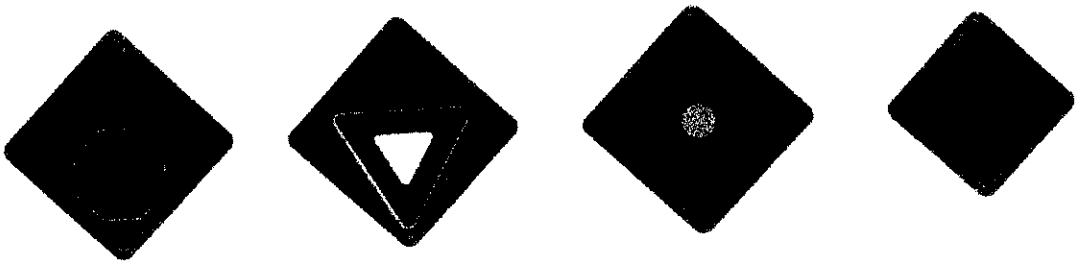
REPUBLIC OF LEBANON
COUNCIL FOR DEVELOPMENT AND RECONSTRUCTION

URBAN TRANSPORT DEVELOPMENT PROJECT (UTDP)
PREPARATORY STUDY
CORRIDOR IMPROVEMENT PROGRAM

WORKSHOP
ON
SAFETY AND MOBILITY
IN THE CONSTRUCTION ZONE

A campaign to increase awareness of work zone safety and mobility for the Public, the Police and the Professional

April 23, 2002



Designed & Published by:

YASA YOUTH ASSOCIATION FOR SOCIAL AWARENESS, *Cert. No.148/96*

SRF SCIENTIFIC RESEARCH FOUNDATION, *Cert. No. 155/97*

الجمهورية اللبنانية
مكتب وزير الدولة لشؤون التنمية الإدارية
مركز مشاريع ودراسات القطاع العام

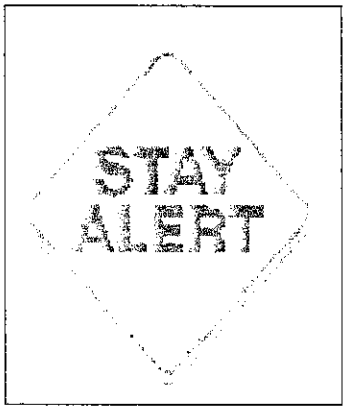
Republic of Lebanon

Office of the Minister of State for Administrative Reform

Center for Public Sector Projects and Studies

(C.P.S.P.S.)

SAFETY AND MOBILITY IN THE CONSTRUCTION ZONE



EDUCATION & AWARENESS WORKSHOP

ORGANIZED BY

COUNCIL FOR DEVELOPMENT & RECONSTRUCTION, CDR
YOUTH ASSOCIATION FOR SOCIAL AWARENESS, YASA
SCIENTIFIC RESEARCH FOUNDATION, SRF

P.S. ***Information included in this booklet was a result of an extensive research of various sources, books, reports, and web sites.***

References:

- *CDR , Manual for Safety, Health and Environmental Regulations*
- *YASA Archive and Library*
- *SRF Archive and Library*
- *LIBNOR*
- *Manual for Uniform Traffic Control Devices, MUTCD*
- *U.S. Department of Transportation, Federal Highway Administration*

Author:

Engineer Clovis N. Abi Nader, YASA' Board of Directors Member

Designed and Published by YASA

- *For any use of this booklet, kindly contact the Organizers.*

WORKSHOP ON
SAFETY AND MOBILITY
IN THE CONSTRUCTION ZONE

TABLE OF CONTENTS

AUTHOR:

Engineer Clovis N. Abi Nader, YASA' Board of Directors Member

Designed and Published by YASA

I. INTRODUCTION

A. BACKGROUND

The proposed Urban Transport Development Project (UTDP) is provided to help Greater Beirut Area meet the challenges of traffic congestion by focusing on establishing key institutions and providing the most necessary infrastructure investments.

The UTDP would seek to improve traffic management, regulate on-street parking, and to improve traffic flow along major corridors. The project includes the following:

- Traffic Management Program - Installation and Operation of 200 Traffic Signals.
- On-Street Parking Management Program – Installation and Operation of 700 Pay and Display parking meters
- Corridor Improvement Program - Construction of grade separation facilities (19 Over-passes and Under-passes)
- Establishing a Traffic Management Organization (TMO)

The safe and efficient flow of traffic through work zones is a major concern for the Council for Development and Reconstruction (CDR), the Public, industries, businesses and commercial motor carriers.

The CDR has requested from the Youth Association for Social Awareness (YASA) to prepare this workshop and an awareness campaign aiming at reducing fatalities and injuries in work zones and enhancing traffic operation and safety during construction, therefore, improving safety for motorists, pedestrians and construction workers.

B. FACTS and STATISTICS

- Over the last 10 years the number of persons killed in motor vehicle crashes in work zones has increased by 25%.
- Over 25% of fatalities resulted from truck crashes.
- 16% of the fatalities were non-motorists (pedestrians and motorcycle drivers).
- Approximately 135 people per year are injured as a result of motor vehicle crashes in work zones.
- Approximately 68 people are injured annually, in truck crashes in work zones.
- Every year, less than half of all work zone crashes occurred during the day. About two-thirds of fatal truck work zone crashes occurred during the day.
- Almost twice as many work zone crashes occurred on weekdays compared to weekends.
- Fatal work zone crashes, regardless of whether a truck was involved or not, occurred most often in the winter.
- The percentage of fatal work zone crashes occurring on highways was more than twice the percentage of all fatal crashes.
- For fatal truck crashes, the percentage of work zone crashes occurring on highways is almost twice as high compared to all fatal truck crashes.
- 75% of fatal work zone crashes for all vehicles and trucks occurred on roads with speed limits of 80 km. per hour or higher.

C. SURVEY

The Youth Association for Social Awareness **(YASA)**, in coordination with the Scientific Research Foundation **(SRF)***, conducted a survey of the driving public to measure satisfaction with Safety Measures in Construction Zones. The Survey included Eleven (11) questions, posed to approximately **250** randomly selected persons in Greater Beirut Area, chosen from various society levels.

The survey questions focused on the public knowledge and awareness of Accident Prevention in Work Zones. It included the following questions:

1- Gender
2- Age
3- Do you obey traffic signs in work zones?
4- Do you believe traffic signs are necessary in work zones?
5- How do you evaluate preventive measures implemented by contractors to minimize accidents in work zones?
6- If the posted normal speed limit is 100 km/hr, what do you think the permitted speed, in work zones, should be?
7- Who, in your opinion is responsible for traffic accidents in work zones?
8- Who are the persons, the most exposed to danger, in work zones?
9- How do you evaluate the Traffic Police role in enforcing the law in the work zones?
10- What is your opinion on the safety measures taken to protect workers on road projects?
11- What is your first reaction when entering a work zone?

The Survey questions, results and analysis (in Arabic) are presented in Exhibit "B".

* ***SRF, the Scientific Research Foundation is founded in 1997. It is a Non-Governmental Organization operating in Lebanon and the Middle East, mainly doing research in the field of Accident Prevention.***

D. WORKSHOP GOALS AND OBJECTIVES

Due to the fact that the implementation of the UTD Project would require the opening of several work sites concurrently, the workshop is focusing on two major issues:

- Safety in the Construction Zones
- Mobility and Traffic Flow during Construction.

The focus of the Campaign for the UTD Project is to promote safety and mobility in the Construction Zone by emphasizing on the **4 E's**:

- **EDUCATION** : Driver and Pedestrian Awareness in the work zone.
- **ENGINEERING** : The use of International Standards by Consultants and Contractors for Safety and Mobility in the Work Zone.
- **ENFORCEMENT** : Cooperation with Traffic Police and Law Enforcement.
- **EMERGENCY** : Dealing with Emergency situations.

As traffic volumes increase and our nation's highway system matures, congestion, delays, fatalities, injuries, and property damage crashes are expected to increase unless the entire transportation community rallies to meet this challenge!

CDR and YASA have accepted this challenge of significantly reducing the needless loss of human life, time, and money in work zones and urge others to become partners in this effort.

The purpose of this workshop is to modernize and improve the effectiveness of CDR and other Governmental Bodies policies and procedures in enhancing safety, improving mobility, and the efficiency by reducing traffic congestion and delays during construction and maintenance operations.

- Lebanon's traveling public is demanding virtually unlimited mobility, and congestion has a significant effect on their mobility.
- Mobility and safety are closely tied together. As congestion builds, crash rates increase and as crashes increase there is more congestion.
- In addition to the safety of the traveling public and highway workers, motorists are delayed when they are not able to travel at the normal operating speed through a work zone.
- While national data on the cost of work zone delays is not readily available, daily road user delay costs, on many roadway and infrastructure reconstruction projects, have been estimated to be very high compared to other countries.
- The number of work zone fatalities in Lebanon, even though not being recorded, is a major concern. It points out the need for continuous emphasis on work zone safety.
- Approximately: ***55% of work zone fatalities occur in rural areas.***
  25% of work zone fatalities involve trucks.

Despite these alarming statistics, inconsistencies in defining and reporting work zone crashes make the problem much worse than indicated by the above percentages.

- The fatality rate for highway construction workers is twice the rate for other types of construction. Approximately 35 percent of all highway worker fatalities were directly related to traffic moving through the work zone.
- In addition to these fatalities, there is a sizable number of injuries, unfortunately also, not recorded accurately.

The demands for rehabilitating highways, increased mobility and safety have resulted in many more projects being constructed adjacent to **HIGH SPEED** traffic.

These factors significantly increase the exposure of the traveling public, highway workers, and pedestrians to work zone hazards.

It is essential to implement a work zone safety program which would improve work zone safety at highway construction sites by enhancing the **QUALITY** and **EFFECTIVENESS** of traffic control devices, safety appurtenances, traffic control plans, and bidding practices for traffic control devices and services.

The objective of CDR and other Government Bodies, involved in the Infrastructure and Roadway Construction, should be to enhance the safety and operational efficiency of highway work zones for all road users (motorists, pedestrians, motorcyclists, bicyclists), and highway workers.

It should be applicable to all public highways and streets with early implementation emphasis.

The intention is to create a model to be followed when developing or revising a work zone improvement programs.

GOAL: "Reducing Delays and Enhancing Safety in Work Zones"

The Workshop Team wants to define how projects need to be planned, programmed, and designed? What refinements in scheduling and contracting procedures should be considered? Identify recommendations for improved construction methods, materials, and equipment; and to define the organizational structure and funding mechanisms needed to support their vision.

Government Officials, Police, CDR, YASA, Consultants and Contractors agree that today's routine practices cannot be continued. Changes must be made if we are going to meet the road users' increasing need for mobility and safety in work zones and if we are to overcome the backlog of highway needs.

In addition to the engineering aspects, Government Bodies and industries must become actively involved in work zone public education, public information, traffic management, and enforcement if we are to substantially reduce delays and enhance work zone safety.

Additionally, a major shift in emphasis from handling traffic on individual projects to corridor traffic management, a road user focus, contractor input, and public participation in the early traffic management decision making were noted as key ingredients to a successful program of enhancing future operations to minimize delay, reduce congestion, and enhance safety for both the motorists and the roadway worker.

Specific OBJECTIVES of the Workshop

The main specific objectives are:

- Establish an organizational baseline of CDR role in reducing motorist delays and enhancing the safety of work zones.
- Evaluate the effectiveness of the practices and policies being used to measure, evaluate, and enhance the flow of traffic in work zones.
- Identify the best practices and policies currently being used to enhance the flow of traffic or to accelerate the progress of work in work zones to minimize the exposure to drivers and highway workers.
- Identify effective models for evaluating the effects (risk, cost, and duration) of lane closures and reduced standards in the work zone.
- Identify effective models for balancing road-user cost against the additional cost. This may be used in the project budget for accelerating the progress of work.
- Identify the specific activities CDR has taken to implement the **"SAFETY, HEALTH and ENVIRONMENTAL REGULATIONS"** Issued 1996.
- Establish a traffic management model program for reducing traffic congestion, minimizing delays, and enhancing the safety in work zones that can be used by Consultants and Contractors.
- Identify any assistance or research needed from CDR to improve activities that enhance safety and reduce traffic congestion in work zones.

II. OBSERVATIONS, COMMENTS, AND RECOMMENDATIONS

A. PRELIMINARY ASSESSMENTS

Traffic management applied to construction and maintenance operations involves a comprehensive series of actions designed to minimize motorist delays while enhancing the safety of the motorist and, the highway worker.
These actions span the entire life of a project; beginning in the early project planning phase and continuing through programming, design, construction, operations, and maintenance.
Work zone traffic management encompasses most of our current areas of emphasis; safety, mobility, quality, team work, road user focus, asset management, Intelligent Transportation Systems (ITS), technology transfer, longer lasting materials, performance-based specifications, innovative contracting, life-cycle costing, motorist information, and incident management.

The objective of traffic management is the development and implementation of an overall strategy, that allows construction and maintenance operations to be completed ***safely*** with a minimum impact on the motorist, the highway worker, and the adjacent residential and business communities.

The key to minimizing motorist delays during construction and maintenance operations is recognizing the impacts that the proposed work can have on traffic and/or adjacent residents and businesses in sufficient time to develop and implement the appropriate cost effective mitigative measures prior to the delays occurring.

Traffic management in the work zone should be proactive as opposed to reactive.

While the principles of traffic management apply to all construction and maintenance operations, traffic management is not a "one size fits all" approach. Obviously, the degree and extent of the techniques needed to mitigate the effects of a construction or maintenance operation vary from project to project and will depend upon the location, traffic demand volumes, and available capacity.

Motorist delay and safety are closely tied together; crashes cause congestion and congestion causes crashes. By reducing the exposure of the motorist in work zones, the number of crashes, disabling injuries, and fatalities in work zones are reduced. Additionally, highway workers and inspection personnel are provided with a safer work environment. Therefore, successful traffic management depends upon reducing the exposure rates in work zones by:

"The key to reducing traffic volumes in work zones is advanced publicity."

1. Reducing the volume of traffic through the work zone:

- Traffic volumes can be reduced by closing the facility, diverting traffic to other routes, modes, ride sharing, and/or spreading out the peak hour volumes over a longer period of time by changing travel times (flextime, alternate work schedules, etc.).

For any of these techniques to be successful the motorist must be provided with accurate information in sufficient time to make an informed decision.

2. Reducing the length of time that work zones are in place:

- The length of time that work zones are in place can be reduced by using the critical path method (CPM) to establish, manage, and monitor contract time.
- Dividing larger projects into usable segments or phases that can be completed in one construction season can be effective in many areas.
- Exposure rates are also reduced by breaking the project length into shorter segments, and having the contractors concentrate their efforts in shorter segments before opening additional segments.
- The length of time that work zones are in place can also be significantly reduced through an effective preventive maintenance program. Preventive maintenance operations can be completed in much shorter time frames and are much less disruptive than rehabilitation and reconstruction projects.

3. Reducing the frequency that work zones are established:

Of the three ways, the greatest potential for reducing the exposure of the highway user/worker is by reducing the frequency that work zones are established. The number of work zones can be significantly reduced by making our products last longer. This is accomplished by improved designs; using longer lasting materials, performance-based specifications, and warranties; and most importantly emphasizing "attention to details" during the construction and maintenance operations, i.e., ***"Do it right the first time."***

The life of a bituminous overlay varies from City to Country, but the national average ranges from 2 to 4 years. If 3 years is used as the national average life of a bituminous overlay, by definition 30 percent of all bituminous pavements undergo a construction or maintenance operation each year.

However, if the life of a bituminous overlay was extended to 5 years, one-half of the number of Kilometers overlaid each year would be eliminated!
Similarly, if we consider a 100 km section of highway and if it takes 2 construction seasons to reconstruct a 10 km segment of that highway and it lasts for 20 years, by the time the last section is finished, the first section will need to be rehabilitated again. In other words, we will never finish the reconstructing projects on that 100 km section of highway.

The traveling public would experience a work zone on this highway for the rest of their lives!

The life of the highway can be significantly increased by practicing preventive maintenance techniques, i.e., performing the right work at the right time. This increase in life results in reduced cost and disruption to the road users.

The number of work zones can also be reduced through a corridor approach as opposed to a project-by-project approach. The corridor approach to traffic management during construction and maintenance operations utilizes all available routes and modes to move traffic through the traffic corridor.

The corridor approach also includes identifying all identifiable long-range needs, pavement, bridge, safety, and traffic operations, preventive maintenance, as well as, rehabilitation in a traffic corridor. Projects are then sequenced and packaged in a way that minimizes the inconvenience to the traveling public.

Successful traffic management depends upon continuous coordination, communication, and cooperation of highway officials, the construction team (owner, contractor, and designer) the motorist, elected officials, police, the media, as well as, the affected communities.

Effective work zone traffic management is a continuous series of acts aimed at balancing safety, motorist delay/cost, project cost, quality of the work, and time to complete the project. However, the good news is that these items (safety, cost, time, and road-user benefits) are not mutually exclusive!

"Traffic control drives the design as well as the material selection."

"The Contractor's primary concern, is that all of his employees are able to go home and have dinner with their families every night."

"Getting the contractors involved in sequencing the job during the preliminary design phase makes a lot of sense."

"It needs to be a team effort to build for success."

"Incentives are the key to getting projects completed faster"

"Give the contractors as much flexibility as you can and you will get a better job that is completed quickly."

"Effective communication is a key to reducing congestion and minimizing delays."

"If the motorist is given enough information ahead of time, some of the traffic will disappear."

"No technique is as effective in getting the driver' s attention to slow down than a police with flashing lights at the beginning of the work zone."

Higher speeds, reduced visibility, impaired drivers, driver fatigue, and driver distraction are more prevalent at night. All of which increase the need for more police in the work zone.

Excessive Speed and Driver Inattention are the two leading causes of work zone crashes.

Most contractors and owners believe that drivers do not slow down unless they see workers close to the driving lanes or they perceive a need to slow down.

There is a compelling need for accurate work zone crash data and the evaluation of traffic handling techniques in order to make sound decisions.

A few studies have been conducted on work zones crashes and work zone issues. However, very little research has been done on the root causes of work zone crashes; the effectiveness of traffic control devices; and/or traffic handling techniques. This situation is due, in part, to the lack of a accurate work zone crash data and a uniform definition for work zones.

Accurate work zone crash data is needed to properly analyze the root causes of crashes. The crash data varies from one location to another.

"To achieve the state of the art in work zones we have to change organizational mind sets from one of planning, designing, constructing, operating, and maintaining highways to the safe and efficient movement of goods and people."

B. MISSION STATEMENT

We do recommend the adoption of the following guidelines:
"...

- Emphasize and promote the philosophy of minimizing construction interference with traffic while ensuring safety through its routine activities and in all work zone-related training efforts.
- Encourage research in innovative methods to reduce traffic congestion during construction.
- Continue to provide technical assistance to the Governmental Agencies in developing and implementing programs that promote effective construction traffic management.
- A "National Quality Initiative" should be adopted to represent a major commitment to promote the partnership of all entities that participate in the funding, design, and construction of our roadways and infrastructures. ..."
- Provide an organizational structure that provides crosscutting teams that tap the expertise and proactive involvement of the all disciplines in the development and selection of corridor Traffic Management Plans (TMP), and project Traffic Control Plans (TCP).
- Re-evaluate policies and procedures to ensure:
    - o Contractor's participation in the development of the TCP, responsibility for successful implementation of the TCP, and rewards for exceeding expectations, i.e., a move towards performance-based traffic control specifications.
    - o Utilization of road-user costs, economic impacts to the business community, and life-cycle-cost in the decision making process.
    - o Public participation during the development and selection of corridor TMPs and project TCPs.
    - o Road user feedback and evaluation.

- Traffic management principles that focus on reducing the exposure of road-users and workers are integrated into all related manuals and guidelines, such as project development schedules, design manuals, consultant selection, and the **Manual on Uniform Traffic Control Devices (MUTCD)**.
- Develop and deliver training courses in work zone traffic management principles and strategies.

STATE-OF-THE-ART: EDUCATION

The driving community and elected officials MUST BE well informed, involved, and sensitive to the highway worker and work site safety needs.

Public Relations, Education, and Outreach (General Public, Driver, and Elected Officials)

To achieve state-of-the-art education and outreach, transportation agencies would need to:

- Assume a proactive leadership role in work zone educational efforts.
- Develop, update, and distribute work zone safety educational materials for:
  - All drivers handbooks and manuals
  - Driver license test questions
  - Driver education courses
  - Media (television, radio, newspaper)
  - Road user groups, insurance companies, rental car agencies (magazines, newsletters, inserts)
  - Elected officials
- Develop media partnerships to educate and inform the public about work zone safety.
- Sponsor national work zone safety awareness initiatives.
- Share work zone public service announcements and educational materials with other government service providers.
- Develop guidance and tools to assist decision makers in balancing the expenditure of additional funds for longer-lasting materials and designs in today's projects to achieve a faster delivery, a longer service life, and reduce future motorist delay and exposure.

STATE-OF-THE-ART: ENGINEERING

Motorist delay, road user, worker safety, and impacts to adjacent communities are assessed on all urban and other high volume corridors.

- Crosscutting teams and multi-interests are used in developing alternatives and selecting the preferred design that minimizes present and future exposure to road users and workers.
- The project development process results in a TCP that provides for shared risk and benefits for owners, contractors, and the traveling public.
- Contract times and motorist delays are minimized through the use of CPM scheduling and accelerated contracting procedures.
- Integrate work zone traffic management principles into the planning process.
- Utilize crosscutting and multi-agency teams to develop corridor traffic management plans.
- Give full consideration to road-user costs and impacts to affected business and residential communities in the selection of the corridor TMP.
- Conduct public relations campaigns that inform the public and involve them in the selection of corridor TMP's.

Project Development/Design

To achieve state-of-the-art project development/design, transportation agencies would need to:

- Extend traffic management principles into **all** construction and maintenance projects adversely impacting traffic, not just high visibility projects.
- Develop TCP options prior to beginning the detailed design.
- Utilize crosscutting teams to develop and evaluate TCPs.
- Provide for contractor involvement in the development of the TCP and active public input into the selection of the TCP.
- Use computer modeling to assess the traffic and safety impacts as well as the construction time required for the TCP options being considered.

STATE-OF-THE-ART

Contracting and bidding procedures reward contractors for quality work, innovation, accelerated early completions, minimizing motorist's delays, and enhancing the safety of road-users and workers. On high-risk, high-visibility, and complex projects contractors are pre-qualified on the basis of quality and past performance.

- Modify project development schedules to reflect development and evaluation of TCP options prior to beginning detailed designs (30 percent stage).
- Consider road-user, life-cycle, and other impact costs in the selection of the preferred design, materials, TCP, and contracting options.
- Utilize CPM scheduling to establish the maximum contract time included in the bid proposal.
- Develop user-friendly computer software to calculate realistic, but expedited contract times.
- Provide CPM scheduling training courses to staff and consultant designers.
- Conduct public relations campaigns to inform the public and involve them in the selection of the preferred TCP.

Contracting and Bidding Procedures

To achieve state-of-the-art contracting and bidding, transportation agencies would need to:

- Utilize time-based bidding and flexible Notice to Proceed dates on **all** projects which adversely affect the existing level of service.
- Incorporate the quality and timeliness of a contractor's past performance into pre-qualification procedures.
- Update and enhance existing computer software for calculating road-user costs to make it user-friendly and ensure that outputs are realistic and legally defensible.

STATE-OF-THE-ART

The same level of service is provided through the work zone. Workers are physically separated and are protected from the traffic. Work areas are sufficiently illuminated at night without blinding the motorist and gawk screens are used to prevent the motorists from being distracted during daytime operations. Contractors have a vested interest in quality, timeliness, and road-user safety.

Specifications and Construction Materials, Methods, and Practices

To achieve state-of-the-art construction materials, methods, and practices, transportation agencies would need to:

- Revise prescriptive-type specifications to performance-based specifications.
- Adopt specifications that reward contractors for innovation, quality, and exceeding expectations.
- Develop and utilize performance-based specifications for traffic control.
- Routinely include warranty specifications with bonuses for exceeding the expected life of the end product.
- Require positive barriers to physically separate the workers from the traffic.
- Adopt specifications that require adequate lighting for all nighttime operations, lane shifts, lane drops, and temporary gores.
- Insist on quality work and timely completion of the work.
- Develop short-term testing and modeling for newly constructed highway components to reasonably predict long-term performance and remaining life.
- Develop design specifications, guidelines, and testing methods for composite materials.
- Standardize design details to encourage a greater use of precast materials.
- Provide real time work zone traffic information to road users and workers in sufficient time to make informed decisions.

STATE-OF-THE-ART

Accurate real-time work zone (construction/maintenance/utility operations) information is provided to the road users in sufficient time to make informed travel decisions.

Traveler and Traffic Information (Project Related)

To achieve state-of-the-art traveler and traffic information at the project level, transportation agencies would need to:

- Monitor work zone traffic conditions on all projects.
- Display real-time work zone traffic conditions on the Internet, Airport, Bus Terminals, major tourist attractions, large parking garages, large office buildings, and other large traffic generators.
- Use changeable message signs, traffic advisory radio, and early warning systems to warn motorist approaching congested work zones.
- Use ITS hardware to safely guide motorists through the work zone.
- Develop media and private sector partnerships that provide real-time work zone information to the public.

STATE-OF-THE-ART

The ITS systems are used to automatically collect and analyze before, during, and after traffic flows in the work zone; provide accurate real-time information automatically to motorists and to the construction team; enforce speed; as well as safely guide motorists through the work zone.

ITS and Innovative Technology

To achieve state-of-the-art ITS and innovative technology, transportation agencies would need to:

- Enhance the software and communication modules on a continuous basis, in order to provide accurate real-time traffic information automatically to motorists and the construction team.
- Utilize portable or fixed traffic management systems to collect and disseminate real-time information to motorists in all work zones:

    - o On high-speed, high-volume facilities,
    - o Involving lane and ramp closures,
    - o Located in severely restricted areas, and
    - o Involving major changes to existing traffic patterns.

  Develop effective tools and techniques for safely and efficiently merging traffic approaching a work zone with lane closures.
- Develop effective tools, techniques, and enforcement for slowing down traffic approaching work zones, as well as maintaining a safe speed through work zones.
- Develop automated equipment to perform high-exposure, short-term maintenance operations.

STATE-OF-THE-ART: ENFORCEMENT and EMERGENCY

Work zone trained and qualified, full-time uniformed police officers must be readily available for construction and maintenance operations. State-of-the-art technology is used to maximize effectiveness of these police officers.

ENFORCEMENT

To achieve state-of-the-art enforcement, officials would need to:

- Utilize uniformed police officers in all work zones to enforce the law on posted construction speed limits, and regulatory signs.
- Police must restrict:

    - o High speed drivers
    - o Drivers entering or trespassing restricted construction limits

- Police must assist in redirecting traffic
- Provide training for uniformed police officers in work zone traffic control, completing work zone data on accident and crash report forms, the MUTCD, and incident management.
- Secure dedicated, full-time uniformed police officers for work zone enforcement activities.
- Use automated speed enforcement in confined and high-speed work zones.
- Equip uniformed police officers with state-of-the-art equipment for use in controlling speed, and crash investigation and reporting.

EMERGENCY

To achieve state-of-the-art Performance in an Emergency, officials would need to:

- Provide an Emergency Plan with every TCP and TMP designed for the work zone
- Provide training for emergency personnel to deal with construction and traffic accidents in work zones
- Equip Emergency Personnel with state-of-the-art equipment for use in case of an Emergency
- Utilize uniformed police officers to manage and divert traffic as necessary to secure a quick access for Emergency vehicles to the crash site and to assist rescue crews.
- Police should keep away curious people from the accident scene
- Equip uniformed police officers to handle emergency cases, (i.e. Flares, flash lights, reflective vests, etc...) at the same time staying out of harm's way.

C. The CDR Leadership Role in Reducing Delays and Enhancing Safety in Work Zones

Meeting the road users' needs for mobility and safety during construction and maintenance operations is the essence of what the transportation industry does--planning, designing, operating, maintaining, rehabilitating, reconstructing, and making improvements to roads and highways are what it's all about.

Almost everything is manifested in a work zone. What a motorist experiences in a work zone gets down to the very essence of what CDR is and does. Local municipalities and other ministries look to CDR to take a leadership role in reducing delay and enhancing safety in work zones.

There are six major roles in which CDR should take a leadership role:

- Research
- Technology Sharing
- Education
- Continuous Quality Improvement
- Partnerships
- Standardization

D. Signing, Pavement Markings, and the MUTCD:

Evaluate effectiveness of using "attention getting" signs in work zones, such as:

"Speed Limit 65 KM/H"

"Slow Down My Dad Works Here"(written in kid font).

- Change the "flagger" symbol on signs, etc., since the "Stop/Slow paddle" is in use today.
- Reevaluate the work zone signing requirements, as work progresses.
- Allow a "Last Exit Before Work Zone" sign for freeways. Also provide pull out/off areas for motorists to plan strategy.
- Develop a good way of identifying exit ramps in work zones.
- Develop a durable temporary pavement marking material that can be easily removed and does not leave a visible residue on the pavement.
- Develop a work zone MUTCD that is tailored to utility companies.
- Experiment with colored symbol variable message signs.

Worker Safety and Protection:

- Develop a longitudinal safety barrier for mobile construction and maintenance operations performed on the road.
- Develop a longitudinal safety barrier for short-term maintenance operations performed adjacent to the shoulder.
- Develop a portable gawk screen for maintenance operations.
- Develop warning system to workers, when a vehicle enters a safe zone.
- Develop a debris removal system.

Awareness:

- Conduct a follow-up survey to find out what the public expects in work zones.
- Set up a work zone information display.
- Establish a national symbol/logo (i.e., "Man with Shovel") for work zone safety which everyone would recognize.
- Post **short** work zone safety messages on CDR 's Homepage. These messages would appear when the Homepage was brought up and would need to be changed periodically, (daily or weekly).
- Establish partnerships with Internet search engines/browsers to place short work zone educational messages on their introductory index pages, i.e., Public Service Announcements on the Internet.
- Get major television networks to do a show and maybe a national television test on work zones.

Driver Education:

- Develop generic up-to-date information on work zones that can be incorporated into the driver licensing manuals.
- Develop work zone modules for driver education classes. Develop a set of work zone questions that could incorporated into driver licensing tests.
- Develop an interactive video of driving though a work zone that could be used by driver education and awareness.

Motorist Information:

Establish a "Nationwide Work Zone Information System" to inform travelers and tourists of work zone information project by project.

"The motorist measures performance by what he experiences in a work zone."

STANDARD TRAFFIC CONTROL PLAN (TCP) DESIGNED FOR WORK ZONE

In order to provide safety and mobility in the work zone, every Construction Project being implemented on the road, must include a comprehensive Traffic Control Plan (TCP).

The TCP shall contain the following components:

ADVANCE WARNING AREA

This is the most important component of the TCP. It must provide a sudden impact on the driver to bring his state of mind to an Alert stage. It contains illuminated or reflective warning signs such as:

"Man with Shovel" symbol
"Road Work 1 KM"
"Right Lane Closed ½ KM"

Putting a Sad Face Symbol can easily bring the driver's attention to the start of work zones. 
Putting an apology sign for inconveniencing the driver would be nice.

TRANSITION AREA

The intent of this component is to move traffic out of its normal path. It must be long enough to allow drivers to slow down, and for traffic to merge away smoothly, without creating conflicts or causing accidents.
This component may begin with a directional light arrow or reflective sign. This part of the area shall be bordered with necessary cones or barrels depending on the posted speed or type of roadway.

ACTIVITY AREA

This area is where actual work is being done. The driver tends to get easily distracted in this part of work zone.

This component is divided in at least 4 stages:

- Longitudinal Buffer Space which must be designed to provide protection for traffic and workers, by installing barricades with flashing lights and reflective ribbons or gawk nets.
- Lateral buffer Space, this keeps a horizontal zone to allow a safe distance between the traffic and the machinery/workers moving in the work zone.
- Traffic Space which allows traffic to pass through the activity area smoothly and safely. This area must be very well defined by installing tightly closed work zone and marked pavement for traffic direction and flow.
- Work Space is set aside for workers, equipment and material storage. This should be clearly marked as "Restricted Area" for public, whether pedestrian or driver.

TERMINATION AREA

This informs the driver that he is leaving the work zone and lets traffic resume normal driving.
Simply install a standard "End of Road Work" Sign at an appropriate distance further away from the actual end of work zone.
Contractors tend to put a smiling face symbol at the end of this area. 

Refer to Exhibit "A" for Samples of Signs extracted from MUTCD

III. CONCLUSION and RECOMMENDATIONS

Meeting the road users' needs for mobility and safety during construction and maintenance operations
is the heart of what CDR does and what it is all about .... planning, designing, constructing, rehabilitating, reconstructing, operating, and maintaining the highway system. What the motorist experiences in a work zone gets down to the very essence of what CDR is and what it does.
It has been estimated that the majority of the population travels through a work zone at least once every day.

- There is no question that the quality of traffic control devices used in work zones and the uniformity of work zones need to be updated and improved to meet the International Standards, MUTCD and LIBNOR Specifications.
- In order to significantly reduce motorist delays and crashes in work zones, work zone traffic management principles must be applied to the majority of maintenance and construction operations.
- CDR must set a clear vision. This vision must be translated into performance objectives and traffic management integrated into the culture of the organization.
- Work zone traffic management principles must be applied through the life the project.
- Successful work zone traffic management is dependent upon reducing the exposure of the road user and the worker.
- Transportation agencies must focus on the bottom line; reducing the loss of life and limb, the waste of individuals' time, and the drain on our nation's economy.
- The road users must be educated on how to behave when driving or walking though a work zone.

CDR vision is

"No Delays and No Crashes in Work Zones."

This vision can only be accomplished, by integrating traffic management principles into the project development process, and by applying these principles to every maintenance and construction operation.

It is up to each of us to make the commitment to make a difference.

For CDR to achieve the strategic goals and objectives for safety, mobility, and productivity, it will have to assume a proactive leadership role in promoting work zone management techniques, dedicate the resources to develop and/or enhance the tools needed by local transportation agencies to achieve the state of the art, create new partnerships for work zone education, and engage all of the stakeholders in a comprehensive cooperative effort.

We have clearly stated the expectations for safety, quality, and, mobility. CDR is expected to take a major leadership role. The time is right for CDR to step up and implement the necessary rules and guidelines.

YASA strongly suggests that all Construction Contracts include a Specific Itemized Bill of Quantity for Traffic Control Devices in Work Zones as Specified by CDR, by adopting the Standard Guidelines and Regulations of LIBNOR and MUTCD

IV. SUMMARY OF RECOMMENDATIONS

Integration of Work Zone Traffic Management into the Project Development Process

- Set the "vision" for work zones
- Develop a road user driven statewide work zone policy
- Adopt strategic goals, objectives, and performance measures for delay and crashes
- Provide an organizational structure that facilitates cross-cutting teams
- Include public and other agencies in the development of safety policy and selecting the project traffic control plan
- Dedicate funds for preventive maintenance
- Sponsor work zone traffic management training courses
- Facilitate public work zone educational and information programs
- Involve contractors in phasing the construction (+/- 30% stage)
- Develop alternate traffic control and alternate corridor traffic management plans with cross-cutting teams
- Use computer modeling to evaluate alternate traffic control plans
- Use road-user costs and life-cycle cost in decision making process
- Inclusion of high performance/low maintenance materials in the design
- Include additional features in design to mitigate traffic impacts of future construction and maintenance operations
- Collect and analyze pre-construction delay and crash data
- Initiate traffic information program
- Include warrantees with bonuses in contracts
- Use performance based specifications to minimize traffic delays
- Use time based bidding procedures
- Identify major traffic corridors
- Inventory long range improvements
- Inventory preventive maintenance needs
- Identify alternate routes / modes in corridor
- Use computer modeling to evaluate alternate corridor traffic management plans
- Involve public in selecting the corridor traffic management plan
- Group and sequence projects to minimize exposure
- Conduct work zone traffic management training courses
- Insist on quality work and timely completion of work
- Continue traffic information program
- Use computer modeling to evaluate proposed changes to the traffic control plan
- Use uniformed police in the work zone
- Collect and disseminate real time traffic information
- Report and analyze all work zone crashes
- Encourage value engineering change proposals
- Reward innovations for reducing exposure to motorist
- Monitor delay and crash performance goals
- Pay contractor incentives for exceeding expectations

SAFETY TIPS TO LIVE BY
WHEN DRIVING THROUGH WORK ZONES

1. STAY ALERT! Dedicate your full attention to the roadway.

2. PAY CLOSE ATTENTION! Signs and work zone flaggers save lives. In addition to other warning signs, a "flagger ahead" warning sign may be posted in the work zone. When you see this, stay alert and be prepared to obey the flagger's directions.

3. TURN ON YOUR HEADLIGHTS! Workers and other motorists must see you.

4. DON'T TAILGATE! The most common crash in a highway work zone is the rear-end collision, so remember to leave two seconds of braking distance between you and the car in front of you. Keep a safe distance between your vehicle and traffic barriers, trucks, construction equipment and workers. Just like you, highway workers want to return home safely after each day's work.

5. DON'T SPEED! Note the posted speed limits in and around the work zone. Slow down when the signs say to. A car traveling 100 km/h, travels 28 m/sec. If you are doing 100 km/h and you pass a sign that says "Road Work 1000 M." , you'll be in that work zone in 35 seconds.

6. KEEP UP WITH THE TRAFFIC FLOW! You may see flashing arrow panels or "lane closed ahead" signs. Merge as soon as possible. Don't zoom right up to the lane closure, then try to barge in - if everyone cooperates, traffic moves more efficiently. Motorists can help maintain traffic flow & posted speeds by moving to the appropriate lane at first notice of an approaching work zone.

7. DON'T CHANGE LANES IN THE WORK ZONE!

8. MINIMIZE DISTRACTIONS! Avoid changing radio stations and using mobile phones.

9. EXPECT THE UNEXPECTED! Keep an eye out for workers and their equipment.
In any work zone along major or minor roads, expect the Unexpected! Normal speed limits may be reduced, traffic lanes may be changed, and people and vehicles may be working on or near the road.

10. BE PATIENT! Remember the crew members are working to improve your future ride. Calm down. Work zones aren't there to personally inconvenience you. They're necessary to improve the roads for everyone.

11. OBEY THE ROAD SIGNS! Some work zones - like line painting, and road patching - are mobile, moving down the road as the work is finished. Just because you don't see the workers immediately after you see the warning signs doesn't mean they're not out there. Observe the posted signs until you see the one that says you've left the work zone.

12. PLAN AHEAD! Expect delays; plan for them and leave early to reach your destination on time. Highway agencies use many different ways to inform motorists about the location and duration of major work zones. Often, the agencies will suggest a detour to help you avoid the work zone entirely. Plan ahead, and try an alternate route.

EVERYONE IS A PEDESTRIAN

FOR A SAFE PATH THROUGH WORK ZONES-"DON'T MISS YOUR SAFETY SIGNS!!"

Most pedestrians walk familiar routes day in and day out, to the office, from the office to a favorite lunch spot, and so on. But this familiarity can cause problems for inattentive pedestrians when they find themselves with a construction work zone in their path.

Statistics show that, 17% of all work zone fatalities were pedestrians.

But we can avoid this needless tragedy by following some simple guidelines. It's important to know that work zone signs and markings are the best SAFETY SIGNS to safe travel for every pedestrian!

Work zones are potentially dangerous places because so much is happening.

Construction vehicles and workers often move suddenly while performing their tasks. It is up to the pedestrian to be alert and stay on the safe path through the work zone!

This is why work zone traffic control devices are installed. These pavement markings and distinctive orange signs define the SAFE way to travel through the work area, both drivers as well as pedestrians!

THE PEDESTRIAN'S FIRST SAFETY RULE IN WORK ZONES

It's always safest to simply AVOID THE AREA. Crossing the street before getting to the work zone, or even going out of your way, can save you from getting muddy shoes, or even a much worse fate!

If it's not practical to avoid the work zone, then the pedestrian must be attentive and careful. It is very important to obey ALL work zone signs, personnel, and pavement markings.

WORK ZONE SAFETY TIPS FOR EVERY PEDESTRIAN TO REMEMBER

- Construction vehicles often move suddenly and quickly! Effective work zone signs and pavement markings will guide the pedestrian away from danger areas, but everyone in a work zone should always be alert for moving construction vehicles and other unexpected hazards.

- Watch where you're going! Construction work may be fascinating to watch, but remember that your first responsibility is to get yourself through the work zone as safely as you can.

- Don't be a "sidewalk superintendent" unless there's a safe vantage point, such as under a well-constructed covered sidewalk in the case of building construction.

SAFETY SAFETY SIGNS TO WATCH FOR IN WORK ZONES

- Orange Work Zones Signs-Communicate to both drivers and pedestrians what is going on and how to travel safely through the work zone. Can indicate that a sidewalk is closed, and that a detour must be taken.

- Pavement Markings - Painted or taped lines on the pavement which delineate vehicle travel lanes, and can also indicate pedestrian paths.

The key to safety is to BE ALERT! DON'T MISS YOUR SAFETY SIGNS!

EVERYONE IS A PEDESTRIAN

Author:

Engineer Clovis N. Abi Nader, YASA' Board of Directors Member

Printed and Distributed by YASA

الجمهورية اللبنانية
مكتب وزير الدولة لشؤون التنمية الإدارية
مركز مشاريع ودراسات القطاع العام

Republic of Lebanon
Office of the Minister of State for Administrative Reform
Center for Public Sector Projects and Studies
(C.P.S.P.S.)