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RESEARCH PROBLEM STATEMENTS FOR USER INFORMATION SYSTEMS

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RESEARCH PROBLEM STATEMENTS FOR USER INFORMATION SYSTEMS

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INTRODUCTION

Development of This Circular

The Transportation Research Board's Committee A3B08, User Information Systems, offers selected research problems that need the most attention considering the needs of people using and operating transportation systems, the changing transportation environment, and the new technologies available today and in the near future. These statements were developed from 1993 to 1996 by User Information Systems Committee members in response to observed needs and concerns of the transportation community they serve. From more than seventy-five original submissions, committee review teams selected and prioritized the 22 statements contained herein during two mid-year committee meetings and several subsequent reviews.

Committee Activities and Perspective

The committee's activities focus on the information exchange between the transportation mode and the user. Particular attention is placed on defining the information requirements, user capabilities, and situation and environmental conditions that affect the adequate and accurate transmission of user information. The committee's purview includes all modes of transportation and also addresses the interface between modes. User information is broadly interpreted by the committee as any stimulus in a transportation environment that can be sensed by a transportation user and aids the user to better complete a trip or perform a trip related operation.

The effectiveness of information systems for transportation users has often been constrained by:

- the insufficient testing of messages on potential users under task loaded conditions;
- the lack of understanding of changing user population requirements;
- the lack of understanding of user problems with specific transportation environments;
- the absence of cost effective technologies;
- the inadequate integration of physical/system designs and human requirements; and
- the incompatible design of user information infrastructures.

Much of the design and positioning of information displays and messages makes its way into practice without the benefit of a comprehensive, valid, and reliable evaluation by the users for whom they are intended. A credible evaluation relies on a fairly extensive knowledge of experimental design techniques and the experience to know how to apply that knowledge in the field. Field validations of laboratory experiments are always desired. However, they are more difficult to analyze since the "real world" is involved. The use of subjects as information users in complementary "field" and "lab" experiments is ideal, but expensive and labor intensive.

Noted in recent problem statement submissions are suggestions to use simulators as a substitute for real environments to at least reduce the set of preliminary test or design alternatives. Although not a substitute for field validation, simulators that employ realistic visualization techniques are more capable, less costly, and easier to apply than in the past for use in preliminary evaluations. The use of simulators that employ realistic visualization techniques should be encouraged both in research and design processes where appropriate to improve the quality and effectiveness of user information systems in transportation.

RESEARCH PROBLEM STATEMENTS

PROBLEM STATEMENT 1: EFFECTIVENESS OF GRAPHIC AND SYMBOLIC MESSAGES FOR VARIABLE MESSAGE SIGNS

Variable Message Signs (VMS) are being employed extensively on highways and in transit systems around the country. Full matrix signs are being employed rapidly as the latest VMS version. Full matrix VMS for traffic control and transportation user information are capable of displaying symbols and graphics that extend well beyond letter fonts and numbers. Some graphics are being displayed on VMS that appear to require more than low VMS resolution levels. The legibility distance of standard transportation symbols and the time it takes for a transportation user to understand a symbol in a matrix format with defined VMS characteristics is not known. The general VMS requirements and principles necessary to display new symbols effectively have not been developed. It is not known if graphics or symbols are more effective or more versatile than words.

Objective

Determine the legibility distance of standard transportation symbols on full matrix VMS in common highway and transit use and at various alternate resolutions. Propose and validate VMS requirements for effectively displaying standard transportation symbols for vehicle and pedestrian traffic situations. Determine symbol design principles for effective transportation use given existing full matrix characteristics. Determine the effectiveness and versatility of graphics and symbols versus words.

Key Words

VMS; full matrix; symbols; graphics; messages; legibility; effectiveness.

Related Work

FHWA contracts on VMS message research.

Urgency/Priority

High.

Costs

$750,000 over 3 years.

User Community

Drivers; transit users; airport users; highway, transit, and airport agencies.

Implementation

Results would be used toward developing a set of guidelines and/or standards for designing and displaying symbols on full matrix VMS.

Effectiveness

This research will assist in improving the legibility of messages displayed to travelers on full matrix VMS so that comprehension is enhanced and confusion is minimized.

Priority

One of twenty-two.

PROBLEM STATEMENT 2: USE OF AUGMENTED REALITY FOR PORT NAVIGATION DURING TIMES OF REDUCED VISIBILITY

Ship traffic in the major ports halts during periods of reduced visibility due to the risk of increased collision. While radar and other technologies exist which have effectively increased the "vision" of the harbor pilot, visual sighting of landmark references remains an imperative component of the navigational paradigm. The cost of a large ship lying at anchor during these reduced visibility periods amounts to $2,000/hour with subsequent delays resulting from the backlog of ship traffic waiting to be unloaded. Augmented/virtual reality is a technology that could allow harbor pilots to see fixed visual references during times of reduced visibility.

Objective

Conduct a feasibility study of current augmented or virtual reality (VR) technology to ascertain the appropriateness for use on-ship. Define the technologies required for ship board position transmission, broadcast transmission, and reception of VR data base. Identify the costs associated with providing a VR installation for a typical harbor, the operational parameters, and related issues. Develop a prototype system for demonstration purposes associated with one of the existing ship simulators.

Key Words

Augmented reality; virtual reality; navigation; ships.

Related Work

Several laboratories have been developing VR from many diverse perspectives. There is a substantial body of knowledge related to VR. Texas A&M University at Galveston (TAMUG) operates a ship simulator for education, training, and research purposes. Several individuals associated with that program have indicated support for the research.

Urgency/Priority

High.

Costs

$200,000 to $500,000 over 2 years.

User Community

Ship navigators; harbor pilots; port and river authorities.

Implementation

Results would be used as a basis for a real-world feasibility test of the technology related to this application.

Effectiveness

The dissemination of such a system could result in a yearly savings of millions of dollars annually by reducing the delays associated with loss of visibility. The potential for the use of VR to reduce collisions in crowded shipping lanes also exists.

Priority

Two of twenty-two.

PROBLEM STATEMENT 3: ICONS AND DISPLAYS FOR TRAFFIC SAFETY AND MANAGEMENT

With the availability of multi-media opportunities for providing traffic safety and management information, a problem has developed as to how information should be presented to the public. Historically, roadside signs have been used as the primary media for communicating safety, regulatory, and traffic information to drivers. Today safety and traffic information can be found in radio, newspapers, kiosks, television announcements, internet, hand-held devices, etc. Icons are frequently used to represent real-time traffic conditions. The icons are sometimes replicates of traffic control devices found in the Manual of Uniform Traffic Control Devices, the national standard to help promote uniformity across the United States. New icons are now appearing, and they are originating from both government and commercial sources. Presumably, the goal is to communicate information quickly and clearly to the recipient whether they be in or out of a vehicle. With all of these competing developments, what is likely to happen is the public will find itself having to learn numerous systems, most of which are attempting to deliver the same message across different media. The lack of uniformity in how traffic and safety information is presented to the public is a problem.

Objective

Review what signs, text, and icons are being used or planned for communicating information to the public both within and outside of the vehicle. The review should be conducted world wide, include all medias of presentation, and originators and distributors of traffic and safety information. Comparability analyses should be undertaken to determine how similar problems have been solved by other industries and users of information. Recommendations shall be made as to what human factor, marketing, or other research is needed to promote uniformity in how icons are applied and used in communicating traffic safety and management information. Recommendations shall also be developed as to how uniformity can be promoted and monitored both now and in the future.

Key Words

Signs; icons; messages; ATIS; ITS; uniformity; safety; incident management; information.

Related Work

The Intelligent Transportation Society of America (ITSA) is trying to develop standards for data elements. Enterprise has developed icons for traffic conditions. Atlanta Showcase has developed icons for use on hand-held devices and television monitors. Similar actions are underway throughout the industry.

Urgency/Priority

High.

Costs

$300,000 over 2 years.

User Community

Drivers; travelers; transit users; airport users; highway, transit, and airport agencies; traffic management centers.

Implementation

Results would be used toward developing a set of standards or guidelines for the uniform use of icons in disseminating traffic safety and management information to users, and the education of those users to the icons they encounter.

Effectiveness

This research will aid in developing uniformity in the design and use of icons in technologies for information dissemination to travelers. Uniformity will help increase user comprehension and decrease error potential, especially relating to in-vehicle technologies.

Priority

Three of twenty-two.

PROBLEM STATEMENT 4: ENHANCEMENT OF VERTICAL SIGNING WITH HORIZONTAL SIGNING

The traditional method of providing information to travelers on the roadway is with vertical signing. However, in certain situations, vertical signing could benefit from supplemental information, such as when large trucks are in the traffic stream and obscure various signs or during times of inclement weather. Supplemental information can be provided in the form of horizontal signing (pavement markings). It is not known under what conditions vertical signing might benefit from supplemental signing, nor is it known to what extent horizontal signing can improve upon vertical signing under such conditions.

Objective

Investigate the extent to which vertical signing can be enhanced with horizontal (markings, symbols, etc. on pavement) signing. Determine the situations where the application of horizontal signing, in addition to the vertical signing, would be of advantage. Develop design rules for horizontal signing (height to width ratios, minimal stroke width, etc.) which are speed dependent and may be dependent upon other factors.

Key Words

Signs; vertical signing; horizontal signing; traffic control devices; pavement markings; information.

Related Work

Not known.

Urgency/Priority

High.

Costs

$300,000 over 2 years.

User Community

Drivers; highway and transit agencies.

Implementation

Results would be used to develop guidelines for the use of horizontal signing to supplement vertical signing and design standards for such signing.

Effectiveness

This research will assist in enhancing and supplementing information provided to drivers, especially under conditions where error potential is increased.

Priority

Four of twenty-two.

PROBLEM STATEMENT 5: AGE DIFFERENCES IN RESPONSE CAPABILITIES FOR ITS SYSTEMS

ITS controls, displays, and information transmission strategies now in the research, development, or engineering prototype stages must be able to be used safely and effectively by older as well as younger drivers if anticipated system-wide benefits are to be realized. There is abundant evidence that older persons divide attention less efficiently during "effortful" processing of information (e.g., while driving), however, in addition to being potentially less capable of operating ITS interface hardware due to sensory, perceptual, muscular, and/or kinesthetic impairments.

Objective

Test the response capabilities of older versus younger drivers for emerging ITS hardware/interface designs under divided attention conditions. Identify and describe ways in which current designs fail to accommodate the needs of older drivers. Develop recommendations for design enhancements or optional features to mitigate against age differences in the usability of ITS systems.

Key Words

ITS; information; control; display; vehicle; driver; age; capability; interface; attention; perception; cognition; response.

Related Work

FHWA/NHTSA work at UMTRI.

Urgency/Priority

High.

Costs

$300,000; additional $200,000 for testing of design enhancements.

User Community

Drivers; travelers; ITS system developers; state and local transportation agencies.

Implementation

Large investments in novel in-vehicle information systems must take into account the manner in which systems will be operated by drivers with diminished capacity, for both from the standpoint of safety and to realize maximum system benefits.

Effectiveness

Significant contribution toward realization of overall ITS systems development/implementation goals, such as improved highway capacity with improved safety of operation, for all drivers.

Priority

Five of twenty-two.

PROBLEM STATEMENT 6: AGE DIFFERENCES IN PROCESSING INFORMATION FROM SEQUENTIAL VERSUS SIMULTANEOUS HIGHWAY SIGN DISPLAY

Recent unpublished research by Avant and Thieman suggests that there is a significant difference among young drivers in the latency times for brain processing of displays of highway signs when showing simultaneous information displays rather than showing the information in sequential messages.

Latency times are much longer for sequential displays. Traffic engineering principles embedded in advanced warning messages for intersection control requiring stop signs, yield signs, and signals, and at railroad crossings, assume that sequential signing is better than simultaneous display of information. Recent study of railroad crossing collisions by Brewer suggests that there may be a significant difference in elderly drivers efficiency in processing advance warning to railroads as compared to younger drivers.

Objective

To determine if there is a quantifiable fundamental difference in the latency of elderly or aging driver in processing sequential and simultaneous sign displays as compared to younger drivers.

Key Words

Older drivers; advance signs; display methods.

Related Work

Recent unpublished research by Avant and Thieman and a study of railroad crossing collisions by Brewer.

Urgency/Priority

High.

Costs

$250,000 over 2 years.

User Community

Older drivers; federal, state, and local transportation agencies.

Implementation

If a difference in latency times for processing simultaneous versus sequential sign display can be shown among elderly drivers in contrast to young and middle aged drivers, then some of the difficulty elderly drivers have in processing advance warning signals, multiple panel overhead signing on freeways and expressways, and changeable message signs may be alleviated by adjusting the spacing and/or positioning of the signs along the roadway as compared to standard traffic engineering practice guidelines.

Effectiveness

Results of this study will be included in a program to alter highway information systems for older drivers.

Priority

Six of twenty-two.

PROBLEM STATEMENT 7: DELINEATION NEEDS IN PAVEMENT TRANSITION AREAS

Many highway agencies have criteria for using raised pavement markers (RPMs) or other forms of delineation which result in these devices being installed when a segment of road is upgraded or widened. The use of these devices will often be discontinued right where they are needed most--where the improved section transitions back to the older section.

Objective

Assess current practices in retaining continuity of delineation through pavement transition areas and to evaluate some of the more commonly used practices or new practices for providing good alignment information to the driver.

Key Words

Raised pavement markers; pavement transitions; RPM placement; delineation.

Related Work

The use of RPMs in construction zones.

Urgency/Priority

High.

Costs

$300,000 over 2 years

User Community

State and local transportation agencies; drivers.

Implementation

Recommendations from this work will be candidate for modification of the MUTCD.

Effectiveness

Attention to RPM use in transitions will have a direct benefit on safety due to a reduction in expectancy related difficulties.

Priority

Seven of twenty-two.

PROBLEM STATEMENT 8: USE OF DELINEATION IN ROADWAY LIGHTING TRANSITION AREAS

Drivers need a few seconds to adjust to changing lighting conditions when driving out of a well-lighted road section into an unlighted one. Roadway delineation of various forms can be used to provide alignment information to drivers especially if that alignment is something other than flat and straight.

Objective

Assess current practices in the use of delineation in lighting transition areas and to evaluate some of the more commonly used practices or new practices.

Key Words

Delineation; highway lighting; light adaptation; expectancy.

Related Work

Work by Edward Rinalducci at the University of Virginia. A series of studies sponsored by FHWA in effort to reduce the cost of electric power at interchanges by using delineation.

Urgency/Priority

Medium.

Costs

$350,000 over 30 months

User Community

Drivers; state and local transportation agencies.

Implementation

Emphasizes the need to coordinate the deployment of lighting and delineation, not found in the MUTCD.

Effectiveness

Driver safety can be improved by regarding the visual highway environment as a dynamic system serving the driver, instead of lighting, delineators, striping, and raised pavement markers as unrelated devices.

Priority

Eight of twenty-two.

PROBLEM STATEMENT 9: CRITERIA FOR DETERMINING LINEAR SPACING OF TRAILBLAZER SYMBOLS TO MAJOR TRAFFIC GENERATORS ON ARTERIAL STREETS

Guidelines are needed to determine the linear spacing of trailblazer symbols to major traffic generators on arterial streets. Trailblazers are a series of guide signs located along major arterials which delineate the best route to major traffic generators. Trailblazer symbols are needed to reduce unnecessary circuitous travel. Circuitous travel increases congestion on arterial streets resulting in increased travel time, increased fuel consumption, and increased motor vehicle pollution. Proper use and spacing of trailblazer symbols would also reduce potential accident situations caused by lost motorists slowing, stopping, or backing up at critical decision points. The use of properly spaced

trailblazer symbols would also decrease the hazardous act of map-reading while driving.

Objective

Evaluate the effectiveness of trailblazer symbols in reducing circuitous travel and increasing safety on arterial streets. Establish criteria for determining the number, linear spacing, and design of trailblazer symbols. Criteria would also be established to determine the type of major traffic generators and appropriate routes to be trailblazed.

Key Words

Trailblazer symbols; guide signs; motorist information systems.

Related Work

National Cooperative Highway Research Program Synthesis No. 162, Signing Policies, Procedures, Practices, and Fees for Logo and Tourist-Oriented Directional Signing. AASHTO guidelines on warrants for traffic generator signing.

Urgency/Priority

High.

Costs

$200,000 over 18 months

User Community

Drivers; travelers; state and local transportation agencies; ITS system developers; motorist information providers; traffic management centers.

Implementation

Criteria for the proper selection of major traffic generators and routes to be trailblazed in addition to guidelines for proper usage of trailblazer symbols would be established. The results of this research should be submitted to the National Advisory Committee's Signs Subcommittee for MUTCD consideration.

Effectiveness

Better motorist information using properly spaced trailblazer symbols would help combat increasing high levels of congestion, travel time delays, and pollution. Also, important savings could be realized in motor vehicle fuel costs. Safety on arterial streets would be improved by reducing erratic behavior at critical decision points.

Priority

Nine of twenty-two.

PROBLEM STATEMENT 10: PAVEMENT CONDITION INFORMATION FOR WINTER DRIVING

Winter weather conditions in the northern states leave drivers often wondering what speed is safe for conditions. Sudden changes in weather can change pavement surface conditions from dry to ice covered in minutes. Without accurate information on the temperature at a given time it is often difficult to tell if the pavement is wet or ice covered. In states where the weather creates these problems, drivers need more information to reduce property damage, injury, or possibly fatal accidents.

Objective

Develop an automated system to sense the weather and pavement conditions on a real-time basis and provide necessary information to the users on the dangers that they might be facing.

Key Words

Pavement sensors; temperature sensors; weather prediction; adverse weather; ice detection.

Related Work

Studies by Eugene Wilson of University of Wyoming and Fred Hanscom of Transportation Research Corp.

Urgency/Priority

Medium.

Costs

$500,000 over 3 years

User Community

Drivers; travelers; state and local highway and transit agencies; traffic management centers.

Implementation

Will serve as a basis for trials in relevant states and the development of specifications. A continuing investigation made more relevant because of the recent emphasis on ITS and the use of variable message signs.

Effectiveness

Real-time driver information relating to slippery surfaces on bridges will be an improvement to present static sign warnings with the development of a reliable detection and prediction system.

Priority

Ten of twenty-two

PROBLEM STATEMENT 11: STANDARD SIGN SIZES

The Manual on Uniform Traffic Control Devices (MUTCD) and the Standard Highway Signs manual contain specifications for sign sizes for warning and regulatory signs. These sizes are specified as minimum, standard, freeway, and expressway. These specifications do not provide clear guidance to the user and are not consistent among similar sign types. Specific problems include standard warning sign sizes varying from 30" to 36" with no apparent rationale and unclear direction on what size sign to use for roads with intermediate speeds (40 - 55 mph). The needs of the older driver should also be considered and guidance provided as to the appropriateness of sign sizes for meeting these needs.

Objective

Review and revise the sign size standards contained in the MUTCD and Standard Highway Signs manual to provide consistent and complete guidance. The selection criteria should be revised to provide the user with more appropriate measures (such as traffic speed) for selecting the correct size. Determine what, if any, changes or guidance are required to accommodate older drivers need.

Key Words

Warning signs; sign sizes.

Related Work

Current formula is 50 feet of legibility distance for every inch of letter height. Some researchers are advising the use of 40 feet in order to adequately consider older drivers. No research is known regarding sign size and sign conspicuity or legibility distance of symbol features.

Urgency/Priority

High.

Costs

$250,000 to $400,000 over 2 to 3 years.

User Community

State and local transportation agencies; drivers.

Implementation

The current manuals should be revised to provide the engineer with the guidance necessary to select appropriate sign sizes to meet user needs.

Effectiveness

The use of proper size signs is an important consideration in providing drivers with sufficient time to recognize and react to sign messages. With the increase in older drivers this has become of greater importance.

Priority

Eleven of twenty-two.

PROBLEM STATEMENT 12: EFFECTIVENESS OF MUTCD FOR URBAN CONDITIONS

The Manual on Uniform Traffic Control Devices (MUTCD) is the primary vehicle through which information on the proper use of a wide variety of traffic control devices is put into practice. Considerable concern has been voiced through organizations such as the Institute of Transportation Engineers and by individual jurisdiction as to the appropriateness of the MUTCD for urban conditions. In general, it is felt that the current edition of the manual and planned revisions to Part VI (work zones) are too heavily weighted to rural conditions. This concern has been raised by both large metropolitan jurisdictions as well as smaller cities. If the MUTCD is to contain standard practice then it should be appropriate for all jurisdictions.

Objective

Examine the current MUTCD and determine its appropriateness for lower speed urban conditions. Isolate specific areas which will require supplemental material and/or additional research to provide guidance that balances the driver needs as well as the practical limitations of urban areas.

Key Words

Traffic control devices; urban warrants; urban guidelines; urban streets.

Related Work

Alexander and Lunenfeld found that signing on urban freeways presented greater driver challenges and that different sign presentation techniques were generally used as countermeasures.

Urgency/Priority

High. There is an urgent need to insure that the MUTCD is applicable and implementable for all types of situations. This document governs all roads open to the public. Currently, in urban areas the MUTCD is not followed because it is felt to be inappropriate. This can adversely impact the driver by providing less than adequate traffic control as well as the jurisdiction by resulting in tort liability cases.

Costs

$500,000 over 3 years.

User Community

State and local transportation agencies; drivers.

Implementation

Findings from a series of studies and discussions will lead to additions to most parts of the MUTCD.

Effectiveness

Special solutions and standardized traffic control device deployments for urban areas will have relatively high safety payoffs due to the higher concentration of intersections and interchanges in urban areas. More specific consideration will need to be given to warrants and guidelines due to higher exposure to vandalism, wear, and damage.

Priority

Twelve of twenty-two.

PROBLEM STATEMENT 13: ENHANCEMENT OF VERTICAL SIGNING WITH AUDITORY INFORMATION

The traditional method of providing information to travelers on the roadway is with vertical signing. However, in certain situations, vertical signing could benefit from supplemental information, such as when large trucks are in the traffic stream and obscure various signs or during times of inclement weather. Supplemental information can be provided in the form of auditory messages provided by emitters installed on or off the roadway. It is not known under what conditions vertical signing might benefit from supplemental information, nor is it known to what extent auditory messages can improve upon vertical signing under such conditions.

Objective

Investigate the extent to which vertical signing can be enhanced with auditory information provided by small emitters installed on or off the roadway. Design such low

cost emitter-receiver (in car, vehicle) systems. Determine the situations where such systems would help a driver and develop application rules. Such systems would be especially useful in cases where vertical signing is obstructed to a large degree because of following large trucks at a short headway, or in inclement weather, with greatly reduced visibility.

Key Words

Signs; vertical signing; auditory messages; traffic control devices; in-vehicle system; information.

Related Work

The application of new techniques for this purpose is not known.

Urgency/Priority

High.

Costs

$300,000 over 30 months.

User Community

Drivers; highway and transit agencies.

Implementation

Results would be used to develop guidelines for the use of auditory messages to supplement vertical signing and design rules for such information dissemination.

Effectiveness

This research will assist in enhancing and supplementing information provided to drivers, especially under conditions where error potential is increased.

Priority

Thirteen of twenty-two.

PROBLEM STATEMENT 14: THE IMPACT OF LATERAL AND VERTICAL OFFSET ON THE LEGIBILITY OF ON-PREMISE SIGNS

On-premise or commercial signs are a key component of the wayfinding system drivers use on the highway. To date, little research has been conducted on the design and placement of these signs in order to optimize legibility. Virtually all existing research on this issue addresses traffic-related signs. This research has only limited applicability to on-premise signs because of numerous inherent differences between the two sign types. Colors, illumination technologies, and fonts used on commercial signs are vastly different from those used on traffic signs. Furthermore, the placement of on-premise signs is generally dictated by sign ordinances that are established by local governing bodies. It is often the case that these ordinances are strict and/or arbitrary in their regulation. Hence, there is a need for empirical data that outlines the impact of lateral and vertical offset on the legibility of on-premise signs.

Objective

Investigate the impact of lateral and vertical offset on the legibility of a typical on-premise sign font displayed using commonly-used illumination technologies. Develop a set of guidelines for locating on-premise signs so as to optimize legibility from the roadway.

Key Words

On-premise signs; offset; legibility; information.

Related Work

Current work at Penn State is looking at the legibility of on-premise signs as a function of color, font style, and illumination technology.

Urgency/Priority

Medium.

Costs

$150,000 over 1 year.

User Community

Drivers; on-premise sign designers; developers; metropolitan governments; highway, transit, and airport agencies.

Implementation

Results will be used toward the development of a set of guidelines that will aid in the placement of on-premise signs to as to optimize legibility.

Effectiveness

This research will assist in locating on-premise signs in locations so that drivers can easily locate and read them and enhance and simplify the wayfinding task.

Priority

Fourteen of twenty-two.

PROBLEM STATEMENT 15: FOUR DIMENSION SIMULATIONS FOR HIGHWAY CONSTRUCTION CHANNELING AND SIGNING

Methodologies which permit small highway departments to plan their construction area design (channelization and signing) are needed. Software which permits four dimensional (time * length * width * elevation) simulations are available for use on personal computers. The training for and application of uses for this software need to be examined so that this technology can be used efficiently.

Objective

Provide implementation data so that small jurisdictions can determine the useability of 4D software for their construction site planning.

Key Words

Simulation; personal computer; signing; construction.

Related Work

Boston tunnel construction.

Urgency/Priority

Medium.

Costs

Phase I feasibility $50,000; phase II up to $100,000 over 18 months.

User Community

Highway and transit agencies.

Implementation

Results will be used by jurisdictions with limited computing and engineering resources for the design of signing/channelization in non-standard construction areas.

Effectiveness

Improved construction zone design will improve safety for workers and motorists and may increase throughput of traffic.

Priority

Fifteen of twenty-two.

PROBLEM STATEMENT 16: ADEQUACY OF STATE DRIVER EXAM BOOKLETS TO DEFINE THE MEANING OF TRAFFIC CONTROL DEVICES

Each driver exam booklet distributed in the 50 states varies somewhat with respect to its definition and description of the meanings and use of traffic control devices. The result is drivers who may be unaware of a device's true meaning, and hence, might misinterpret the required response or maneuver to the device. It is unknown to what extent current state driver exam booklets fully and adequately describe the meaning of traffic control devices drivers encounter on the roadways.

Objective

Investigate to what extent present state driver exam booklets cover the meaning of traffic control devices such as yellow pavement markings, advisory speeds, etc. Propose additions,

if necessary. Also propose means to update long term drivers who passed the driver exam 10, 20, or 30 years ago (pamphlets, television public service announcements, etc.). Develop a minimum set of knowledge items with regard to the meaning of traffic control devices a driver should know on a national basis.

Key Words

Driver exam; traffic control devices; driver licensing.

Related Work

Not known.

Urgency/Priority

Medium.

Costs

$200,000 over 18 months.

User Community

Driver education and licensing agencies.

Implementation

Results would be used to develop guidelines for updating state driver exam booklets so that a minimum knowledge base is created among all drivers in the United States.

Effectiveness

This research will assist toward educating the general driving public on the true meaning of traffic control devices and reduce the potential for driver error when encountering such devices in the roadway environment.

Priority

Sixteen of twenty-two.

PROBLEM STATEMENT 17: EFFECTIVENESS OF HIGHWAY ADVISORY RADIO (HAR) FOR INCIDENT MANAGEMENT

When incidents such as accidents, spilled loads, or stalled vehicles occur, one of the most effective ways of reducing motorist delay is to provide accurate, timely, and reliable traffic information to motorists who are approaching the incident site. This is done through a number of methods including variable message signs, radio, dial-up telephone services, information kiosks, and by the Internet. The accuracy and reliability of this information varies tremendously from one location to another and is highly source dependent. Radio information is usually provided through commercial sources or through highway advisory radio (HAR) which is maintained by a public sector agency and broadcast at radio frequencies of 530 kHz or 1630 kHz. Traditional HAR is not held in high regard by motorists for providing reliable current traffic information. It is used most often at major construction sites where information is not changed frequently. The temptation to broadcast non-germane messages decreases the credibility of HAR for providing reliable traffic information. In addition the range and quality of the broadcast is often poor, especially at 530 kHz. In order to make HAR more effective, some agencies have installed digital equipment to make updating of the broadcasts easier and to target the broadcast of specific information to specific areas. In addition, some locations have installed flashers on HAR advisory signs to tell motorists that there really is an important message that they need to hear. Information is needed on the effectiveness of these and other methods to improve the credibility of HAR services and on what kind of information drivers regard as important and relevant to their trip or commuting habits.

Objective

Obtain information from driver surveys and media experts on the importance of reliable traffic condition information to motorists, its use by motorists, and the desirable features involved in formatting and presenting this information so that it is understood and used.

Key Words

Incident management; freeway management; motorist information; highway advisory radio; communications; traffic reporting.

Related Work

Not known.

Urgency/Priority

Medium.

Costs

$300,000 over 1 year.

User Community

Traffic management centers; drivers; transit users; state and local highway and transit agencies; traffic reporting agencies.

Implementation

Motorist information and incident management are two of the Intelligent Transportation Infrastructure (ITI) elements. Results of this work will be extremely useful to agencies planning and developing Intelligent Transportation Systems (ITS) programs and will help them determine the most effective ways of providing traffic information to motorists.

Effectiveness

This effort will help focus work in providing effective and credible motorist information as part of ITS programs.

Priority

Seventeen of twenty-two.

PROBLEM STATEMENT 18: IMPLEMENTATION OF VISUALIZATION TECHNOLOGIES WITHIN A TRANSPORTATION AGENCY

Over the past few years, transportation agencies have experienced an increased use of 3D and 4D computer imaging (visualization) technologies. The ability to more effectively communicate proposed designs to public audiences has been noted as the primary reason. In spite of its success, there has been a reluctance to fully implement 3D and 4D visualization as a standard tool for the planning, design, analysis, construction, and operations of transportation systems. Other engineering disciplines have demonstrated notable success in using visualization. Boeing, for example, utilized this technology effectively in the planning, design, and construction of their new 777. There have been numerous islands of development in transportation, but to this date, no one has demonstrated the full implementation of these technologies in a transportation agency. The issues surrounding and barriers to implementation were recognized and discussed at TRB's - *3D In Transportation Symposium* held in May of 1995.

Objective

Establish a working national research project in a transportation agency, geared to address the related visualization questions and concerns which came out of the above TRB Symposium. Begin removing the barriers which have been preventing the effective implementation of visualization technologies in transportation agencies.

Key Words

3D; 4D; visualization; computer imaging; transportation; integration; national working research project.

Related Work

TRB Synthesis Project 20-5 (IHSDM).

Urgency/Priority

Medium.

Costs

$175,000 for startup equipment/supplies; $450,000 over 1 to 2 year technology implementation period.

User Community

State and local transportation agencies; design engineers; regional planners; local governments.

Implementation

Since this project involves the direct integration and implementation of visualization technology into a

transportation agency, the resulting experience can be applied directly to addressing the everyday questions and issues related to this technology, and act as a model agency to other departments of transportation.

Effectiveness

This project would stand to absorb the growing pains that all transportation agencies throughout the nation are experiencing in deciding how to make the progression into the 3D environments. Standards and implementation methodologies through hands-on experience would be more readily available.

Priority

Eighteen of twenty-two.

PROBLEM STATEMENT 19: EVALUATION OF THREE-DIMENSIONAL DATA GATHERING TECHNIQUES

Accurate three dimensional information, which includes topography, built structures, and other physical features is an important consideration for the process of transportation planning, project development, and user information systems design. Slight changes in highway alignment can have a major impact on project costs. Presently, this data is collected from on-site survey and fly-overs. While the current technology is well understood and has a high level of accuracy, the cost of data collection can be high and is frequently limited to the ROW because of accessibility to private property and the limitations of photogrammetric techniques. Several new techniques include aerial laser scanning and vehicle mounted GPS/video systems. However, no systematic study has been made to analyze the accuracy, costs, benefits, and/or negative aspects of these technologies compared to current data collection methods.

Objective

Conduct a controlled survey of a representative test area(s) comparing available surveying techniques. Compare the timed phases and costs of data collection. The survey area(s) should represent a variety of building density, topography, vegetation, and highway types. Prepare a report that analyzes and compares each of the survey technologies.

Key Words

3D data; computer modeling.

Related Work

Terry May, P.E. of the Dallas District (TxDOT) ROW, is very interested in such a study as a means of reducing the cost of model construction for ROW litigation. Houston Area Research Consortium (HARC) has performed some preliminary comparisons and found the results very cost effective compared to traditional methods with an accuracy of 0.3 meter. Donald Di Rosa of Houston Space Center has developed an aerial laser scanning system.

Urgency/Priority

Medium.

Costs

$100,000 to $150,000 over 1 year.

User Community

State highway and transit agencies; transportation planners; surveyors.

Implementation

The results of this study would benefit those transportation agencies developing 3D models for planning, design, public information, and litigation purposes.

Effectiveness

The results would help DOTs in potentially lowering the cost of 3D data collection based on the need and required accuracy.

Priority

Nineteen of twenty-two.

PROBLEM STATEMENT 20: A METHODOLOGY FOR EVALUATING IMPACTS OF ADVANCED PUBLIC TRANSPORTATION INFORMATION SYSTEMS

New technologies may offer opportunities to lessen the decline in transit use. The purpose of this study is to explore the impacts/benefits of new transit information technologies. Examples of new technologies include pre-trip, in-terminal and in-vehicle information systems. The impacts of these technologies will be explored in terms of operator-based performance measures such as reduction in delay incurred by transit vehicles due to real-time information, as well as, traveler-based performance measures such as improved pre-trip and real-time information, reduced travel times and lower anxiety.

Objective

Develop a classification structure for APTIS (Advanced Public Transportation Information System) technologies and relevant performance measures, develop a mathematical formulation for the structure, and survey early implementations of new transit information technologies, i.e., transit agencies. The study will delve deep into the efforts/experiences of transit operators with regards to new technologies. It is particularly important to document experiences with individual and joint application of new technologies (e.g., mutually chained and customized transit information technologies might produce greatly enhanced benefits). Explore strategies that may allow transit information technologies to work together synergistically. Finally, examine technology impacts with a perspective to identify successes (to replicate them in other transit agencies) and costly mistakes (and learn to avoid them in the future). In the final stage, we will document the experiences of transit agencies nationwide.

Key Words

ITS; APTS; performance measures; information; advanced technologies; transit.

Related Work

Not known.

Urgency/Priority

Medium.

Costs

$300,000 over 2 years.

User Community

State and local transportation and transit agencies; traffic management centers; drivers.

Implementation

The main benefit of the study will be a guide that can be used by transit agencies to acquire and use new transit information technologies. Given a transit operations context, the guide will suggest the most appropriate new technologies. This will provide a useful database and the analysis will give a better sense of synergies and interactions among new technologies.

Effectiveness

The results will allow a clearer evaluation of the potential benefits and provide an understanding of transit operator decisions to acquire and use new information technologies.

Priority

Twenty of twenty-two.

PROBLEM STATEMENT 21: STATED AND REVEALED PREFERENCES FOR INVESTIGATING MODE DIVERSION PROPENSITY THROUGH INTELLIGENT SURVEY RESEARCH TOOLS

Travel information may have profound impacts on travelers decisions. For example, individuals may switch to transit if unexpected traffic congestion occurs. Moreover, ATIS may be successful if they effectively influence traveler decisions; in this regard, a critical factor is how might we present scenarios of new ATIS technology to the respondent.

Objective

This study will conduct a stated and reported preference survey to examine factors that can cause a mode switch. The methodology involves developing a new computer-based stated preference tool for investigating traveler response to travel information received from the current systems and new ATIS (Advanced Traveler Information Systems) technology

alternatives, particularly, in the context of incident-induced delays. The computer-based survey tool will add realism to the stated preference questions--allowing customization of scenarios. The empirical portion of this study will be based on a small survey of commuters. Travelers will express their real-life mode diversion behavior and their willingness to divert in response to various scenarios; for example, the scenarios would investigate diversion propensity if the congestion lasts longer, if congestion information is received from various technology sources as opposed to observing congestion, if trip direction is home-to-work rather than work-to-home, if they are familiar with their alternate modes, if they perceive their alternate modes as safe or unsafe. The hypothetical scenarios will be customized to the traveler. For example, if a person has a short commute trip, then the hypothetical scenarios will be generated taking into account such information. Moreover, the stated preference scenarios will be intertwined with reported (revealed) behavior. This would allow us to compare and contrast stated and reported preferences and investigate validity issues.

Key Words

ATIS; ITS; APTS; transit; travelers; stated preference; revealed preference; information; modes.

Related Work

Not known.

Urgency/Priority

Medium.

Costs

$300,000 over 18 months.

User Community

Transportation planners; traffic management centers; state and local highway agencies; transit agencies; drivers.

Implementation

The useful products of this research are: (1) evaluation of benefits from the current travel information system and recommendations on how best to improve travel information quality; and (2) development of a computer-based stated preference tool which will help in future survey research regarding the role of new transportation technologies.

Effectiveness

This study will develop a tool to support the evaluation of the effects of current travel information system as well as new technologies on traveler behavior. The tool will then be used to understand mode diversion behavior in incident conditions.

Priority

Twenty-one of twenty-two.

PROBLEM STATEMENT 22: ADVANCED TRAVELER INFORMATION SYSTEMS EVALUATION

There are several Advanced Transportation Management and Information Systems (ATMIS) field operational tests underway (e.g., Bay Area and Boston). The goal of this traveler response study is to develop and implement a plan for evaluating ATMIS field test impacts in several contexts. Where possible, the data collected by the ITS project research team will be used.

Objective

Evaluate traveler behavior impacts of ATIS technology in terms of changes in travel choices; and based on behavioral surveys, assess the benefits of ATIS technologies. Determine the profile of individuals who access, acquire and use information available through ATMIS technologies. If good quality behavioral data are not available, then targeted behavioral surveys can focus on a "high impact" corridor and incident conditions, when ATMIS impacts/benefits are most likely to occur. By repeatedly surveying a panel of travelers, evaluate the *changes* in their response to improved travel information provided by ATMIS; and calculate the consequent benefits in terms of travel time savings and other performance measures.

Key Words

ATIS; ITS; ATMS; travelers; information; behavior.

Related Work

Not known.

Urgency/Priority

Medium.

Costs

$200,000 over 1 year.

User Community

Traffic management centers; drivers; transportation planners; traveler information services.

Implementation

This results will help develop a set of guidelines or procedures for evaluating the impacts of advanced traveler information and advanced traffic management systems in various contexts.

Effectiveness

This effort will help the transportation community evaluate the effectiveness of various ITS systems and technologies and help reduce delay and congestion associated with transportation in the nation.

Priority

Twenty-two of twenty-two.