A Report to the Arizona Department of Transportation

Forecast and Capacity Planning for

Nogales' Ports of Entry

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1   Executive Summary

This document provides the final report of the activities performed under the project Nogales POEs Traffic Study: Forecast and Capacity Planning for Nogales' Ports of Entry sponsored by the Arizona Department of Transportation (ADOT) under Grant JPA 08-024T. Some of the main activities of this study include:

- A baseline analysis of the Nogales Ports of Entry (POEs), Mariposa POE and DeConcini POE. Including analysis of historical data for these POEs, a visit to the Mariposa POE and conclusions gathered from any relevant previous studies.
    - Different types of traffic were investigated, including commercial traffic (mainly truck), POV (Privately Owned Vehicle), pedestrian, bus and train.
    - Through our analysis, we discovered that the truck traffic contained a very strong seasonality pattern while other modes of traffic did not.
    - Previous to our study, there were not many studies dedicated to forecasting border crossing traffic.
    - None of the studies we reviewed had dealt with the seasonality pattern we observed here.
    - Economic indices were usually incorporated in the models; however, one should take caution when choosing the proper indices to incorporate into the model.
    - The Mariposa POE was the only one of the Nogales POEs that processed truck crossings, thus a traffic spilt between POEs only occurred with POV, buses and pedestrian traffic.
    - The traffic split between the two POEs was stable throughout the years. For pedestrians, the DeConcini POE consistently accounted for nearly 95% of the pedestrian traffic. POV traffic had a ratio of roughly 60:40 (DeConcini: Mariposa) before 2007, and then 70:30 (DeConcini: Mariposa) from late 2007 onwards. Bus traffic had a ratio of roughly 25:75 (Deconcini: Mariposa) over the years analyzed.
- Testing of various model alternatives on the historical data for the different modes of traffic to find the best methods for creating our forecasts.
    - We built different types of models on the historical data, including different types of regression models and time series models. The performance of the models was compared, and the best performing models were chosen to produce the forecasts.
    - For the POV traffic, we built the model based on the number of vehicles, since the POVs were processed by vehicle.
    - Models for bus traffic were built on the number of bus passengers, since bus vehicle capacity might not be fully utilized.
    - Generally, the time series models were better for short term forecasts.

- o We found that the exchange rate between the Mexican Peso and US dollar was the most influential economic variable for truck traffic.
  - o We tested the external variables on other traffic types, but none of them was statistically significant. However, we found that including Arizona employment data improved the quality of the models for pedestrian traffic.
  - o No model was built for rail traffic because only the Union Pacific operates through Nogales, and company-specific decisions seemed to drive the history.
- Using the chosen models to provide forecasts of border crossings for the next 5, 10 and 15 years into the future
  - o Time series models were used to produce all the short term (5 year) forecasts for all the traffic modes.
  - o Regression models were used to produce the long term (10-year and 15-year) forecasts for POV, pedestrian and bus.
  - o Time series models were used to produce the long term (10-year and 15-year) forecasts for trucks.
  - o Long term forecasts for the economics indices were not available, so we defined plausible scenarios and used these scenarios in our models for crossing traffic.
  - o According to our forecasts we found that the number of Commercial Vehicle (mainly truck) crossings might increase up to 50% in 15 years when compared to the number of crossings recorded in 2008.
  - o The POV traffic and pedestrians were more sensitive to the changes in the economic climate and therefore their forecasts are less reliable than those obtained for commercial vehicles.
  - o Our forecasts suggest that, in the near future, POV, pedestrian and bus traffic will decrease slightly. We do not believe they will continually decrease; however, we could not be sure when the declines will reverse.
  - o These near term trends are probably driven by the economic downturn that began in late 2007.
- Creating a simulation model to test the capacity of the Nogales POE given our forecasted future traffic demands. Some of the results produced through this simulation include the following:
  - o If our forecasts are correct, the maximum queue length based on our capacity estimates will be approximately 2300 trucks (over one day's backlog). The bottleneck location is the super-booth area for most of our scenarios.
  - o Given existing infrastructure and time constraints (i.e. 11 hour workday), the current Mariposa POE does not have capacity to service our predicted maximum levels of traffic.