SOCIAL COST CALCULATOR FOR INFRASTRUCTURE PROJECTS

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OVERVIEW

- Introduction
- Social Costs
- Calculator
- Case Study
- Conclusions
INTRODUCTION

- Many of the benefits that trenchless technologies provide to society are currently absent from the bid process.

- Traditional utility improvement and installation methods (i.e. open-trench) are normally associated with significant disruption of normal life patterns in and around the construction area; potentially significant adverse economic impacts in commercial or industrial zones.
SOCIAL COSTS

Traveler Delays account for a large part of the social costs assumed by society due to detours, slower moving traffic and loss of pedestrian access.

Related Effects and Costs

- Traffic Delay Costs (> 50%)
- Vehicle Operating Costs
- Pedestrian Delay Costs
SOCIAL COSTS

Increased Pollution due to construction equipment and increased travel times is another social cost.

Related Effects and Costs
- Increased Air Pollution
- Reduced Production due to Noise Pollution
- Increased Cleaning Costs due to Dirt and Dust
SOCIAL COSTS

Pavement maintenance and restoration is increased when installations and repairs are done using traditional methods that disturb the surface.

Related Effects and Costs

- Increased Pavement Restoration Costs due to reduced service life (pavement cutting, presence of track-mounted construction equipment and increased traffic loads in secondary roads)
SOCIAL COSTS

Reduced access for the public can have various impacts on society.

Related Effects and Costs

- Loss of Business Revenue
- Loss of Parking Space
- Increased accident rate
- Loss of Revenue from Parking Fines
SOCIAL COSTS

Safety is another concern when using open trenches for utility projects.

Related Effects and Costs

- Reduced Safety of the Public and Workers (open trenches, change of normal traffic circulation patterns)
SOCIAL COST SUMMARY

IMPACTS AND SOCIAL COST INDICATORS RELATED TO CONSTRUCTION PROJECTS IN URBAN ENVIRONMENTS

ADVERSE IMPACT

TRAFFIC
- PROLONGED CLOSURE OF ROAD SPACE
- DETOURS
- UTILITY CUTS

ECONOMIC ACTIVITIES

POLLUTION
- NOISE
- DUST
- VIBRATION
- AIR/WATER POLLUTION

ECOLOGICAL/SOCIAL/HEALTH
- SURFACE/SUBSURF. DISRUPTION
- DAMAGE TO RECREATIONAL FACILITIES

SOCIAL COST INDICATOR

LOSS OF PARKING SPACE
- ADDITIONAL FUEL CONSUMPTION
- TRAVEL DELAY
- INCREASED ACCIDENTS
- ACCELERATED DETERIORATION OF ROADS
- ROAD RAGE

LOSS OF INCOME
- PRODUCTIVITY REDUCTION
- LOSS OF TAX REVENUES
- PROPERTY DAMAGE

TREATING COMPROMIZED PHYSICAL/MENTAL HEALTH
- REDUCED QUALITY OF LIFE
- RESTORATION COST
The calculator assists the user in quantifying social costs related to utility improvement projects.

Some social costs can be calculated using rational mathematical models, while others must be estimated based on the experience and empirically collected data.
Traffic Delays are caused by lane closures and detours and are calculated using equations from the Highway Capacity Manual (HCM).

Vehicle Operating Costs increase due to longer travel distances from detours.
CALCULATOR

Pedestrian Delays are required to take detours due to rerouting of public transportation and blocked access to sidewalks and streets.
Dust and Dirt control is needed due to the significant amount of extra airborne dust created by open excavations.

In addition to the calculation shown above an estimate can also be made based on the size of buildings adjacent to the site and their distance from the site.
Decreased Road Surface value leads to an increase in pavement restoration costs.

Open excavations can result in pavement being deformed and cracked on the edges of the trench cut, which leads to accelerated deterioration of the pavement.

Reduction in useful pavement life due to an open-cut excavation is estimated to be as high as 30% (Tighe et al. 2002).
Loss of Business Revenue can be caused by loss of access due to traffic congestion, less parking and construction barriers.

- Although not easy to quantify trenchless methods tend create fewer obstructions to businesses.
- One possible method of quantifying the impact on the weekly turnover of a business used two factors: No. of Branches & Location/Access.

Loss of Parking Space reduces revenue from parking meters and parking fines. This can be calculated from the number of lost meters, rates of occupancy and frequency of fines.
Loss of production due to noise pollution can be calculated as function of level of noise (i.e. its distance to the site) and the associated reduction in production.

The use of heavy construction equipment results in a higher noise level in the vicinity of the work area (Gilchrist et al. 2003).

An increase of 1 dBA leads to a decrease in housing value estimated at 0.4% (Transportation Research Board 1996).
Safety is not a quantifiable monetary cost, but the amount of accidents occurring due to open trenches are enough to verify its importance.

Continuous open trenches pose a higher risk to workers and pedestrians compared with the pits/shafts employed by trenchless construction methods.

Accidents related to trenching are about 112% higher than the average value for construction work in general, with more than 60 workers killed in trenching accidents each year (Jung and Sinha 2004).
Case Study

- Traffic delays account for a large majority of the social costs, especially in urban areas.

- For the following example you can see a double in traffic density lead to a social cost increase of almost 4 times.
Cast Study

- Traffic delays account most of the social costs and the figure below shows the impact the amount of traffic had on this factors value.

<table>
<thead>
<tr>
<th>5000 AADT</th>
<th>10,000 AADT</th>
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<tr>
<td><strong>Project Data Input</strong></td>
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<tr>
<td>Duration of Project</td>
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</tr>
<tr>
<td>AADT (Average Annual Daily Traffic) 2-Way</td>
<td>5000 Vehicles</td>
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<tr>
<td>Proportion of Heavy Vehicles</td>
<td>5 %</td>
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<tr>
<td>Value of Time for Each Vehicle Passenger</td>
<td>$10/Day (Default $10/Day)</td>
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<tr>
<td>Value of Time for Each Heavy Vehicle Passenger</td>
<td>$25/Day (Default $25/Day)</td>
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<tr>
<td><strong>Anticipated Delay for Each Vehicle</strong></td>
<td><strong>Anticipated Delay for Each Vehicle</strong></td>
</tr>
<tr>
<td>or Calculate Vehicle Delay Directly</td>
<td></td>
</tr>
<tr>
<td>Duration of Peak Period of Traffic</td>
<td>2 Hours</td>
</tr>
<tr>
<td>Area Type (Check One)</td>
<td>Urban Area</td>
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<td></td>
<td>Rural Area</td>
</tr>
<tr>
<td>Social Cost due to Travel Delay</td>
<td><strong>$12,961.98</strong></td>
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## Direct Comparison

### Traffic Delay and Vehicle Operating Cost

**Open Cut Project Data Input**
- **Traffic for Open Cut Project**: Roadway with One-Way Traffic Closed and Detoured
- **Duration of Open Cut Project**: 10 Days
- **Peak Period of Traffic**: 2 Hours
- **Length of Detour**: 4 Miles
- **Length of Closed Road**: 1 Mile
- **Area Type**: Urban Type Area
- **Value of Time for Each Vehicle Passenger**: $16.39/Hour
- **Value of Time for Each Heavy Vehicle Passenger**: $28.93/Hour
- **Operating Cost Allowance for Passenger Vehicles**: 0.1518/mile
- **Operating Cost Allowance for Heavy Vehicles**: 0.5386/mile
- **Total Lanes in One Direction**: (Min. 1)
- **Cost due to Travel Delay**: $98,139.86
  - **Open Cut Total**: $98,139.86
- **Cost due to VOC**: $14,961
- **Total Savings**: $64,596.26

**Trenchless Method Project Data Input**
- **Traffic for Trenchless Project**: Two-Lane Highway with One-Lane Closed and Traffic Light or Flag Person
- **Duration of Trenchless Project**: 5 Days
- **Peak Period of Traffic**: 2 Hours
- **Length of Detour**: 4 Miles
- **Length of Closed Road**: 1 Mile
- **Area Type**: Urban Area
- **Value of Time for Each Vehicle Passenger**: $16.39/Hour
- **Value of Time for Each Heavy Vehicle Passenger**: $28.93/Hour
- **Operating Cost Allowance for Passenger Vehicles**: 0.1518/mile
- **Operating Cost Allowance for Heavy Vehicles**: 0.5386/mile
- **Total Lanes in One Direction**: (Min. 1)
- **Cost due to Travel Delay**: $33,543.6
  - **Trenchless Total**: $33,543.6
CONCLUSIONS

- By including the social cost calculator in the planning stages of a utility project the true cost of the project to society can be realized and the impact can therefore be reduced through proper selection of the construction methods utilized.

- Well documented case histories are crucial in developing a database for better estimating social costs.

- The development of an acceptable mechanism for incorporating social costs into the bid evaluation process is key for sustainable construction practices.
QUESTIONS?