Risk-Based Prioritization of Transportation Corridors Vulnerable to Development

James H. Lambert, Alexander S. Linthicum, and Matthew J. Schroeder
Center for Risk Management of Engineering Systems, University of Virginia

http://www.virginia.edu/crmes/corridorprotection

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Overview

- Introduction
- Background
- Illustration of Methodology
- Statewide Training and Implementation
- Conclusions
Introduction
Motivation

- Over 9000 miles of interstate and primary roads in Virginia
- Increasing vulnerability to development activity
- Escalating land values affects right of way acquisition
- Desire to avoid unnecessary congestion and costly retrofits

- VDOT must anticipate future development in corridors and take timely action: *Corridor Protection*
  - Pre-purchase right-of-way
  - Obtain easements, developer proffers
  - Access management
Goal

Develop a repeatable, data-driven, GIS-based methodology to identify and prioritize countywide corridors that are vulnerable to land development.

Test the methodology in Fauquier County, VA and surrounding counties.
Background
Corridor Protection

- Potential fiscal and social benefits
- Many stakeholders
- Methods
  - Access management
  - ROW acquisition
- Legal issues

Sources: (Williams and Frey, 2003; Armour, Rose, Butler, and Waters, 2002; Corridor Capacity Preservation Program, 2002; Stokes, Russell, and Vellanki, 1994; Perfater, 1989; Kamprath and Miller, 2004)
Access Management

- Safety
- Congestion
- Network design
- Effects on businesses
- HB 2228

Right of Way Acquisition

- Pressure to complete ROW estimations
- Lengthy acquisition process
- Uncertainties with damages and court costs
- Uneconomic remnants
- Common pitfalls

Sources: (Corridor Capacity Preservation Program, 2002; Barnes and Watters, 2002; Heiner and Kockelman, 2005; Williams, Zhou, and Hagan, 2004;)
Map Data and Transportation Planning

- **UPLAN: A Versatile Urban Growth Model for Transportation Planning** (Johnston and Shabazian, 2002)

- **Characterizing urban land capacity** (Landis, 2001)

- **Smart Land-Use Analysis: The LUCIS Model** (Zwick and Carr, 2007)

- **An approach for greenway suitability analysis** (Miller et al., 1998)

- **Forecasting exurban development to evaluate the influence of land use policies on wildland and farmland conservation** (Merenlender et al., 2005)
Illustration of Methodology
Overview of Methodology

Risk Assessment

1. Define Scope
   - What can go wrong?

2. Collect Data
   - What are the likelihoods?

3. Identify Factors

4. Derive Factors

5. Scale Factors

6. Combine Factors

7. Screen Results

8. Analyze Sections

9. Evaluate Alternatives

Risk Management

- What are the trade-offs?

- What can be done?
  (also addressed in the Literature Review)

- What are the impacts of current decisions on future options?
  (also addressed in the Literature Review)
1. Define Scope

2. Collect Data

3. Identify Factors

4. Derive Factors

5. Scale Factors

6. Combine Factors

7. Screen Results

8. Prioritize Sections

9. Uses of Results
Define Scope
Define Scope (cont.)

- Beyond D.C. suburbs
- Rural character
- Service Districts
- Six major corridors

<table>
<thead>
<tr>
<th>Corridor</th>
<th>Miles</th>
</tr>
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<tbody>
<tr>
<td>US-17</td>
<td>53.8</td>
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<tr>
<td>PR-55</td>
<td>18.0</td>
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<tr>
<td>I-66 Ramps</td>
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<tr>
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<tr>
<td>US-28</td>
<td>13.7</td>
</tr>
<tr>
<td>US-29</td>
<td>22.2</td>
</tr>
</tbody>
</table>

Total: 164.1
Define Scope (cont.)
Define Scope (cont.)

- 32,000 Parcels
Overview of Map Data

**CONSTRAINT FACTORS**
- Public land
- Wetlands
- Conservation easements
- Ag and forestal Districts

**INDICATOR FACTORS**
- Population & employment Centers
- Vacant & undervalued land
- Transportation

**MANAGEMENT FACTORS**
- Access point density
- Land assessment
- Utilities
1. Define Scope

2. Collect Data

3. Identify Factors

4. Derive Factors

5. Scale Factors

6. Combine Factors

7. Screen Results

8. Prioritize Sections

9. Uses of Results

Constraint: Protected Parcels
Constraint: Protected Parcels

Conservation Easements  Parks and Schools  Agricultural and Forestal Districts

Source: Fauquier County Department of Community Development; VDOT TPMD
Indicator: Parcels Near Major Corridors
Indicator: Parcels Near Major Corridors

1 mile
0.25 miles
Indicator: Parcels Near Intersections

Number of Intersecting Corridors:

- 1
- 2
- 3
Indicator: Parcels Near Population Centers

Source: 2000 US Census
Indicator: Parcels Near Employment Centers

Employees
- 17,500
- 2,375
- 150
- 30
- 5

Source: Virginia
Constraint: Economically Unsuitable Parcels

Improvement-to-land ratio

- > 0.90  Not suitable
- <= 0.90  Suitable
1. Define Scope
2. Collect Data
3. Identify Factors
4. Derive Factors
5. Scale Factors
6. Combine Factors
7. Screen Results
8. Prioritize Sections
9. Uses of Results
Combine Factors

INDICATOR FACTORS

CONSTRAINT FACTORS

+ + +

0 1

3 6 10

1 2

5

10

1 2 3 4 5 6 7 8 9 10

0

1

0

1
Combine Factors

Likelihood of Land Development

- Very Low
- Low
- Med
- High
1. Define Scope
2. Collect Data
3. Identify Factors
4. Derive Factors
5. Scale Factors
6. Combine Factors
7. Screen Results
8. Prioritize Sections
9. Uses of Results
Six Fauquier Corridors

- PR 55
- I 66 R
- US 211
- US 17
- US 28
- US 29
## Six Fauquier Corridors

### I 66 Ramps - 5.6 miles

<table>
<thead>
<tr>
<th>Parcels</th>
<th>Acres (K)</th>
<th>Acres (%)</th>
<th>Land Val ($M)</th>
<th>Avg Val per Parcel ($K)</th>
<th>Avg Val per Acre ($K)</th>
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<tbody>
<tr>
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<td>536</td>
<td>5.9</td>
<td>30</td>
<td>103</td>
<td>193</td>
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<tr>
<td>Low</td>
<td>30</td>
<td>1.9</td>
<td>10</td>
<td>16</td>
<td>521</td>
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<tr>
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<td>667</td>
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<td><strong>100</strong></td>
<td><strong>402</strong></td>
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### US 211 - 7.0 miles

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<tr>
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<th>Acres (K)</th>
<th>Acres (%)</th>
<th>Land Val ($M)</th>
<th>Avg Val per Parcel ($K)</th>
<th>Avg Val per Acre ($K)</th>
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<tbody>
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<td>50</td>
<td>510</td>
<td>193</td>
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<tr>
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<td>70</td>
<td>1.9</td>
<td>16</td>
<td>25</td>
<td>354</td>
</tr>
<tr>
<td>Med</td>
<td>167</td>
<td>2.5</td>
<td>22</td>
<td>54</td>
<td>326</td>
</tr>
<tr>
<td>High</td>
<td>1,196</td>
<td>1.2</td>
<td>11</td>
<td>308</td>
<td>258</td>
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<td><strong>Total</strong></td>
<td><strong>4,082</strong></td>
<td><strong>11.3</strong></td>
<td><strong>100</strong></td>
<td><strong>897</strong></td>
<td><strong>220</strong></td>
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### PR 55 - 18.0 miles

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<th>Land Val ($M)</th>
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<th>Avg Val per Acre ($K)</th>
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<tr>
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<td>783</td>
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<td>39</td>
<td>167</td>
<td>213</td>
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<tr>
<td>Low</td>
<td>239</td>
<td>6.8</td>
<td>22</td>
<td>79</td>
<td>332</td>
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<tr>
<td>Med</td>
<td>463</td>
<td>5.5</td>
<td>18</td>
<td>125</td>
<td>271</td>
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<tr>
<td>High</td>
<td>653</td>
<td>6.4</td>
<td>21</td>
<td>209</td>
<td>320</td>
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<td><strong>Total</strong></td>
<td><strong>2,138</strong></td>
<td><strong>30.8</strong></td>
<td><strong>100</strong></td>
<td><strong>580</strong></td>
<td><strong>271</strong></td>
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### US 28 - 13.7 miles

<table>
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<th>Land Val ($M)</th>
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<th>Avg Val per Acre ($K)</th>
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<tr>
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<td>1,670</td>
<td>4.1</td>
<td>19</td>
<td>225</td>
<td>135</td>
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<tr>
<td>Low</td>
<td>9</td>
<td>0.5</td>
<td>2</td>
<td>6</td>
<td>669</td>
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<tr>
<td>Med</td>
<td>737</td>
<td>10.1</td>
<td>46</td>
<td>128</td>
<td>174</td>
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<tr>
<td>High</td>
<td>539</td>
<td>7.2</td>
<td>33</td>
<td>131</td>
<td>244</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>2,955</strong></td>
<td><strong>22.0</strong></td>
<td><strong>100</strong></td>
<td><strong>491</strong></td>
<td><strong>166</strong></td>
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### US 17 - 53.8 miles

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<th>Acres (K)</th>
<th>Acres (%)</th>
<th>Land Val ($M)</th>
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<td>379</td>
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<td>16</td>
<td>126</td>
<td>332</td>
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<tr>
<td>Med</td>
<td>1,182</td>
<td>21.5</td>
<td>30</td>
<td>348</td>
<td>294</td>
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<tr>
<td>High</td>
<td>2,218</td>
<td>11.0</td>
<td>16</td>
<td>663</td>
<td>299</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>10,504</strong></td>
<td><strong>70.6</strong></td>
<td><strong>100</strong></td>
<td><strong>2,362</strong></td>
<td><strong>225</strong></td>
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### US 29 - 22.2 miles

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<th>Acres (%)</th>
<th>Land Val ($M)</th>
<th>Avg Val per Parcel ($K)</th>
<th>Avg Val per Acre ($K)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Low</td>
<td>5,515</td>
<td>9.7</td>
<td>32</td>
<td>893</td>
<td>162</td>
</tr>
<tr>
<td>Low</td>
<td>371</td>
<td>2.5</td>
<td>8</td>
<td>42</td>
<td>112</td>
</tr>
<tr>
<td>Med</td>
<td>1,088</td>
<td>11.9</td>
<td>39</td>
<td>266</td>
<td>244</td>
</tr>
<tr>
<td>High</td>
<td>1,323</td>
<td>6.2</td>
<td>20</td>
<td>432</td>
<td>326</td>
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<tr>
<td><strong>Total</strong></td>
<td><strong>8,297</strong></td>
<td><strong>30.4</strong></td>
<td><strong>100</strong></td>
<td><strong>1,632</strong></td>
<td><strong>197</strong></td>
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</tbody>
</table>
Distribution of Corridor Priorities, Acres per Centerline Mile
Parcels within 1 mile of corridor centerline

- Very Low
- Low
- Med
- High

- I 66 R
- PR 55
- US 17
- US 211
- US 28
- US 29

Acres / Mile
1. Define Scope
2. Collect Data
3. Identify Factors
4. Derive Factors
5. Scale Factors
6. Combine Factors
7. Screen Results
8. Prioritize Sections
9. Uses of Results

Management: Access Point Density
Management Factor: Access Points

US-17
418 access points
Considerable uncertainty
Management Factor: Access Points, US 28

[Graph showing the distribution of access points along different segments of US 28, with labels for Bealeton, Midland, Calverton, and Catlett. The graph includes bar charts for low and high volume access points.]
1. Define Scope
2. Collect Data
3. Identify Factors
4. Derive Factors
5. Scale Factors
6. Combine Factors
7. Screen Results
8. Prioritize Sections
9. Uses of Results

Management: Land Assessment Value
Management Factor: Value per Acre, US 28

![Map showing value per acre across various locations. The x-axis represents priority score, with values ranging from 0.5 to 14.0. The y-axis represents value per acre, with values ranging from 0 to 18.0. Locations such as Bealeton, Calverton, and Catlett are marked on the map, showing variations in value per acre across different areas.]

- **Priority Score**: 0, 2, 4, 6, 8, 10, 12, 14, 16, 18
- **Value per Acre (100Ks)**: 0, 2, 4, 6, 8, 10, 12, 14, 16, 18

For detailed analysis, please refer to the accompanying data or report.
1. Define Scope
2. Collect Data
3. Identify Factors
4. Derive Factors
5. Scale Factors
6. Combine Factors
7. Screen Results
8. Prioritize Sections
9. Uses of Results
Uses of the Results

• Field visits
• Context sensitive corridor protection strategies
  – ROW Acquisition
  – Land use controls / concessions
  – Network design
Uses of Results (cont.)

Conclusions
Conclusions

• Results can effectively be communicated to County Board of Supervisors and Planning Commission
  – Reinforce critical need to implement VDOT Safety Improvement Plan for crossovers along US 15/29
  – Identify where land use management controls should restrict future access

Source: Rick Carr, Fauquier County, 10/18/2007
Conclusions (cont.)

- Identification of *what* corridor sections should be protected must be followed with *how* corridor sections will be protected

  - Several existing options
    - Access management
    - Land use controls
    - Police powers

  - Enabling laws differ from state to state
Conclusions (cont.)

• Methodology can assist counties and towns in complying with legislative acts

• HB 3202
  – Identifying suitability of urban development areas
  – Identifying Traffic Impact Fee Service Area

• HB2228/SB1312
  – Developing statewide access management standards

Source: Rick Carr, Fauquier County, 10/18/2007
Conclusions (cont.)

• Rappahannock-Rapidan Regional Commission (RRRC) and other PDCs can apply the methodology at the regional level
  – Insure more coordinated transportation/land use approach among member jurisdictions
  – Provide GIS-based analysis to member jurisdictions that lack staffing capabilities to develop independent studies
Conclusions (cont.)

• Methodology is flexible and can accommodate a variety of datasets

• Future efforts may include
  – Land use and zoning
  – Functional classification of corridors
  – Green infrastructure (VDCR)
  – Transportation infrastructure of additional modes such as bike and pedestrian, rail, bus, and air
  – Out-of-county property owners
  – Bird or animal migration corridors

Source: Project Steering Committee, 10/18/2007; VDOT District Planners, 11/28/2007