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16. Abstract

Only a small fraction of the millions of daily hazmat shipments interrupt their planned journey due to an incident that may severely threaten public and environmental safety. However, this threat of very rare but very severe consequences elevates the concern over transportation of hazmat through population centers. Furthermore, concern now exists over possible intentional hazmat releases and their use as a means to invoke human, economic, and environmental damage.

It is vital for the transportation planning community at all levels to fully understand methods to effectively manage the movement of hazardous materials; thereby improving incident prevention and mitigation, increasing public safety, and reducing risk, without undue burden to commerce. This guidebook strives to answer common but critical questions concisely, present facts, and examples of management strategies. The intent is to also provide references for further information so that sub-state level transportation planners, in particular, are well informed and equipped to make optimal decisions regarding the transport of hazardous materials as prescribed by local conditions.

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PUBLIC GUIDANCE FOR MANAGING HAZARDOUS MATERIAL TRANSPORTATION IN TEXAS

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Disclaimer

The contents of this product reflect the views of the authors, who are responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official view or policies of the Federal Highway Administration (FHWA) or the Texas Department of Transportation (TxDOT). This report does not constitute a standard, specification, or regulation.

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Chapter 1:
Introduction

Background

There are numerous players involved in the movement of hazardous materials and the planning preceding it. The public, for one, expects safe auto travel alongside hazmat trucks, safe transit of hazmat by trains, and safe practices at hazmat-related facilities. Hazmat *is* transported safely every day with very low probability for even minor incidents (spills/releases). Consequently, there is generally no real reason for gnawing concerns. However, the public, hazmat transporters, and hazmat manufacturers also expect diligent planning and practices on the part of transportation officials in order to maintain the safety levels and timely response time in the event of a hazmat incident. Serious incidents are very rare, but the serious potential consequences, especially in urban areas, dictate dedicated transportation planning and practices to ensure the safe transit of hazmat through our cities and communities.

Purpose of Guidebook

There may be an array of management strategies, at the planning or operational level, likely to lead to solutions or improvements related to safe transport of hazardous materials, depending on the level of government concerned (local, regional, or statewide). This guidebook strives to answer common but critical questions concisely; present basic but key facts; briefly describe examples of management strategies and the resources required; and provide references for further information. This information ensures that sub-state level transportation planners, in particular, are well informed and equipped to make optimal decisions regarding the transport of hazardous materials as prescribed by local conditions.

Chapter 2:
Hazmat Transport: Questions & Answers

Introduction

This chapter provides concise answers to basic, yet common and critical, questions related to the transport of hazardous materials that the general public, community officials, or transportation planners and practitioners may have. The answers to these questions provide vital guidance necessary to identify hazardous material transportation risks, subsequent management needs, and solution options. In addition to a brief answer, each question references the related fact sheets in Chapter 3 that clarify and describe options for management strategies.

Questions

1. What is hazardous material (hazmat)?
2. Why is hazmat needed?
3. What is the risk involved with hazmat transport?
4. What are the consequences of an incident (spill/release) whether due to a vehicular accident or not?
5. Who is in charge after a hazmat incident occurs (retroactively)?
6. Who is in charge before a hazmat incident occurs, i.e., responsible for maintaining safety in terms of prevention (proactively)?
7. Can I prevent hazmat trucks or rail cars from passing through my neighborhood or city?
8. What can individuals, groups, or authorities do to improve safety in hazmat transportation?

Question 1. What is hazardous material (hazmat)?

Answer:

The U.S. Department of Transportation defines hazardous material as a substance or material capable of posing an unreasonable risk to health, safety, or property when transported in commerce.[1] More than 3,000 materials subject to regulation are identified by name, along with thousands of unnamed materials categorized as explosive, flammable, corrosive, infectious, or otherwise hazardous.[2]

Hazardous materials are categorized into nine hazard classes based on the type of danger posed in transportation.[3] The hazard classes are further sub-categorized into divisions. Below are the nine hazard classes and the division numbers under each class:[4]

Class 1: Explosives (Divisions 1.1, 1.2, 1.3, 1.4, 1.5, 1.6)
Class 2: Gases (Divisions 2.1, 2.2, 2.3)
Class 3: Flammable liquids and Combustible liquids
Class 4: Flammable solids, Spontaneously combustible materials, and Water-reactive substances (Divisions 4.1, 4.2, 4.3)
Class 5: Oxidizing substances and Organic peroxides (Divisions 5.1, 5.2)
Class 6: Toxic substances and Infectious substances (Divisions 6.1, 6.2)
Class 7: Radioactive
Class 8: Corrosive
Class 9: Miscellaneous hazardous materials

Related Information Sheet(s):

- Sheet 10. Alternatives to Hazardous Materials

[1] U.S. Department of Transportation, Pipeline and Hazardous Material Safety Administration (PHMSA). "Glossary." Online. Available at http://phmsa.dot.gov/hazmat/glossary.
[2] National Research Council, Transportation Research Board (TRB). *Special Report 283. Cooperative Research for Hazardous Materials Transportation: Defining the Need, Converging on Solutions*. Washington, D.C., 2005. Online. Available at http://onlinepubs.trb.org/Onlinepubs/sr/sr283.pdf
[3] PHMSA
[4] National Oceanic and Atmospheric Administration (NOAA), Office of Response and Restoration for the U.S. Coast Guard. "Hazard Classes and Numbers." Online. Available at http://chemresponsetool.noaa.gov/placards_field_guide/hazard_classes.htm.

Question 2. Why is hazmat needed?

Answer:

Hazardous materials are necessary components in many manufacturing processes, such as the refining of petroleum products and the purification of our drinking water. They are also used extensively throughout hospitals, refrigeration plants, and some government facilities. In addition, we all buy and use them every day at home. Many cleaners, fertilizers, pesticides, home maintenance, pool care, fuels, and a host of other products are made of the same and just as hazardous materials, as the highly regulated commercial materials. Those in our homes are simply not regulated because they do not exist in quantities large enough to pose a serious risk to ourselves or to others. Some chemical names and their everyday uses include:

- Ammonia (fertilizers, pesticides, detergents, plastics, dyes, textiles)
- Chlorine (disinfectant, bleaching products, water purification, wastewater treatment)
- Formaldehyde (preservative, nail polish)
- Hydrogen Fluoride (production of other chemicals, e.g., gasoline, etching glass)
- Methyl Bromide (refrigerant)
- Nitric Acid (for etching steel)
- Phenol (disinfectant)
- Sulfuric Acid (used in batteries)
- Sulfur Dioxide (food additive)
- Dry Cleaning Materials

Related Information Sheet(s):

- Sheet 10. Alternatives to Hazardous Materials

Question 3. What is the risk involved with hazmat transport?

Answer:

Every day millions of hazardous materials shipments are moved safely. Risk calculations take into account the amount of product, toxicity of product, and population exposed to that product. Nationwide only about 20 percent of all hazmat incidents requiring official reporting occur during the *transportation* phase of the shipment. Most incidents occur in the loading or unloading phases. In addition, by far the most common causes of hazmat incidents are human error and inadequate or improper transportation preparation.

Higher risk does not necessarily imply unsafe conditions in the transport of the product. It simply implies that transportation companies that transport hazmat and their employees require specialized training, licensing, and inspection to maintain highest possible safety levels.

Related Information Sheet(s):

- Sheet 1. Hazardous Material Route Designation – Route Risk Assessment
- Sheet 4. Commodity Flow Surveys – Regional Risk Assessment
- Sheet 5. Comprehensive Hazard Planning
- Sheet 9. Education and Outreach

Question 4. What are the consequences of an incident (spill/release) whether due to a vehicular accident or not?

Answer:

The consequence of a hazardous material incident is primarily its impact on people and the environment. These consequences, and naturally the risk, on the general public depend on the type of product, toxicity, and the population density in the proximity of the incident site. Additionally, proper incident response in terms of time and mitigation may also directly affect the final impact of the incident. The *2008 Emergency Response Guidebook (ERG)* provides guidance to the first responders to an incident. Once the hazmat is identified by the first responder, the ERG provides guidance on the appropriate mitigation actions to control and contain a spill or release. The appropriate action may be the evacuation of population within a certain distance of the incident site. For example, a large chlorine release requires an initial isolation and protective action distance of 2,000 feet. If it occurs at night that distance increases to 5 miles for persons located downwind of the spill.

Related Information Sheet(s):

- Sheet 1. Hazardous Material Route Designation – Route Risk Assessment
- Sheet 4. Commodity Flow Surveys – Regional Risk Assessment
- Sheet 5. Comprehensive Hazard Planning

Question 5. Who is in charge after a hazmat incident occurs (retroactively)?

Answer:

The first responder to a hazardous material incident will most likely be the police and/or fire department. The Texas Administrative Code identifies the Texas Department of Public Safety as the responsible entity for on-site coordination in unincorporated areas and, if requested, in cities. A hazardous materials response team, usually maintained within a local fire department, will be called to the scene to assess the situation and determine the appropriate initial and subsequent actions. Local industry response teams, such as those that reside at a large refinery, or private hazardous materials response teams may also be called to the scene.

Related Information Sheet(s):

- Sheet 4. Commodity Flow Surveys – Regional Risk Assessment
- Sheet 5. Comprehensive Hazard Planning

Question 6. Who is in charge before a hazmat incident occurs, i.e., responsible for maintaining safety in terms of prevention (proactively)?

Answer:

Local hazmat planning is undertaken by the Local Emergency Planning Committee (LEPC), which usually consists of area industry representatives, government representatives, fire and police representatives, as well as private citizens. Their directive is to develop local hazard planning documents. The State of Texas also has a Statewide Mitigation Plan, along with an Emergency Management Plan.

Little can be done locally to restrict rail operations. The picture is brighter at the federal level. New federal regulations require railroads to evaluate routes utilized to transport hazmat to ensure that they are the safest alternatives. In addition, routes where toxic-by-inhalation (TIH) hazardous materials are transported will be required by 2015 to implement a Positive Train Control (PTC) signal system. New regulation also requires rail tank cars transporting the most toxic of hazmat to be designed at higher safety standards than the existing tank cars. In lieu of

using the improved tank cars, rail operations will have to be altered to otherwise increase the safety level associated with existing tank car designs.

The Department of Homeland Security continuously undertakes research and investigation of ways to prevent and protect hazmat in transportation from the threat of sabotage or terrorism.

The transportation of hazardous materials can be safer and more efficient through a variety of other transportation and urban planning activities; many of which are not confined to these purposes:

- Transportation planning;
- Freight planning;
- Land use planning; and
- Local, regional, state, and federal regulation.

Related Information Sheet(s):

- Sheet 1. Hazardous Material Route Designation – Route Risk Assessment
- Sheet 4. Commodity Flow Surveys – Regional Risk Assessment
- Sheet 5. Comprehensive Hazard Planning
- Sheet 7. Highway-Rail Grade Crossings
- Sheet 8. Commercial Motor Vehicle Inspections
- Sheet 11. Security Measures

Question 7. Can I prevent hazmat trucks or rail cars from passing through my neighborhood or city?

Answer:

It depends. Not all hazmat can be directed away from communities. Gas stations, businesses, industry, and other facilities—not to mention homes, people, and cars—require the use of hazmat. A mechanism is available for local communities to designate specific hazmat highway routes in their jurisdiction. The process must follow federal regulations and is described in the document *Highway Routing of Hazardous Materials: Guidelines for Applying Criteria*.[5]

Little can be done locally to restrict rail operations. Railroads operate over a limited, self-owned network, and typically the best quality track travels through populated urban areas,

[5] *Highway Routing of Hazardous Materials: Guidelines for Applying Criteria*. National Highway Institute (NHI) Course No. 38064. Federal Highway Administration (FHWA), U.S. Department of Transportation (USDOT). Arlington, VA, November 1996. Online. Available at http://hazmat.fmcsa.dot.gov/nhmrr/index.asp.

where the end customers or processing facilities are naturally located. However, recent and new federal regulations require railroads to evaluate routes utilized to transport hazmat to ensure that they are the safest alternative.

Related Information Sheet(s):

- Sheet 1. Hazardous Material Route Designation – Route Risk Assessment
- Sheet 2. Truck Highway Operational Management Strategies
- Sheet 4. Commodity Flow Surveys – Regional Risk Assessment
- Sheet 5. Comprehensive Hazard Planning
- Sheet 6. Land Use Planning/Corridor Management and Preservation
- Sheet 12. Rail Relocation
- Sheet 13. Truck-Only Facilities

Question 8. What can individuals, groups, or authorities do to improve safety in hazmat transportation?

Answer:

There are several strategies that can directly or indirectly reduce the risk associated with the transportation of hazardous materials. Depending on the type and the level of need (local, regional, or statewide), one or more of the following strategy categories may be considered:

- Route and/or Operational Strategies
  Examples: hazardous materials route designation, truck operational management, system design;
- Planning Strategies
  Examples: conducting commodity flow studies at regular intervals, comprehensive hazard planning, land use planning;
- Safety Strategies
  Examples: grade crossings, commercial vehicle and driver inspection programs, educational and outreach efforts, security measures; and
- Infrastructure Strategies
  Examples: construction of truck-only facilities and rail bypasses.

Related Information Sheet(s):

- All – Every Information Sheet addresses the relevant management strategies

Chapter 3:
Hazardous Materials Information Sheets

Introduction

The following information sheets describe strategies available, either individually or in combination, to help reduce the risk associated with the movement of hazardous materials through Texas communities. The strategies can be categorized into four main strategy categories: Route and/or Operational Strategies, Planning Strategies, Safety Strategies, and Infrastructure Strategies.

Information Sheets

- Route and/or Operational Strategies
    1. Hazardous Materials Route Designation – Route Risk Assessment
    2. Truck/Highway Operational Management
    3. System Design
- Planning Strategies
    4. Commodity Flow Surveys – Regional Risk Assessment
    5. Comprehensive Hazard Planning
    6. Land Use Planning/Corridor Management and Preservation
- Safety Strategies
    7. Highway-Rail Grade Crossings
    8. Roadside Inspections
    9. Education and Outreach
    10. Alternatives to Hazardous Materials
    11. Security Measures
- Infrastructure Strategies
    12. Rail Relocation
    13. Truck-Only Facilities

Sheet 1. Hazardous Materials Route Designation – Route Risk Assessment

Overview:

The *Highway Routing of Hazardous Materials: Guidelines for Applying Criteria* document provides guidance to states, Indian tribes, and local governments on how to apply and implement the federal standards for establishing, maintaining, and enforcing designated Non-Radioactive Hazardous Materials (NRHM) routes. There are two types of designations: designated routes and restricted routes. Figure 1 illustrates the highway signs showing these designations. Designated routes are those highways on which NRHM must be transported, and restricted routes are those highways on which NRHM may not be transported. Restrictions can include tunnels, lanes, time of day, prior notice, escort requirements, etc.

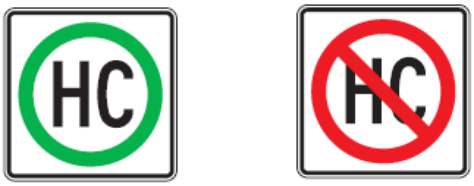

Figure 1. Texas 2006 MUTCD Hazardous Material Route and Prohibition Signs.

The federal standards provide for enhancement of safety, public participation, consultation with other parties, through highway routing, reasonable routes to facilities such as terminals, timely agreement between jurisdictions, and timely local compliance. In addition, 13 factors are to be considered in the designation process:

1. Population density
2. Highway type
3. NRHM type and quantity
4. Emergency response capabilities
5. Consultation with others
6. Risk exposure of sensitive areas (e.g., homes, hospitals, schools, water sources, natural areas)
7. Terrain
8. Route continuity
9. Consideration of alternative routes
10. Effects on commerce
11. Delays in transportation of NRHM
12. Climatic conditions
13. Congestion and accident history

The methodology in the *Highway Routing of Hazardous Materials: Guidelines for Applying Criteria* reflects approaches for determination of accident probability and consequences in the primary risk calculations. Different methods requiring varying degrees of input data and calculations provide options to agencies. Additional quantitative and qualitative considerations

are included as well as a worked example to illustrate the application of preferred methods identified in the main body. At the beginning of each section a box indicates which of the standards and factors are discussed within that section. This helps the user ensure that all standards and factors are considered as required by the Routing Rule.

Sheet 1 Resources:

- Texas Administrative Code. Title 43, Part 1, Chapter 25, Subchapter F Hazardous Material Routing Designations. http://www.sos.state.tx.us/tac/index.shtml.
- *Highway Routing of Hazardous Materials: Guidelines for Applying Criteria*. National Highway Institute (NHI) Course No. 38064. Federal Highway Administration (FHWA), U.S. Department of Transportation (USDOT). Arlington, VA, November 1996. Online. Available at http://hazmat.fmcsa.dot.gov/nhmrr/index.asp.
- Title 49, Code of Federal Regulations, Part 397, Subpart C – Routing of Non-Radioactive Hazardous Materials (NRHM). http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=1f09dc9ce8ce52cf67afc7f437104fb8&rgn=div6&view=text&node=49:5.1.1.2.40.3&idno=49
- Texas Non-Radioactive Hazardous Materials (NRHM) Routing – http://www.txdot.gov/services/traffic_operations/non_radioactive_routing.htm
- National Hazardous Materials Route Registry and Route Maps – http://hazmat.fmcsa.dot.gov/nhmrr/index.asp?page=route and http://hazmat.fmcsa.dot.gov/nhmrr/index.asp?page=maps

Sheet 2. Truck/Highway Operational Management

Overview:

Truck/highway operational management strategies are a part of the overall managed lanes practice that is employed by transportation operations personnel. A managed lane is defined as "a facility that increases freeway efficiency by packaging various operational and design actions. Lane management operations may be adjusted at any time to better match regional goals."

Reasons to consider truck operational management on highways include:

- Speed differential,
- Grade or curvature issues,
- Other difficult operational areas,
- Weaving,
- Entry/Exit ramps or configurations,
- Truck driver hours of service restrictions,
- Seasonal variations,
- Truck weight and/or dimensions, and
- Perceived comfort or safety by traveling public.

Types of managed lane strategies for trucks include:

- Exclusive Lanes – provide certain vehicles, usually designated by vehicle type, an exclusive operational lane.
- Separation and Bypass Lanes – are a treatment for a specific section or segment of roadway. This strategy often addresses a roadway segment with one of the following characteristics: weaving area, a significant grade, high percentage of truck traffic, and/or congestion.
- Dual Facilities – have physically separated inner and outer roadways in each direction.
- Lane Restrictions – is a strategy that limits certain types of vehicles to specified lanes, as illustrated by the highway sign in Figure 2.

Figure 2. Truck Lane Restriction Sign on Texas Freeway.

Sheet 2 Resources:

- Jasek, Debbie, Mark Shafer, Dale Picha, and Tom Urbanik II. *Guidelines for Truck Lane Restrictions in Texas*. Research Report 1726-S. Texas Transportation Institute. College Station, TX, August 1997.
- D.R. Middleton, S.P. Venglar, C.A. Quiroga, D. Lord, and D.L. Jasek. *Strategies for Separating Trucks from Passenger Vehicles: Final Report*. Research Report 0-4663-2. Texas Transportation Institute, College Station, TX, 2006. Online. Available: http://tti.tamu.edu/documents/0-4663-2.pdf.
- D.R. Middleton, S.P. Venglar, C.A. Quiroga, D. Lord, and D.L. Jasek. *Strategies for Separating Trucks from Passenger Vehicles: Truck Facility Guidebook*. Research Product 0-4663-P1. Texas Transportation Institute, College Station, TX, October 2006. Online. Available: http://tti.tamu.edu/documents/0-4663-P1.pdf.
- D.R. Middleton, A. Clayton, C.A. Quiroga, and D.L. Jasek. *Truck Accommodation Design Guidance: Final Report*. Research Report 0-4364-1. Texas Transportation Institute, College Station, TX, October 2003. Online. Available: http://tti.tamu.edu/documents/0-4364-1.pdf.

Sheet 3. System Design Considerations

Overview:

Roadway design can play a major role in the safe and efficient movement of hazardous materials through communities, as well as to and from fixed facilities. The movement of hazardous materials does not occur by specialized trucks when considering operational standards. Thus, the same roadway design considerations that apply to universal truck operations are also valid for hazmat trucks and include:

- Turning radii
- Pavement strength
- Interchanges
- Highway entrances/exits
- Merging/weaving locations
- Passing lanes
- Roadway/shoulder widths
- Turn lanes
- Storage space
- Parking facilities
- Signing
- Traffic control
- Access management

Sheet 3 Resources:

- D.R. Middleton, A. Clayton, C.A. Quiroga, and D.L. Jasek. *Truck Accommodation Design Guidance: Final Report*. Research Report 0-4364-1. Texas Transportation Institute, College Station, TX, October 2003. Online. Available: http://tti.tamu.edu/documents/0-4364-1.pdf.
- TxDOT *Roadway Design Manual* (TRDM) – http://onlinemanuals.txdot.gov/txdotmanuals/rdw/rdw.pdf
- AASHTO's "Green Book" - *A Policy on Geometric Design of Highways and Streets*
- Access Management Resources
    - Access Management TRB Committee AHB70 – http://www.accessmanagement.gov and http://www.accessmanagement.info/
    - W.E. Frawley and W.L. Eisele. *Access Management Guidebook for Texas*. Research Product 0-4141-P3. Texas Transportation Institute, College Station, TX, June 2005. Online. Available: http://tti.tamu.edu/documents/0-4141-P3.pdf.

Sheet 4. Commodity Flow Surveys – Regional Risk Assessment

Overview:

Federal hazardous materials law established a grants program for states that wish to address transportation-related risks in emergency response planning and provide training funds for emergency responders. Commodity flow surveys are one of the activities eligible for funding under the legislation. The law also authorized states to designate hazardous materials highway routes. Prior to designating routes, planners need to analyze the risks associated with hazardous materials transportation within their jurisdiction. Conducting an analysis of commodity flows is an important step in assessing transportation-related hazardous materials risks. Specific purposes of a commodity flow study include:

- Identification of frequently used transportation routes in the area;
- Assessment of total truck traffic and its daily and seasonal variations;
- Improvement of commercial driver awareness and training;
- Assessment and improvement of local emergency response personnel training;
- Risk assessment of hazardous materials routes, evaluation of alternative routes, and route designations;
- Improvement of highway/infrastructure safety; and
- Input to urban and regional planning activities (transportation and land use).

Commodity flow surveys are resource intensive, in terms of money, labor, and time. Exploration of existing data sources for hazardous materials origins, destinations, and routes in the area is recommended before determining whether expensive field data collection is necessary to fulfill the goals of the study, especially since many hazardous materials movements are restricted to designated routes.

The purpose for the study, the design specifics of the study, and the resources and time available are interconnected, so multiple revisions and iterations may be necessary at the study design stage. The federal guide, *Guidance for Conducting Hazardous Materials Flow Surveys*:

- Provides step-by-step guidance to states, Local Emergency Preparedness Committees (LEPCs), and other planners on how to conduct a commodity flow study for hazardous materials moving by highway.
- Discusses the need and objectives for this type of study and details how to review baseline information and design the study.
- Explains the international hazard classification system of the nine classes of hazardous materials.

- Includes step-by-step instructions and examples for collecting the data via field studies, analyzing the results, and applying these results back to the purpose of the study.
- Describes selected recent state and local hazardous material flow studies.
- Illustrates how to conduct and complete a hazmat flow survey from beginning to end through a case study example.
- Describes a model that allocated commodity flows between producers and consumers to further emphasize that models may be useful for predicting national trends, but state and sub-state movements of hazardous chemicals can only be determined more accurately through a commodity flow study.

Upon completion of a commodity flow study based on this guidance, planners will have a better understanding of hazardous materials transportation patterns and can use these data to conduct planning and estimate risks facing the jurisdiction.

Numerous states and metropolitan areas have successfully conducted hazardous materials commodity flow surveys in the manner recommended by the guide, and their case studies are included in the published document.

Sheet 4 Resources:

- *Guidance for Conducting Hazardous Materials Flow Surveys*. Office of Hazardous Materials Safety, Research and Special Programs Administration, U.S. Department of Transportation (USDOT). Washington, D.C., January 1995. Online. Available at http://hazmat.dot.gov/training/state/hmep/guide_flow_surveys.pdf.
- Emergency Planning and Community Right-To-Know Act (EPCRA) / Superfund Amendment and Reauthorization Act of 1986 (SARA Title III). Code of Federal Regulations (CFR), Title 40, Parts 300-374. Online. Available at http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?sid=f7f69c6b5c04a4e7b1e66fe50e09efff&c=ecfr&tpl=/ecfrbrowse/Title40/40cfrv27_02.tpl

Sheet 5. Comprehensive Hazard Planning

Overview:

In Texas, the Governor's Division of Emergency Management (GDEM) is "charged with carrying out a comprehensive all-hazard emergency management program for the State and for assisting cities, counties, and state agencies in planning and implementing their emergency management programs."[6] The GDEM indicates that a comprehensive emergency management program includes:

- Mitigation – Pre- and post-disaster mitigation of known hazards to reduce their impact;
- Preparedness – Preparedness activities, such as emergency planning, training, and exercises;
- Response – Provisions for effective response to emergency situations; and
- Recovery – Recovery programs for major disasters.

As indicated in the *Local Emergency Management Planning Guide*, state law directs each political subdivision (county or incorporated city) to maintain an emergency management program or participate in an inter-jurisdictional program. This document provides procedures for submitting these emergency planning documents to the GDEM.

Local Hazardous Materials Planning

According to the GDEM, the Local Emergency Planning Committees (LEPCs) assist local governments in carrying out emergency planning related to hazardous materials. The role of LEPCs is to "form a partnership between local government and industry as a resource for enhancing hazardous materials preparedness," including:

- Ensuring the local hazard analysis adequately addresses hazmat incidents;
- Incorporating planning for hazmat incidents into the local emergency management plan and annexes;
- Assessing capabilities and developing hazmat response capability using local resources, mutual aid, and contractors;
- Training responders; and
- Exercising the plan.[7]

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[6] Governor's Division of Emergency Management. "GDEM Mission, Organization, & Responsibility." Online. Available: http://www.txdps.state.tx.us/dem/pages/mission.htm.

[7] Governor's Division of Emergency Management. *Local Emergency Planning Committee (LEPC): A Primer for Local Planning for Hazardous Materials*. July 2006. Online. Available: ftp://ftp.txdps.state.tx.us/dem/lepc/lepc_handbook_texas_07262006.pdf.

LEPCs are identified as the link between citizens, industry, and government. With every county having or participating in at least one LEPC, there are 270 LEPCs in Texas.

Sheet 5 Resources:

- Governor's Division of Emergency Management (GDEM)
  - Website – http://www.txdps.state.tx.us/dem/pages/index.htm
  - *State Emergency Management Plan* – ftp://ftp.txdps.state.tx.us/dem/plan_state/state_plan_20040211.pdf
  - *State of Texas Mitigation Plan* – ftp://ftp.txdps.state.tx.us/dem/mitigation/tx_mitigation_plan_2007.pdf
  - *Local Emergency Planning Committee (LEPC): A Primer for Local Planning for Hazardous Materials* – ftp://ftp.txdps.state.tx.us/dem/lepc/lepc_handbook_texas_07262006.pdf

Sheet 6. Land Use Planning/Corridor Management and Preservation

Overview:

Land Use Planning Considerations

Land use planning can increase safety, provide business development and expansion, and improve transportation efficiency. Some things to consider for public land use planning include:

- Zoning for compatible land uses;
- Proximity of neighborhoods and population centers compared to Tier II facilities, such as water treatment plants and industrial locations; and
- Facilitation of industrial and commercial developments that allows for continued growth and expansion without encroachment of incompatible adjacent land uses.

Corridor Management and Preservation

Corridor management and preservation "generally refer to measures or practices to preserve or protect rights-of-way (ROW) in combination with managing how development occurs along a transportation corridor."[8] Corridor management and preservation activities bring together land use and transportation planning decisions. Preserving ROW for future corridor development and managing the development along existing corridors allows for long-term retention of intended function of the corridor. Improper corridor management may reduce operations and safety along a transportation corridor and increase the cost to 'fix' prior planning mistakes.

Corridor management and preservation relates to all transportation corridors, such as highways, rail lines, and waterways. Primarily focusing on management and preservation along highways and rail lines, communities and planners should consider the following aspects:

- Highway Corridor Preservation Considerations[9]
  - Typical corridor problems – Numerous and poorly spaced driveways, closely spaced signals, and lack of interconnectivity between adjacent developments;
  - Possible long-term consequences – Reduced mobility, increased congestion, and reduced safety; decline in property values; and loss or re-alignment of a planned corridor due to development; and
  - Tools and techniques:

[8] Hard, Edwin, Patricia Ellis, Brian Bochner, and Deborah Spillane. *Creating Partnerships with Local Communities to Manage and Preserve Corridors: Technical Report*. Research Report FHWA/TX-08/0-5606-1. Texas Transportation Institute. College Station, TX July 2008. Online. Available: http://tti.tamu.edu/documents/0-5606-1.pdf.

[9] Ibid.

- Access management
- Zoning and development regulations
- Operational measures and intelligent transportation
- Miscellaneous techniques, such as impact fees, interim uses, and density transfers
- Subdivision regulations

- Railroad Corridor Preservation Considerations[10]
  - Primary community concerns – noise, vibrations, air quality, safety, and rail yard activities;
  - Private railroad concerns – safety, trespassing, legal considerations, grade crossings, environmental justice, and business development;
  - Incompatible land uses for freight rail operations include – residential development, schools, daycare facilities, playgrounds, hospitals, hotels, and high-precision manufacturing operations; and
  - Effective corridor protection strategies:
    - Advance corridor approval and official mapping
    - Protective condemnation
    - Setback standards
    - Development permitting
    - Overlay zoning
    - Joint development and informal negotiations with the private sector
    - Flexible and cluster zoning
    - Transfer of development rights

Sheet 6 Resources:

- Hard, Edwin, Patricia Ellis, Brian Bochner, and Deborah Spillane. *Creating Partnerships with Local Communities to Manage and Preserve Corridors: Technical Report*. Research Report FHWA/TX-08/0-5606-1. Texas Transportation Institute. College Station, TX July 2008. Online. Available: http://tti.tamu.edu/documents/0-5606-1.pdf.
- Loftus-Otway, Lisa, C. Michael Walton, Lynn Blais, and Nathan Hutson. *Protecting and Preserving Rail Corridors Against Encroachment of Incompatible Uses*. Research Report 0-5546-1. Center for Transportation Research at the University of Texas at Austin. Austin, TX, September 2007. Online. Available: http://www.utexas.edu/research/ctr.

[10] Loftus-Otway, Lisa, C. Michael Walton, Lynn Blais, and Nathan Hutson. *Protecting and Preserving Rail Corridors Against Encroachment of Incompatible Uses*. Research Report 0-5546-1. Center for Transportation Research at the University of Texas at Austin. Austin, TX, September 2007. Online. Available: http://www.utexas.edu/research/ctr.

Sheet 7. Highway-Rail Grade Crossings

Overview:

Highway-rail grade crossings are an issue for both the rail operator and the roadway users. The Federal Railroad Administration indicates that there are over 14,700 public at-grade crossings in Texas. There were 295 reported highway-rail grade crossing accidents in Texas in 2007. Of these, only two indicated the transport of hazmat by the highway user, while 195 indicated the transport of hazmat by rail equipment. Railroads transport hazardous materials throughout their system serving producers and customers. Collisions between trains and vehicles at highway-rail grade crossings represent an increased risk of rail car derailment. Most derailments do not result in rail cars exiting the track, falling over, or receiving structural damage that would result in a hazardous materials release. In addition to the rail car concern, there is also concern at grade crossings with the potential involvement of a roadway vehicle transporting hazardous materials.

Particular Truck Safety Situations:

Storage Space

Intersections adjacent to a parallel roadway present a scenario where there is limited storage space between the rail track and the intersection. Figure 3 illustrates the roadway signs indicating parallel roadways and low ground clearance at highway-rail grade. Truck drivers need to be cognitive of the total length of their equipment compared to the available space when approaching intersections with limited storage space, or queuing space. Transportation planners should evaluate these intersections to determine if additional treatments are required to enhance safety, such as altering the stop line position prior to the rail tracks.

Figure 3. Texas 2006 MUTCD Highway-Rail Grade Crossing Signs.

Low-Profile Crossings

Low-profile, or humped crossings, result when the approach to the railroad track is steep where a low-profile trailer may get caught on the rail track. The low ground clearance traffic sign (see Figure 3) indicates crossings evaluated to be a humped crossing. Crossings that present this challenge may require roadway reconfiguration. A full engineering evaluation may also show that with existing adjacent crossings presenting opportunity to close unsafe humped crossings.

Private Crossings

Railroad tracks and right-of-way are private property with access strictly limited to railroad personnel and others granted permission by the railroad. Depending on a crossing need and use, railroad companies issue permits, easements, or leases for encroachments. Therefore, private crossings, especially those associated with a company or industrial area with frequent hazardous material shipments, may require coordination between public entities, the railroad, and the industries operating over the private crossings.

Sheet 7 Resources:

- Ogden, Brent D., Korve Engineering. *Railroad-Highway Grade Crossing Handbook – Revised Second Edition 2007*. Report No. FHWA-SA-07-010. Federal Highway Administration Office of Safety Design, U.S. DOT. Washington, D.C., August 2007. Online. Available: http://safety.fhwa.dot.gov/xings/07010/07010.pdf.
- Texas Department of Transportation. *Texas Manual on Uniform Traffic Control Devices (TMUTCD), 2006 Edition.* Austin, Texas. Online. Available: http://www.txdot.gov/publications/traffic.htm.
- Federal Motor Carrier Safety Administration (FMCSA) website
    - Highway-Rail Grade Crossings: 7 Steps for Safety at http://www.fmcsa.dot.gov/documents/outreach/visor-vert-both-04.pdf
- Operation Lifesaver, Inc. – www.oli.org

Sheet 8. Commercial Motor Vehicle Inspections

Overview:

The practice of inspecting commercial motor vehicles means to ensure safe and secure operations of all commercial vehicles, including those transporting hazardous materials. In particular, inspecting commercial vehicles transporting hazardous materials can ensure regulatory compliance and security procedures.

FMCSA Motor Carrier Safety Assistance Program (MCSAP)

The MCSAP is a "Federal grant program that provides financial assistance to States to reduce the number and severity of crashes and hazardous materials incidents involving commercial motor vehicles."[11]

The North American Standard Inspection Program – Driver/Vehicle Inspection Levels

The FMCSA describes the North American Standard Driver/Vehicle Inspection Levels in great detail on their website. Below is a brief description of the levels:

- Level I – North American Standard Inspection
  - Includes complete inspection of the driver and vehicle
- Level II – Walk-Around Driver/Vehicle Inspection
  - Includes complete inspection of the driver and vehicle components not requiring inspection under the vehicle
- Level III – Driver-Only Inspection
  - Includes complete driver-specific inspection items, such as driver's license, medical certificate, and hours of service
- Level IV – Special Inspections
  - Typically a one-time examination of a particular item
- Level V – Vehicle-Only Inspections
  - Includes complete vehicle inspection, without the driver present

[11] Federal Motor Carrier Safety Administration. *Motor Carrier Safety Assistance Program*. Online. Available: http://www.fmcsa.dot.gov/safety-security/safety-initiatives/mcsap/mcsap.htm

The Critical Vehicle Inspection Items include:[12]

- Brake system
- Coupling devices
- Exhaust systems
- Frame
- Fuel System
- Lighting devices
- Safe loading
- Steering mechanism
- Suspension
- Tires
- Van and open-top trailer bodies
- Wheels, rims, and hubs
- Windshield wipers
- Emergency exit for buses

Sheet 8 Resources:

- Federal Motor Carrier Safety Administration (FMCSA)
  - Motor Carrier Safety Assistance Program – http://www.fmcsa.dot.gov/safety-security/safety-initiatives/mcsap/mcsap.htm
  - North American Standard Driver/Vehicle Inspection Levels – http://www.fmcsa.dot.gov/safety-security/safety-initiatives/mcsap/insplevels.htm
- The Commercial Vehicle Safety Alliance (CVSA) – http://www.cvsa.org
- City of Houston Police Department, Truck Enforcement Unit – http://www.houstontx.gov/police/teu/index.htm

[12] Commercial Vehicle Safety Alliance (CVSA). *Understanding the North American Standard Inspection Program*. 2006. Online. Available: http://www.cvsa.org

Sheet 9. Education and Outreach

Overview:

The Federal Motor Carrier Safety Administration (FMCSA) indicates that over half of accidents involving commercial motor vehicles have been determined to be due to fault of the passenger vehicle operating around large trucks. The FMCSA has developed an educational initiative called "Share the Road Safely" that identifies safe operations for both commercial vehicle operations and the traveling public as they operate around large trucks and buses.

Of particular concern is the operation of passenger vehicles in commercial vehicle blind spots. These areas are identified as "No-Zones." The FMCSA informs commercial vehicle drivers to be vigilant in recognizing vehicles in the "No-Zones." Also, educational material related to passenger vehicle operations around large trucks has been published and disseminated to the traveling public, as demonstrated in Figure 4.

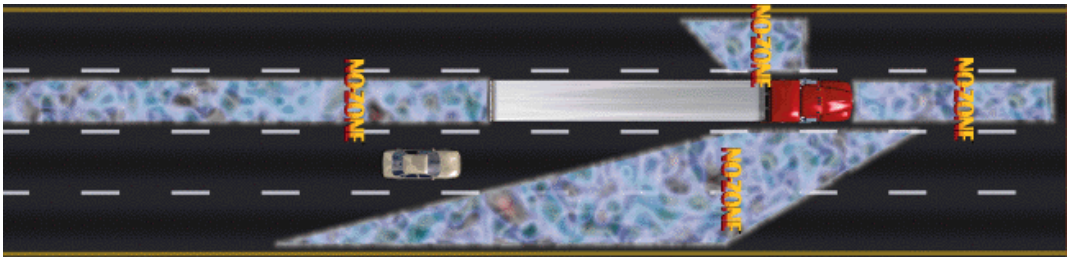

Figure 4. The "No-Zone" Illustration.

Law enforcement in the state can address unsafe vehicle operating practices by monitoring both commercial vehicle and passenger vehicle operations on roadways. Unsafe practices include tailgating, unsafe lane changes, speeding, failing to signal lane changes, and aggressive driving, which is a combination of the previous behaviors. The Austin Police Department is the first municipal department to receive a FMCSA grant for the Ticketing Aggressive Cars and Trucks program. Previously only administered to states, this program strives to reduce fatalities and injuries from unsafe driving behaviors by passenger vehicles and commercial motor vehicles. Educational material encourages the public to "Leave More Space for Trucks," as demonstrated in Figure 5.

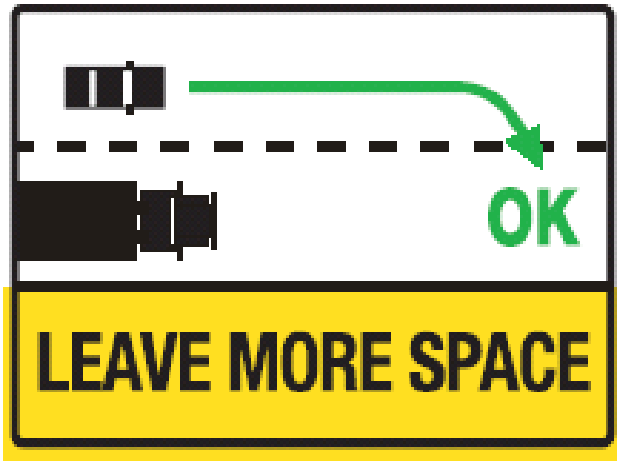

Figure 5. "Leave More Space for Trucks" Illustration.

Sheet 9 Resources:

- Federal Motor Carrier Safety Administration (FMCSA)
  - "Share the Road Safely" and "No-Zone" – www.sharetheroadsafely.org

Sheet 10. Alternatives to Hazardous Materials

Overview:

Hazardous materials are utilized in a wide spectrum of applications, from home cleaning products to catalysts for the production of chemicals. Hazmat is moved because it is needed for a particular use at a particular place. In some instances, hazmat can be substituted with less toxic chemicals or processes. Most of this activity tends to occur within the private industry if driven by market forces. For example, consumers that are concerned about toxic products now have the option of purchasing less toxic and/or "greener" alternatives, which is a growing trend. Some less-toxic processes can also be adopted. For example, the use of ultraviolet rays to kill harmful bacteria at water treatment plants is an option in lieu of using chlorine. However, altering the process or developing a new process that uses less toxic alternatives comes with trade-offs, such as the loss of beneficial residual chlorine in the water system or the cost to reconfigure a water treatment plant for performing an entirely different process.

Sheet 10 Resources:

- Industry trade organizations
- University of Massachusetts Lowell Toxics Use Reduction Institute (TURI) – http://www.turi.org/

Sheet 11. Security Measures

Overview:

Until recently, the primary concern of hazardous materials transport was the risk of an *accidental* release that could adversely, and possibly catastrophically, affect public safety and health. Today there is considerable concern for the *intentional* release or use of hazardous materials shipments by terrorists to purposely harm society. Beginning with the 1975 Hazardous Materials Transportation Act, and continuing through its reauthorizing legislation, the Secretary of Transportation's role in hazardous material regulation and enforcement has been empowered. Governmental efforts pushed toward unifying the previously fragmented hazardous materials regulatory and enforcement authorities. Today, major legislative and regulatory focus lies on the security of the nation's transportation system, especially freight, and in particular highly dangerous hazardous materials such as the Toxic Inhalation Hazard Materials (TIH).

The industries involved in hazardous materials transport are currently working to improve the security of the shipments. For example, the Association of American Railroads reports that the rail industry created a Railroad Security Task Force in 2001 that developed a "Terrorism Risk Analysis and Security Management Plan."[13] The railroads are also working closely with major shippers, the chemical industry, and tank car manufacturers in a partnering effort to increase safety and security of rail shipments. Even more recent proposed and finalized initiatives indicate the types of future actions required to enhance safe and secure transport of hazardous materials. Two of these actions include:

- Tracking of TIH tank car movements in high threat urban areas – The collection and analysis of TIH tank car movements is intended to monitor the standstill time TIH cars remain in one location. Alerts would be issued for excessive dwell times.
- Requirement of railroads to route hazardous materials based on a range of safety and security factors – Jointly developed between the Department of Homeland Security and the U.S. Department of Transportation, this requires railroads to "perform a safety and security risk analysis to determine the most appropriate route for shipping hazardous materials."[14] Under this requirement, railroads would be required to compile information on the commodities transported and the routes utilized.

[13] Association of American Railroads. Statement of Nancy L. Wilson, Senior Assistant Vice President, Safety and Security before the Committee on Public Works and the Environment, District of Columbia City Council, January 23, 2004.

[14] U.S. Department of Transportation. U.S. Department of Transportation Proposes to Require Railroads to Route Hazardous Materials Based on Range of Safety and Security Factors. DOT 116-06, Friday, December 15, 2006.

- Positive Train Control – Rail routes where passenger and freight operations coexist and routes where toxic-by-inhalation hazardous materials are transported are required by 2015 to have Positive Train Control signal systems. This technology provides continual monitoring of train positions in relation to each other and automatically maintains safe separations.

Sheet 11 Resources:

- State of Texas
  - Office of Homeland Security – http://governor.state.tx.us/homeland/ and http://www.texashomelandsecurity.com/
  - Division of Emergency Management – http://www.txdps.state.tx.us/dem/pages/index.htm
- U.S. Department of Homeland Security
  - Website – http://www.dhs.gov/index.shtm
  - Transportation Security Administration – http://www.tsa.gov/

Sheet 12. Rail Relocation

Overview:

Most urban development occurred along with the expansion of the rail system throughout the U.S. and Texas. Urban centers were the locations of rail customers, rail yard operations, and rail line intersections. The economic development spurred by the rail service into cities also gave rise to conflict as urban areas began to grow and expand around the complex intertwined rail network. Today, rail operations largely remain in the urban centers just as they have for a century. Meanwhile, there are growing concerns pertaining to safety, travel delays, and quality of life due to intersection conflicts between rail operations and major roadways, especially at densely populated urban neighborhoods. These concerns have led to investigations of possibilities for relocating freight rail operations outside of Texas urban areas.

Texas is a national forerunner in the development of mechanisms, such as the Railroad Relocation Fund, which entails the study of rail relocation practices in several U.S. cities and the detailed analysis of rail operations in urban areas. Potential new federal legislation and initiatives may increase TxDOT's ability to improve freight rail operations, urban mobility, vehicular emissions, and quality of life by relocating rail operations outside urban centers.

Recent research reviewed 59 existing and proposed rail relocation efforts around the U.S., performing in-depth analyses for five representative projects. Almost all projects involved removing conflicting rail activities away from city centers. The research concluded that railroad relocation is a viable option for addressing several issues within urban areas and should be considered as one of several potential options for improving mobility and safety, reducing congestion, increasing capacity, and providing new economic development opportunities.[15]

Sheet 12 Resources:

- C.A. Morgan, J.E. Warner, C.E. Roco, G.C. Anderson, L.E. Olson, and S.S. Roop. *Rail Relocation Projects in the U.S.: Case Studies and Lessons for Texas Rail Planning*. Research Report 0-5322-1. Texas Transportation Institute, College Station, TX, February 2007. Online. Available at http://tti.tamu.edu/documents/0-5322-1.pdf.

[15] C.A. Morgan, J.E. Warner, et.al. *Rail Relocation Projects in the U.S.: Case Studies and Lessons Learned for Texas Rail Planning*. Research Report 0-5322-1. Texas Transportation Institute, College Station, TX, February 2007. Online. Available at http://tti.tamu.edu/documents/0-5322-1.pdf.

Sheet 13. Truck-Only Facilities

Overview:

Developing new infrastructure to solely accommodate commercial motor vehicles creates a facility where trucks can operate without interaction with passenger vehicles. The concept of a truck-only facility is that in a corridor with heavy truck traffic, a facility where large trucks are segregated from passenger vehicles would provide a safer, more efficient roadway. Research that has investigated truck-only facilities provides contrasting views of these potential benefits, indicating that a detailed analysis would be required to determine the potential benefits of a project to implement truck-only facilities. Once completed, the benefits of a separate truck facility would have to be compared to the cost of construction and long-term maintenance, both of which could be substantial. There are currently no implemented truck-only facilities of considerable length in the U.S.

Sheet 13 Resources:

- D.R. Middleton, S.P. Venglar, C.A. Quiroga, D. Lord, and D.L. Jasek. *Strategies for Separating Trucks from Passenger Vehicles: Final Report*. Research Report 0-4663-2. Texas Transportation Institute, College Station, TX, November 2006. Online. Available: http://tti.tamu.edu/documents/0-4663-2.pdf.
- D.R. Middleton, S.P. Venglar, C.A. Quiroga, D. Lord, and D.L. Jasek. *Strategies for Separating Trucks from Passenger Vehicles: Truck Facility Guidebook*. Research Product 0-4663-P1. Texas Transportation Institute, College Station, TX, October 2006. Online. Available: http://tti.tamu.edu/documents/0-4663-P1.pdf.
- D.R. Middleton, A. Clayton, C.A. Quiroga, and D.L. Jasek. *Truck Accommodation Design Guidance: Final Report*. Research Report 0-4364-1. Texas Transportation Institute, College Station, TX, October 2003. Online. Available: http://tti.tamu.edu/documents/0-4364-1.pdf.
- Jasek, Debbie, Mark Shafer, Dale Picha, and Tom Urbanik II. *Guidelines for Truck Lane Restrictions in Texas*. Research Report 1726-S. Texas Transportation Institute. College Station, TX, August 1997.
- Douglas, James. *Strategies for Managing Increasing Truck Traffic*. NCHRP Synthesis 314. Transportation Research Board, Washington, D.C., 2003. Online. Available: http://onlinepubs.trb.org/Onlinepubs/nchrp/nchrp_syn_314.pdf.