



Pickens County, South Carolina
Hazardous Materials Commodity Flow
Study
April 2018

Acknowledgements

The following EnviroSafe and Pickens County Emergency Management staff were the Planning Team for this commodities flow study:

- Denise Kwiatek, Director
- Chuck Whitworth, Project Lead
- Kevin Turner, Project Manager
- Steve Naylor and Greg Grayson, Project Support

In April, 2018, an EnviroSafe team and agency representatives conducted twenty (20) highway surveys, including attaining railway commodity flow data necessary for the preparation of this report.

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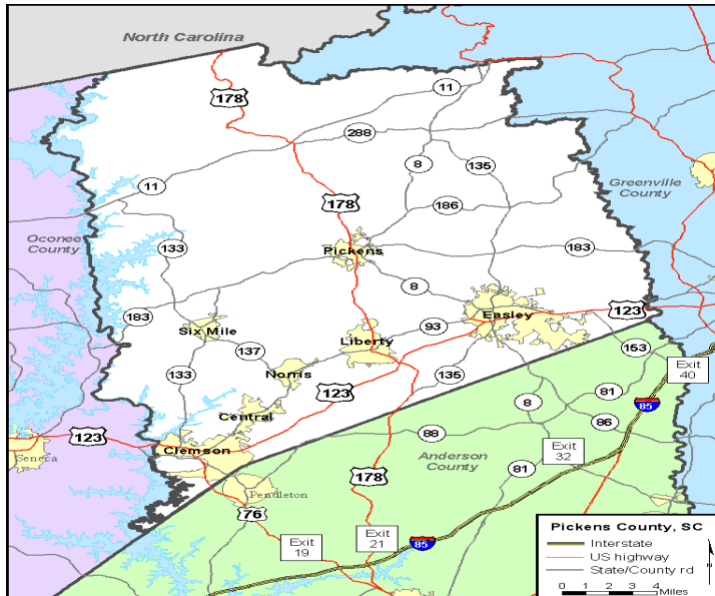
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Article I. Introduction

This report incorporates the results of a Hazardous Materials Commodities Flow Study (HMCFS) for Pickens County, South Carolina (SC). The study was conducted by EnviroSafe Consulting and Investigation Inc., in partnership with Pickens County Emergency Management (PCEM). The area of Pickens County, South Carolina is shown in Figure 1.

Figure 1: Map Area of Pickens County, SC



The objective of this HMCFS Report is to provide a general awareness of the hazardous materials commodities that are transported through the county of Pickens in South Carolina. This report focuses on the movement of hazardous materials transported by highway and railway systems, identify the wide-ranging types of hazardous materials in transit, and the various highway vehicles types and configurations. By approximating the quantities of hazardous material commodities transported through the highway and rail systems, the Authority Having Jurisdiction (AHJ), first responders and emergency planners will have valued information for resolutions regarding equipment distributions, minimum training scenarios and emergency planning. As the information is evaluated, these studies can be the foundation for additional informational projects in related fields, such as future infrastructure developments, essentials of community businesses, forecasting highway and zoning decisions.

Section 1.01 Background

A commodities flow study focusing on hazardous materials in transportation is a distinctive and meaningful venture. They purposefully classify those hazardous materials transported through quantified areas (local populations, metropolitan areas, counties, or a state). The study follows a systematic data identification and validation process to pinpoint and measure the unique hazmat transportation hazards that may be present in a community (Bierling, 2016, p. 10). The Bureau of Transportation Statistics defines a commodity as goods that an institution manufactures, trades, or dispenses; exempted items include any waste or byproduct of the institution's process (U.S. Department of Transportation, 2017). Principally by laws and regulations, hazardous materials are well defined and controlled, within the United States (U.S.) by the U.S. Environmental Protection Agency (EPA), the U.S. Occupational Safety and Health Administration (OSHA), the U.S. Department of Transportation (DOT), and the U.S. Nuclear Regulatory Commission (NRC). Each agency's definition is distinctive of their primary mission. OSHA's meaning is any material or chemical which poses health or physical hazard. The EPA integrates the OSHA characterization, including items or chemicals, which can dangerously expose people, plants, or animals when unconstrained into the environment. The DOT classifies a hazardous material, when transported in commerce, as presenting a potential risk to public safety or to the environment, including all types of radiological materials, which is regulated by the NRC (What are Hazardous Materials, 2018). To determine if a chemical is hazardous, OSHA's appraises the full array of obtainable scientific data to label a chemical hazardous. The overall classification process is intricate and evaluates if a chemical is inherently hazardous. (Occupational Safety and Health Administration, 2016, p. 3) OSHA's Hazard Classification System (HCS) defines health and physical hazards as chemicals that can harm human health through a variety of routes. Persons can be exposed to hazards by inhaling vapors, mists, or dusts from the chemical; by ingesting the chemical; or by getting it on their skin. Symptoms from exposure can be acute or chronic. The hazards include those that affect eyes, skin, reproduction, and specific target organs. In addition, some chemicals can be toxic, corrosive, or carcinogenic. Concurrently, physical hazards often cause harm to workers by exposing them to fire or explosions. (Occupational Safety and Health Administration, 2016, p. 32).

Section 1.02 Regional Summary

Pickens County is located in the northwest part of South Carolina and has seven cities including multiple unincorporated communities; Pickens County is considered a rural area, with higher population in the cities and towns. The populace density is 240 people per land square mile. There are approximately 496 square miles of land and approximately 15 square miles of water within the county boundary. Once a large textile manufacturing area, the area has seen over 4,000 new jobs created by involved new types of commerce. The Pickens County Commerce Park has been the main provider for economic growth in the area including the local educational institutions and tourism industry. In 2010, the county was selected for inclusion in the Greenville-Mauldin-Easley Metropolitan Statistical Area, (Greenville, Pickens, and Laurens Counties) which has had a 13.8 percent increase in population from 2000-2010. Also included in the Greenville-Spartanburg-Anderson Statistical Area, which is comprised of eight (8) upstate counties, had a combined population of 1,266,995 in 2010. (Comprehensive Plan 2010-2030, May) Figure 2 shows the 2010 population (U.S. Census Bureau) with the five year (2012-2016) estimated population forecast. In 2016, Pickens County’s total population was estimated at approximately 122,722, indicating a 1.26% change from the 2010 U.S. Census data. The current population (July 1, 2017) is estimated at approximately 123,479, indicating a 3.57% increase from the 2010 population.

Figure 2: Pickens County Population U.S. Census (Bureau, U.S. Census)

Municipalities	2010	2012	2013	2014	2015	2016
City of Clemson	13,905	13,904	14,070	14,254	14,664	15,008
City of Easley	19,993	20,046	20,146	20,242	20,374	20,464
City of Liberty	3,269	3,266	3,272	3,262	3,254	3,254
City of Pickens	3,126	3,134	3,149	3,137	3,148	3,166
Town of Central	5,159	5,082	5,167	5,170	5,160	5,187
Town of Norris	813	705	748	803	818	839
Town of Six Mile	675	895	867	928	918	814
Unincorporated Area	70,274	70,123	70,051	69,767	69,773	69,974
Pickens County Total	119,224	119,167	119,483	119,577	120,124	120,722

Figure 3 lists the industries with highest compensation rates in Pickens County. The top five (5) industries include:

1. Non-Farm Compensation [forestry, fishing, hunting, and logging]
2. Government [military, state & federal]
3. Manufacturing [machinery, computer, and transportation]
4. Retail [food, automotive, general merchandise]
5. Health Care [ambulatory services, medical, and social services]

Figure 3: Employee / Industry Compensation in Pickens County (Analysis, Bureau of Economic)

Industry	2015	2016
Non-Farm Compensation	\$ 1,929,987	\$ 1,848,242.00
Government	\$ 742,556	\$ 708,778.00
Manufacturing	\$ 369,358	\$ 351,660.00
Retail	\$ 164,783	\$ 161,736.00
Health Care	\$ 162,790	\$ 154,795.00
Food Services / Accommodations	\$ 104,007	\$ 98,987.00
Construction	\$ 66,986	\$ 61,575.00
Other Services	\$ 64,373	\$ 63,461.00
Finance /Insurance	\$ 45,243	\$ 44,390.00
Professional Services	\$ 40,765	\$ 43,236.00

Figure 4 shows the 78 industries operating in Pickens County. The top three (3) industries (by total number of employees] are (1) Metal Products, (2) Aerospace and (3) Textiles.

Figure 4: Industries Operating in Pickens County (South Carolina Department of Commerce, 2018)

Industry	# of Businesses	Total # of Employees
Aerospace	7	1,710
Alternative Energy	2	50
Automotive	3	110
Chemicals	5	420
Composites & Advanced Materials	1	500
Construction	1	0
Consulting Services	1	0
Electronics/Computers	4	310
Food Processing	3	250
Information Technology	1	50
Machinery	6	960
Medical/Pharmaceutical/Biotech	1	500
Metal Products	19	1,990
Non-Metallic Minerals	4	250
Plastics and Rubber	5	350
Textiles	9	1,510
Wood & Paper	6	350
Grand Total	78	9,310

Section 1.03 Commodity Study Components

The three (3) components of the HMCFS were traffic and placard surveys, examination of reported transportation incidents involving hazardous materials and an analysis of railroad commodity flow information. Collecting data and developing the Pickens County HMCFS Report began on March 7, 2018 and concluded on April 30, 2018. Descriptions of each process are listed below.

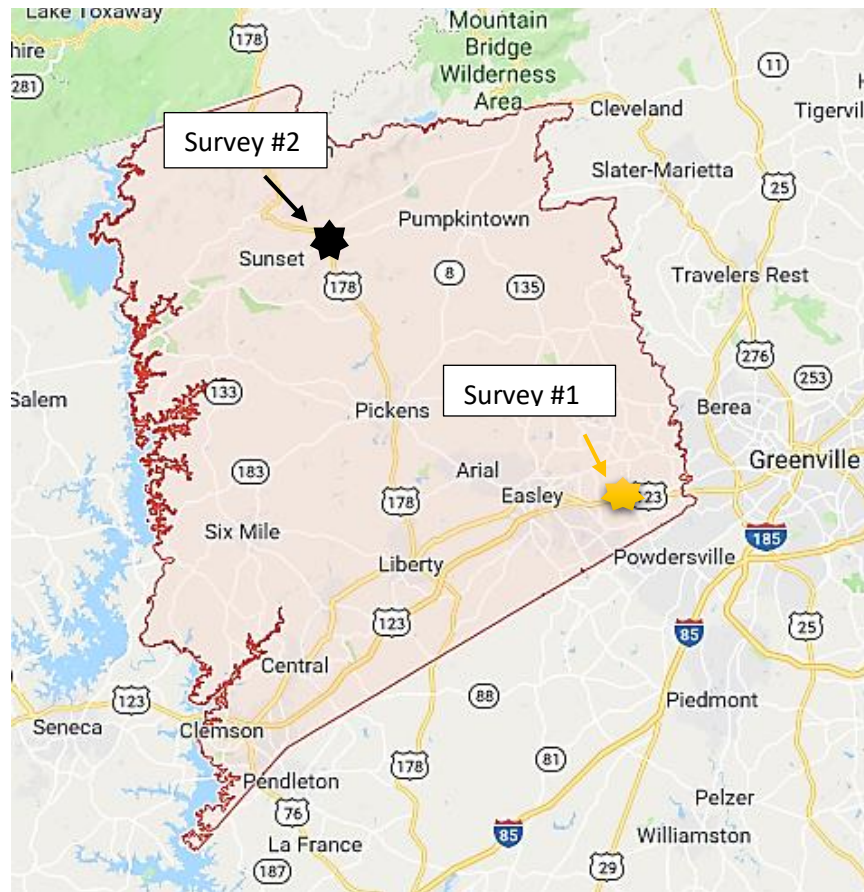
(a) Traffic and Placard Survey

Twenty (20) traffic and HAZMAT placard surveys were conducted at two (2) locations in Pickens County, SC during the month of April 2018, see Appendix B. Both traffic and placard surveys locations are shown in Figure 5. EnviroSafe employees conducted traffic and placard surveys observations. Each employee utilized a Highway Commodities Flow Study Data Collection Guidelines Notebook, which outlined data collection procedures, a placard identification chart, cargo body type chart, vehicle configuration chart and training on the survey process. Additionally, each received a U.S. DOT 2016 Emergency Response Guidebook (ERG). Each Surveyors recorded their observations on a Highway Commodities Flow Study Data Collection Form, documenting the location and direction, date, time, truck type/configuration, UN/NA#'s placard ID# and any notable observations. Surveyors recorded their observation in thirty-minute intervals for a total of eight (8) hours per shift.

Survey # 1 was conducted at U.S. Highway 123 at South Carolina Highway 153. U.S. Highway 123 runs north and south and is a part of the U.S. Highway System. The highway runs approximately seventy-five (75) miles in Georgia and South Carolina. The highway runs through or near the City of Clemson, Town of Central and the City of Easley in Pickens County. South Carolina Highway 153 is a state highway that runs approximately seven (7) miles between Interstate 85 and U.S. Highway 123. It is a commercial route that travels southeast to northwest. It terminates at U.S. Highway 123 in Pickens County. There were a total of ten survey shifts (five day-times and five night-times) shifts for a total of 80 hours.

Survey #2 was conducted at South Carolina Highway 11 at U.S. Highway 178. South Carolina Highway 11 is a state highway that runs for approximately one hundred nineteen (119) miles in the northern region of South Carolina. It is also known as the Cherokee Foothills Scenic Highway. U.S. Highway 178 runs from Ridgeville, SC to Rosman, NC for approximately two hundred forty (240) miles. The highway runs through or near the Rocky Bottom community, City of Pickens and the City of Liberty in Pickens County. There were a total of ten survey shifts (five day-times and five night-times) shifts for a total of 80 hours.

Figure 5: Pickens County Traffic and Placard Survey Sites



(b) Hazardous Materials Transportation Incidents

One of the core objectives of this study is to offer an understanding of the hazardous materials that are transported in and through Pickens County, SC. No review or analysis of local Hazmat responses was prepared for this report. Transportation incidents (highway and railway) that involved hazardous materials, were researched from the U. S. DOT, Pipeline and Hazardous Materials Safety Administration (PHMSA) website. The statistical information included transportation incidents by type, year, geographical location and other incident dynamics. Reporting regulations can create variables with the information provided. For example, U.S. DOT requires any persons in custody of hazardous materials or any hazardous waste in transportation to report any accidental release to the U. S. DOT within 30 days. When the carrier takes ownership of the hazardous materials, the carrier is responsible or owns the hazardous material until it arrives at its terminus. Subsequently, any release, while the carrier is in possession, is deemed an incident and is required to submit a report. Exception to this requirement is when an incident happens when the shipper is loading bulk packaging (cargo tank, rail car, containerized

material) onto the motor vehicle before the cargo leaves for its destination. (Gorsky, 2005) There was no review or analysis of local hazardous materials responses prepared for this report.

(c) Railroad Commodity Flow

In April, the Pickens County Emergency Management (PCEM) Director formally requested a Hazardous Materials Railroad Shipment Reports from the Norfolk Southern Corporation (NSC) and the CSX Corporation. NSC responded to the request and provided the report on April 12, 2018. The NSC report summarizes all loaded shipments of hazardous materials commodities recorded at the NSC Location #496 in Easley, South Carolina from March 1, 2017 to February 28, 2018. As a Class I railway organization, the Norfolk Southern system operates in the eastern United States (U.S.). The current rail system, once owned by Norfolk & Western and Southern Railway, controls 679 route miles in South Carolina. This equates to 30% of the rail system in South Carolina. Transported commodities include chemicals, coal, lumber, paper products and associated equipment and products. (OpenStreetMap Wiki Contributors, 2017)

As stated by the Pickens County Emergency Management Director and a CSX Corporation representative, the CSX Corporation doesn't have railway access in Oconee County. Any commodities originated and transported by the CSX Corporation, through Oconee County, must be transferred (temporarily) to the railway authority having jurisdiction (AHJ). Therefore, all loaded hazardous materials shipments contained in the NSC Report will be representative of the CSX Corporation.

Section 1.04 Hazmat Commodities Flow Study Report Structure

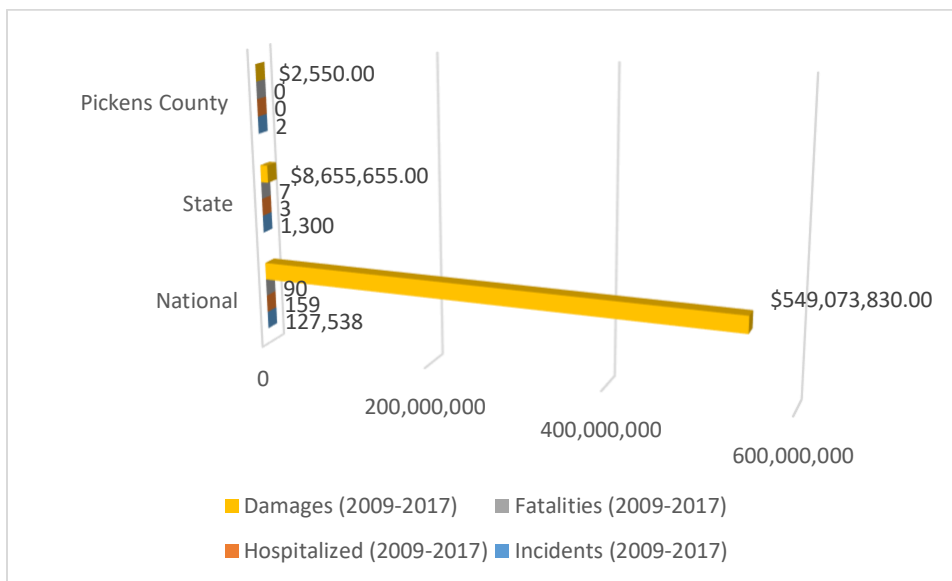
The purpose and background of the HMCFS is summarized in Article I. It describes the study area, methodology and components. Article II provides a comparative analysis of hazardous materials transportation incidents. Article III railroad commodity flow analysis, traffic and placard survey results are in Article IV and V. Article VI lists the results and recommendations. Appendices include DOT Classification and Packing Guide, Pickens County Survey Schedule, Vehicle Body Type and Configuration a list of all DOT Placarded observed.

Article II. Hazardous Materials Transportation Incidents

Section 2.01 Highway Incidents

Statistical data on Federal Motor Carrier Safety Administration (FMCSA) highway transportation incidents was obtained from the PHMSA website. Figure 6 shows that nationwide there were 127,538 incidents, 159 hospitalizations, and 90 fatalities resulting in \$548,073,830 in damages (this includes clean-up / abatement cost). The State of South Carolina reported 1,300 highway incidents, 3 hospitalizations, and 7 fatalities resulting in \$8,655,655 in damages. Pickens County is described in Section 2.03.

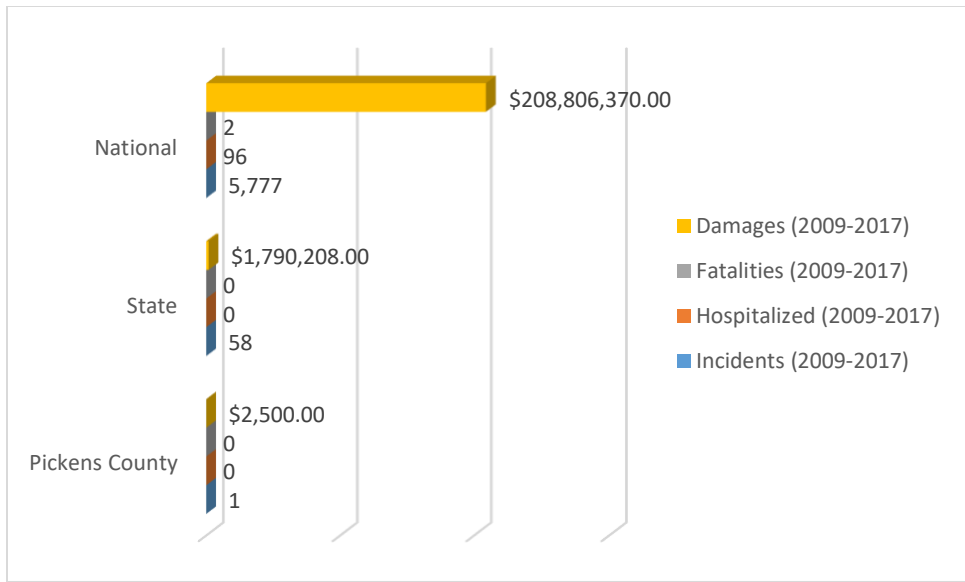
Figure 6: Highway Transportation Incidents 2009-2017 (U.S. Department of Transportation, 2017)



Section 2.02 Railway Incidents

Shown in Figure 7, is the statistical data on Federal Railroad Administration (FRA) railway incidents obtained from the PHMSA website. Nationally, there were 5,777 incidents reported, resulting in 96 hospitalizations and 2 fatalities. Clean up and abatement cost was \$208,806,370. In South Carolina, there were 58 railway incidents, with no hospitalizations or fatalities resulting in \$1,790,208 in damages. Pickens County is described in Section 2.03.

Figure 7: Railway Incident Damages (2009-2017) (U.S. Department of Transportation, 2017)



Section 2.03 Pickens County Incidents

There were two (2) FMCSA designated incidents involving flammable liquids materials. 15 gallons of Paint (UN1263) was spilled due to a load shift in a Box Tractor Trailer, and 5 gallons of Methyl methacrylate monomer, stabilized (UN1247) spilled from a Cargo Tanker as a result of incorrect off-loading procedure. There were no hospitalizations or fatalities with a total cleanup cost of \$2,550.

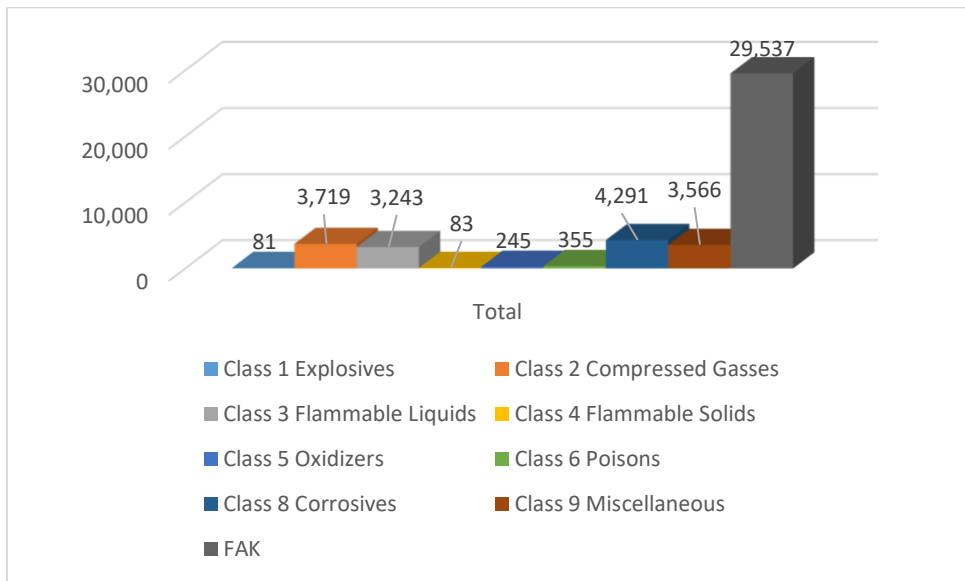
There was one FRA designated incident involving the Norfolk Southern Corporation (NSC). A multi-car derailment occurred in Liberty, SC. Three (3) tank cars, transporting Hazardous waste liquid (UN3082), spilled 19,000 gallons. Two (2) tank cars, transporting Isopropanol (UN1219), spilled 18,000 gallons. The derailment caused a mandatory evacuation of 536 residences that lasted approximately 18 hours. The NSC handled all cleanup operations for a total cost of \$2,500.

Article III. Railroad Commodity Analysis

The Norfolk Southern Corporation (NSC) provided a copyrighted report (March 1, 2017 to February 28, 2018) listing all loaded shipments classified as hazardous materials. Report data was recorded at NSC Location #496 in Easley, SC. Data interpretation was conducted to measure the proportion of the commodities transported.

Figure 8 shows a total of 45,120 loaded hazardous materials cargo shipments arranged by the assigned DOT Hazardous Classification (See Appendix A). The report identifies 29,537 shipments as FAK. FAK is an acronym for “Freight All Kinds” and is defined as a combined shipment of various commodities at one freight rate (WebFinance Inc., 2018). In the NSC Report, FAK is not linked to any proper shipping name or given a DOT Class designation. Although FAK shipments may possibly include hazardous materials, those materials do not qualify, because of their specific chemical type, quantity and/or weight requirements and will preclude DOT regulations. Consequently these shipments are excused from DOT placarding or identification requirements.

Figure 8: NSC Report-Total Shipments by DOT Hazmat Classification (Norfolk Southern Corporation, 2018)



Excluding the FAK shipments, there were 15,583 shipments comprised of 403 materials classified as hazardous materials. Figure 9 shows an estimated weekly shipment by DOT Class. It should be noted that no Class 7 (Radioactive Material) were transported through Pickens County by the NSC.

Figure 9: NSC Report Estimated Weekly Shipment by DOT Class (Norfolk Southern Corporation, 2018)

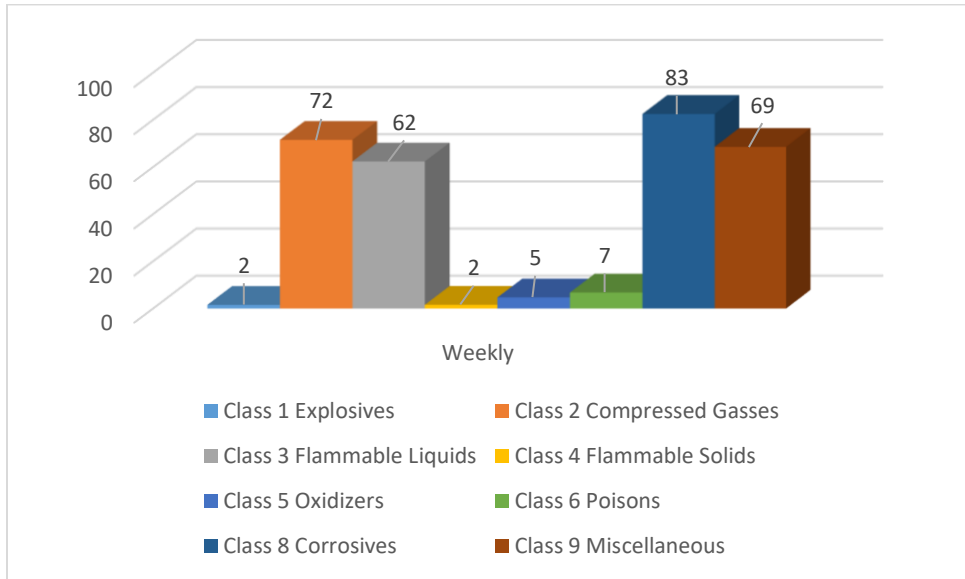


Figure 10 shows the 403 hazardous materials proportionally by the DOT Class. Class 3 has the most materials designated at 125, followed by Class 8 (95), Class 2 (61), Class 9 (59), Class 6 (23), Class 5 (20), Class 4 (16), and Class 1 (4).

Figure 10: NSC Report-Hazardous Materials by DOT Class (Norfolk Southern Corporation, 2018)

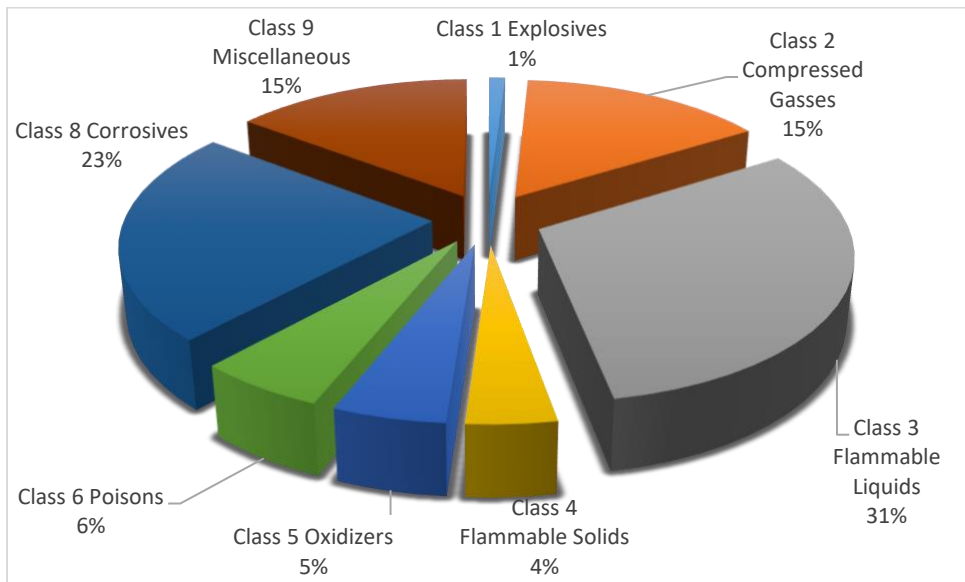
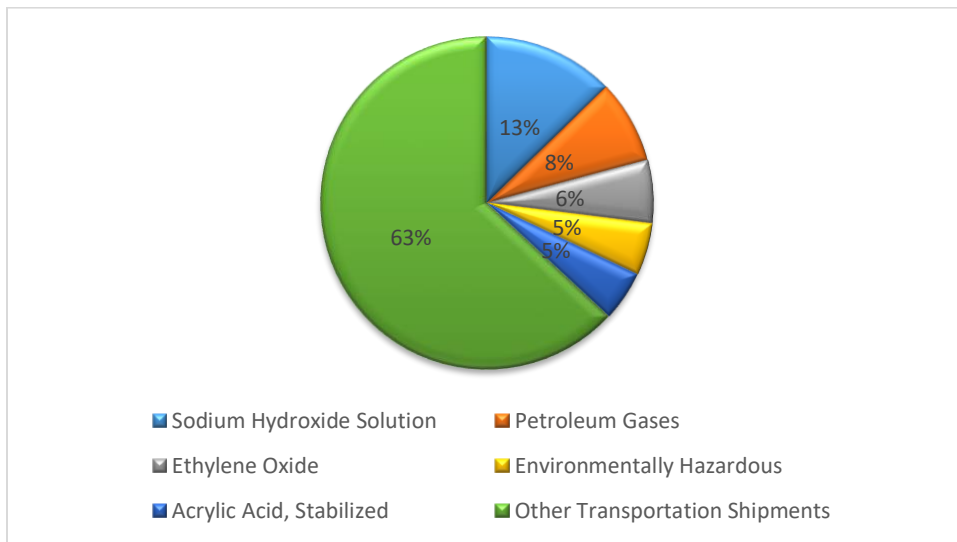


Figure 11 shows proportionally, the top five hazardous materials, selected by their assigned 4-Digit United Nations (UN) or North American (NA) number and cumulative shipment totals. Sodium Hydroxide Solution (UN1824) is the most frequently transported at 1,987 shipments, followed by Petroleum Gases (UN1075) at 1,261, Ethylene oxide (UN1040) at 956, Environmentally Hazardous materials (UN3082/NA3082) at 787, Acrylic acid, stabilized (UN2218) at 760. The remaining 4,081 shipments are identified as “Other”. FAK shipments were not included.

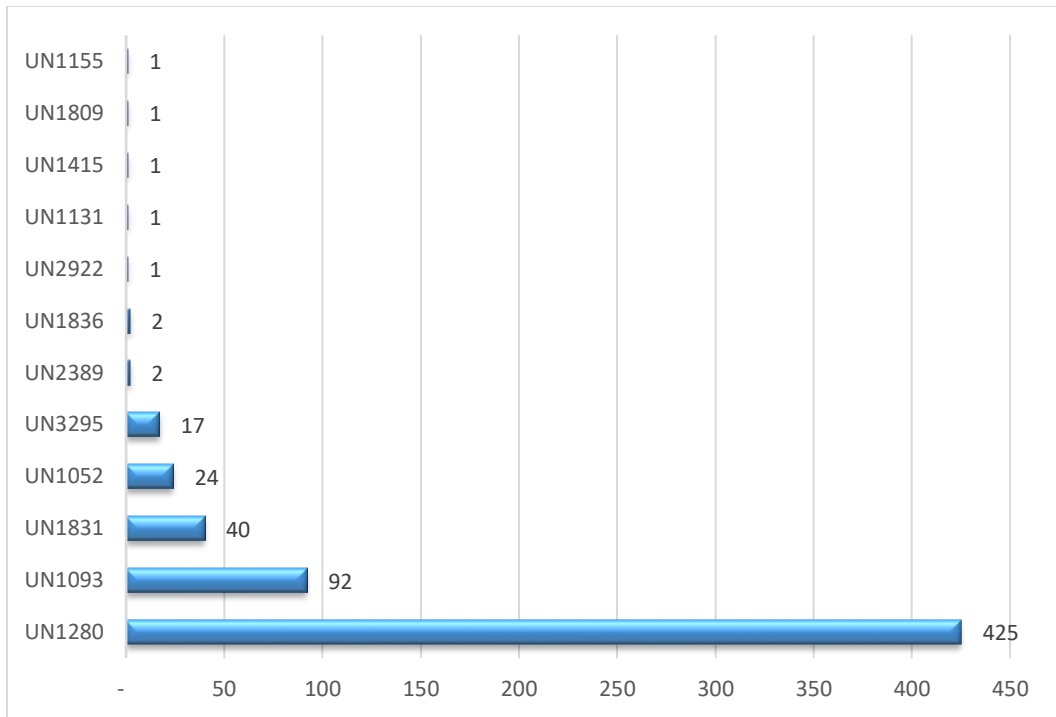
Figure 11: NSC Report-Top Five Transported Hazardous Materials (Norfolk Southern Corporation, 2018)



Required for certain hazardous materials in transportation, DOT requires a Packing Group (PG) to indicate the amount of danger a particular material is capable of generating uncontrolled. (See Appendix A) Figure 12 shows all PG I (Great Danger) materials, including the total shipments. The majority of the chemical/products listed have a low frequency of movement through Pickens County, however, the following PG I materials have a moderate frequency of movement.

- Propylene oxide (UN1280)
- Acrylonitrile Stabilized (UN1093)
- Sulfuric Acid, Fuming (UN1831)
- Hydrogen Fluoride (UN1052)
- Hydrocarbons, Liquids (UN3295)

Figure 12: NSC Report Top Packaging Group I Chemical/Products (Norfolk Southern Corporation, 2018)



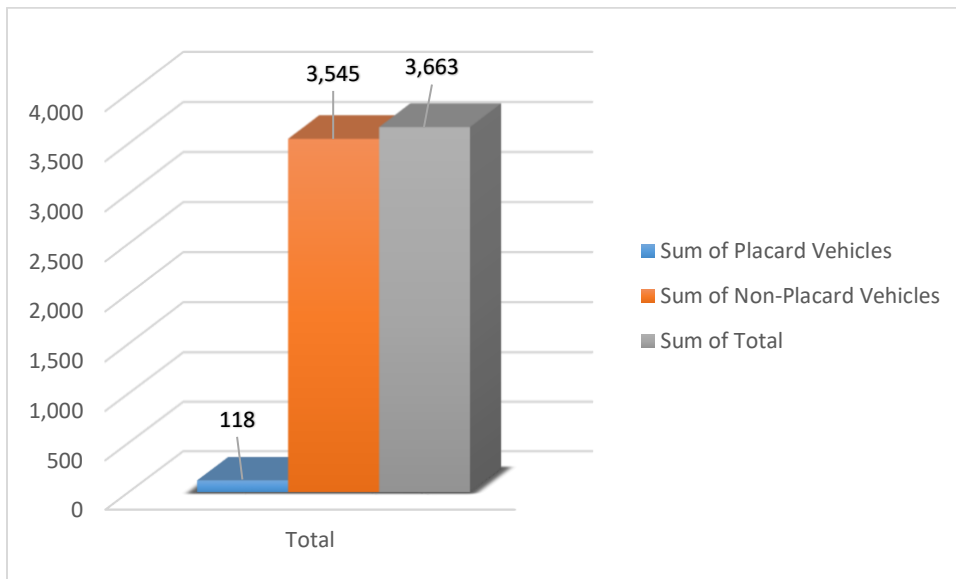
Article IV. Results of Traffic and Placard Survey #1

A traffic and DOT Placard survey was conducted at the intersection of U.S. Highway 123 at South Carolina Highway 153 in April 2018 see Appendix B. Observations and data collection included all vehicles displaying DOT Placards, 4-digit United Nations (UN) number and vehicle type & configuration. There were a total of ten survey shifts for a total of 80 hours.

Section 4.01 Combined Survey Results

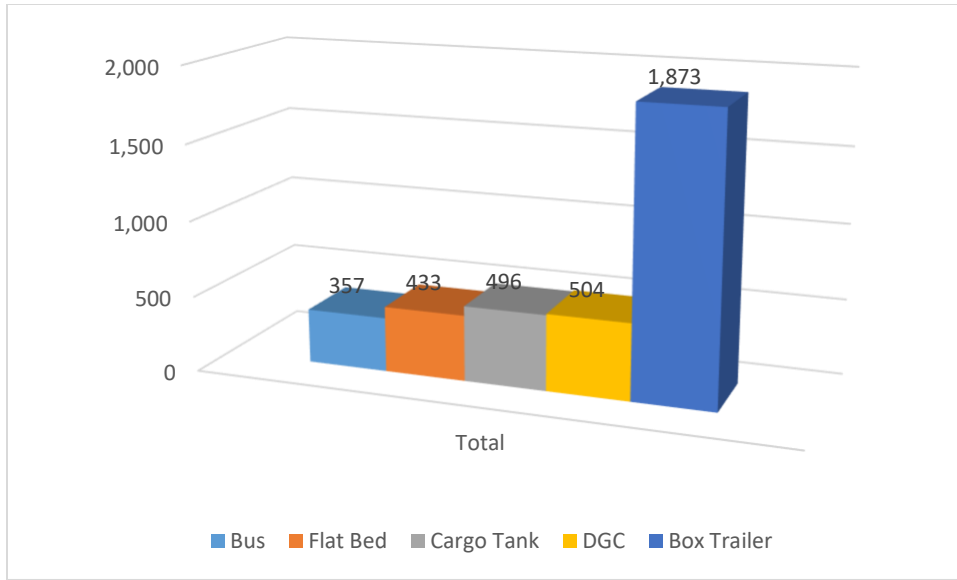
Figure 13 shows a total of 3,663 vehicles were observed during the survey period, 118 vehicles were displaying DOT Placards/4-Digit UN number, 3,545 were not (non-placard).

Figure 13: Total of All Vehicles Observed (Survey 1)



Vehicle type and configuration data (Figure 14) shows Box Trailer type vehicles were predominate at 51%, followed by DGC and Cargo Tank at 14%, Flat Bed at 12% and Buses at 10%, see Appendix C for vehicle descriptions.

Figure 14: Total of All Vehicle Type and Configurations (Survey 1)



Section 4.02 Average Vehicle Movement by Day of the Week

Figure 15 shows the average movement for all vehicles observed during the survey period. The highest average movement occurred on Thursday (28.4%), trailed by Tuesday (27.9%), then Friday (21%). The lowest average movement occurred on Wednesday (15%) followed by Saturday (4.6%) and Sunday (2.9%).

Figure 15: Average Vehicle Movement of All Vehicles by Day of the Week (Survey 1)

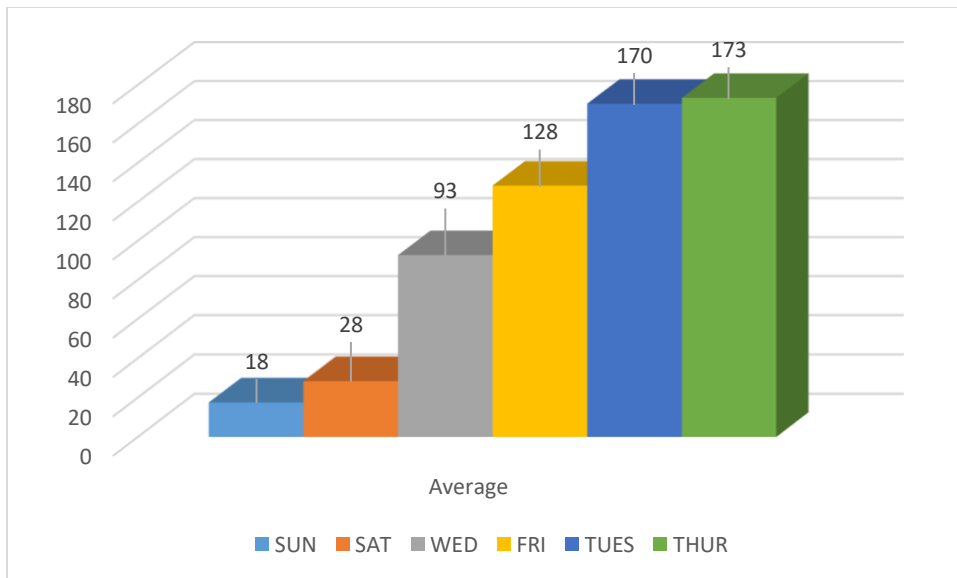
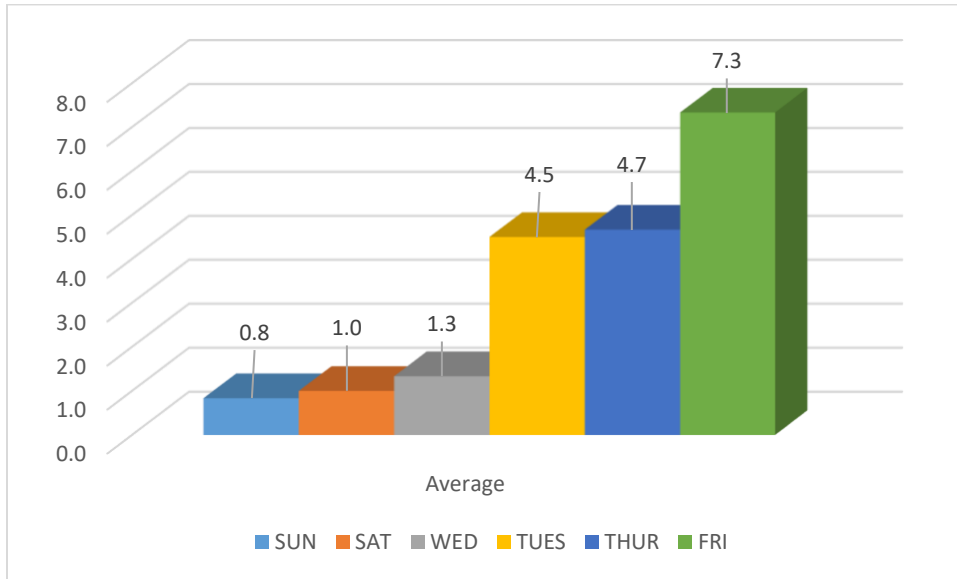


Figure 16 shows the average movement of vehicles displaying placards peaked on Friday at 37%, followed by Thursday (24%), Tuesday (23%). The movement declined on Wednesday (7%), followed by Saturday (5%) with Sunday showing the lowest rate at 4%.

Figure 16: Total of Placarded Vehicles by Day- (Survey 1)



Section 4.03 Vehicle Movement by Shift (Day or Night) / Hour

Observing all vehicle movement during the survey (Figure 17), overall the daytime shift was the most active at 69%, while movement during the nighttime shift was at 31%, see Appendix C.

Figure 17: All Vehicle Movement by Shift (Survey 1)

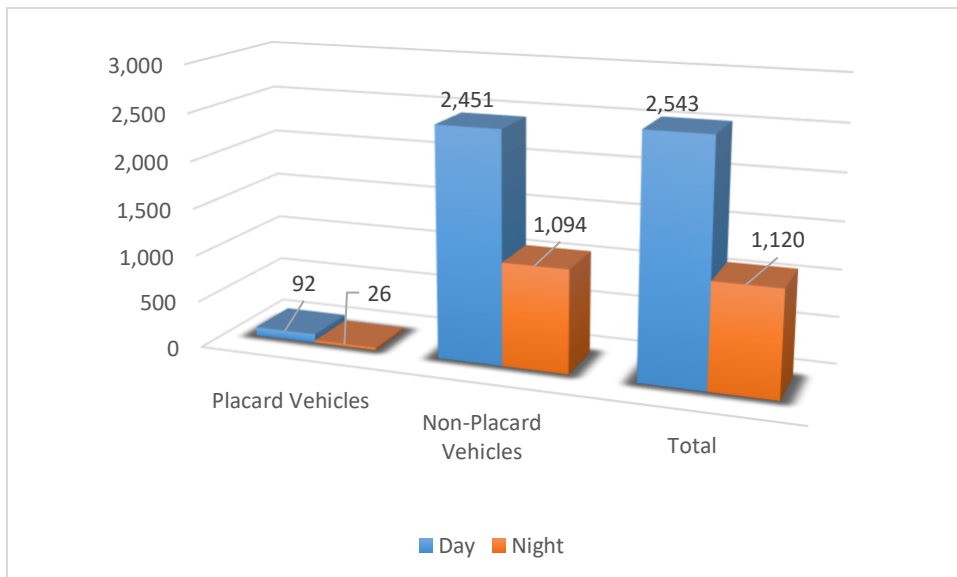


Figure 18 shows the hourly movement of vehicles displaying placards during the “Day Shift”. The hourly placard count peaked mid-morning between 9:00 AM and 12:00 PM at 48%. The second highest level occurred in the afternoon between 12:00 PM and 3:00 PM at 32%, followed by the early morning, 7:00 AM to 9:00 AM at 16%. Movement during the late afternoon, 3:00 PM to 5:00 PM declined sharply at 4%.

Figure 18: Highest Movement by Hour, Day Shift (Survey 1)

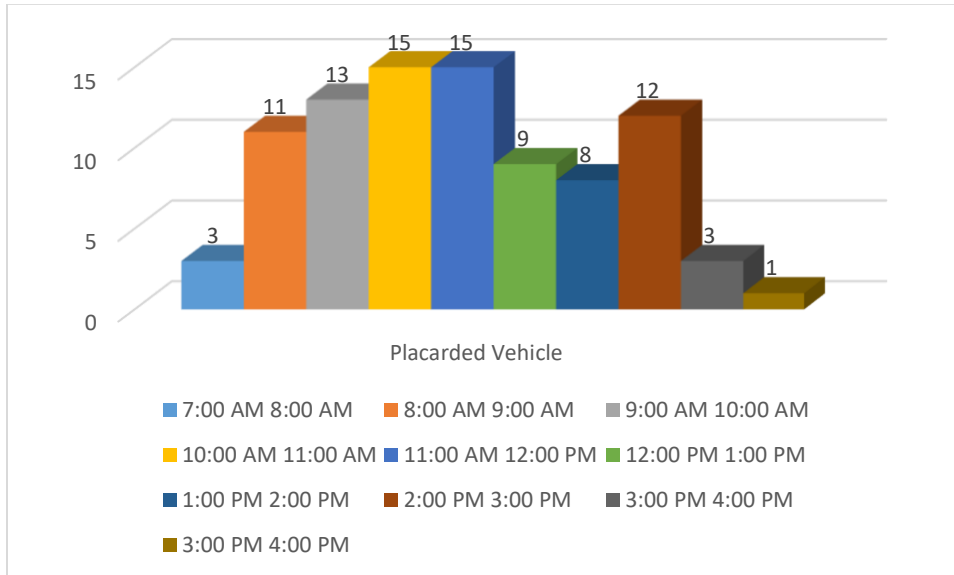
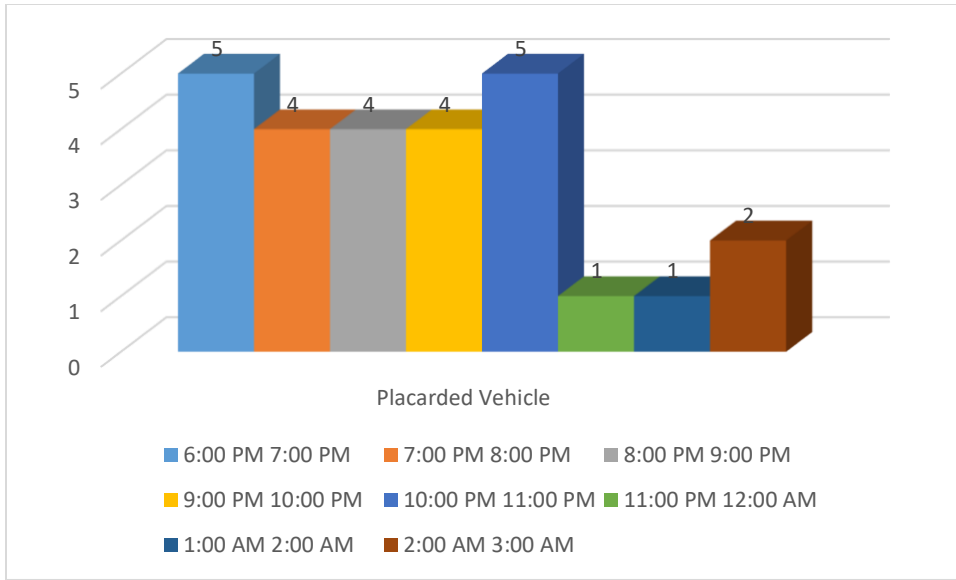


Figure 19 shows the hourly movement of vehicles displaying placards during the “Night Shift”. The peak time occurred during 9:00 PM and 12 AM mid-night at 38%, followed by 7:00 PM to 9:00 PM at 31%, then 5:00 PM to 7:00 PM. The lowest movement occurred after midnight at 12%.

Figure 19: Highest Movement by Hour, Night Shift (Survey 1)



Section 4.04 Hazardous Materials Configuration and Frequency

There were 118 hazardous materials observed. Arranged by the DOT Classification (see Appendix A), Figure 20 shows that Class 3 materials were the most frequently observed at 53%, followed by Class 2 at 36%. Of the 118 hazardous materials 23 were identified by the 4-digit UN number.

Figure 20: Hazardous Materials by DOT Class (Survey 1)

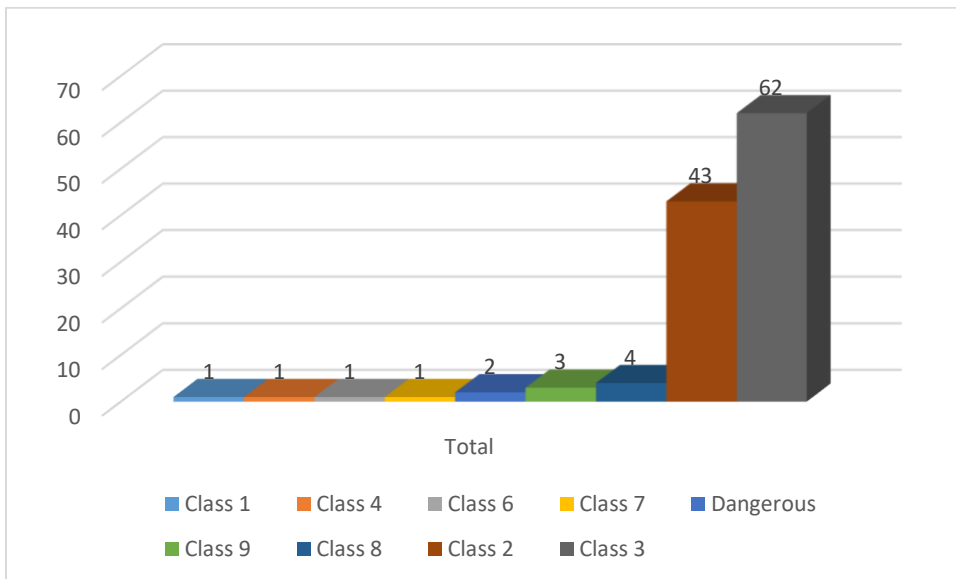


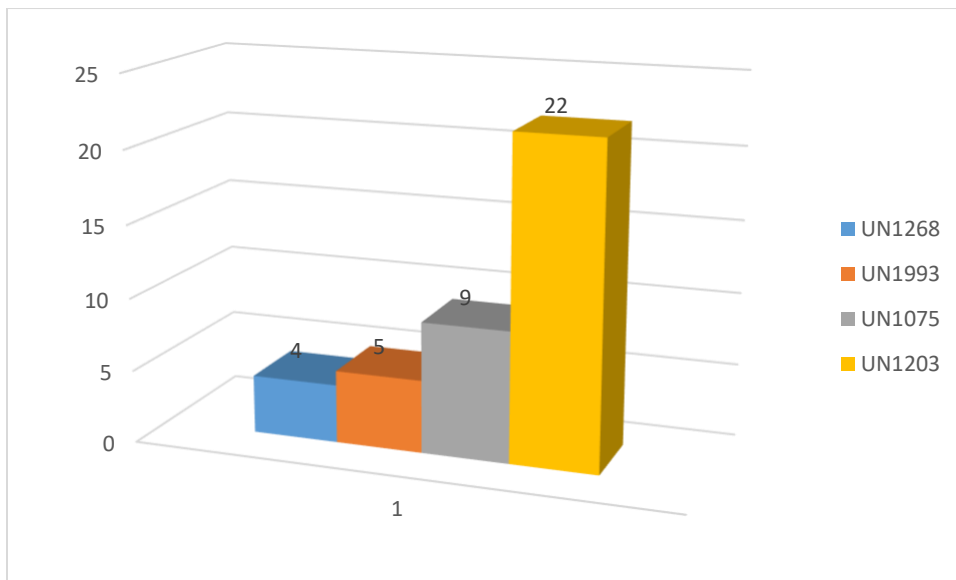
Figure 21 shows UN1203 (Gasoline) was the most common at 32%; other materials observed were UN1075 (Liquefied Petroleum Gas) at 13%, UN1993 (Diesel, Fuel Oil) at 7%, and UN1268 (Petroleum distillates, n.o.s.) at 6%.

The frequencies of the following hazardous materials were low, but have distinctive hazardous potential that necessitates citing herein:

- UN3507 (Uranium hexafluoride) is radioactive and corrosive, primarily dangerous to health and is water sensitive.
- UN3287 (Poisonous, inorganic) is dangerous to health.
- UN2189 (Dichlorosilane) is poisonous, flammable gas as well as corrosive.
- UN3532 (Chlorine, adsorbed) is poisonous, an oxidizer and corrosive.

See Appendix D for a list of all UN and DOT Placards observed during the survey.

Figure 21: Hazardous Materials by 4-Digit UN # (Survey 1)



Article V. Results of Traffic and Placard Survey #2

Traffic and hazardous materials survey was conducted at the intersection of South Carolina Highway 11 at U.S. Highway 178. Survey data collection comprised of all vehicles displaying DOT hazardous materials placards, 4-digit United Nations (UN) number and vehicle type & configuration. There were a total of ten survey shifts for a total of 80 hours.

Section 5.01 Combined Survey Results

Figure 22 shows there were a total of 30 vehicles displaying DOT Placards, 735 non-placarded vehicles for an aggregate of 765 vehicles observed.

Figure 22: All Vehicles Observed (Survey 2)

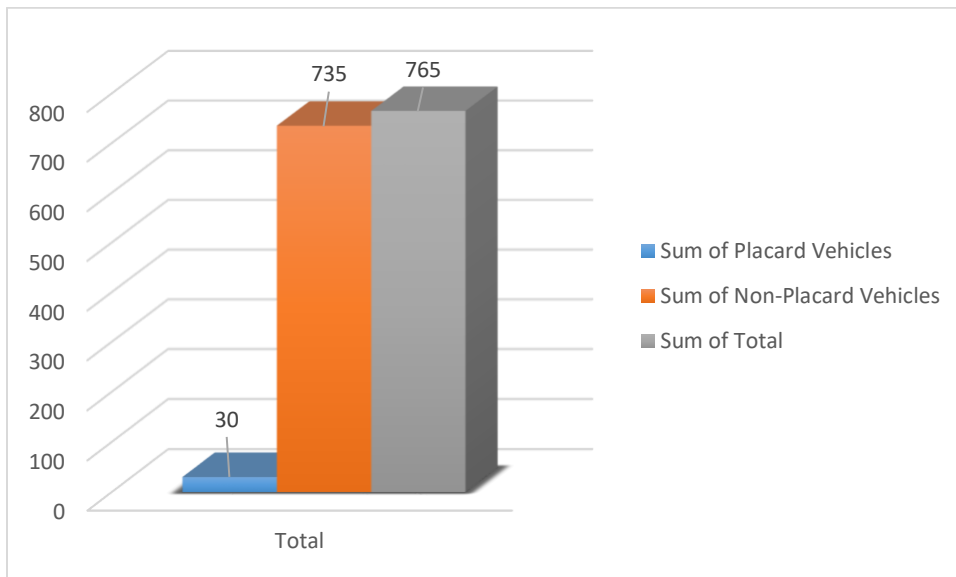
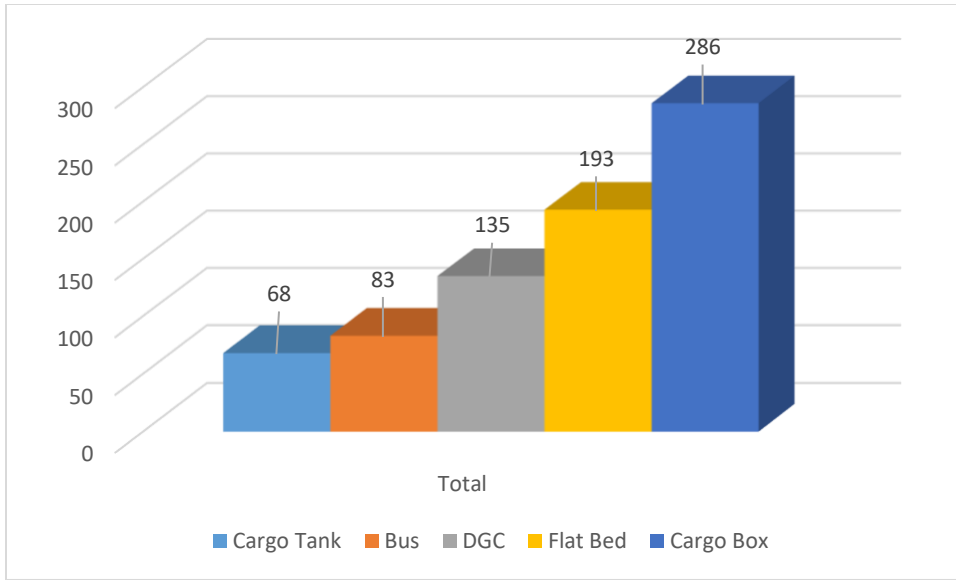


Figure 23 shows the total vehicle type and configuration. There were 286 Cargo Box, 193 Flat Bed, 135 DGC, 83 Bus and 68 Cargo Tank, see Appendix C.

Figure 23: All Vehicles Type and Configurations (Survey 2)



Section 5.02 Average Vehicle Movement by Day of the Week

Figure 24 shows that the highest average movement peaked on Tuesday (27%), followed by Friday (24%), Wednesday (21%) and Monday (19%). The lowest amount of movement was recorded on Sunday (6%), with Thursday having the smallest amount (4%).

Figure 24: Average Movement of All Vehicles by Day of the Week (Survey 2)

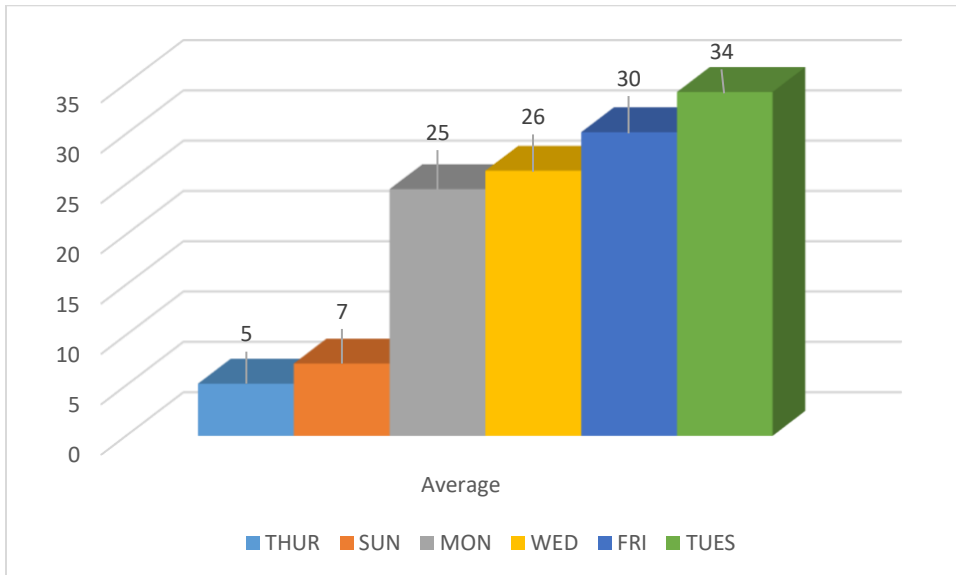
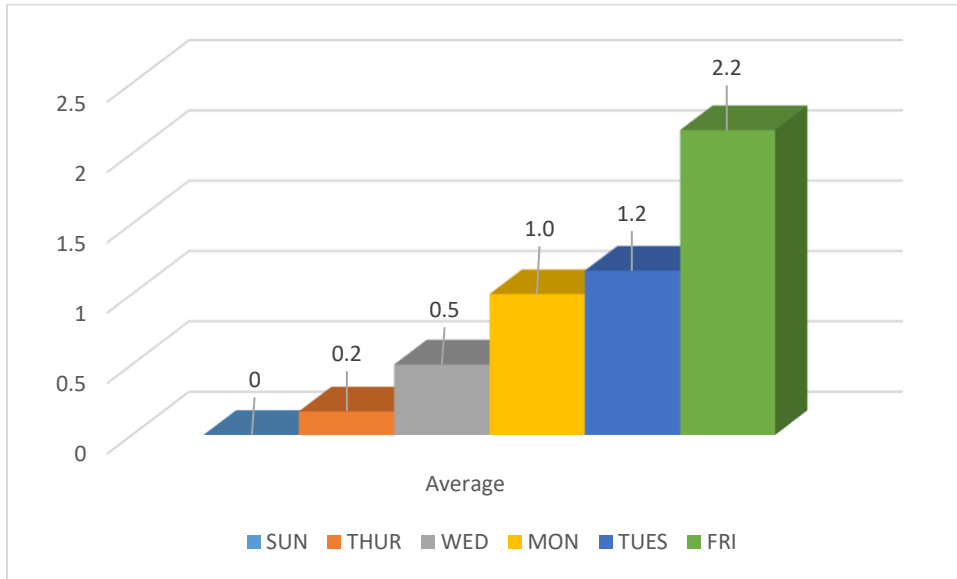


Figure 25 shows the average movement rate of all placarded vehicles. Friday was the highest at 43%, followed by Tuesday (23%), Monday (20%) and Wednesday (10%). The lowest average movement rate occurred on Thursday (3%). There were no placarded vehicles observed on Sunday.

Figure 25: Average Movement of All Placarded Vehicles by Day of the Week (Survey 2)



Section 5.03 Vehicle Movement by Shift / Hour

Figure 26 shows all vehicle movement was the highest during the day shift (83%) versus the night shifts (17%).

Figure 26: All Vehicle Movement by Shift (Survey 2)

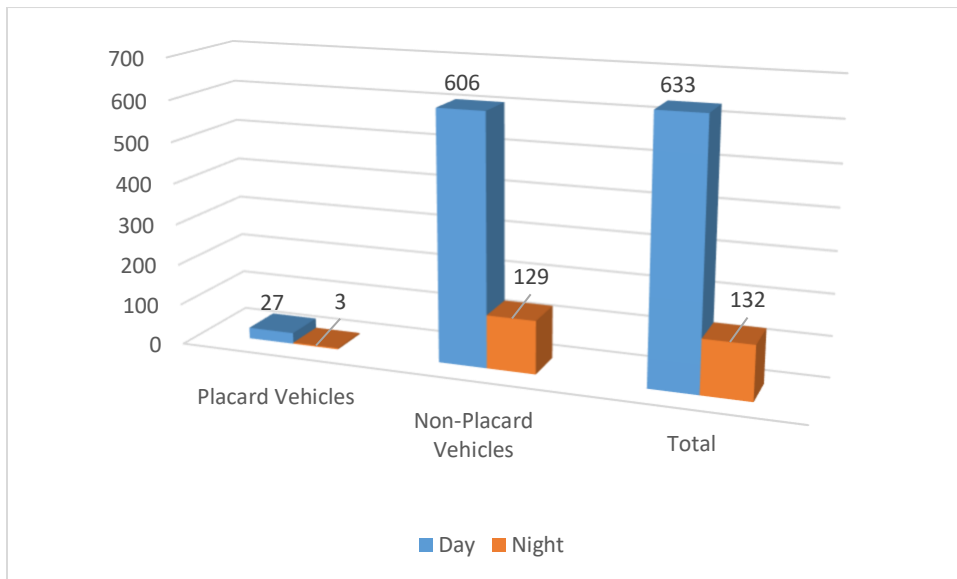


Figure 27 shows the hourly movement of vehicles displaying placards during the “Day Shift”. The hourly placard count peaked mid-morning at 44% (9:00 AM and 12:00 PM), followed by the afternoon period at 41% (12:00 PM and 3:00 PM). Movement during the early morning (7:00 AM to 9:00 AM) was the lowest at 15%.

Figure 27: Highest Movement by Hour, Day Shift (Survey 2)

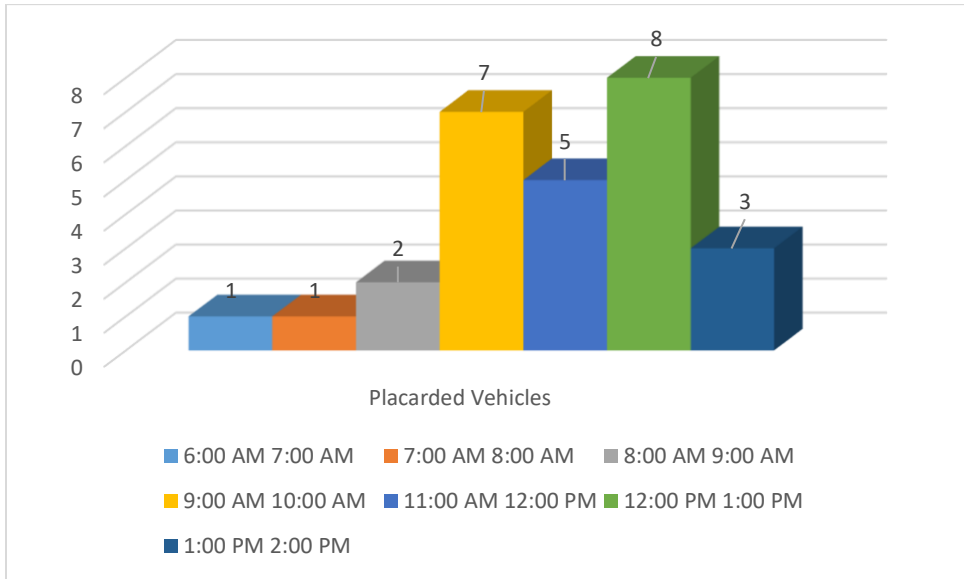
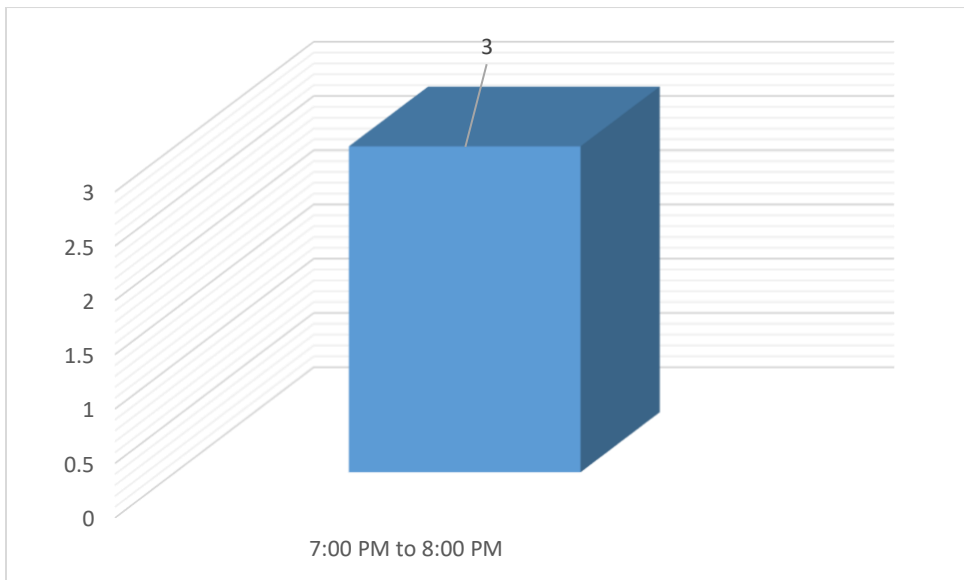


Figure 28 shows the hourly movement of vehicles displaying placards during the “Night Shift”. The movement was extremely low (7:00-8:00 PM)

Figure 28: Highest Movement by Hour, Night Shift (Survey 2)



Section 5.04 Configuration of Hazardous Materials Transported

There were a total of 27 DOT Placards / 4-Digit UN numbers observed. Organized by the DOT Classification, Figure 29 shows that DOT Class 2 materials (57%) were the highest commodity observed, followed by Class 3 (27%) and Class 9 (13%), with Class 8 (3%) being the least.

Figure 29: Hazardous Materials by DOT Class (Survey 2)

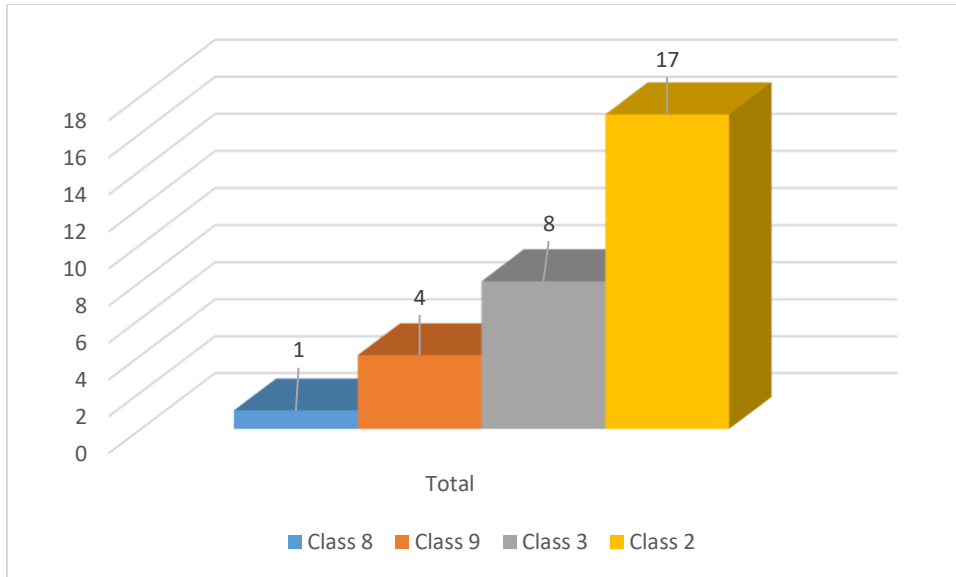
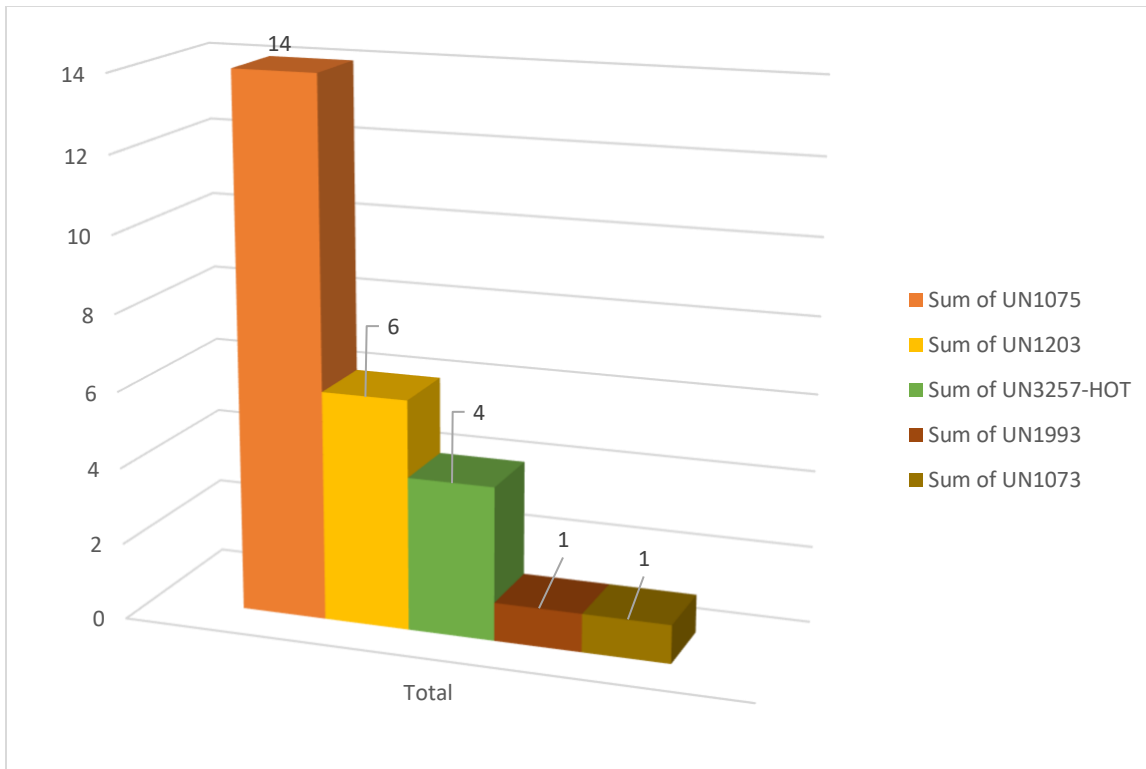


Figure 30 shows the five hazardous commodities, identified by the 4-Digit UN number. As shown, Liquefied Petroleum Gas (UN1075) had the highest rate at 47%, others observed were Gasoline (UN1203) at 20%, followed by Oils/Polybutene (UN3257-HOT) at 13%, Diesel/Fuel Oil (UN1993) at 3%, Oxygen-refrigerated (UN1073) at 3%. See Appendix E for a list of all placards / 4-digit UN numbers observed.

Figure 30: Hazardous Materials by 4-Digit UN # (Survey 2)



Article VI. Results and Recommendations

Section 6.01 Preface

The results and recommendations presented are regulated by the commodities study report modules. Limited by the aforementioned constraints, the following endorsements do not reflect or feature any established Pickens County Emergency Management or Pickens County Emergency Services standard operating procedures, guidelines or policies. All recommendations are based on best practices related to the proven statistical evidence and calculations successively made.

Section 6.02 General

Emergency response readiness and effectiveness depends on knowledge, skills and the ability to effectively address the multifaceted issues created by a hazardous materials incidents. By understanding the movement and the frequency characteristics of hazardous commodities, the AHJ and community companion agencies, can initiate the planning process for evaluating emergency response readiness, understanding the potential threats to the transportation corridors and potential environmental consequences. This report can serve as the basis for formulating critical databases in support of these initiatives.

Section 6.03 Results and Recommendations

(a) Transportation Incidents

From January 2009 to December 2017 there were three (3) transportation incidents reported to the Federal Motor Carrier Safety Administration. Statistical information indicates the frequencies of transportation incidents in Pickens County are low, but the consequences are potentially elevated.

(i) Recommendation

Beneficial for hazardous materials mitigation preparedness (training and equipment), public safety concerns and potential complex coordination issues, it is recommended that the Pickens County Emergency Management and Pickens County Emergency Services should do the following:

- Collectively review the hazardous commodities statistics contain in this report,
- Superior consideration should be given to the hazardous materials transported by the railway system.

(b) Movement Rates of Hazardous Commodities

The movement of hazardous commodities was the highest during the weekdays versus the weekends. The highest hours of movement were between the hours of 9:00 AM and 12:30 PM.

(i) Recommendation

Beneficial for the identification of available emergency services manpower, including specialized assistance, and the development of contingency plans to provide dedicated and supplementary emergency services manpower, it is recommended that the Pickens County Emergency Management and Pickens County Emergency Services should do the following:

- Collectively review the movement of hazardous commodities identified in this report.
- To augment this report, the Pickens County Emergency management should consider an additional study to measure specific railway movement rates in Pickens County.

(c) Hazardous Commodities

Weekly, 67% of hazardous commodities were transported via the railway system, in comparison to the highway system at 33%. The most frequently transported hazardous commodities were Flammable / Combustible Liquids (Class 3), followed by Flammable Gases (Class 2), Poisonous / Toxic materials (Class 6) and Corrosive materials (Class 8). Railway FAK shipments are not included in this result.

(i) Recommendation

Utilizing the hazardous commodities statistical data, acknowledged in this report, having the greatest potential for toxicity, reactivity and volatility, the Pickens County Emergency Management and Pickens County Emergency Services should do the following:

- Develop a comprehensive risk assessment and emergency response plan.
- Obtain qualified hazardous materials level training for emergency response personnel.
- Conduct an assessment of available and required hazardous material mitigation and personal protection equipment.
- Develop a comprehensive county wide coordination plan focusing on the following:
 - Emergency shelters and reunification centers
 - Public warning systems and evacuations strategies
 - Interoperable communications
 - Potential impacts to infrastructure and environmental concerns
 - Continuous operation of critical systems

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Appendix A-DOT Classification and Packing Guide

Class 1 – Explosives

Class 2 – Gases, Non-Flammable Gas, Flammable Gas, Poison Gas (compressed gas or refrigerated liquid)

Class 3 – Flammable or Combustible Liquids

Class 4 – Flammable Solid, Spontaneously Combustible or Dangerous When Wet

Class 5 – Oxidizer, Organic Peroxide

Class 6- Poison

Class 7- Radioactive

Class 8 – Corrosive

Class 9- Miscellaneous

Packing Groups

- PG I: Great danger
- PG II: Medium danger
- PG III: Minor danger

Appendix B-Pickens County Survey Schedule

Pickens Survey 1		U.S. Highway 123 at South Carolina Highway 153			
Survey #	Date	Day	Shift	Start Time	End Time
1	4/3/2018	Tuesday	Day	5:00 AM	1:00 PM
2	4/17/2018	Tuesday	Night	5:00 PM	1:00 AM
3	4/8/2018	Sunday	Day	6:00 AM	2:00 PM
4	4/4/2018	Wednesday	Night	6:00 PM	2:00 AM
5	4/5/2018	Thursday	Day	7:00 AM	3:00 PM
6	4/12/2018	Thursday	Night	7:00 PM	3:00 AM
7	4/6/2018	Friday	Day	8:00 AM	4:00 PM
8	4/20/2018	Friday	Night	8:00 PM	4:00 AM
9	4/7/2018	Saturday	Day	9:00 AM	5:00 PM
10	4/11/2018	Wednesday	Night	5:00 PM	1:00 AM
Pickens Survey 2		South Carolina Highway 11 at U.S. Highway 178			
Survey #	Date	Day	Shift	Start Time	End Time
11	4/3/2018	Tuesday	Day	5:00 AM	1:00 PM
12	4/3/2018	Tuesday	Night	5:00 PM	1:00 AM
13	4/4/2018	Wednesday	Day	5:00 AM	1:00 PM
14	4/4/2018	Wednesday	Night	6:00 PM	2:00 AM
15	4/9/2018	Monday	Day	7:00 AM	3:00 PM
16	4/5/2018	Thursday	Night	7:00 PM	3:00 AM
17	4/6/2018	Friday	Day	8:00 AM	4:00 PM
18	4/6/2018	Friday	Night	8:00 PM	4:00 AM
19	4/8/2018	Sunday	Day	9:00 AM	5:00 PM
20	4/8/2018	Sunday	Night	5:00 PM	1:00 AM

Appendix C-Vehicle Body Type Descriptions

- **Cargo Tank (Tanker-Dry Bulk-Vacuum Tanker)**, designed to carry liquids, dry goods or gases in bulk. They may be insulated or non-insulated; pressurized or non-pressurized; and designed for single or multiple loads. **Examples:** Gasoline, Milk, Liquefied Petroleum Gas (LPG), Coal, Dry Chemicals, Sugar, Grains, Plastics, Sludge, Slurries or Mixtures.
- **Cargo Box (Step Van-Enclosed Box-Refrigerated-Auto Transporter)**, designed to carry various types of commodities or goods for commercial distribution, delivery services, and courier companies. **Examples:** food, furniture, parcels, chemicals, perishable goods, general freight, vehicles, boats.
- **Flat Bed (Intermodal Chassis-Pole-Log)**, designed to carry heavy or bulk equipment, raw materials, and intermodal containers. **Examples:** chemicals, construction supplies, steel, plywood/lumber and freight.
- **DGC (Dump-Grain, Chips, Gravel-Concrete Mixer)**, designed for transporting loose materials and construction materials. **Examples:** asphalt, sand, gravel and agricultural products
- **Bus**, designed for recreation, commercial passenger transport, delivery and couriers use. **Examples:** private charter, tour buses, commercial bus lines and parcels.

Vehicle Configuration Descriptions

- **Single-Unit (SU)** - All trucks on a single frame with four or more axles.
- **Tractor/Semi Trailer (TT)** - A unit with the combination of a tractor unit and one semi-trailers to carry freight. A semi-trailer attaches to the tractor with a fifth wheel hitch, with much of its weight borne by the tractor.
- **Combination-Multi-Trailer (MT)** - Combination-Multi-Trailer consisting of three or more units, one of which is a tractor or straight truck power unit.

Appendix D-Survey 1-DOT Placards Observed

DOT CLASS	UN 4-DIGIT #
2	UN1978
2	UN2189
2	UN3252
2	UN3520
2	UN1072
2	UN1983
2	UN2187
2	UN3500
2	UN1075
3	UN1090
3	UN1133
3	UN1219
3	UN1865
3	UN2348
3	UN1202
3	UN1268
3	UN1993
3	UN1203
4	UN1333
6	UN3287
7	UN3507
8	UN1824
9	UN3077

DOT CLASS	PLACARD Markings
1	Explosives 1
2	Flammable Gas 2.1
2	Non-Flammable Gas 2.2
3	Combustible Liquid 3
3	Flammable Liquid 3
8	Corrosive 8
9	Miscellaneous 9
	Dangerous

Appendix E-Survey 2-DOT Placards Observed

DOT CLASS	4-DIGIT UN #
2	UN1075
2	UN1073
2	UN1993
3	UN1203
9	UN3257-HOT

DOT CLASS	PLACARD Markings
2	Flammable Gas 2.1
2	Non-Flammable Gas 2.2
2	Poison Gas 2.3
3	Combustible Liquid 3
3	Flammable Liquid 3
8	Corrosive 8