- **HF-B Human Factors Issues for Safety of Emergency Responder Vehicles**
- **Safety and Human Factors Workshop**

- Larry Avery, BMT Designers and Planners, Inc, presiding
- Jeffrey W. Muttart, Crash Safety Research Center, LLC, presiding
- Sponsored By:
- Transportation Safety Management (ANB10)
- Emergency Medical Services Safety (ANB10(5))

- This workshop will address human factors issues associated with first responder vehicle safety from the context of the two key operational phases of first response, “enroute to or from an emergency call site” and “on location at the call site”. Specific topics that will be addressed within the context of these operational phases include, but are not limited to, vehicle conspicuity, occupant protection, and factors that influence driver performance.
- 9-9:30am – General introductions and administration
- 9:30-10:30am – General discussion of human factors issues associated with first responder vehicle safety
- 10:30-Noon – Human factors issues associated with first responder vehicle safety at the call site
- Noon-1:30 – Lunch
- 1:30-4pm – Human factors issues associated with first responder vehicle safety when enroute
- 4-5pm – Wrap up

- **Emergency Medical Services Safety Subcommittee, ANB10(5)**
- Safety and Human Factors
- Nadine Levick, EMS Safety Foundation, presiding
- Sponsored By:
- Transportation Safety Management (ANB10)

- 1. Registration 8:00 -8.15 AM

- 2. Opening Remarks - Nadine Levick and Eileen Frazer 8:15 – 8:30 AM

- 3. Subcommittee Meeting 8:30 –10:15 AM
- 3.1 Introductions
- 3.2 Review and Approval of Minutes from 2013
- 3.3 Review of Subcommittee activities 2013
- 3.4 Sub-committee work program updates:
- 3.4.1 Ambulance Transport Safety Summit 2015
- 3.4.2 Research Needs Statements - Research Topics Database
- 3.4.3 Administrative issues
- 3.4.3.1 Liaison organizations
- 3.4.3.2 TRB Changes/Communications/Website
- 3.4.3.3 Membership/Recruitment
- 3.4.3.4 2015 TRB Session Topics and Calls for Papers
- 3.5 EMS National Updates –
- 3.5.1 NASEMSO MRAVD
- 3.5.2 TIMS
- 3.5.3 NAEMT Safety Course Update
- 3.5.4 Federal Projects

- 4 BREAK 10:15 to 10:30 AM

- 5 Standards and Guidelines Update 10:30-10:45 AM

- 6 New Technologies, Innovation – and You! 10:45-11:45 AM
- 6.1 Wireless patient monitoring
- 6.2 Transportation Human Factors update
- 6.3 The INDEMO Project
- 6.4 Tech Innovation from Rettmobil 2013

- 7 Research Needs 11:45-12:00PM

- Adjourn for lunch at Keck cafe 12:00PM

- **Linking Police and Hospital Road Accident Records: How Consistent Can It Be?**
- Marco Amorim, University of Porto, Portugal, presenter
- Sara Pinho Ferreira, University of Porto, Portugal, presenter
- António Fidalgo Couto, University of Porto, Portugal, presenter

- This paper presents the description of various steps to be applied in the linkage of road traffic accident records using the case study of the city of Porto, Portugal. The importance of this process is well recognized by institutions such as IRTAD (OECD/ITF) that are promoting the combination of various data sources to fully assess the consequences of road accidents and monitoring progress. The complexity of this process is mainly concerned with several issues found in the data sets; mistakes and missing values are frequently detected and there are only a few common data fields that can be matched by the linkage process. This study shows the application of a mixed deterministic and weight-based probabilistic method to link the police and hospital records. The tolerance calibration and weights computation are critical for the final linkage rate, as well as for the correct matching of the results. The results obtained lie within the range of rates found by other authors. Additionally, to improve the linkage record results, a validation process based on the emergency ambulance data is performed. Despite the missing values, it was possible to check 98% of the matched records as true matches. Finally, a preliminary investigation of bias after data linkage is described, showing that the variables selected for comparison indicate similar statistical values. The main outcome of this study is a road accident linkage process that can be adapted, developed and applied in different contexts, aiming to promote future developments on police, hospital and emergency ambulance data in Portugal and in other countries. Future developments are being planned for each one of the steps present in this paper.

- **Heuristic Approach for Optimizing Emergency Medical Services in Road Safety Within Large Urban Networks (Poster Session)**
- Yi Liu, Illinois Institute of Technology, presenter
- Arash M. Roshandeh, Illinois Institute of Technology, presenter
- Zongzhi Li, Illinois Institute of Technology, presenter
- Konstantinos Kepaptsoglou, National Technical University of Athens, Greece, presenter
- Harshingar Patel, Illinois Institute of Technology, presenter
- Xi Lu, Illinois Institute of Technology, presenter

- This paper introduces a double standards model (DSM), along with a genetic algorithm (GA), for assigning emergency medical service (EMS) fleet from vehicle locations to intersection vehicle crash sites such that crash demand sites could be covered in accordance with two service coverage standards. Specifically, all demand sites are required to receive single coverage according to the secondary coverage standard and at least a portion (á) of demand sites need to maintain single coverage as per the primary coverage standard. The proposed model is applied for top two hundred intersections in city of Chicago selected using intersection crash records for 2004-2010 according to crash frequency-based and severity-based scenarios. The top two hundred intersections are split into high and low severity sites for model application. Using the EMS vehicle fleet size currently maintained by the Chicago Fire Department as 15 basic life support (BLS) and 60 advanced life support (ALS) ambulances, almost 100 percent of double vehicle coverage can be achieved. Extended model application is conducted by keeping 15 BLS ambulances unchanged and reducing the 60 ALS ambulances by 50 percent to 30. Results show that nearly 90 percent of double coverage according to the primary standard can still be reached.

- **Experimental Modeling of the Effect of Hurricane Wind Forces on Driving Behavior and Vehicle Performance (Poster Session)**
- Jose Manuel Rodriguez, Louisiana State University, presenter
- Julius Atta Codjoe, Louisiana State University, presenter
- Osama Osman, Louisiana State University, presenter
- Sherif Ishak, Louisiana State University, presenter
- Brian Wolshon, Louisiana State University, presenter

- While traffic planning is important for developing a hurricane evacuation plan, vehicle performance on the roads during extreme weather conditions is critical to the success of the planning process. This novel study investigates the effect of gusty hurricane wind forces on the driving behavior and vehicle performance. The study explores how the parameters of a driving simulator could be modified to reproduce wind loadings experienced by three vehicle types (passenger car, ambulance, and bus) during gusty hurricane winds, through manipulation of appropriate software. Thirty participants were then tested on the modified driving simulator under five wind conditions (ranging from normal to hurricane category 4). The driving performance measures used were heading error and lateral displacement. The results showed that higher wind forces resulted in more varied and greater heading error and lateral displacement. The ambulance had the greatest heading errors and lateral displacements, which was attributed to its large lateral surface area and light weight. Two mathematical models were developed to estimate the heading error and lateral displacements for each of the vehicle types for a given change in lateral wind force. Through a questionnaire, participants felt the different characteristics while driving each type. The findings of this study demonstrate the valuable use of a driving simulator to represent different vehicle types, and to develop mathematical models to estimate and quantify driving behavior and vehicle performance under hurricane conditions.

- **Priority System for Multimodal Traffic Signal Control**
- Mehdi Zamanipour, University of Arizona, presenter
- Larry Head, University of Arizona, presenter
- Jun Ding, University of Arizona, presenter

- There are many users of signalized traffic intersections including passenger vehicles, commercial vehicles/trucks, pedestrians, bicycles, transit buses, light rail vehicles, snowplows, and emergency vehicles such as fire trucks and ambulances. North American approaches to traffic signal control are centered on general vehicles with either accommodations for other modes or exceptions for special considerations such as emergency vehicles. This paper presents a unified decision framework for multi-modal traffic signal control that simultaneously considers the needs of different modal users based on wireless communications, as well as traditional detection methods. This framework is based on a mathematical optimization model where each modal traveler can request service using priority requests. The mathematical programming framework allows multiple priority requests to be considered simultaneously based on a hierarchical control policy. In addition to modal users, system-operating principles such as coordination are included as priority requests within the decision framework. The system has been developed and tested using both microscopic traffic simulation and in a live network of six intersections in Anthem, Arizona using emerging technology developments in Connected Vehicle systems. The responsible operating agency must establish a policy for each equipped section of traffic signals that determines the relative importance of different modes of travel. For example, one section might be selected to be pedestrian and transit friendly and another section might be selected to be truck friendly. This priority policy would impact how the signal timing is adapted to accommodate the multiple active requests for priority. This paper explores the ability of the section priority policy within the unified priority control decision framework for multi-modal travelers to provide improved quality of service for each mode within the structure of the priority policy.

- **Influence of Accessibility for Emergency Medical Services on Fatality Rate in Hokkaido, Japan**

- Toru Hagiwara, Hokkaido University, Japan, presenter
- Masayuki Hirasawa, Civil Engineering Research Institute for Cold Region, Japan, presenter
- Yusuke Noda, Hokkaido University, Japan, presenter
- Hisaya Hara, Ministry of Land, Infrastructure, Transport, and Tourism, Japan, presenter

- In the study, we focused on trends of a fatality rate for severe crashes in Hokkaido, Japan. The fatality rate is defined as percentage of the number of fatal crashes to total of the number of fatal and serious crashes. The study examines an effect of distance between crash site and location of the Life-Saving Emergency Center (Distance2EMC) on the fatality rate. Distance2EMC could show accessibility to EMS and also hazard potential of crash site that is occurred further away from seven central cities in Hokkaido prefecture. We determined the shortest route and its distance according to a distance of each route measured by Google Maps route search function. There were 20,390 severe crash records from 1989 to 2009 occurred at all national roads in Hokkaido. The study could indicate that Emergency Medical Service systems in Hokkaido are becoming important components to reduce the fatality rate.

- **Improving the Quality of Current and Forecast Weather Information Provided to Emergency Medical Services Responding to Motor Vehicle Crashes**
- Marie Flanigan, CUBRC, Inc., presenter
- Kevin Majka, CUBRC, Inc., presenter
- Alan Blatt, CUBRC, Inc., presenter
- Kunik Lee, Federal Highway Adminstration, presenter

- Once a motor vehicle crash happens, emergency medical services (EMS) offer the best prospects for improved patient outcome. It is therefore important to identify and address any issue which can negatively impact the effectiveness of EMS response to a crash. One such issue relates to shortfalls in the accuracy and completeness of current and forecast weather information. These shortfalls are often due to limitations in the geographic resolution of measured data, as well as difficulties with obtaining real-time access to weather information as an event unfolds. This paper examines the need for improved weather information to support emergency response by ground and air medical responders. First, the operating environments for responders are examined. Established sources of measured weather data are then described, in particular, the system of automated weather stations which support ‘current’ and ‘forecast’ weather reporting in the U.S. This is followed by a consideration of existing and emerging mobile sensor platforms which could broaden the geographic extent of measured data, especially as advanced intelligent transportation systems evolve. Next, a review of weather-related issues identified in helicopter EMS (HEMS) pilot reports and severe weather ‘after-action’ reports by municipalities are presented. For ground responders, a need for real-time, route-specific weather information was identified. For air responders, the system of airport-based weather observation stations developed for fixed wing aircraft was found to be inadequate for HEMS. A rational, step-wise approach for expanding weather data collection to create a more spatially resolved, low-altitude weather information system to support EMS is presented.

- **Cyclist Safety and Operations (Poster Sessions)**
  - Injury Severity Study of Bicycle-Motor Vehicle Crashes
    - Randy B. Machemehl, University of Texas, Austin, presenter
    - Mubassira Khan, University of Texas, Austin, presenter
  - Circumstances of Bicyclist Injuries
    - Paul M. Schimek, TranSystems, presenter
  - Modeling Bicyclists' Injury Severity Levels in Province of Nova Scotia, Canada, Using Generalized Ordered Probit Structure
    - Muhammad Ahsanul Habib, Dalhousie University, Canada, presenter
    - Justin Forbes, Dalhousie University, Canada, presenter
  - Cyclist Accident Typology: Survey Methodology Using a Medical Registry
    - Alice Billot-Grasset, French Institute of Science and Technology for Transport, Development and Networks, presenter
    - Emmanuelle Amoros, French Institute of Science and Technology for Transport, Development and Networks, presenter
    - Martine Hours, French Institute of Science and Technology for Transport, Development and Networks, presenter

- **Research and Applications in Evacuation Planning (Poster Session)**
- **Time-Dependent Vehicle Routing and Assignment in No-Notice Evacuations**
  - Ismail Cem Kuru, Southern Illinois University, Edwardsville, presenter
  - Xin Chen, Southern Illinois University, Edwardsville, presenter
  - Ryan Fries, Southern Illinois University, Edwardsville, presenter

Natural and man-made disasters are consistent threats to populated areas. As the population density in major cities increases each year, the effects of these disasters can only increase. The intensity of these disasters may occasionally require an execution of an emergency evacuation order. In order to reduce the uncertainty immediately following such an order, emergency response agencies are required to have evacuation plans, which become more important when there is no advance knowledge of the event. One element to include in these plans is the positioning of emergency response vehicles (ERVs) to direct traffic away from affected areas and towards evacuation shelters. The aim of this study is to apply a mathematical model and effective and efficient algorithms to optimally assign and route ERVs to critical points in the road network. This paper extends the Dijkstra's Algorithm for dynamic travel times and integrates it with an assignment model. This combined approach minimizes the total arrival time or latest arrival time of ERVs much faster than the mixed integer programming (MIP). The methodology is validated using an evacuation road network in a metropolitan area.