

Introduction

Chico is well known for being a party town with a history of alcohol abuse amongst the young adults who inhabit the town during the school year. Over the past years, and especially over the last months, we have heard of many incidents where people are being killed and hurt due to both irresponsible and drunk drivers.

- We would like to see if there is a relationship between the location where crashes occur, and their proximity to alcohol vendors.
- Our hypothesis is that DUI accidents will be within a 100 ft vicinity of Bar
- We will analyze whether there is a significant difference between the mean distance from DUI accidents to alcohol outlets, versus traffic accidents and their mean distance to alcohol outlets.
- Some things to consider for our study are that there are many different types of alcohol outlets; liquor stores don't allow for immediate consumption so we can insinuate that a buyer will take their beverages elsewhere if they drive to the store, whereas bars allow consumption on site, and allow us to insinuate that the buyer will leave the establishment and drive in an inebriated state.

Data and Methods

We utilized the 2005 Chico Police Department Call Records for our study, this data had over 68000 calls, but we managed to extract the geocoded point data for the following:

- Traffic Accidents (1730 total records)
- Confirmed DUI Accidents (75 total records)

We also digitized all alcohol vendors within the Chico city limits based on the license type issued by the California Department of Alcoholic Beverage Control. The four major license types issued in the city include:

- License 20 - Off Sale Beer and Wine (Liquor Stores) (37 total)
- License 21 - Off Sale General (Grocery Stores, Mini-Marts) (13 total)
- License 41 - On Sale Beer and Wine Eating Place (Bars) (78 total)
- License 47 - On Sale General Eating Place (Restaurants) (19 total)

We used the Chico city streets shapefile, which included speed limit data, found on our lab's server, as well as the block population groups from the United States Census from the year 2000.

Our methodology required the use of several Spatial Analyst and Spatial Statistics tools on ArcGIS, including:

- Line Density - for the analysis of speed by road
- Kernel Density - for the calculation of distance surfaces
- Getis-Ord Gi* - hot spot analysis
- Euclidean Distance - based on Manhattan Distance to show the distances from alcohol vendors
- Zonal Statistics as Table - for the acquisition of mean distance from crash location to alcohol outlet
- Spatial Join - to merge population density data with crash points

We also utilized the Statistical Package for the Social Sciences (IBM SPSS) to test our hypothesis by seeing the relationships among p-values. The tools used were:

- Independent Samples T-Test
- Boxplot graphs

Analysis

- The first step was to run four Euclidean Distance processes, one for each of the different alcohol license types. The distance used was 100 ft.
- Second, we determined the street density weight by speed limit.
- For both the DUI crashes and Traffic Accidents, we ran zonal statistics by table to figure out the mean distances to the four different alcohol vendor types, this gave us eight tables in total that we appended on Excel into four fields.
- We selected all block groups within the accident locations to create a density surface, and figure out the population percentages.
- For both the DUI crashes and Traffic Accidents, we ran four different kernel density processes to see the clusterization of alcohol outlets, and analyze the mean distances from the accident locations, this gave us another eight tables that we also appended into four different fields on our same excel file. The total fields used for analysis are shown in table 1.

A Spatial Analysis of the Distribution of Alcohol-Related Motor Vehicle Accidents and their Proximity to Alcohol Outlets in Chico, CA.

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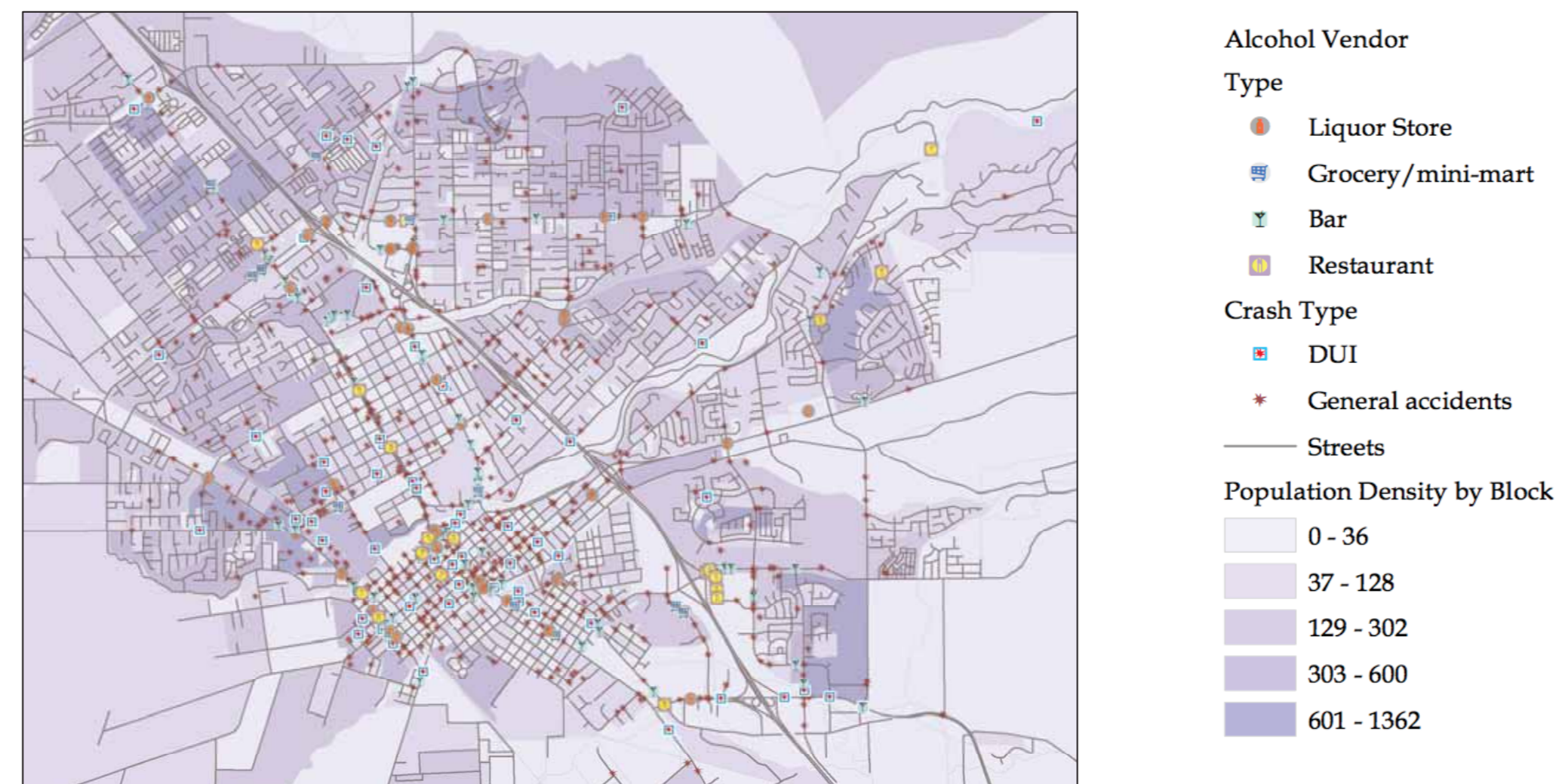


Figure One. Density of Population per Block Group

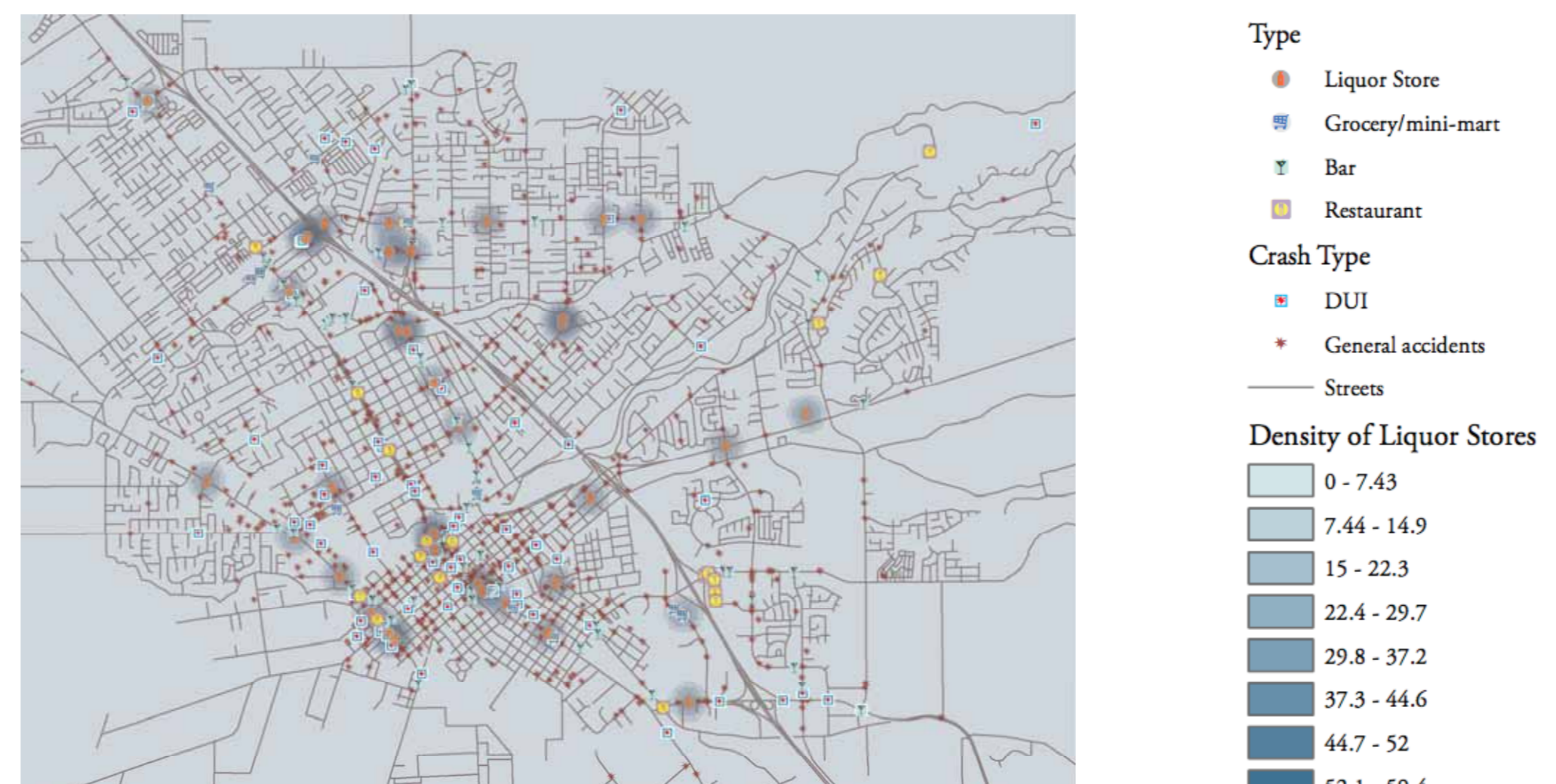


Figure Two. Density of License Type 20 (Liquors)

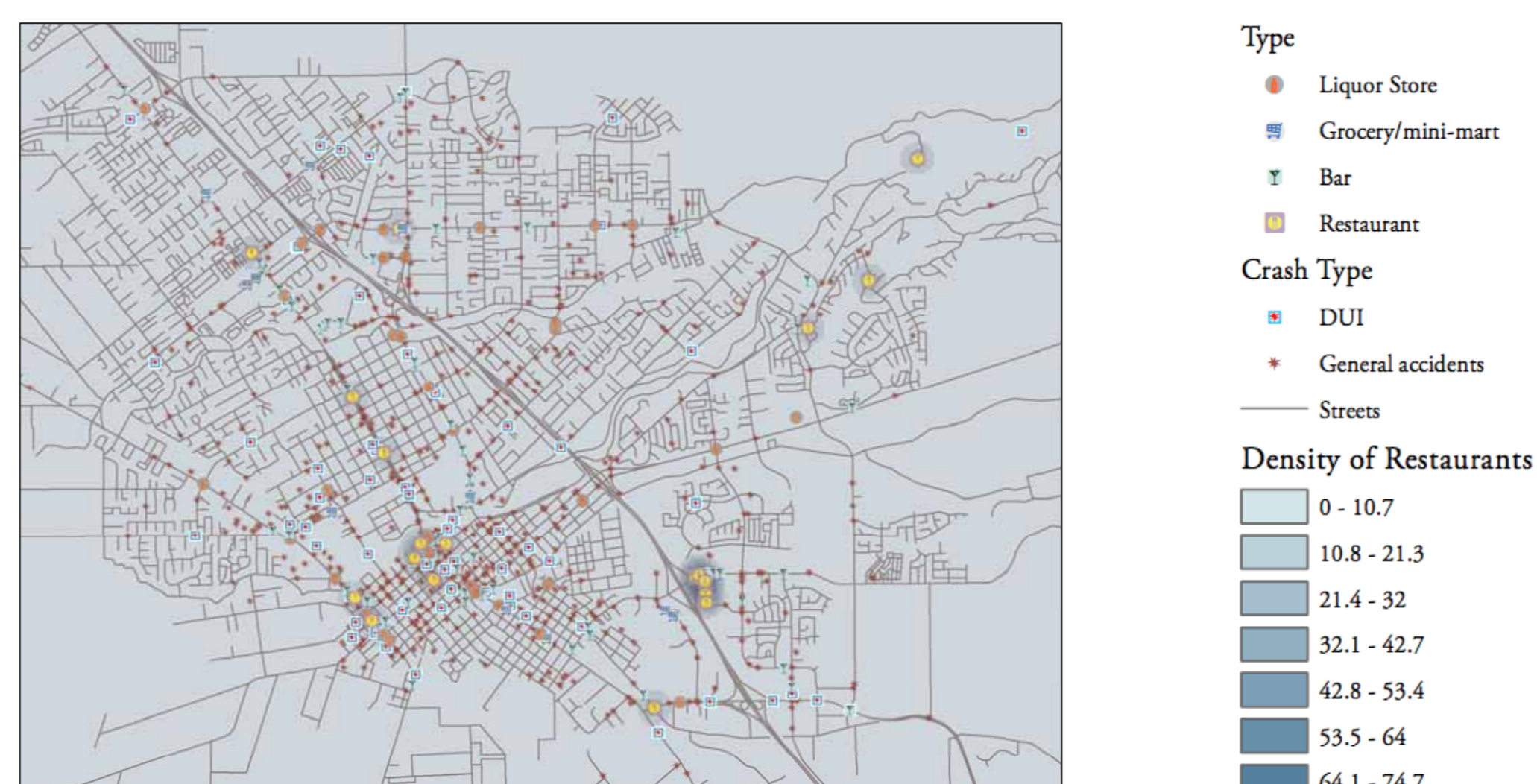


Figure Three. Density of License Type 47 (Restaurants)

Results

After we created our data comparison table, we ran several different tests on SPSS to see the relationships. Unfortunately, the results indicated that the distance to most alcohol outlets wasn't significant for the traffic accidents. For the DUI crashes, we found significance in the following:

- Population Density by Block with a p-value of .003 (Figure One)
- Density of Liquor Stores with a p-value of .004 (Figure Two)
- Density of Restaurants with a p-value of .025 (Figure Three)

Table 1. List of Results from SPSS Analysis

Variables Tested: DUI Crashes vs. Traffic Accidents	p-value
Distance to Grocery Stores / Mini-Marts (License 21)	.333
Distance Liquor Stores (License 20)	.595
Distance to Restaurants (License 47)	.172
Distance to Bars (License 41)	.464
Speed Density	.219
Density of Grocery Stores / Mini-Marts (License 21)	.213
Density of Liquor Stores (License 20)	.004
Density of Bars (License 41)	.372
Density of Restaurants (License 47)	.025
Population Percent by Block	.003



Figure Four. Photo of sobriety tests, a preventative measure. Source: DailyTech.com



0 0.5 1 2 Miles

Conclusions

Based on our analysis, our hypothesis was proven incorrect. We can conclude that there is a probability that a DUI accident will occur within a densely populated block, near liquor stores or restaurants. Further analysis could include more information on the different road signs and types, such as one-way streets, alternating yield and stop signs, as well as more information about the accidents such as distractions or even climatic factors that could cause accidents.

Sources

Chico Police Department, California Department of Alcoholic Beverage Control, Dean Fairbanks.