Evaluating the Effects of Heavy Sugar Cane Truck Operations on Repair Cost of Low Volume Highways

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Overview

- Background
- Objectives
- Scope
- Methodology
- Pavement Cost Analysis
- Discussion of Results
- Pavement and Bridge Costs
- Conclusions
- Recommendations
Background

- The 1997 FHWA Cost Allocation Study data showed that, at the national level, trucks weighing over 80,000 lb. paid only half the road costs they cause.

- Current LA-legislation allows transporters of agricultural products to purchase special overweight permits to carry 100,000 lb. GVW on FHWA Type 9 vehicles at permit Fee $100/year/vehicle permit fee

- Recent fees paid by Sugar cane trucks amounted to only $74,800/year.
- Steering axle
- 2 load axles, tandem axle on tractor and tandem axle on semi-trailer, dual tires
- Steering axle
- 2 load axles, tandem axle on tractor and triple axle on the semi trailer, dual wheels
Objectives

- Estimate the additional rehabilitation costs to roads damaged by heavy sugar cane trucks.
- Develop truck-axle configurations which produce less pavement damage by permitted overweight trucks.
**Scope**

- Determine the overlay costs on highways that the LA-DOTD is responsible for constructing, rehabilitation, and maintaining.

- Determine the pavement costs associated with changing the load axle on the semi-trailer from a tandem to a triple axle.
Methodology

- Identify the amount of sugar cane produced and the routes used from field to mills
- Collect pavement cross section data and ADTs on each road carrying sugar cane
- Group roads by ADT
  - Conduct detailed analysis on each GVW scenario and FHWA vehicle type
## Case Studies

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Gross Vehicle Weight (GVW)</th>
<th>80,000 lb.</th>
<th>100,000 lb.</th>
<th>120,000 lb.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario 1</td>
<td>FHWA Type 9</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Scenario 2</td>
<td></td>
<td></td>
<td>FHWA Type 9</td>
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<tr>
<td>Scenario 2a</td>
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<td></td>
<td></td>
<td>FHWA Type 10</td>
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<tr>
<td>Scenario 3</td>
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<td></td>
<td></td>
<td>FHWA Type 9</td>
</tr>
<tr>
<td>Scenario 3a</td>
<td></td>
<td></td>
<td></td>
<td>FHWA Type 10</td>
</tr>
</tbody>
</table>
Cost Analysis

- Calculate # of trips required to transport sugar cane on each control section under each GVW and truck type scenario:
  - Payload/truck = GVW - empty wt. of truck
  - # trips = [Total sugar cane carried on control section] / [payload/truck]

- Determine overlay costs using AASHTO pavement design guide procedure
Cost Analysis – cont’d

- Get costs for each GVW scenario and truck type combination for each control section
- Calculated net present worth of pavement overlay costs for each combination for 20 years at 5% interest
- For each ADT group get total net present worth cost for control sections
Data represents the statewide costs of overlays produced by the presence of sugar cane trucks at each GVW and truck type combination

- Data as net present worth
- Data as annual cost for 20 years at 5% interest/year
Statewide NPW of overlay costs for each GVW scenario

- Type 9: 80,000# - $484.75
- Type 9: 100,000# - $504.14
- Type 10: 100,000# - $473.13
- Type 9: 120,000# - $523.20
- Type 10: 120,000# - $484.55
## Cost Analysis

<table>
<thead>
<tr>
<th>Scenario</th>
<th>(NPW M-$)</th>
<th>(Annual M-$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scenario 1 (80,000 lb. GVW)</td>
<td>FHWA TYPE 9</td>
<td>484.75</td>
</tr>
<tr>
<td>Scenario 2 (100,000 lb. GVW)</td>
<td>FHWA TYPE 9</td>
<td>504.13</td>
</tr>
<tr>
<td>Scenario 2a (100,000 lb. GVW)</td>
<td>FHWA TYPE 10</td>
<td>473.15</td>
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<tr>
<td>Scenario 3 (120,000 lb. GVW)</td>
<td>FHWA TYPE 9</td>
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<tr>
<td>Scenario 3a (120,000 lb. GVW)</td>
<td>FHWA TYPE 10</td>
<td>484.55</td>
</tr>
</tbody>
</table>

Statewide **NPW of Overlay Costs** for all control sections carrying sugarcane for all GVW/FHWA truck type combinations, **Million $**

Statewide **annual Overlay Costs** for all control sections carrying sugarcane for all GVW/FHWA truck type combinations, **Million $**
Discussion of results

- Scenario 2 (100,000 lb. GVW) Vs Scenario 1 (80,000 lb. GVW) with FHWA type 9
- Sugarcane trucks pay $74,800/year in permit fees to haul at 100,000lb. instead of 80,000 lb.
  - Type 9 GVW at 100K vs 80K
  ($40.45M - $38.90M) amount to $1.55 million/year
- Sugarcane trucks produce $1.55 million/year in extra pavement overlay costs that DOTD pays
- Permit fees is $100/year, $1.55M/748permits should be $2,072/year to produce equity
Scenario 2 (100,000 lb. GVW)
- Income $74,800 From FHWA Type 9

Statewide cost for all control sections carrying sugarcane amounts to:
- FHWA Type 9 trucks: $40.45M
- FHWA Type 10 trucks: $37.97M

Requiring FHWA Type 10 vehicles would **SAVE** ($37.97M - $40.45M) $2.48 million/year for current laws
Discussion of results – cont’d

- Scenario 3 (120,000 lb. GVW)
- Income not determined, since 120,000 lb. is not legal
- Statewide cost for all control sections carrying sugarcane amounts to:
  - FHWA Type 9 truck $41.98M/year
  - FHWA Type 10 truck $38.88M/year
- **SAVINGS** using Type 10 over Type 9 are $3.10M/year
Statewide annual costs per vehicle for all GVW and truck type combination

- Type 9: $0, $2,072, $-1,243
- Type 10: $4,117, $-27
- Type 9: $0, $2,072, $-1,243
- Type 10: $4,117, $-27
- Type 9: $0, $2,072, $-1,243
- Type 10: $4,117, $-27

Annual Cost/Truck for Equity

<table>
<thead>
<tr>
<th>GVW</th>
<th>Type 9</th>
<th>Type 9</th>
<th>Type 10</th>
<th>Type 9</th>
<th>Type 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>80,000#</td>
<td>$0</td>
<td>$2,072</td>
<td>$-1,243</td>
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<td>$2,072</td>
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<td>$-27</td>
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<tr>
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<td>$0</td>
<td>$2,072</td>
<td>$-1,243</td>
<td>$0</td>
<td>$2,072</td>
</tr>
</tbody>
</table>
But Bridge Costs Should be considered

- About 15 Million tons of Sugarcane production
- 748 permits for Sugarcane trucks.
- Assume each truck will cross one bridge per trip.
- The sugarcane season starts on August 1 and ends on December 31, ie 153 days.
Statewide Annual Costs per vehicle for All GVW Truck Type Combinations

Annual Cost/Truck for Equity

<table>
<thead>
<tr>
<th>Type</th>
<th>GVW</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>80,000#</td>
<td>$0</td>
</tr>
<tr>
<td>9</td>
<td>100,000#</td>
<td>$5,545</td>
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<tr>
<td>10</td>
<td>100,000#</td>
<td>-$683</td>
</tr>
<tr>
<td>9</td>
<td>120,000#</td>
<td>$9,517</td>
</tr>
<tr>
<td>10</td>
<td>120,000#</td>
<td>$5,373</td>
</tr>
</tbody>
</table>
**Conclusion**

- Reduce the GVW for FHWA Type 9 sugar cane trucks from 100K to 80K lb. or
  - Increase the permit fee from $100 to $5,545/truck/year.
  - Use FHWA Type 10, NO permit fee and issue $683/year tax incentive to pay for the conversion.
- If the GVW for FHWA Type 9 increased from 100K to 120K lb. the pavement overlay and bridge fatigue costs will increase from about $5,545 to over $9,517/truck/year, Makes the risk of bridge damage and even bridge failure too significant to ignore.
- Allocate more highway funding for handling the extra damage caused by the increase of truck load limits.
Recommendations

- Keep the GVW for sugar cane trucks at 100,000 lb., Require that FHWA Type 10 Trucks, each sugar cane truck could be given a tax incentive of $683/year to assist with the conversion cost.

- It is not recommended that the legislature increase the GVW from 100,000 lb. to 120,000 lb. due to additional costs and the potential damage to bridges.
Recommendations

- It is recommended that future studies should evaluate alternative transport system and to develop an investment business plan for sugarcane harvest which will reduce highway damage and/or reduce costs.

- These options should include:
  - Use of lighter trucks and different trailer types
  - Mill delivery system or Bin transport system
  - It is recommended to allocate more highway funding for handling the extra damage caused by the increase of truck load limits.
Comments / Questions