Research
Report Summary

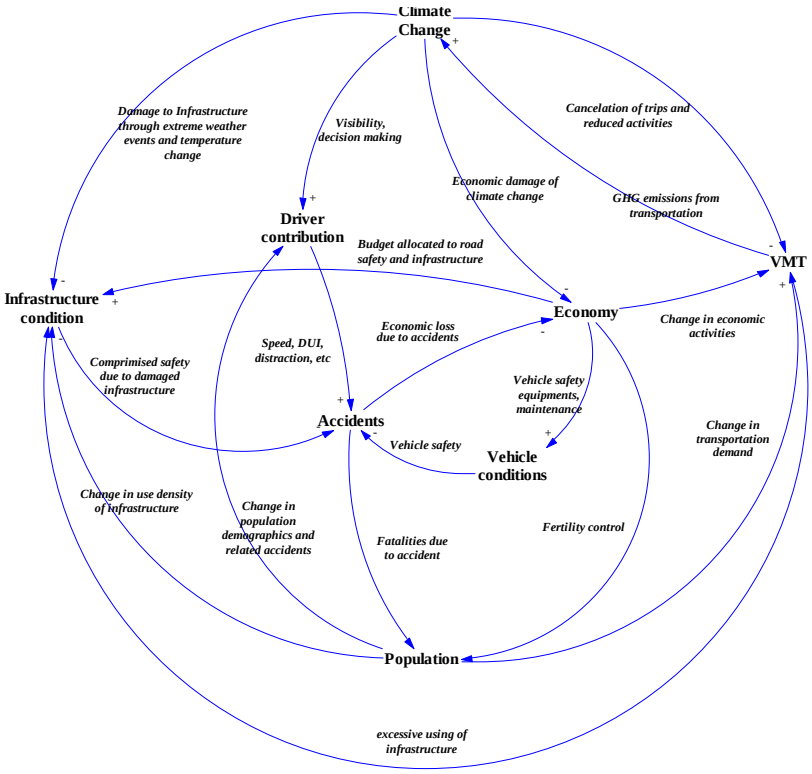
SAFER SIM
SAFETY RESEARCH USING SIMULATION
UNIVERSITY TRANSPORTATION CENTER

Omer Tatari, PhD *8/1/15*

Dynamic Simulation Models for Road Safety and Its Sustainability Implications

Road safety is one of the most complicated topics pertaining to the transportation sector and involves many interdependencies. Therefore, a sufficiently thorough analysis of road safety requires a novel system-based approach in which the associated feedback relationships and causal effects are given appropriate consideration. To this end, this project investigated common issues related to traffic accidents by considering the major causes and influences associated with such accidents and their complex relationships with climate change and with certain economic parameters. The factors affecting accident frequency and severity are highly dependent on economic parameters and weather conditions. The economic factors and/or impacts involved in roadway accidents and fatalities, including property damage costs and injury-related costs, have always been strongly affected by various road safety concerns and, conversely, by efforts to improve road safety

and/or to reduce the likelihood of future traffic accidents. However, the environmental factors related to road safety, though not always accounted for as well as they should be, also interact very strongly with the transportation sector in terms of environmental causes and effects.



Causal loop diagram

This project used a novel system dynamics modeling approach to model the climate change–road safety–economy nexus, thereby investigating the complex interactions among these important areas by tracking how they affect each other over time. For this purpose, five submodels were developed to model each aspect of the overall nexus and to interact with each other to simulate the overall system. As a result, this comprehensive model could provide a platform for policymakers to test the effectiveness and/or consequences of different policy scenarios with which to reduce the negative consequences of traffic accidents and/or improve road safety.

The three main policy areas investigated are:

Worldwide CO2 emissions reductions: This policy investigated whether worldwide greenhouse gas emissions could affect road safety. The results showed that reducing CO2 emissions by 25% and 50% could reduce the number of weather-related roadway fatalities to 6,560 and 6,480, respectively, by the year 2100. If no action is taken, this number could reach 6,640.

Travel demand reduction: This scenario attempted to investigate the effects of travel demand reduction on vehicle miles traveled (VMT), as well as its effects on the number of fatalities and on other parameters involved in this system. Based on this scenario, reducing VMT by 25% and 50% could reduce the number of road accident fatalities to 89,000 and 75,000, respectively, by 2100. If no action is taken, this number could reach 105,000.

Vehicular safety index increase: The increasing vehicle safety scenario focused on decreasing roadway accidents and the number of fatalities and injuries through increasing the safety index of vehicles. The modeling showed that increasing the vehicular safety index by 10% and 15% could increase the number of lives saved by vehicle safety technologies to 66,000 and 71,000, respectively, while if the current trend continues, this number could be 61,000 by the year 2100.