Tour Behavior of Clean Drayage Trucks in Southern California
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ABSTRACT
- Introduced an analytical framework for processing GPS data from clean drayage trucks in Southern California
- Applied the method to conduct an empirical study examining clean drayage truck tour behavior at a major port.
- Discussed distinct tour features and insights for potential applications using these data.

1. INTRODUCTION
- Freight movements are responsible for a large share of diverse problems in transportation. Conventional freight transportation modeling is mostly trip based and uses travel survey data. However, it does not address extensive trip chaining behavior in freight truck movements.
- In this study, three objectives were proposed in order to interpret clean drayage truck tour behavior using GPS data collected from the San Pedro Bay Port (SPPB) complex in Southern California.
  - A new framework for GPS analysis incorporating two new critical tour criteria such as spatial allowance for Traffic Analysis Cells (TACs) and stop duration for identifying tours was shown to be more effective than state of the art models.
  - The comprehensive framework of GPS preparation process for the tour-based information was proposed for the first time.
  - GPS data collected from the SPBP complex was empirically studied using a tour-based framework for the first time, which led to useful insights for current port truck related strategies and policies that would not have been known using only port gate count information.

2. DESCRIPTION OF STUDY AREA AND DATA
- Study Site
  - Freeways system: The I-710 and the I-110 along with cross freeways
  - Railroad system: The Alameda corridor rail link and a number of rail yards
- Clean Truck Program (CTP)
  - Part of California’s Goods Movement Emissions Reduction Program
  - Under the CTP, from January 1, 2010, the SPBP banned trucks with 1993 and older engines, in addition to almost all 1994-2003 trucks
  - All CTP truck owners must tag their vehicle with a RFID for compliance monitoring, and truck owners receiving public truck replacement funds must allow a GPS device to be installed.

- CTP trucks movements
  - 1 year of GPS data from 540 trucks
  - Almost 60% of GPS installed CTP trucks movements occurred in study area – transport containers to the intermodal facilities or nearby logistics companies
  - 40% of trucks movements: Oakland, Sacramento, Riverside, San Bernardino, Chino, San Diego

3. A FRAMEWORK OF GPS DATA PROCESSING
- STEP 1: Selected potential O-D stops (5,349,369 records in 2010)
- STEP 2: Identified each truck’s depot in order to define the tour as closed and open.
- STEP 3: Geocoded all potential O-D stops and each truck’s depot according to TAC, a higher resolution block group level geographical boundary.
- STEP 4 and 5: core procedure to identify tours using spatial and temporal criteria.
- STEP 6: Condensed consecutive waiting activities, i.e. two or more waiting activities not separately followed by a moving activity.
- STEP 7: Assigned new tours to activities lasting longer than the criteria to avoid a false-positive tour.
- STEP 8: Cross-checked average speeds, travel distance, and travel time from the identified tours for abnormal pairs of trips/tours and presented the final set of clean truck tour data.

4. TOUR RESULTS
- Observed Trip Chain Behavior
  - The CTP trucks operated an average of 1.7 tours per day which was higher number than those of other commercial vehicles.
  - Approximately 3.1 visited per tour (equivalent to 6.2 trips per day! lower number then other commercial vehicles due to use of drayage trucks which were often involved in lengthy loading/unloading of containers in and out of SPBP and at each stop

- Four types of tours were identified: three type tours (B, C, and D) exhibited repetitive trip patterns.
  - Type A: 34.36% (2010)
  - Type B: 44.17% (2010)
  - Type C: 3.11% (2010)
  - Type D: 18.35% (2010)

- Observed Tour Characteristics by Fuel Type
  - Tour Travel time: Diesel truck > LNG truck
  - Tour Distance: Diesel truck > LNG truck
  - Diesel trucks: more fuel stations available & less frequent fueling required

- Observed Tour Characteristics by Month
  - While travel time and distance varied by month, the number of trip within one tour was consistent.
  - Tour characteristic patterns were positively correlated with port activity lagged by approximately one month.

5. CONCLUSION
- Clean drayage trucks visited 3.1~3.9 stops per tour because of lengthy loading/unloading of containers.
- Four tour types were identified (with three including repetitive patterns reflecting the intrinsic nature of drayage truck operations) that were quite different from other commercial vehicle circulative movements.
- Clean trucks at the SPBP mostly completed one tour within one day; one day of travel behavior was not necessarily representative of any other day.