Research Project

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Capsule

Technology Transfer Program

LTRC

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Predicting Water Use and Wastewater Generation at Interstate Rest Areas in Louisiana

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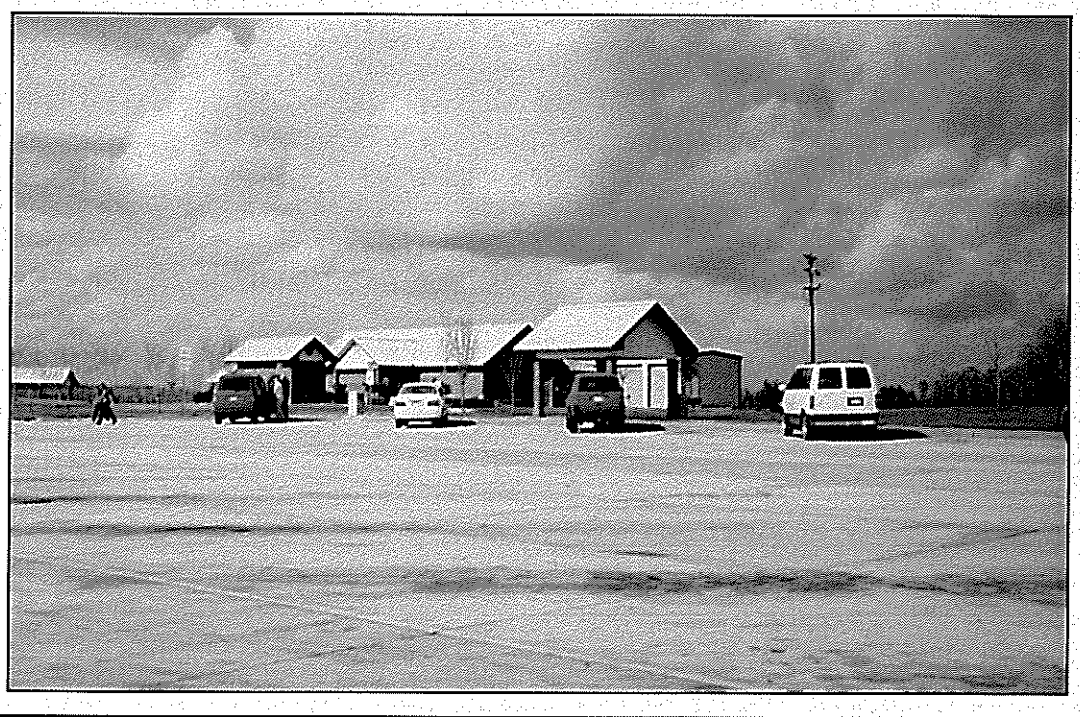
Problem

An important element in the design of roadside rest areas is relating water use and wastewater generation to the number of vehicles using the facility and also the highway total ADT. In addition, it is desirable to know to what extent a relation developed for one region of Louisiana (i.e. metropolitan) can be used in another (rural).

Objectives

The objectives of this research are as follows:

1. Determine if a constant relationship exists between water use or waste generation (gal/vehicle) and daily traffic counts within the rest area site. If the relationship is not constant determine its degree of variability. This will allow DOTD to develop a rational basis of design for interstate rest areas and the associated water-related systems required therein.



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2. Determine the relationship between the 24 hr. ADT on the interstate highway and the 24 hr. vehicle count within the rest area.

3. Objectives 1 and 2 will be evaluated for several rest areas in different demographic areas of the state. Objective 3 will be a comparison of the values obtained to determine to what degree values obtained at one location can be extrapolated to other regions of the state.

Specifically, continue to evaluate the relationship between water use and vehicle counts within at the Grand Prairie rest area. Begin to evaluate the relationship between 24 hour ADT on the interstate and that within the rest area. Carry out similar investigations at Tchefuncte, Slidell and Mound rest areas. Since these rest areas are located in different regions of the state and have very different traffic densities, finding similar relationships would be good evidence that the result can be assumed statewide.

Description

Three rest areas in differing regions of the state (Tchfuncte, Slidell and Mound) will be instrumented with the necessary equipment to measure and record water flow rates and vehicle counts inside the rest area.

Data from the nearest traffic counter(s) on the interstate will also be collected in order to compute the fraction of cars stopping at the rest area.

A fourth rest area (Kentwood) may be instrumented to log wastewater production in order to further verify the assumption(obtained at Grand Prairie) that water use and waste generation rates are approximately equal. This is important since it is generally easier and cheaper to monitor water flow than waste flow. Using commercially available equipment, flow (water or wastewater) can be monitored and logged at essentially any desired time interval.

In order to maximize the amount of information obtained from a single study we propose that it be logged and stored at short intervals (1 min. to 5 min.). This will cost no more and will allow examination of intra day water use rates. These higher, short term, usage rates are necessary in the design of wells, hydro pneumatic pressure tanks, and distribution systems.

Data will be downloaded twice per month over a 12-16 month period. This will be accomplished by visiting and downloading data from the flow meter(s) and traffic counter at each site using a laptop computer. If water and wastewater flow are monitored, both meters will be downloaded in ASCII format. If a one-minute data logging time interval is used, each download consists of approximately 20,000 pieces of data. Downloaded data is then transferred to Excel.

Templates have been developed in Excel to allow computation of daily flows quickly and easily. Mathematical, graphical and statistical manipulations will be carried out by transferring Excel data to MathCad or Splus. Using the data collected, mathematical and/or statistical (probabilistic) relationships will be developed and evaluated. For example, we can compute the water flow per vehicle actually in the rest on a daily basis for each day on which data is collected.

We can also calculate, on a daily basis, the fraction of vehicles, passing on the interstate which actually stop at the rest area. These data can be manipulated and presented as separate probability plots or as regression equations relating total vehicles to total water used at the facility.

Using such plots we can rationally estimate water use at a rest area. In the case of probabilistic models we can estimate the number of times our estimate will be exceeded. Data and probability plots obtained for different areas of the state can be compared. The relationships developed will be verified by comparing predicted and observed flow rates at the same facilities during the final six months of the project.

Implementation Potential

This study will result in mathematical models (equations) which relate water use to the 24 hr. ADT. These models may be in the form of regression equations (linear or non-linear) relating total vehicles stopping at the rest area to total water used or probabilistic models similar to what we already have for water use at the Grand Prairie rest area.