Using a Custom Geoprocessing Model to Estimate Impacts of New and Modified Transit Services

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Outline

– Transit Service Changes/Uses for Model
– Brief Overview of Geoprocessing Models
– NEC FUTURE Case Study
– Summary/Other Applications
Transit Service Changes/
Uses for Model
Transit Service Changes/Uses for Model

– New/expanded services into previously unserved areas
– Modified services to meet changing transit service needs/emerging markets
– National Environmental Policy Act (NEPA)/Environmental Impact Statement (EIS)

This method is applicable for all transit service types/modes
Geoprocessing Models
Overview

- ESRI’s Model Builder

- Method
  - Pre-processing steps
    - Model inputs
      - Geography
      - Transit Service
      - Resources
    - Standardization
  - Model Development
    - Tools
    - Process Steps
  - Testing
  - Deployment
NEC FUTURE CASE STUDY

“NEC FUTURE is a comprehensive planning effort to define, evaluate, and prioritize future investments in the Northeast Corridor (NEC), from Washington, D.C. to Boston. The FRA launched NEC FUTURE in February 2012 to consider the role of rail passenger service in the context of current and future transportation demands. Through the NEC FUTURE program, the FRA will determine a long-term vision and investment program for the NEC, and provide a Tier I Environmental Impact Statement (EIS) and Service Development Plan (SDP) in 2016 in support of that vision.” Source: necfuture.com
Project Description

- NEC FUTURE Case Study
  - Environmental resource analysis
  - Estimating impacts
  - Uniform results
  - Enormous level of detail

The NEC is the busiest rail corridor in the nation, and is vital to the economy and cities of the Northeast region.

- 750,000
  - Passengers Daily
- 2,220
  - Passenger Trains Daily
- 70
  - Freight Trains Daily

Source: necfuture.com
Tier I EIS Alternatives

**Alternative 1: Maintain**

**Alternative 2: Grow**

**Alternative 3: Transform**
Creating Geoprocessing Models to Estimate Impacts to Resources

– Preparation
– Building and Testing Models
– Running Models
– Checking Results
– Analysis and Presentation of Results
  • Stations
  • Representative Route
  • Construction Type
  • Service Type
Preparation of Geographies

Using a Custom Geoprocessing Model to Estimate Impacts of New and Modified Transit Services
Preparation of Alternatives

Using a Custom Geoprocessing Model to Estimate Impacts of New and Modified Transit Services
Environmental Resources

- Land Cover
  - Developed Land Covers
  - Undeveloped Land Covers

- Agricultural Resources
  - Prime Farmland
  - Prime Timberland

- Parklands
  - Parks/Recreation Areas
  - Wild and Scenic Rivers
  - Conservation Lands
  - Wildlife Preserves

- Air Quality

- Hydrology
  - Fresh- and Salt-water Wetlands
  - Floodplains
  - Coastal Zones

- Ecology
  - Ecologically Sensitive Habitats
  - Essential Fish Habitat
  - Threatened and Endangered Species

- Geologic Resources

- Climate Change

- Energy

- Environmental Justice/Demographics/Socioeconomics
  - Population
  - Minority Population
  - Low Income Population

- Noise and Vibration

- Transportation

- Economics

- Visual and Aesthetic Resources

> 30 separate datasets/resources!
Points, Lines, Polygons, Combinations
Model Inputs

- Resources
- Geographies
- Alternative Routes
- Stations

Example Location

Using a Custom Geoprocessing Model to Estimate Impacts of New and Modified Transit Services
Model Tools

- **Identify Tools**
  - Clip
  - Intersect
  - Calculate Area
  - Merge

- **Build Models**
  - Split Resources by Geographies
  - Three Parallel Tracks
    - Affected Environment
    - Representative Route
    - Stations

- **Summarize Results**
  - Frequency Tool
  - Excel Pivot Tables
Running the Model

– Identify Tools
  • Clip
  • Intersect
  • Calculate Area
  • Merge

– Build Models
  • Split Resources by Geographies
  • Three Parallel Tracks
    o Affected Environment
    o Representative Route
    o Stations

– Summarize Results
  • Frequency Tool
  • Excel Pivot Tables

Blue: Data Inputs
Yellow: Geoprocessing Tools
Green: Files Created

Standardized to ‘Name’ and ‘Type’ fields only

Using a Custom Geoprocessing Model to Estimate Impacts of New and Modified Transit Services
Model Outputs

- Identify Tools
  - Clip
  - Intersect
  - Calculate Area
  - Merge

- Build Models
  - Split Resources by Geographies
  - Three Parallel Tracks
    - Affected Environment
    - Representative Route
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- Summarize Results
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Model Outputs

– **Identify Tools**
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– **Build Models**
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    - Representative Route
    - Stations

– **Summarize Results**
  - Frequency Tool
  - Excel Pivot Tables
### Sample Results
(actual results may vary)

<table>
<thead>
<tr>
<th>Resource</th>
<th>Measurement</th>
<th>Existing NEC</th>
<th>Alternative 1</th>
<th>Alternative 2</th>
<th>Alternative 3 (range)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Population</strong></td>
<td><strong>Population</strong>: Total population of census tracts intersecting Representative Route</td>
<td>2.2 million</td>
<td>2.2 million</td>
<td>2.5 million</td>
<td>3.2–3.4 million</td>
</tr>
<tr>
<td><strong>Environmental Justice</strong></td>
<td><strong>EJ Census Tracts</strong>: Percentage of EJ census tracts among all census tracts within the Affected Environment</td>
<td>59% census tracts</td>
<td>59% census tracts</td>
<td>57% census tracts</td>
<td>54–56% census tracts</td>
</tr>
<tr>
<td><strong>Population</strong></td>
<td><strong>Minority</strong>: Percentage of population among all census tracts within the Affected Environment</td>
<td>54%</td>
<td>54%</td>
<td>52%</td>
<td>48–52%</td>
</tr>
<tr>
<td><strong>Population</strong></td>
<td><strong>Low Income</strong>: Percentage of population among all census tracts within the Affected Environment</td>
<td>17%</td>
<td>17%</td>
<td>16%</td>
<td>16%</td>
</tr>
<tr>
<td><strong>Land Cover</strong></td>
<td><strong>Conversion</strong>: Percentage of Representative Route with potential conversion of undeveloped land</td>
<td>23%</td>
<td>24%</td>
<td>25%</td>
<td>21-25%</td>
</tr>
<tr>
<td><strong>Water Resources</strong></td>
<td><strong>Flood Risk</strong>: Percentage of Representative Route within floodplain</td>
<td>16%</td>
<td>15%</td>
<td>14%</td>
<td>13-15%</td>
</tr>
<tr>
<td><strong>Water Resources</strong></td>
<td><strong>Coastal Zone Impact</strong>: Percentage of route miles within coastal zones</td>
<td>40%</td>
<td>43%</td>
<td>35%</td>
<td>29–35%</td>
</tr>
<tr>
<td><strong>Cultural Resources and Section 4(f)/6(f)</strong></td>
<td><strong>6(f) Parks</strong>: Total Resources</td>
<td>20</td>
<td>21</td>
<td>23</td>
<td>21-26</td>
</tr>
<tr>
<td><strong>Cultural Resources and Section 4(f)/6(f)</strong></td>
<td><strong>Wildlife and Waterfowl Refuges</strong>: Total resources</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td><strong>Cultural Resources and Section 4(f)/6(f)</strong></td>
<td><strong>NHL</strong>: Total Resources</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>4–5</td>
</tr>
<tr>
<td><strong>Cultural Resources and Section 4(f)/6(f)</strong></td>
<td><strong>NRHP-Listed</strong>: Total Resources</td>
<td>31</td>
<td>142</td>
<td>171</td>
<td>132-150</td>
</tr>
</tbody>
</table>

Source: NEC FUTURE, 2015

Note: Environmental consequences calculated based on the representative routes of the alternatives unless noted.

1. Environmental justice figures as represented correspond to a 1-mile Affected Environment
2. Potential land cover conversion figures exclude tunnel and major bridge construction types
Benefits of Using a Geoprocessing Model to Estimate Impacts

– Uniform results that can be used for evaluation/comparison of alternatives and can be summarized by:
  • Mode
  • Alternative/Segment
  • Geography
  • Construction Type

– Applicability to all types of modes/modifications/expansions
  • Case study covers very large service area
  • Local scale possibilities

– Can be used to illuminate both potential issues and potential benefits
Thank You

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