from) a term on the same level of subdivision within the family whose parent is the same BT. These terms are sometimes referred to as **siblings**, drawing on the metaphor of family relationships. For example, WASPS would be considered an RT to BEES within a hierarchy of INSECTS.
>
> The second kind of RT is to (and from) a term that is outside the immediate family (i.e., outside the immediate hierarchy). For example, HONEY would be considered an RT to (and from) BEES, even though the term BEES would probably be located in a hierarchy of INSECTS, while HONEY would probably be located in a hierarchy of FOOD PRODUCTS. RT relationships of this kind cannot be derived automatically from the established hierarchies. Each reference must be recognized as useful and inserted deliberately by the lexicographer.

HN **Historical Note** will give (in later editions of the TRT) the date and details of any significant change affecting a particular term as they occur as part of the thesaurus maintenance effort (described in Section E). Because the second edition of the TRT maintenance has only just begun, especially with reference to the TRIS database, no HNs appear.

C.4 Display Formats

The TRT is displayed in four formats: 1) hierarchical, 2) rotated (in this case, a KWOC index), 3) alphabetical, and 4) the full display traditionally associated with a thesaurus. Each of these formats conforms to the current NISO guidelines for monolingual thesauri.

C.4.1 Hierarchical

This format displays a taxonomy or hierarchy of all postable terms in the order of their notational codes. Scope Notes (SN) are included, where necessary, for clarification of their use in indexing and searching. UF references are listed, showing all nonpostable terms for which the postable term is the preferred term. BT and NT are shown by the position in the hierarchy. RTs within the family are shown implicitly as terms at the same level of subordination. RTs outside the family are listed explicitly on separate lines, showing the notation of the RT in its own facet.

C.4.2 KWOC Index

The Key Word Out of Context (KWOC) index display is a vital cross-reference and searching tool. It displays, in alphabetical order, every significant word of every term or phrase in the TRT, regardless of the word's position in the term or phrase, and regardless of its context in the TRT. For example:

DATA

Data processing	Xbk
Tables (Data)	Xxt
Traffic data	Btea

The notational code of each term is included in the KWOC index to allow quick and easy cross-reference to the appropriate facet in the Hierarchical display. Nonpostable terms are included in the KWOC display, with a USE cross-reference to the notational code of the postable term. When using the Thesaurus Viewer, clicking on the nonpostable term displays the postable term in full, so every significant word of both postable and nonpostable terms is accessible through the KWOC index. The words from the SNs are not included in this index; they would introduce extraneous and insignificant terms.

C.4.3 Alphabetical

This display provides an alphabetical listing of all descriptors and lead-in terms (postable and nonpostable terms), showing also the notational code for each term. This listing allows easy scanning of the descriptors for experienced users who know the terminology.

C.4.4 Full Display

The full display is the format showing "family" relationships traditionally associated with thesauri. The full display for any term can be generated on the Thesaurus Viewer screen from any of the basic displays (hierarchical, KWOC, or alphabetical) by double-clicking on a highlighted term. (See Section H.7.)

The full display for each postable term shows the following information: its notational code; its SN, if any; all terms for which it is the preferred term (UFs); its BT; its NTs (usually more than one); and all of its RTs, both within and outside the family. For example:

AIRSTRIPS Pmfk
SN Runways without airport or airbase facilities
UF LANDING STRIPS
BT AIR TRANSPORTATION FACILITIES
NT EMERGENCY AIRSTRIPS
RT AIRPORT RUNWAYS

HIGHWAY TRAFFIC CONTROL Dcmth
SN Includes both highway traffic control systems and traffic control devices
UF STREET TRAFFIC CONTROL
VEHICULAR TRAFFIC CONTROL
BT TRAFFIC CONTROL
NT HIGHWAY TRAFFIC CONTROL SYSTEMS
TRAFFIC CONTROL DEVICES
RT AIR TRAFFIC CONTROL
RAILROAD TRAFFIC CONTROL
VESSEL TRAFFIC CONTROL

RAILROAD VEHICLE OPERATIONS Brr
SN Passenger and freight vehicle operations for local and line-haul railroads
BT VEHICLE OPERATIONS
NT TRAIN OPERATIONS

CAR OPERATIONS
LOCOMOTIVE OPERATIONS
OPERATING RULES
CAR SERVICE RULES
INTERCHANGE RULES
RT FLEET MANAGEMENT
AIRCRAFT OPERATIONS
MOTOR VEHICLE OPERATIONS
VESSEL OPERATIONS
CONTAINER UTILIZATION
TRANSIT VEHICLE OPERATIONS

D USING THE TRT

D.1 Indexing

To index a document, an indexer uses as many postable terms from as many hierarchies (facets) as needed to describe the document fully. The number of terms will vary according to the nature and content of the document, but typically range from six to ten terms per document. The examples below show titles, the recommended index terms, and notational codes. (Note that the first letter of each notation indicates the facet from which the postable term is taken.)

Title *The Impact of Highways on Wetlands*

Postable Term	Notation	Facet
HIGHWAYS	Pmrccch	P: FACILITIES
ENVIRONMENTAL IMPACTS	Jfc	J: ENVIRONMENT
WETLANDS	Vmc	V: AREAS & REGIONS

Title *Vehicle Probes as Real Time ATMS Sources of Dynamic O-D and Travel Time Data*

Postable Term	Notation	Facet
PROBE VEHICLES	Qbddkxjp	Q: VEHICLES & EQUIPMENT
ORIGIN AND DESTINATION	Bksa	B: TRANSPORTATION OPERATIONS
ADVANCED TRAFFIC MANAGEMENT SYSTEMS	Dcmthca	D: COMMUNICATION & CONTROL
TRAVEL TIME	Bkn	B: TRANSPORTATION OPERATIONS
TRAFFIC FLOW	Bthf	B: TRANSPORTATION OPERATIONS
REAL TIME CONTROL	Dcgt	D: COMMUNICATION & CONTROL

Title *The Elasticity of Demand for Air Travel in Third World Countries*

Postable Term	Notation	Facet
ELASTICITY (ECONOMIC)	Kcu	K: ECONOMIC & SOCIAL FACTORS
DEMAND	Kadme	K: ECONOMIC & SOCIAL FACTORS
AIR TRAVEL	Bmca	B: TRANSPORTATION OPERATIONS
DEVELOPING COUNTRIES	Vyad	V: AREAS & REGIONS

[THIRD WORLD is a synonym for DEVELOPING COUNTRIES]

Title *Alternative Fueled Vehicles: Potential Effects of Exemptions from Transportation Control Measures*

Postable Term	Notation	Facet
ALTERNATE FUELS	Rbfpb	R: MATERIALS
MOTOR VEHICLES	Qbdd	Q: VEHICLES & EQUIPMENT
EXEMPTIONS	Crfe	C: MANAGEMENT & ORGANIZATION
AIR QUALITY MANAGEMENT	Jfgyb	J: ENVIRONMENT
REGULATIONS	Crft	C: MANAGEMENT & ORGANIZATION

Title *Measuring Traffic Congestion and Delay on an Urban Freeway Following a Ramp Accident*

Postable Term	Notation	Facet
TRAFFIC MEASUREMENT	Bte	B: TRANSPORTATION OPERATIONS
TRAFFIC CONGESTION	Bthfc	B: TRANSPORTATION OPERATIONS
TRAFFIC DELAY	Bthd	B: TRANSPORTATION OPERATIONS
FREEWAYS	Pmrccdf	P: FACILITIES
RAMPS (INTERCHANGE)	Pmrcpjsrr	P: FACILITIES
TRAFFIC ACCIDENTS	Hbbgt	H: SAFETY & SECURITY

Title *Reliability of Radar Installations at Major Airports*

Postable Term	Notation	Facet
RELIABILITY	Qvr	Q: VEHICLES & EQUIPMENT
RADAR AIR TRAFFIC CONTROL	Bcmtbw	B: TRANSPORTATION OPERATIONS
AIRPORT OPERATIONS	Bqa	B: TRANSPORTATION OPERATIONS

D.2 Searching

Searching is performed in the same way as indexing; ideally, the searcher should select the same terms as the indexer. In real life, however, the terms are likely to differ. The TRT is designed to help searchers and indexers use the same language, thus increasing the effectiveness of both processes.

D.2.1 Constructing the Search Statement

A search statement consists of postable terms drawn from the thesaurus that together represent the desired topic. To find those terms, the user may consult any display of the TRT (hierarchical, KWOC index, or alphabetical).

The KWOC index provides the most comprehensive access, since it shows all the contexts of any significant word, even if buried within a phrase, of all postable terms and all cross-references to it. Since the KWOC index shows the notational code, it is easy to refer to the hierarchy to determine the specific context of the selected term. On the Thesaurus Viewer screen, the user may click on the hierarchy button to jump to the location of the highlighted term. (See Section H.8.)

Users who are familiar with the structure of the hierarchies may prefer to go directly to the appropriate hierarchy and scan it to find the desired topic.

Users who are familiar with the vocabulary of the TRT may choose to go directly to the alphabetical display.

Users who prefer to see the traditional display of thesaurus relationships may do so in the Thesaurus Viewer by double-clicking on any term in any of the displays: hierarchical, KWOC, or alphabetical.

In an automated environment, the searcher may combine the desired terms using the Boolean operators AND, OR, and NOT. (Note that using the AND operator narrows the search; using the OR operator expands the search.) In some automated environments, the search software automatically constructs the search statement and the searcher need only key in or highlight the desired search terms.

D.2.2 Narrowing the Search

If too many documents are retrieved, the searcher may narrow the search by adding more terms using the AND operator. For example, if too many documents are retrieved using the search statement: HIGHWAYS [AND] ENVIRONMENTAL IMPACTS [AND] WETLANDS, the searcher may add any other term, such as [AND] TRUCKS.

If the retrieved documents are in the desired subject area, but too general, the search can be made more specific by using the notational code to refer to that section of the hierarchy and by selecting any more specific code or term shown. For example, the hierarchy reveals that a more specific term under HIGHWAYS is ARTERIAL HIGHWAYS, which can be substituted for the broader term.

D.2.3 Broadening the Search

To increase the retrieved set, select more terms and use the OR operator. For example, if a search on the term TAILGATING retrieves too few documents, use

TAILGATING [OR] CAR FOLLOWING [OR] FOLLOWING DISTANCE

Another way to increase the number of retrieved documents is to use the **notational code** of any relevant retrieved document and search on the code's truncation. For example, if too few documents are retrieved on TAILGATING (Bthkt), search on **Bthk** (VEHICLE SPACING) to retrieve everything on BUNCHING, CAR FOLLOWING, FOLLOWING DISTANCE, HEADWAYS, PLATOONING, and TAILGATING. Refer to the hierarchy to understand the relationship of these terms.

Another way is to substitute a broader term for one of the terms. Either consult the hierarchical view or use the full display option with any view of the TRT to find a broader postable term (e.g., use VEHICLE SPACING instead of TAILGATING). However, this method will not search on subordinate terms, as will the notational search suggested above.

Yet another way to broaden the search is to drop a term from the search statement, preferably the least significant term. For example, if the search terms had been

WHIPLASH [AND] TAILGATING [AND] REAR END COLLISIONS [AND] MOUNTAIN ROADS

then remove MOUNTAIN ROADS from the search statement.

D.3 Indexing Exercises Using the TRT

The process of indexing involves scanning the document or passages in it that are likely to yield the most relevant terms that describe its "aboutness." These terms are then translated into as many appropriate terms as can be found in the thesaurus and in authority lists.

In practice, these two activities are often combined, because an experienced indexer can objectively recognize the concepts as they appear in the document and simultaneously translate them into the formal index language without the risk of arbitrarily choosing the first terms in the thesaurus that seem at least roughly appropriate to the document or of starting with any term in the document that catches the eye but may not be essential to describing the document.

In learning how to index, it is better to keep the following two activities separate and explicit: first, write down the raw terms in the language of the document and see if they add up to a fair representation of the document's "aboutness"; and second, translate as many of the raw terms as possible in terms of the thesaurus.

D.3.1 Exercise Documents

Excerpts of ten documents are provided below for use in practicing using the TRT for indexing. Recommended indexing terms for each document are also supplied in Section D.3.2.

The first two Exercise Documents are intended to be used for demonstration purposes. Recommended TRT descriptors and indexing terms for these documents are shown immediately after the text of the document.

A sample Indexing Process Sheet has been completed for the first Exercise Document, and a blank Indexing Process Sheet is provided from which to make multiple copies for use in indexing other documents.

Indexing Process Sheet

Keywords: Exercise Document # ____

RAW TERMS	DESCRIPTORS

Identifiers and/or Geographic names:

____

____

____

____

Uncontrolled/Candidate terms:

____

____

____

Indexing Process Sheet

Keywords: Exercise Document # i

RAW TERMS	DESCRIPTORS
Rural	Rural areas
Smart work zones	Work zone traffic control
Warning system	Warning signs
Motorists	-----
Interstate roadway	-----
Detection units	Incident detection
Changeable message signs	Variable message signs
Highway advisory radios	Highway advisory radio
Video cameras	Video cameras
Cellular modems	Portable equipment

Identifiers and/or Geographic names:

Iowa

Uncontrolled/Candidate terms:

Exercise Document # i

RURAL SMART WORK ZONE:
A Warning System for Motorists During
Interstate Reconstruction Projects

Steve J. Gent P.E.

PROJECT OVERVIEW:

In Iowa, traffic is maintained on interstate reconstruction projects by placing head-to-head traffic on two lanes of the interstate roadway while the other two lanes are being reconstructed. This traffic control strategy works adequately until the traffic volumes exceed the roadway capacity of the open lanes. When this occurs, high-speed interstate traffic quickly comes to a halt and creates the potential for severe rear-end type crashes. This report describes a smart work zone project that was implemented on an I-80 reconstruction project during the 1997 construction season.

The smart work zone system was designed to monitor approaching traffic speeds and volumes, determine when traffic backups occur, activate the warning devices, and inform surveillance personnel of the problem. All in real-time and without human intervention. The four components of the system include the incident detection units, changeable message signs, highway advisory radios, and video cameras.

This research project has provided the Iowa Department of Transportation with much valuable information on several new and innovative work zone devices. The Highway Advisory Radios and the video cameras (transmit video using cellular modems) were successfully tested and determined to be valuable tools for similar projects in the future. The research project also highlighted the fact that Intelligent Transportation Systems are only as good as the companies who manufacture and support the systems. The company that developed the incident detection units has struggled with, and continues to struggle with, providing operational units that function as promised.

...

TRT DESCRIPTORS:
Work zone traffic control
Warning signs
Incident detection
Variable message signs
Highway advisory radio
Video cameras
Portable equipment

GEOGRAPHIC NAMES:
Iowa

Exercise Document # ii

AN OVERVIEW OF THE CANADIAN GUIDE TO
NEIGHBOURHOOD TRAFFIC CALMING

Gene Chartier, Diane Erickson, John Kizas, Gary Mack, and Michael Skene

INTRODUCTION

As in Europe, the United States, and Australia, Canadian municipalities are beginning to consider traffic calming as a possible resolution to traffic and safety problems on residential streets. However, with limited and isolated experience with traffic calming to date in Canada, little reference material exists to guide implementation. As a result, there is considerable variation in the way in which traffic calming is defined and applied in different communities, which has lead [sic] to unique, inconsistent, and in some instances, inappropriate solutions.

Recognizing the growing popularity of traffic calming, and the current absence of consolidated information and consistent guidelines in Canada, the Transportation Association of Canada (TAC) and the Canadian Institute of Transportation Engineers (CITE) have prepared a national Guide to Neighbourhood Traffic Calming. The Guide provides advice on the application of traffic calming measures on residential local and collector streets for a wide audience of users, which includes transportation professionals, as well as non-technical persons with an interest in the topic.

This paper provides an overview of the Guide. It describes why and how the Guide has been developed and outlines the structure and content of the document.

OVERVIEW OF THE CANADIAN ...

TRT DESCRIPTORS:
Traffic calming
Neighborhoods
Residential streets
Traffic restraint
Traffic safety

GEOGRAPHIC NAMES:
Canada

Exercise Document # iii

CITY OF CONCORD
EVALUATION OF BUS PRIORITY SIGNAL SYSTEM
JULY 1978
BY
TJKM
TRANSPORTATION CONSULTANTS
WALNUT CREEK, CALIFORNIA

<u>CONSULTANT STAFF</u>

Project Director:	Chris D. Kinzel
Before Study:	Ed Jiu
Time-Lapse Photography:	Ty Tekawa
After Study and Report Preparation:	Cindy Carson
Graphics:	Dale Purzner and Paul Louen
Report Typing:	Virginia Bacon

SUMMARY

A transit bus traffic signal priority system was evaluated on a 3.5 mile arterial corridor through the City of Concord, California. Twelve (12) signalized intersections were equipped with traffic signal preemption devices and 15 buses were equipped with emitters. In the operation of the system, in most cases as a bus approaches an intersection, the signal will hold an existing green phase or advance to a green phase.

Average bus trip times were reduced by 10%, with a resulting increase in schedule reliability. Bus delay was reduced 36% at the preempted signals, and the number of stops decreased by 18%. All improvements were tested and found to be significant. Reduction in bus starting, stopping, and waiting improves operating cost, saves fuel, and lowers air and noise pollution.

No increase in delay to passenger vehicles occurred to either the arterial corridor or the sidestreet traffic. This was possibly due to the light to moderate amount of bus traffic using the corridor. It is reasonable to assume that heavy bus usage would not result in the same favorable absence of increases to sidestreet delays.

It can be concluded that the traffic signal priority system in effect on the arterial corridor in Concord has produced significant improvements in bus operation, without any observed adverse effects on traffic or on the environment.

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Exercise Document # iv

PARKING TAXES AS ROADWAY PRICES: A CASE STUDY OF THE SAN FRANCISCO EXPERIENCE

Damian Kulash
1212-9
March 1974

THE URBAN INSTITUTE
Washington, D.C.

ABSTRACT

This paper presents an ex post facto analysis of the impacts of a 25 percent parking tax that was in effect in San Francisco from October 1, 1970, to June 30, 1972. It develops parking price elasticity estimates for various types of parking facility. Commuters demonstrated greater sensitivity to the price changes than did shoppers, but the overall effect on the number of parking stall occupancies was relatively slight. The impact on parking lot profitability was found to be severe.

Because of the small effect on parking lot usage, the parking tax had little influence on problems of congestion, air pollution, and energy consumption. There was also no evidence of any harm to downtown businesses (other than parking lots) that could be traced to the tax.
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Exercise Document # v

Title and Subtitle:	Vehicle Aggressivity: Fleet Characterization Using Traffic Collision Data
Authors:	Hans C. Joksch, Dawn Massie, and Robert Pichler
Performing Organization:	The University of Michigan Transportation Research Institute 2901 Baxter Road, Ann Arbor, MI 48109-2150
Under Contract to:	U.S. Department of Transportation, Research and Special Programs Administration John A. Volpe National Transportation Systems Center, Cambridge, MA 02142-1093
Date:	February 1998

Abstract:

Aggressivity of a vehicle is defined as the fatality or injury risk for occupants of other vehicles with which the vehicle collides. Because of the strong effect vehicle weight has on this risk, gross aggressivity, which includes the effect of weight, and net aggressivity, which excludes the effect of weight, are distinguished. Data from the Fatal Analysis Reporting System (FARS) and the General Estimates System (GES) for 1991 to 1994 were used for fatalities and for crash involvements, respectively. The relation between weight and wheelbase of cars was studied, and the concept of "overweight" introduced. For collisions between two cars, the relation of fatality risks with car weight, overweight, wheelbase and bumper height were studied. Also, adjustments were made for the higher vulnerability of older victims. Collisions between cars and light trucks—including utility vehicles, pickup trucks and vans—were studied. A limited analysis of the effect of vehicle weight was performed. The driver fatality risks in collisions between cars and light trucks were studied by collision configuration. In all cases, the risk for car drivers was much higher than for drivers of light trucks.

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Exercise Document # vi

New York's Air Travelers

The Port of New York Authority
Aviation Department, Forecast and Analysis Division
June, 1955

The Eno Foundation for Highway Traffic Control
Saugatuck, Connecticut
1956

INTRODUCTION

The survey, which is the subject of this report, was conducted as a joint undertaking by the domestic airlines serving La Guardia, New York International, and Newark Airports and The Port of New York Authority, to determine some of the basic characteristics of air travelers using these airports. The rapid and undiminished growth of air travel volume during the last few years has clearly indicated the changing character of air travel and travelers and the development of a new dimension in the air transportation market.

The airlines and the Port Authority have a joint interest and obligation in developing and serving the untapped potential market for air transportation. One of the ways to foresee the nature and volume of air travel in the future, as it will affect the terminals and airlines serving the New York-Northern New Jersey Metropolitan Area, is to analyze the changing composition and characteristics of the people who use the airlines serving this area today, and periodically to conduct similar surveys in the future to determine and project the changing nature of the air travel market. Since most of the information considered relevant to the analysis can be supplied most readily, or exclusively, by travelers themselves, a questionnaire technique was used in this survey.

It is necessary to study the characteristics of sufficient air travelers selected by methods that will assure the general validity and applicability of the findings within precise limits of accuracy. Since it is impracticable to study the characteristics of all ten million passengers who pass through the New York and Newark Airports during the year, the Port Authority proposed, in the summer of 1954, a sample survey of passengers departing from the three airports for domestic destinations, to be conducted jointly by the Port Authority and the thirteen airlines serving these airports. The airlines agreed to this proposal. The survey was conducted in accordance with the agreed plan, and significant findings are reported herein.

CONTENTS

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Exercise Document # vii

P T P: PREVENTION THROUGH PEOPLE
Achieving Marine Safety and Environmental Protection for the 21st Century

"Good safety programs and performance are the result of clear messages delivered by senior line management, which enable people working for an organization to make the cultural changes necessary to place safety equal to profitability."
J. H. Pyne, President, Kirby Corporation

WHAT IS PTP?

Prevention Through People is a systematic, people-focused approach to reducing casualties and pollution. It was developed by the Coast Guard in cooperation with the marine industry.

The PTP approach recognizes that safe and profitable operations require the constant and balanced interaction between management, the work environment, the behavior of people, and the appropriate technology. It encourages companies to assess and improve their safety posture. The easiest way to understand the approach is to think of safe operations as a stable structure, with human elements as comprising four groups joined by a solid foundation of rules, regulations and standards.

Management Commitment to safe operations—including dedicating resources and fostering a culture of safety.

Work Environment—includes those factors that influence a worker's capabilities, judgement and effectiveness.

Behavior—influenced by factors such as fatigue, stress, attitude, knowledge, awareness and experience.

New Technology—applications created with human capabilities and limitations in mind.

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Exercise Document # viii

INNOVATION BRIEFS
Urban Mobility Corporation
Vol. 9, No. 4 - Automobile-Related Issues - Jul/Aug 1998

The Wired Car

Remember when a mobile cellular phone was considered the frontier of communications technology? Not any more. Soon, personal computers will offer car owners the ultimate in connectedness. Motorists will be able to download information from the Internet, send and retrieve e-mail, transfer data from their office computers, receive real-time traffic information and weather reports, and obtain driving directions. Such at least, is the future as seen by Microsoft, Intel, and a host of other computer firms.

For the computer industry, the car is the last untapped consumer frontier. With fifteen million new cars sold every year in the United States alone, capturing even a small fraction of the new car sales would represent a huge new market for computer equipment and software suppliers. To market researchers, the prospect for large demand for in-car PCs does not appear unrealistic. "Next to the home and the workplace, cars are where Americans spend the most time," says Perry Lee, product manager for Microsoft's Auto PC. Vehicle owners will demand the same ease of communication and access to information that they already enjoy at home and in the office.

A key attraction of an in-vehicle PC would be its "multi-functionality." Drivers could send and receive e-mail and gain access to a host of Internet-based travel-related services and information sources. Passengers in the back seat could use the PC for on-board entertainment and interactive games linked to the Internet. In addition, PCs could be used to integrate the automobile's growing number of electronic subsystems that monitor engine performance, brakes, air bags and climate control. In the longer term, some visionaries speculate that PC-equipped cars could become nodes on the Internet with their own unique Internet protocol address. Having an Internet address, the car could become an integral part of cyberspace.

Outwardly, the car-based PC would share few features in common with its desk-top counterpart. The user interface components like the display, control devices and CD-ROM drive will be mounted in the dashboard, but the remaining electronics will most likely be hidden behind the dashboard or located in the trunk. Gone also will be the familiar keyboard and mouse used with desktop computers. Instead, car-based PCs will respond to voice commands and communicate through synthesized voice messages to minimize driver distraction.

At the Consumer Electronics Shown in Las Vegas in January 1998, Microsoft unveiled its entry, "Auto PC," powered by Windows CE 2.0 operating software. Intel followed with the "Connected Car PC," a Pentium processor-based computing platform that can provide a variety of in-vehicle services and amenities, such as access to real-time information, communications, navigation, entertainment and security. Visteon Automotive Systems, a unit of Ford Motor Co., has unveiled its own version of a car PC, called ICES (Information, Communication, Entertainment, Safety&Security). All three systems rely on speech recognition technology. At the Las Vegas show, Microsoft's Auto PC suffered some well-publicized failures to respond to voice commands. But these problems are well on their way to being overcome, according to industry sources.

Human Factors

The prospect of personal computers in cars, however, has its downsides. According to a recent report by the National Highway Traffic Safety Administration (NHTSA), the use of cellular phones and other forms of wireless technology may increase the inattention that contributes to car crashes. A study published in the February 1997 issue of the New England Journal of Medicine was even more specific: "The risk of a collision when using a cellular telephone was four times higher than the risk when a cellular telephone was not being used," the study's authors reported. NHTSA Administrator Ricardo Martinez has echoed this concern: "As cars more and more become an extension of the home and office, we are creating a whole new array of potentially hazardous distractions that must be better understood," he stated in recent testimony.

Auto industry spokespeople have expressed similar concerns. At a May 7 seminar on The Vehicle as a Connected Commuting Environment during ITS America's Annual Meeting in Detroit, senior car company representatives cautioned that there are limits to a driver's ability to communicate and process information, speech recognition technology notwithstanding. "Keeping the driver's mind on the road is just as important as keeping his hands on the wheel," one participant remarked.

The Market

Just how big a market for in-vehicle PCs will develop remains a much debated question. Consumers might think twice before spending $1,000 for an on-board PC when they can obtain many of the same communication and entertainment functions from less-costly cellular phones, audio equipment and stand alone navigation devices. But computer industry executives think the vast array of new features and functions offered by on-board computers will have strong customer appeal. "PCs will provide a lot of functionality for the money," says Microsoft's Perry Lee. Auto executives at the May 7 seminar weren't so sure. They cited the industry's common wisdom that consumers are generally reluctant to spend more than $300 for an item of optional equipment (fancy stereo systems notwithstanding). One executive wondered aloud whether on-board computers might not fall into the category of "clever gadgets," with only limited appeal to the car buying public. All auto industry representatives stressed the need for software and hardware reliability. "Rebooting is not acceptable," one speaker summed up, referring to the computer systems' penchant for occasionally "crashing."

> We agree with the NHTSA report that it would be unrealistic and ill-advised to conclude that drivers should be deprived of in-vehicle wireless communications devices because they might be a source of distraction. Rather, the goal should be to make in-vehicle communications systems as compatible with safe driving as the state-of-the-art allows through the application of good engineering and human factors design, and by educating drivers about the potential risks associated with using this technology while driving. With computers becoming more and more a part of our daily lives, and with millions of motorists spending hours each day cruising the highways or stuck in traffic, the benefits of the "wired car" would seem to outweigh the risks.

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Exercise Document # ix

Multimedia moves: Development of onboard multimedia for the global market

Giuliano Trenta, ERTICO and Bruno Murari, ST/SGS-Thomson (CMOBA)

An ERTICO committee began working on a car multimedia open bus architecture last July. To date, the team has focused on two studies—an assessment of present and future user needs and a comparison of all existing proprietary standard bus solutions—with completion expected in September.

Cars of the near future will be equipped with different electronic systems for telecommunications (e.g., GSM), traffic and travel information (e.g., RDS-TMC) and entertainment (e.g., audio, DAB, DVD, video games, integrated PC/mobile office) that must communicate and interact with each other. Other technologies, such as microcameras and microwave radar to help drivers, speech recognition for system control, voice synthesis and active noise reduction, will be more affordable. Finally, new materials and semiconductor technologies promise increased performance and lower cost, bringing high data speed and computation power at the level of single devices.

All this requires high-performance multimedia and probably multilevel bus architecture, featuring an appropriate network topology, very high bandwidth and true real-time behaviour for digital audio and video applications. The architecture should also satisfy additional factors specific to the vehicle environment, such as compatibility with existing car electronics equipment, robustness, safety, minimal obsolescence, ease of maintenance and repair and, last but not least, acceptable cost.

Industry challenge

To meet this challenge, in July 1997 the ERTICO Supervisory Board approved the formation of a new committee on Car Multimedia Open Bus Architecture (CMOBA). This project is led by the Ertico partner, Franco-Italian semiconductor company ST/SGS-Thomson Microelectronics, which is active in the automotive, communications, consumer and computing markets. Bruno Murari, director of R&D in the SGS-Thomson=s Dedicated Products Group, has been appointed chair of the project. "It is our interest to bring our experience and become a competence pole in this field, working closely with car manufacturers, electronic industry, service providers, standardisation bodies and any other key players," he explains.

Indeed, members of the project include car manufacturers, makers of after-market electronic equipment, suppliers of electronic components/materials, communications services providers and infrastructure operators. The CMOBA membership includes Audi, Becker/Harman, BMW, Bosch, Communication and Control Electronics Ltd, Daimler Benz/ITF Intertraffic, Delphi/Delco, Ericsson, Fiat, Ford/Visteon, Hewlett-Packard, LSI Logic Europe, Magneti Marelli, Mannesmann/VDO Car Communication, Molex Elektronik, Motorola, Navtech, Nokia, Panasonic, Philips, Pioneer, Pirelli, Renault, SAE International, Siemens, ST/SGS-Thomson Microelectronics, Sun Microsystems, Tele Atlas BV, Texas Instruments, Valeo and Volvo.

Not European but global

During the kick-off meeting, it became clear that the industry demands solutions that meet global market requirements, not just European ones. Therefore, as its main objective, CMOBA will develop and agree on a solution for the global market that must be capable of supporting existing and emerging in-vehicle technologies, including communications, navigation, information, entertainment, HMI and driver assistance systems. The activity is obviously technical, but has strong commercial implications because of the multitude of entrenched systems. In such a context, key tasks of the project include

- Identify and agree on the needs of the industry (vehicle and electronics) and service providers;
- Review the development status of existing buses;
- Develop specifications for car multimedia open bus architecture;
- Initiate and support standardisation.

Two work groups within CMOBA are carrying out vital preliminary work to define the market needs and user requirements and to compile the technology state of the art; results from these working groups will enable the committee to develop system requirements and a specification for a car multimedia open bus architecture.

Work on market needs and users' (functional) requirements is complete; key results include the identification of in-vehicle multimedia applications and their related mass-market production for high-, medium- and low-level cars in the short and medium term; the group is addressing the ideal bus architecture (topology), as well as the speed (data rate) required. In addition to the car industry sector, key input is provided by the consumer and fibre sectors.

The second group is examining and comparing all existing proprietary and standard bus solutions in Europe, the USA and the Far East, from the PC and entertainment environments, in addition to those proposed specifically for the automotive environment. Key inputs are again provided by the consumer sector.

The two groups are expected to finalise their work by September 1998.

Next stage
In the second half of the year, based on these two studies, CMOBA will investigate and define the technical requirements for and develop a common technical specification of a car multimedia open bus architecture; this may also build on existing solutions.

CMOBA is collaborating with SAE and other Japanese initiatives to ensure the emergence of a global solution. Methods of collaboration are currently being explored to avoid any conflicting situations. However, the nature and the quality of the membership of CMOBA ensure a worldwide consensus platform for whatever solution is finally agreed upon within this committee.

When convergence on a global solution is finally achieved, a fast-track standardisation process will become an important issue for CMOBA. Preliminary contacts with ISO TC 22 have already been established, and official liaison will follow shortly.
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Exercise Document # x

VOLPE TRANSPORTATION JOURNAL
SPRING 1997
VOLPE ENGINEERS USE BIOMETRICS TO HELP EASE BORDER CRUSH
Contributor: William R. Baron

Using technology previously reserved for military and other high security applications, engineers from the Safety and Security Systems Division of the Volpe Center have developed a number of automated biometric systems to speed the processing of frequent travelers through United States immigration and to reduce the dependence on manual immigration inspections. These systems, now in use at selected border crossings by the Immigration and Naturalization Service, may serve as the basis for future automated immigration processing developments, both in the United States and around the world.

Ten years ago, the field of biometrics was the stuff of spy movies. But thanks to applied research being conducted at the Volpe National Transportation Systems Center, biometrics is being used to solve everyday problems dealing with the increasing flow of U.S. travelers through the country's immigration points of entry.

In conjunction with the U.S. Immigration and Naturalization Service (INS), Volpe Center project engineers are working to automate the identification and processing of immigration credentials for frequent travelers. Toward that end, they have introduced a number of pilot programs based on biometric technologies at selected airport gateways and border crossings. These pilot programs portend the future of international travel and even international commerce.

What Is Biometrics?

The field of biometrics involves the use of a physical or behavioral characteristic to verify the identity of an individual. Identification systems based on biometric technologies are now being used on an experimental basis by military organizations, government agencies, and private companies as a means of controlling access and gathering important statistical data about users.

Typically, biometric identification systems utilize any one of six different personal characteristics. The systems most commonly in use verify fingerprints or hand geometry, or can authenticate voice patterns. But other more sophisticated systems can check for patterns in the human retina or iris, or in the way a person signs his or her name, or even in how an individual types on a keyboard. The type of system selected generally depends on the level of security required and on the nature of the verification process.

As a tool for identification purposes, biometrics offers significant advantages over manual methods. Biometric identification systems are completely automated and provide accuracy not achieved by manual systems. Such systems also remove the subjective judgment factor that most manual systems employ, at least as a first line of defense in the screening process.

Further, biometric identification systems cannot be easily compromised by theft or counterfeiting. Because the metric used by the system to verify identity is a physical characteristic unique to the individual—such as a hand print, a voice pattern, or the composition characteristics in the human eye—it is virtually impossible for a user to pretend to be someone else. Credit cards and other swipe cards can be stolen or forged. Personal identification codes can be overheard or randomly identified. But biometric identification systems rely exclusively on information that only the authorized individual can provide, thereby offering significant advantages over other types of identification systems in high security applications.

In addition to their resistance to fraud, biometric identification systems also can work with surprising efficiency to identify valid users, especially considering the complexity of the task. That's because most biometric systems work on one-to-one search principles. Credit card verification systems, for example, must search an extensive database of invalid account numbers, usually maintained in a remote location, to determine whether a particular account is valid.

Biometric identification systems, on the other hand, can match information encoded on the user's identification card with a machine scan of the user's physical characteristics. Because the system is only attempting to determine whether two pieces of information match, verification can take place quickly and accurately.

Facing the Wave of Humanity

In 1993, more than 480 million people gained entry to the United States through one of several hundred immigration stations at airports, ship terminals, and land-based border crossings. INS inspectors are charged with the responsibility of handling this wave of humanity, screening out criminals and international terrorists while providing quick and efficient access to the vast majority of visitors and returning citizens.

To put this task in perspective, INS annually processes two people for every single U.S. citizen—a staggering task. The ports of entry at El Paso, Texas, admit more than 42 million people every year. That's more than 100,000 entries each day! And at other border crossings, such as the one at Otay Mesa, California, near Tijuana, Mexico, long lines to clear immigration can mean waits of up to two hours.

With the number of annual entries expected to exceed 500 million by the year 2000, INS officials clearly face a growing problem of how to screen larger numbers of people, quickly admitting legitimate travelers while focusing the attention of inspectors on suspect admissions. So INS turned to the Safety and Security Systems Division of the Volpe Center in 1992 to conduct preliminary research in how biometric technology might be used to automate immigration processing.

This collaboration has led to the development of several automated entry systems to address a variety of specific immigration situations, such as vehicular or pedestrian traffic at our numerous border stations along the Canadian and Mexican borders, or arrivals at our international airports. While these systems are still undergoing preliminary testing, the response from INS officials and the traveling public have been sufficiently positive to warrant significantly expanded systems deployment in 1997.

Equally important, the work being conducted by Volpe Center engineers on this project represents some of the most advanced applied research on the use of biometric technology today. It has resulted in a greater understanding of both the advantages and the limitations of biometrics in user identification applications and will help pioneer the more widespread use of the technology in both government and industrial environments.

The INSPASS Program

The first automated inspection system using biometric verification developed by the Volpe Center was unveiled in 1993 with the deployment of automated kiosks at New York's John F. Kennedy Airport and Newark International Airport, and at Pearson International Airport in Toronto, Canada. This program, appropriately named INSPASS, is intended to focus on airports with arriving international flights as well as border crossings where high volumes of pedestrian traffic need to be processed by immigration inspectors.

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D.3.2 Recommended Indexing Terms for Exercise Documents

Exercise Document # i **RURAL SMART**

TRT DESCRIPTORS
Work zone traffic control
Warning signs
Incident detection
Variable message signs
Highway advisory radio
Video cameras
Portable equipment

GEOGRAPHIC NAMES
Iowa

Exercise Document # ii **OVERVIEW OF THE CANADIAN**

TRT DESCRIPTORS
Traffic calming
Neighborhoods
Residential streets
Traffic restraint
Traffic safety

GEOGRAPHIC NAMES
Canada

Exercise Document # iii **BUS SIGNAL PRIORITY SYSTEM**

TRT DESCRIPTORS
Traffic signal preemption
Transit buses
Speed and delay studies

GEOGRAPHIC NAMES
Concord (California)

Exercise Document # iv **PARKING TAXES**

TRT DESCRIPTORS
Taxes
Parking facilities
Elasticity (Economics)

Road pricing
Economic impacts

GEOGRAPHIC NAMES
San Francisco (California)

Exercise Document # v **VEHICLE AGGRESSIVITY**

TRT DESCRIPTORS
Risk assessment
Fatalities
Crash injuries
Traffic accidents
Vehicle weight

Exercise Document # vi **NEW YORK'S AIR TRAVELERS**

TRT DESCRIPTORS
Air travel
Travel surveys
Passengers
Trip purpose
Origin and destination
Airports

GEOGRAPHIC NAMES
New York Metropolitan Area

Exercise Document # vii **P T P**

TRT DESCRIPTORS
Marine safety
Environmental protection
Oceans

IDENTIFIERS
United States Coast Guard

Exercise Document # viii **WIRED CAR**

TRT DESCRIPTORS
Personal computers
Wireless communication systems
Automobiles

Human factors
Mobile computing

Exercise Document # ix **MULTIMEDIA MOVES**

TRT DESCRIPTORS
Multimedia
Buses (Electricity)
Open systems architecture
Standards
Electronic equipment
Vehicle electrical systems
Mobile computing

UNCONTROLLED/CANDIDATE TERMS
Vehicle electronics

Exercise Document # x **VOLPE ENGINEERS**

TRT DESCRIPTORS
Biometrics
Identification systems
Ports of entry
Travelers
Human characteristics

IDENTIFIERS
INSPASS
U.S. Immigration and Naturalization Service

UNCONTROLLED/CANDIDATE TERMS
Customs administration

E MAINTENANCE OF THE TRT

The thesaurus is a living language that should reflect current concepts and usage, while at the same time providing standards and a stable structure. As new areas of interest and concentration appear and are accepted, it is essential to have a strategy and a tactical mechanism to change the thesaurus accordingly. The thesaurus represents a considerable investment of time and money and must be maintained to protect its ongoing value.

E.1 Thesaurus Maintenance Management

Maintaining the thesaurus requires a management effort that involves four kinds of functions: managerial, lexicographical, administrative, and technical. These functions may be carried out by the same person or office or may be delegated to others, depending upon the particular situation. In any case, the responsibilities must be clearly delineated.

E.1.1 Overall Management

A person or office with sufficient authority to make fiscal and personnel decisions should be responsible for the overall management of the thesaurus.

E.1.2 Lexicographical Management

A small team of professional staff and subject experts, led by a professional lexicographer, should be designated to consider the candidate terms. End users may be invited to participate at the discretion of the manager.

The team should convene regularly, perhaps quarterly, to consider proposed changes to the thesaurus.

E.1.3 Administrative Detail

A Thesaurus Administrator should be designated to handle administrative details.

E.1.4 Technical Detail

A Technical Coordinator should be designated to implement the actions and decisions of the Lexicographical Team. The Technical Coordinator must maintain an up-to-date version of the thesaurus and ensure that appropriate changes are made in the reference structure and in the corresponding database files and tables.

E.2 Thesaurus Maintenance Activities

Suggestions for changes to the TRT may come from the professional staff or from end users.

These suggestions are usually called candidate terms.

There are three functions involved in handling changes to the TRT: collection of the candidate terms, consideration of the candidate terms, and disposition of the candidate terms.

E.2.1 Collection of Candidate Terms

A single collection point should be designated, and all candidate terms should be channeled there. Each candidate term must be properly recorded on a suitable form, together with an indication of the source of the candidate term.

A formal mechanism may be established for submission of suggestions for new terms. However, the mechanism must be simple and flexible enough to encourage suggestions from users of all kinds. For example:

- A simple tear-out form may be included with all printed forms of the TRT, with instructions on how to submit suggestions.
- For electronic versions of the TRT, instructions for submitting suggestions should be included in a README file.
- At a minimum, any form or set of instructions for submission of suggestions should include the address, email, and fax number of the collection coordinator.
- All public contact service staff should be briefed on accepting suggestions directly from users, and public notices should be posted at any terminal, station, or desk that provides access to the TRT.
- If the organization sets up any on-line contact point, such as a website, information on the TRT should also be included.

E.2.2 Consideration of Candidate Terms

All candidate terms should be considered by the Thesaurus Maintenance Team, led by a professional lexicographer. The Thesaurus Administrator should ensure that the decisions of the team are passed on to the Technical Coordinator, whose responsibility is to make changes in the master thesaurus file and in other versions, as appropriate.

E.2.3 Disposition of Candidate Terms

All new terms, certain amended terms, all deleted terms, and the date of change should be recorded in a separate **Significant Change** File, as well as in a special field in the TRT. Customarily, a Historical Note (HN) reference is added to a term's record in the thesaurus to show when a term replaces an earlier, displaced term. The separate **Significant Change** File provides a useful record of changes that can easily be displayed chronologically or by other parameters.

As a courtesy, each submitter of a candidate term should be notified of the disposition of the submission and receive a brief note thanking him or her for his or her interest and inviting further suggestions.

It is essential that all changes also be announced to users of the TRT.

A separate **Rejected Candidate Terms** File should be created to store all rejected terms for reference and for review at periodic intervals, perhaps annually. This procedure may allow the early recognition or confirmation of a new area of interest, as other rejected terms are viewed as a group over time.

E.3 Lexicographical Maintenance Activities

The following section discusses the three technical steps for consideration of candidate terms: adding new terms, amending terms, and deleting terms.

To place these steps in the proper context and to understand the principles underlying the TRT, please refer to the discussion of **Facet Analysis** in Section A.2.

E.3.1 Adding New Terms

New concepts represented in raw vocabulary will be encountered continually in future documents. New terms to represent these concepts should be solicited and welcomed from information staff or from end users. These candidate terms should be considered for inclusion in the thesaurus just as raw terms were in the development of the thesaurus (described in Section A). Each candidate term should be assigned to one of the following four categories.

E.3.1.1 Category 1: New Concept

If the candidate term represents a new and valid concept and should be included, the following steps should be taken.

- o Determine the appropriate facet and the appropriate level within the facet.
- o Determine the appropriate form of language to conform with other terms in the facet. This step involves the following tasks.

First, confirm the level of detail needed. Any term below that level of specificity will be included as a USE reference to the nearest term above it in the generic hierarchy.

> For example, THEORY OF SETS OF FINITE ORDER might appear as SETS OF FINITE ORDER in a thesaurus for mathematics, but, in a general scientific thesaurus, it would more likely appear as a USE reference to SET THEORY, and, in a thesaurus like the TRT, simply to ALGEBRA.

Second, translate the raw vocabulary into terms acceptable to users. A scientific thesaurus would probably prefer MAGNESIUM SILICATE, with a reference from TALC, but a popular thesaurus might reverse that reference.

> Phrases should be entered and used as they appear in natural language. In general, the choice between singular and plural forms is determined by which question applies to the term: "how much?" = singular, and "how many?" = plural.

Third, distinguish between the same word with different meanings or applications in the thesaurus.

> For example, the word CELL used in BIOLOGY and in ELECTRICAL ENGINEERING represents basically the same concept, but with different applications. The word SIZE can mean MAGNITUDE and also a GLUTINOUS WASH used to prepare paper before painting or decorating—quite different concepts. In all such cases, try to find acceptable synonyms so that the terms are unique, or add qualifiers to the term: Cell (BIOLOGY); CELL (ELECTRICAL ENGINEERING).

Fourth, clarify the way in which a term should be used by adding a scope note, if necessary.

> Be careful: a scope note is not a definition, though some definitions may be good scope notes. **A scope note is a definition of use**. A psychologist's definition of ADOLESCENCE is not as useful to an indexer as the scope note information "Youths aged 12 - 20".

o Assign the appropriate notational code. Follow the pattern within the facet, allowing space if possible for future additions.

- Assign appropriate cross-references (UF, BT, NT, RT).
- Ensure that all reciprocal relationships are entered. For example, the BT of the new term must show that it has gained an NT, and if the new term has an RT reference, the new term and its RT reference must reference each other as RTs; likewise, if the new term has a UF reference, the UF term must indicate the new term as a USE reference.
- Add an HN showing the date the new term was added.

E.3.1.2 Category 2: Similar Concept

If the candidate term is synonymous with an existing postable term, there are two possibilities: 1) Add the candidate term as a nonpostable term cross-referenced to the existing postable term; or 2) Add the candidate term as a postable term and change the existing postable term to a nonpostable term. Both of these options require reciprocal USE and UF references. The following steps should be taken.

- Confirm that the language of the candidate term is in conformity with the rest of the TRT.
- Confirm or assign the appropriate notational code.
- Enter the candidate term as a USE or UF reference, depending on the decision as to which is preferable.
- Make reciprocal reference from the other term. The finished entries should be in the following form:

  Xxx POSTABLE TERM
  UF Nonpostable term

  and

  NONPOSTABLE TERM
  USE Postable term Xxx

- Review and adjust all references as needed, following procedure shown above in Section E.3.1.1 for adding new concepts.

E.3.1.3 Category 3: Too Specific

If the candidate term is useful, but too specific for the purpose of the TRT, a USE reference should be made from the candidate term to the more general postable term already in the TRT. The following steps should be taken.

- o Identify the appropriate postable term in the hierarchy.
- o Insert the candidate term as a UF term following the postable term.
- o Make a reciprocal USE reference from the candidate term to the postable term.

E.3.1.4 Category 4: Inappropriate

If the candidate term is not appropriate for inclusion, it should be stored in a separate file of **Rejected Candidate Terms** for later review (see Section E.2.3).

E.3.2 Amending Terms

Use of the TRT may reveal spelling errors, confusing terms, and so forth. Even though a simple correction in the term or scope note may be all that is required, it is strongly recommended that all changes should be brought to the Thesaurus Review Team for consideration and decision. It is possible that even seemingly simple changes may have ramifications that are not readily apparent. If the change is approved, the team can also determine whether the change warrants inclusion in the **Significant Change** File described above in Section E.2.3.

E.3.3 Deleting Terms

Indexing and/or searching may reveal terms that are rarely used or that are misleading. Each term should be considered as if it were a candidate term. If the Thesaurus Maintenance Team determines that a term should be removed from the list of postable terms, there are three options:

1) The term may then be considered for inclusion as a USE reference.

2) The term may be considered for adding to the **Rejected Candidate Terms** File (see Section E.2.3) for later reconsideration.

3) The term may be rejected, in which case it should be included in the **Significant Change** File described in Section E.2.3.

F USE OF PROPER NAMES (IDENTIFIERS)

Proper names, also called **identifiers**, are the names of government agencies, organizations, persons, computer files, and so forth, rather than the mostly common nouns, which are the descriptors in the thesaurus proper. Identifiers cannot easily be controlled in a thesaurus in the way descriptors can. The government, company, or institution determines its own name(s) and the names of its products, and these are subject to frequent changes.

The TRT does not include identifiers, except in the case of certain proper names that are in common use, such as DIESEL. Instead, it is recommended that variant forms of proper names be controlled by adopting a standard published list of identifiers. The Project Team has, however, prepared a separate file of identifiers (called TRTIDEN) drawn from the TRIS database to serve as an example or model of a transportation-oriented file. See Section I.

A file of identifiers is not structurally complex and may well be best maintained as a text file by a word processor. The easiest format is alphabetical by the preferred identifier name; each of the non-preferred versions should also be listed in the alphabetical sequence with a "use" reference to the preferred name. For example:

International Union of Public Transport
  use UITP
UITP
UNESCO
Union International des transports publics
  use UITP
United Nations Educational Scientific & Cultural Organization
  use UNESCO

Whenever possible, standard lists of identifiers should be used unless there are special conditions that preclude using them. If an authority file of identifiers needs to be created, the following points are suggested:

1. For corporate names, the form most commonly found on a corporate body's own publications should be used, even if that name is an acronym. If that name conflicts with the name of another corporate body, qualify it. For example:

   Department of Transport (Australia)
   Department of Transport (U.K.)
   IBM (rather than International Business Machines)
   INRETS (rather than Institut national de recherche sur les transports et leur securité)

2. For personal names, use the surname that is in the form used by the individual or that

is common in the culture to which the individual belongs, followed by the forename and initials, or just the initials of the forenames. For example:

Abbot, A. A.
Ashton-Green, P. T.
De La Mare, Walter
La Fontaine, Henri de

3. For system/program names, use the most common form of the name, often an acronym, followed by a qualifier in parentheses. For example:

BRS SEARCH (Computer program)
TRIS (Computer database)

4. Refer from all nonpreferred versions, in whatever form they appear in the literature, to the preferred version of the name.

5. Geographic place names are a special kind of identifier. A few thesauri include them, perhaps arranged hierarchically by location. Place names may alternatively be included in a special identifier list, arranged either hierarchically or alphabetically.

The TRT does not include geographic place names. The TRT has a facet for AREAS AND REGIONS that contains descriptors for concepts like LAND AREAS (e.g., PLAINS, MOUNTAINS, and ISLANDS).

For specific geographic place names, it is strongly recommended that a standard list be used (e.g., the list of place names approved by the United States Board of Geographic Names or the Library of Congress Authority File). The Project Team has prepared a sample file of geographic place names (called TRTGEOG), which may be used as a model if preferred. See Section I. It is the responsibility of the user to update and maintain this file.

G INSTALLATION OF THE TRT FROM A CD-ROM

The Thesaurus Viewer is designed to run within Windows 95 or above. It is being published and distributed on CD-ROM in a special customized version to provide navigation for the TRT.

To install the program in Windows, insert the CD into its drive, then click on START and then on RUN and type D:\SETUP (or the appropriate drive letter for the CD-ROM disk), and press ENTER. Then follow the instructions displayed on the screen.

The installation routine allows the user to select options for special situations or considerations, but most users should be able to use the standard installation.

H VIEWER USER GUIDE

H.1 What is the Viewer?

The Viewer is a software program for the navigation of a thesaurus. Its primary purpose is to assist the user in locating the proper term(s) to describe a given concept, for either indexing or retrieval.

H.2 What is a View?

There are three main views, or displays of the thesaurus: Hierarchy, KWOC, and Alphabetical. The Viewer allows the user to see a term in any of the views and to switch easily from one view to another.

The Viewer also allows the user to see the thesaurus a fourth way: the full display of family relationships of a term within any of the views. This is the display traditionally associated with thesauri. (See Section H.7.)

In all views, postable terms are shown in blue; nonpostable terms are shown in gray.

H.3 Navigating the Viewer

The Viewer uses the same basic techniques for moving around as Windows. For questions about using the mouse, scroll bars, and pop-up screens, refer to the relevant Windows manual.

Any button in the Viewer that has an underlined letter in its label can also be activated by holding down the ALT key and pressing the underlined letter. For example, all of the screens that "pop up" have a "Close" button, with the initial "C" of "Close" underlined. Holding down the ALT key and pressing "C" is the same as clicking on the button. Also, at most points, pressing the ESC key will close the pop-up.

H.4 Navigating if Notation is Known

Click on the Hierarchy tab at the top of the screen, and then click on the facet letter from the row of tabs immediately below. Then either click on the directional buttons at the bottom of the screen or use the directional keys on the keyboard. Note that holding a directional key down, or keeping the mouse button down while on one of the directional buttons, will scroll the display quickly. Alternatively, once in the Hierarchy view, click on the "Move to a Different Notation" button at the bottom of the screen, and follow the directions in the pop-up window.

H.5 Navigating if First Word of Term is Known

Click on the Alphabetical tab at the top of the screen. The movement rules are the same as for the Hierarchy view.

H.6 Navigating if Only One Word is Known

Click on the KWOC tab at the top of the screen. The movement rules are the same as for the Hierarchy view, except that using the "Move to a Different Keyword" button brings up a pop-up window that allows the choice of any of the keywords in the currently highlighted term or the entry of a different keyword.

H.7 Seeing the Full Display ("Family" Relationships) of a Term

Double-clicking on any term anywhere while in the Hierarchy, KWOC, or Alphabetical view will pop up a window that shows the complete "family" of references for the term. This is the full display traditionally associated with thesauri that may include an SN telling how the term should be used, references to and from nonpostable terms (UF/USE), BTs and NTs to the given term, and RTs. Later editions of the thesaurus may show HNs that tell when a term began to be used, was changed, or went out of use.

Terms within the family pop-up window can also be double-clicked, allowing the user to follow references throughout the thesaurus. When the family pop-up is closed, however, the display reverts to the term that was first double-clicked.

If the family of references is too large to fit in the pop-up window, the scroll bar at the right of the window can be used to move down in the display, as can the directional keys on the keyboard.

H.8 Seeing a Term in Different Views

To move between views, click on one of the three view tabs near the top of the screen. Every move is to the highlighted term in the selected view if a **postable** term is highlighted. If a nonpostable term is highlighted, a move will be made to the postable term to which it refers.

Because the KWOC view is sorted by keywords rather than by terms, a move from a single word term in another view will be to the occurrence of that term in the KWOC view, and a move from a multiple word term will pop up a window that allows the choice of any of the significant words in the term or the entry of another word altogether. If the highlighted term is nonpostable, the move that is made is to the postable term to which it refers. For example, if the nonpostable term LANDING STRIPS is highlighted in the Hierarchy view, and you click on the KWOC view tab, the move to the KWOC view is made to LANDING STRIPS's postable term, which is AIRSTRIPS.

H.9 Seeing the Facet Outline and Summaries

Clicking on the "Outline" button will bring up the thesaurus outline, which shows the highest level term in each facet and its notation, which is always a single capital letter.

To see a facet definition or summary, once the outline is on the screen, position the mouse cursor on the letter or name of the desired facet and then depress and hold down the mouse button.

H.10 Finding Out More About the Thesaurus

Clicking on the "About TRT" button pops up a scrolling window similar to the Help window that includes more information about the thesaurus. To exit the "About TRT" screen and return to the thesaurus, click on the "Close" button, or press the ALT/C key combination.

There are also several printable files included in the electronic version of the TRT that are installed automatically with the Thesaurus Viewer. These files contain more information about the TRT. Details are given in Section I.

H.11 Viewer Help

Click on the "Help" button to pop up a scrolling window that provides information about the Thesaurus Viewer. HELP is organized as a single document. Move within the Help window by using the keyboard directional keys (PageUp, PageDown, Home, End, and the arrow keys). The mouse can also be used to move around by clicking on the scroll bar (located to the right of the help window). To exit HELP, use the mouse to click on the "Close" button, or press the ALT/C key combination.

Paul Rosenberg of Information Designs Limited will assist with any problems with the Viewer that cannot be resolved locally. (See Section K for contact information.)

H.12 Exiting the Viewer

Click on the "Exit" button to close the Thesaurus Viewer and click on "Yes" to confirm that you wish to end the session and return to the Windows screen.

H.13 Using the Viewer With a Data Entry or Search System

The Thesaurus Viewer can be used in conjunction with other programs to reduce the burden of keying in terms and to ensure that terms are entered correctly. Compatible programs must have the ability to "paste" data from the Windows clipboard. This capability works best with screen resolutions of 800x600 or greater so that the Thesaurus Viewer and the other program are both visible on the screen.

In any of the views, right-clicking on a term will bring up a submenu with commands for using the clipboard to store terms. Each of these commands has a corresponding function key.

The REPLACE CLIPBOARD WITH TERM command (or F10) will copy the current term to the clipboard after erasing what was on the clipboard.

The ADD TERM TO CLIPBOARD command (or F11) will add the current term to the clipboard (even if the clipboard is empty).

The VIEW/EDIT CLIPBOARD TERMS command (or F12) will display the current contents of the clipboard. A displayed term can be removed from the clipboard by double-clicking on it, or by highlighting it and then pressing the DELETE key.

If the currently selected term is a USE reference or an SN, the program will find the preferred term and copy it instead. The term as it has been copied to the clipboard is displayed in a pop-up message.

Once terms are on the clipboard, they can then be pasted into another application, such as a data entry or search system. Pasting is usually done by positioning the cursor at the point where the data is to be pasted, and then selecting PASTE from the EDIT menu or pressing CTRL/V.

Technical details on how the terms are copied to the clipboard, including how to specify the separators between terms, are in the ReadMe.txt file described in Section I.

I PRINTABLE FILES ON THE CD-ROM

A number of special ASCII files are included on the CD-ROM and are automatically installed with the Viewer. These files are located in the same drive and directory as the Thesaurus Viewer and the TRT. If the standard installation is followed, the directory is \TRT. Any or all of the following ASCII files may be handled by a word processor for local printing, viewing on the screen, and so forth.

I.1 Documentation Files

README.TXT

This ASCII file documents the versions of the TRT and provides other essential technical information.

TRTMANL.TXT

This ASCII file contains the TRT User Guide and Maintenance Manual. It will produce about 60 single-sided pages.

TRNEWS.TXT

This ASCII file contains an article written by David Batty about the TRT. It was published in TRNEWS in the March-April 1998 issue. It will produce 8 single-sided pages.

I.2 TRT Files

TRTHIER.TXT

This ASCII file contains the full version of the TRT hierarchy (with all SNs, UF references, and RT references to and from other facets). It will produce about 260 single-sided pages. A nonproportional font, such as COURIER, is recommended to preserve the proper indentations of the hierarchy.

TRTKWOC.TXT

This ASCII file produces a rotated term index (i.e., an index of all significant words in all descriptors, showing the whole descriptor and its notational code). Index entries for nonpostable terms indicate the postable term and notation that should be used instead. The file will produce about 370 single-sided pages. A nonproportional font and either a smaller font (such as Courier 10 point) or narrow margins are recommended to prevent wraparound.

TRTGEOG.TXT

This is an ASCII file of a sample of specific common geographic names (of countries, states, cities, rivers, oceans, etc.) in a recommended standard format arranged alphabetically. Variant forms of names are included and shown as USE references. This file will produce about 20 single-sided pages.

TRTIDEN.TXT

This is an ASCII file of a sample of specific identifiers (proper names of companies, agencies, etc.) common to the transportation field in a recommended standard format. Variant forms of names, abbreviations, or acronyms are included and shown as USE references. This file will produce about 10 single-sided pages.

TRTOUTL.TXT

This ASCII file contains an abbreviated version of the TRT hierarchy. This abbreviated version is intended only for assisting in exploring and understanding the thesaurus and its structure. It is not for use as a substitute for the full thesaurus or the full hierarchy. This file produces about 20 single-sided pages.

TRTAUTH.TXT

This ASCII file contains all the postable TRT terms arranged alphabetically; notation is included. It may be loaded into automated systems for use as an authority file, or it may be printed using a word processor. It will produce about 170 single-sided pages.

Printed copies of the thesaurus formatted in any of these and/or any other version (KWOC, Full Display, etc.) are available for a fee. Contact David Batty of CDB Enterprises, Inc., for further information. (See Section K.)

I.3 Minithesauri Files

The following three ASCII files are included on the CD-ROM as examples of special interest transportation minithesauri of only a few hundred descriptors each. They are compatible with the TRT and are extensions of it in the sense that they include more detailed vocabulary, usually organized in appropriate, more detailed subfacets. All are presented here only as hierarchical displays, although they are available in other displays.

ITSHIER.TXT

This ASCII file contains the hierarchical display of the Intelligent Transportation Systems (ITS) Thesaurus developed by Michael Kleiber and Seyem Petrites. The ITS Thesaurus supports PATH Database, which is housed at the Harmer E. Davis Transportation Library, University of California, Berkeley, and sponsored by the California PATH Program and the California Department of Transportation.

WKZNHIER.TXT

This ASCII file contains the hierarchical display of the Work Zone Safety Thesaurus prepared by Michael Kleiber and Sandra Tucker. This Thesaurus supports the National Work Zone Safety Clearinghouse at Texas A&M University sponsored by the Federal Highway Administration and the American Road and Transportation Builders Association.

CALMHIER.TXT

This ASCII file contains the hierarchical display of the Traffic Calming Thesaurus prepared by David Batty. It was developed for the traffic calming literature project undertaken by the Institute of Transportation Engineers on behalf of the Federal Highway Administration.

J GLOSSARY, ABBREVIATIONS, AND SYMBOLS

J.1 Glossary

Candidate Term: A term to be considered for inclusion in the thesaurus. Such a term may be included as a postable or a nonpostable term. The NISO guidelines make a distinction between suggested terms taken from the literature ("candidate terms") and terms not so far used in the literature ("provisional terms"). (See Section E.2.)

Descriptor: A word or phrase in the controlled language of a thesaurus.

Facet: A group of concepts, expressed as postable and nonpostable terms, that share a single characteristic. Each concept may have a number of characteristics, but only one is chosen as the organizing principle to collect the concepts into a facet. Facets may be divided into subfacets when there are internal characteristics of division that identify subgroups. Facets and subfacets are usually organized into hierarchical order.

Hierarchy: An arrangement of terms in a thesaurus showing generic-specific relationships (THING, KIND OF THING) or general-special relationships (THING, PART OF THING) as a taxonomy. It is the oldest kind of display of ideas, originating in the works of Aristotle and his commentators.

Identifier: Formal names of organizations, persons, places, computer files, and so forth. (See Section F.)

Keyword: A word or phrase contributed by a lexicographer, indexer, or user, taken from any source other than the thesaurus. It is not a controlled term, though it may become one if accepted as a thesaurus descriptor.

Nonpostable Term: (also known as a **lead in** or **entry term**) The nonpreferred expression of a concept that is referred to the postable or preferred term. Note that nonpostable terms are not only synonyms of the postable term, but may be also quasi-synonyms, inversions of the postable term, and subsumed terms that are too specific to be included in the thesaurus as postable terms, and are therefore included as nonpostable term references. The NISO guidelines's definition of **entry term** describes only the first of the specifications of nonpostable terms given above. (See Section C.2.1.)

Notational Code: A set of characters assigned to each term in a thesaurus, usually to establish and preserve its position in a hierarchy. If the notational scheme is **expressive,** the notational code contains as many characters as there are levels of subdivision for a given term. (See Section C.1.)

Postable Term: (Also known as a **preferred term** or a **descriptor**) The preferred expression of a concept in the Thesaurus. The NISO Guidelines use **descriptor**; we have used **postable term** to indicate a function as well as a meaning. (See Section C.2.1.)

Precoordinated Terms: Precoordinated terms are descriptors that combine two or more terms from the thesaurus to make a descriptor that is a phrase in general use (e.g., TRAFFIC SAFETY and EDUCATION to make the term TRAFFIC SAFETY EDUCATION). (See Section C.2.3.)

Qualifier: A word or phrase in parentheses added after a term to indicate its context. (See Section C.2.2.)

Subfacet: A group of terms within a facet that share a second characteristic more specific than the principal characteristic for the facet.

Thesaurus: A controlled vocabulary in which concepts relevant to the interests of a community are represented by terms comprehensible to the community of users. The accepted major display of a thesaurus is an alphabetical list of both postable and nonpostable terms, in which the nonpostable terms indicate simply which postable term should be used instead, and in which the postable terms have an elaborate display of all terms to which they are related, and have notes about the ways in which the terms have been and should be used. Other common display formats of a thesaurus are hierarchical and rotated (KWOC index); increasingly, these are preferred by indexers and searchers.

Top Term: The most general term in a thesaurus hierarchy. In the TRT, this means the most general term in a facet; it is used as the facet name.

J.2 Abbreviations

AASHTO American Association of State Highway and Transportation Officials
ATRIS Air Transportation Research Information Services
BT Broader Term (see Section C.3)
HN Historical Note (see Section C.3)
HRIS Highway Research Information Services
HSL Highway Safety Literature
ITRD International Road Research Documentation
ITS Intelligent Transportation Systems
KWOC Key Words Out of Context

MRIS	Maritime Research Information Services
NT	Narrower Term (see Section C.3)
RRIS	Railroad Research Information Services
RT	Related Term (see Section C.3)
SN	Scope Note (see Section C.3)
TLIB	Transportation Libraries (from Northwestern University and the University of California, Berkeley)
TRB	Transportation Research Board
TRIS	Transportation Research Information Services
TRT	Transportation Research Thesaurus
UMTRIS	Urban Mass Transportation Research Information Services
UF	Use For (see Section C.3)
USE	lead-in vocabulary (this term is not an acronym)

J.3 Symbols

()	Qualifier of a term (see Section C.2.2)
=	Used with notation to indicate a nonpostable term (see Section C.2.1)
>	Used with notation in the Hierarchy view only to indicate that the term is a Related Term (the notation of the Related Term follows the term and is enclosed by parentheses)

K CONTACT INFORMATION

General comments, questions, and suggestions; queries regarding the availability of different versions and formats of the TRT; and suggestions for specific changes involving the TRT (new terms, errors, omissions, etc.) are welcome and should be directed to

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The latest version of the TRT and ancillary files are available for downloading from the following website:

http://www.infodesigns.com

The **Transportation Research Board** is a unit of the National Research Council, which serves the National Academy of Sciences and the National Academy of Engineering. The Board's mission is to promote innovation and progress in transportation by stimulating and conducting research, facilitating the dissemination of information, and encouraging the implementation of research results. The Board's varied activities annually draw on approximately 4,000 engineers, scientists, and other transportation researchers and practitioners from the public and private sectors and academia, all of whom contribute their expertise in the public interest. The program is supported by state transportation departments, federal agencies including the component administrations of the U.S. Department of Transportation, and other organizations and individuals interested in the development of transportation.

The National Academy of Sciences is a private, nonprofit, self-perpetuating society of distinguished scholars engaged in scientific and engineering research, dedicated to the furtherance of science and technology and to their use for the general welfare. Upon the authority of the charter granted to it by the Congress in 1863, the Academy has a mandate that requires it to advise the federal government on scientific and technical matters. Dr. Bruce M. Alberts is president of the National Academy of Sciences.

The National Academy of Engineering was established in 1964, under the charter of the National Academy of Sciences, as a parallel organization of outstanding engineers. It is autonomous in its administration and in the selection of its members, sharing with the National Academy of Sciences the responsibility for advising the federal government. The National Academy of Engineering also sponsors engineering programs aimed at meeting national needs, encourages education and research, and recognizes the superior achievements of engineers. Dr. William A. Wulf is president of the National Academy of Engineering.

The Institute of Medicine was established in 1970 by the National Academy of Sciences to secure the services of eminent members of appropriate professions in the examination of policy matters pertaining to the health of the public. The Institute acts under the responsibility given to the National Academy of Sciences by its congressional charter to be an adviser to the federal government and, upon its own initiative, to identify issues of medical care, research, and education. Dr. Kenneth I. Shine is president of the Institute of Medicine.

The National Research Council was organized by the National Academy of Sciences in 1916 to associate the broad community of science and technology with the Academy's purpose of furthering knowledge and advising the federal government. Functioning in accordance with general policies determined by the Academy, the Council has become the principal operating agency of both the National Academy of Sciences and the National Academy of Engineering in providing services to the government, the public, and the scientific and engineering communities. The Council is administered jointly by both the Academies and the Institute of Medicine. Dr. Bruce M. Alberts and Dr. William A. Wulf are chairman and vice chairman, respectively, of the National Research Council.

Abbreviations used without definitions in TRB publications:

AASHO	American Association of State Highway Officials
AASHTO	American Association of State Highway and Transportation Officials
ASCE	American Society of Civil Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
FAA	Federal Aviation Administration
FHWA	Federal Highway Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
IEEE	Institute of Electrical and Electronics Engineers
ITE	Institute of Transportation Engineers
NCHRP	National Cooperative Highway Research Program
NCTRP	National Cooperative Transit Research and Development Program
NHTSA	National Highway Traffic Safety Administration
SAE	Society of Automotive Engineers
TCRP	Transit Cooperative Research Program
TRB	Transportation Research Board
U.S.DOT	United States Department of Transportation

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