Roadway Alignments as Assets: Evaluating Alternatives for Valuing Major Highway Corridor Rights of Way

Final Report
December 2010

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In most highway asset management exercises, real estate used in alignments is considered to be an asset class that does not depreciate. Although the treatment of right of way assets as non-depreciable real property may be appropriate as an accounting exercise, the fact is that the real estate contained in transportation corridors can in fact lose value from a traffic service point of view. Such facilities become functionally obsolete in that they no longer serve the purpose that was intended when they were planned, designed, and built. This report is intended to begin a discussion of the topic of how highway alignments ought be valued as assets as opposed to how they generally are valued, at either book value or replacement value, given it can be shown that some highway alignments do in fact depreciate in value.			
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ROADWAY ALIGNMENTS AS ASSETS: EVALUATING ALTERNATIVES FOR VALUING MAJOR HIGHWAY CORRIDOR RIGHTS OF WAY

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TABLE OF CONTENTS

Acknowledgments vii
Problem Statement 1
The Issue: Functional Obsolescence of Highway Alignments 1
Different Ways of Valuing Alignments 2
Analysis Methodology 3
Data Collection and Sources 4
Using the Impact Calculator 5
Analytical Findings 6
Key Conclusions 14
References 17
Appendix: Review of the Virginia Department of Transportation's GASB 34 Infrastructure Valuation 19
  Infrastructure Ownership 19
  Capitalization 19
  Initial Inventory Value 20
  Depreciation 26

LIST OF FIGURES

Figures 1 and 2. Travel times based on current traffic levels 7
Figures 3 and 4. Travel times based on projected 2020 traffic levels 8
Figures 5 and 6. Travel speeds based on projected 2020 traffic levels 8
Figure 7. Cost of travel time for users of IA 163 9
Figures 8 and 9. Changes in crash rates due to increased or decreased access 10
Figures 10 and 11. Cost of crashes on urban highway segments in Des Moines and Dubuque 11
Figure 12. Average cost of Iowa DOT highway projects 12
Figure 13. Average right-of-way costs for Iowa DOT highway projects 13
Figure 14. Project costs spread out over the average lifetime of a highway 14

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PROBLEM STATEMENT

Right of way for major highway transportation corridors is every much as valuable an asset as pavements or bridge structures. Yet, these right-of-way assets have received very little consideration in discussions of transportation asset management. One reason for this is that under generally accepted accounting principles for government agencies, transportation right of way is considered real property and is not subject to depreciation. Real property is assumed to have an indefinite physical life and can never become physically obsolete in the manner that a pavement or bridge structure would.

Right of way assets represent the value of land that is used to accommodate transportation corridors. An example of a state that has valued its investment of transportation corridor right of way is Virginia (See the Appendix).

The Virginia Department of Transportation (VDOT) valued total Road Inventory Network assets at $11.4 billion with accumulated depreciation of $7.0 billion for a net capitalizable value of $4.4 billion on June 30, 2000. VDOT valued its transportation right of way assets at $711 million as of June 30, 2000. This was about six percent of all VDOT highway assets.

Pavements and structures made up the vast majority of the agency's highway assets. These are each considered to be depreciable assets because they have limited life spans and simply because they wear out due to accumulated effects of time, weather, and traffic.

In most highway asset management exercises, real estate used in alignments is considered to be an asset class that does not depreciate. Although the treatment of right of way assets as non-depreciable real property may be appropriate as an accounting exercise, the fact is that the real estate contained in transportation corridors (henceforth referred to as alignments) can in fact lose value from a traffic service point of view. Such facilities become functionally obsolete in that they no longer serve the purpose that was intended when they were planned, designed, and built.

This report is intended to begin a discussion of the topic of how highway alignments ought be valued as assets as opposed to how they generally are valued, at either book value or replacement value, given it can be shown that some highway alignments do in fact depreciate in value.

THE ISSUE: FUNCTIONAL OBSOLESCENCE OF HIGHWAY ALIGNMENTS

There are a number of reasons that highway alignments can become functionally obsolete. One is that geometric design standards change over time as more becomes known about traffic flow and improving safety.

Geometric standards for horizontal curvature, vertical curvature, lane width, medians, clear zones, shoulders, and features to accommodate merging streams of traffic (to name a few) have changed dramatically in the past 50 to 80 years. A highway alignment that had been judged perfectly acceptable for moving long-distance traffic in the 1950s may need to be replaced today to accommodate a highway with contemporary geometric standards.

A more intriguing way that highway alignments can become functionally obsolete over time has to do with changes in the way that traffic and access to adjacent land development are managed (or not managed). Changes to highway facilities such as the addition of traffic signals or stop signs and the addition of median openings or private driveways can dramatically diminish their functionality over time. Often, such changes occur in an incremental fashion (e.g., one traffic signal or one private driveway at a time). This sort of functional obsolescence tends to occur on two types of roadways:

- Suburban arterials with originally planned operating speeds of 35 to 50 mph
- Rural surface arterials with originally planned operating speeds of 50 to 65 mph (referred to as rural expressways in Iowa)

DIFFERENT WAYS OF VALUING ALIGNMENTS

There are many possible ways of placing a value on the real estate parcels that make up highway alignments:

- Book value
- Replacement value
- Willing buyer-willing seller
- Comparable transactions method
- Income-based methods (Telecommunities March 2002)

These methods should be expected to produce widely different results in valuation.

Book value is generally the original value of the asset when it was placed on the agency or company's books less any accumulated depreciation (usually assumed to be zero for real estate) and encumbrances for debt utilized to purchase and/or build the asset. Given that highway alignment real estate may have been acquired decades ago, this method may be expected to produce a very conservative estimate of valuation.

Replacement value is the cost required to assemble and replace the real estate parcels that make up the highway alignment in today's marketplace. This method might generally be expected to produce a higher estimate of valuation than book value. The book value and the replacement value approaches could be expected to differ greatly in areas where the value of real estate has risen rapidly historically, such as coastal areas of the US and inside metropolitan areas.

Willing buyer-willing seller is a market-based approach to establishing the value of assets. The value is what the buyer and seller would agree to. For all practical purposes, it should be the same or nearly the same as the replacement value.

Comparable transactions is a technique often used in residential real estate valuation. In this approach, the value of a sample of nearby, similar properties or "comps" that have recently sold is used to establish the value of properties. Again, this approach should produce a result nearly the same as either replacement value or willing buyer-willing seller.

Income-based methods are often used to place a value on commercial real-estate assets. In the case of highway alignments, the alignment might be better thought of as a facilitator of a stream of public benefits rather than as a producer of a stream of income. One could argue that from the transportation agency's point of view, the income stream would be the taxes and user fees that would accrue to the agency as a result of the alignment being open to traffic. However, the true economic value of the roadway alignment is its ability to produce three reductions:

- Travel time for users (travel time savings)
- Vehicle operating costs
- Crash costs

There may also be a value stream associated with improvements to the reliability of travel time. In other words, highway users may place a value of having more certain arrival times at their personal or shipping destinations. However, less is known about valuing reliability than about valuing travel time, vehicle operating cost, or safety.

ANALYSIS METHODOLOGY

Public right-of-ways for roadways are major investments. According to the Federal Highway Administration (FHWA), there are approximately four billion miles of roads and streets in the US, and three billion of these are publicly managed. Assuming that the average right-of-way has a 40 ft width, there are approximately 625 billion sq ft of public right-of-way for roads in the US.

Using $9 as the average cost of a square foot of land abutting a right-of-way, the value of all of the public right-of-way in the US. totals about $3.5 trillion, with about $70 billion of this being the cost incurred by an average-sized state.

Because of the value of this investment and the high cost associated with purchasing new or additional right-of-way in highway corridors, it should be managed and protected. However, this is not the case in many areas. Decisions made to allow direct access to an arterial, adding traffic signals, median breaks, or allowing additional land development can potentially lower the value of a right-of-way.

Accounting exercises, such as those required by the provisions of Government Accounting Standards Board Statement 34 (GASB 34), assume that a right-of-way for a road is to have a service life of 100 years or more and do not depreciate in value. In reality, a right-of-way can and will depreciate in the value of service it provides to motorists and the value of access it provides to properties. As a result, a road or highway can become partially functionally obsolete in that it no longer adequately provides the level of transportation and access it was designed to provide.

This section of the report describes the data collection and analysis methods used in the beginning to construct a more realistic value of a highway alignment based on the stream of benefits it provides and the potential for that stream to be reduced. This research project, like most others, involve the following steps: define the problem, create a hypothesis, collect the necessary data, analyze the data to test the hypothesis, and determine whether or not the hypothesis holds true. The remainder of this section describes the problem studied, proposed hypothesis, data collected, and data analysis.

The purpose of this project is to begin to develop a method for valuing a road right-of-way that serves as a major highway corridor. This research compares this value to the costs incurred by the Iowa DOT in building a new highway or rebuilding an existing one. By comparing negative costs associated with additional driveways and traffic signals to the cost of DOT projects involving the purchase of right-of-way, it is hoped to show that the value of the right-of-way making up an alignment can be negatively affected, given the stream of benefits it supports can experience reductions.

This project looks at two case study highways: US 20 west of Dubuque and IA 163 east of Des Moines. Traffic and road data were collected for each of these segments. Each highway was then broken up into three segments: urban, suburban, and rural.

Current data (the “as is” situation) were analyzed both graphically and statistically for each segment, as well as hypothetical changes to access as well as projected traffic increases. This information was then used to create costs incurred by the individual user as well as by the Iowa DOT in maintaining the segment. These costs can then be compared to the costs of purchasing additional right-of-way or building/rebuilding a highway.

A Geographic Information System (GIS), ArcView 3.3, was used for the graphical analysis part of this project. This program allowed each segment to be mapped and, with the addition of Color Infrared (CIR) photographs, access within each segment to be studied.

Five different software packages were reviewed for their ability to measure the costs associated with changes to each segment effectively. The four packages reviewed during the course of this project were Highway Economic Requirements System State Version (HERS-ST), Surface Transportation Efficiency Analysis Model (STEAM), Sketch Planning Analysis Spreadsheet Model (SPASM), IMPACTS, and the Impact Calculator: Impacts of Access Management Techniques. Each package was looked into as a potential tool for calculating the value of a right-of-way, or the costs associated with changes to access. The Impact Calculator was found to be able to best meet the objectives of this project, so it was used to perform the analysis for this research.

DATA COLLECTION AND SOURCES

GIS information for this project was obtained from the Iowa DOT. The information included road location and characteristics, traffic signal location, and municipal boundaries. Additional

GIS information in the form of CIRs, was obtained from the Iowa Department of Natural Resources (DNR).

Road and traffic information, along with some traffic signal information on the IA 163 corridor, was obtained from the Iowa DOT. US 20 traffic signal information was obtained from the City of Dubuque. IA 163 signal information from the City of Des Moines. Travel time to work was gathered from the U.S. Census Bureau’s Census Transportation Planning Package (CTPP).

USING THE IMPACT CALCULATOR

The Impact Calculator was used to determine how travel speed, travel rate, and crash rate would be affected by changes in traffic signalization and access to each corridor segment. The calculator is based on the information contained in National Cooperative Highway Research Program (NCHRP) 420: Impacts of Access Management Techniques (Gluck, Levinson, and Strover 1999).

Through the input of traffic volume (or projected volume), signal timing, and speed limit, the Impact Calculator can determine the travel speed and rate on a particular segment of road. This is useful to see how additional traffic, adding signals, or changing signal timings affects traffic flow. It can also calculate the crash rate for a road segment based on the number of signals, number of driveways, and median type, or based on total access. By using this calculator, it is possible to show how crashes will increase or decrease due to changes in access.

Value of Travel Time

To calculate the value of time for the occupants of a vehicle, it is necessary to know the average weekly or hourly wage, number of passengers, and travel time. By knowing these three pieces of information, it is possible to calculate the value of time per vehicle and the cost of travel time per vehicle.

The value of travel time per vehicle is simply a further breakdown of the average wage, showing the value of a minute of time in a vehicle as a dollar amount. Determining the cost of travel time is more useful. This shows the value of time as a dollar amount that a vehicle occupant would be making if they were working during the length of time they were in the vehicle. This information is useful because it can show the value of losses in time due to increased travel time.

Cost of Crashes

To determine the cost of crashes, the first step is to determine the number of crashes on each segment, and the severity of these crashes. By knowing the number and severity of crashes, the cost of vehicle crashes on a segment can be calculated. This value can be compared to the cost of crashes on other segments, or to the annualized cost of a highway or its right-of-way. The annualized cost being the cost of the highway or right-of-way spread out over its projected lifespan.

The Impact Calculator calculates the crash rate for a segment of road based on the amount of traffic, the speed limit, and number of access points. To find the cost of crashes on a segment, it is necessary to convert this crash rate into the annual number of crashes. This is accomplished by multiplying the crash rate by the total millions of vehicle miles traveled on that segment.

The number of each severity of crash was projected from trends established by looking at previous years' crashes. Five years of crashes were looked at and divided up by their severity. The percentages of each severity for each year were then calculated and averaged together. These percentages were then used to determine the number of each type of crash that would occur on a given segment.

Given there are average costs associated with each level of crash severity, it is possible to then calculate the cost of all the crashes by multiplying the cost for each severity by the projected number of each severity and then adding the values together.

Iowa DOT Highway Construction Costs

Highway construction and right-of-way costs were obtained from the Iowa DOT five-year improvement plan (highway projects involving new construction or the rebuilding of a road). Both projects that included the purchase of right-of-way and those that did not were selected.

By calculating the cost of the right-of-way (ROW) of the project over the lifetime of the ROW, or the annual cost of the ROW, it is possible to compare this and the annual cost of crashes on a segment of similar length.

To calculate the annual cost of a project's right-of-way, information on the cost of the ROW for a particular project needs to be known, along with the annual interest rate and the expected life of the ROW. When all of these pieces of information are known, the annual cost can be calculated using the formula for determining the Capital Recovery Factor as follows:

$$A = P[\ i\ (\ 1 + i\ )\ n\ ]\ [\ (\ 1 + i\ )\ \hat{}\ n - 1\ ]$$

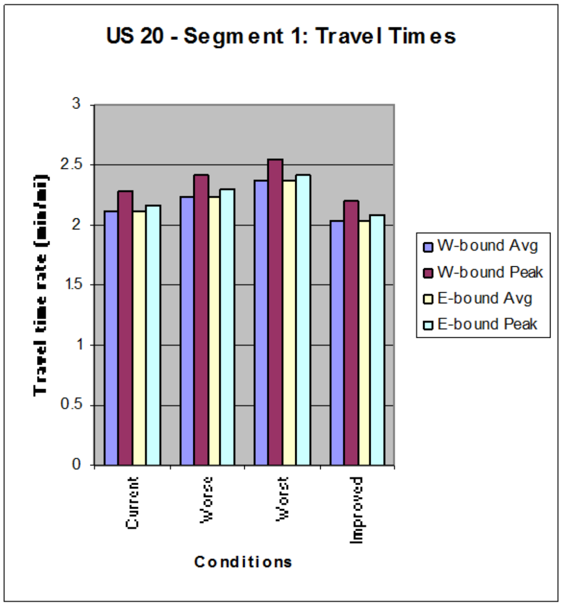
where A = end of year payment, P = present sum of money (or cost), i = interest (discount) rate, and n = number of years (lifetime of project).

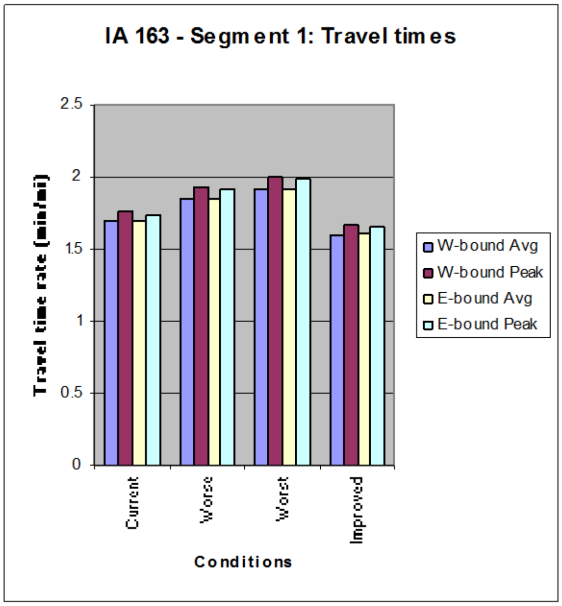
ANALYTICAL FINDINGS

The purpose of this section is to describe the findings of this study in determining how changes to a highway corridor create benefits and costs. These benefits and costs can then be used to determine the effectiveness of the corridor in moving vehicles and show how they affect the value of the ROW via the reduction of its ability to provide a stream of benefits in terms of travel time and reduced crash costs. The end result should show if a highway corridor can become "cluttered" with driveways and traffic signals to the point where the annual costs meet or exceed the annual cost of the ROW or the highway segment.

Using the Impact Calculator, it was possible to calculate the travel speed and travel time for the US 20 and IA 163 corridors based on their current traffic volumes, speed limits, and driveway and signal densities. Increasing the number of driveways and signals showed how travel speed would decrease and travel time would increase as a result of increased congestion. Or, by decreasing the number of driveways and signals (as a result of possible consolidation) showed how travel speed would increase and travel time would decrease.

Figures 1 and 2 show how travel times for the current levels of traffic would be impacted on the busiest segments of both highways.

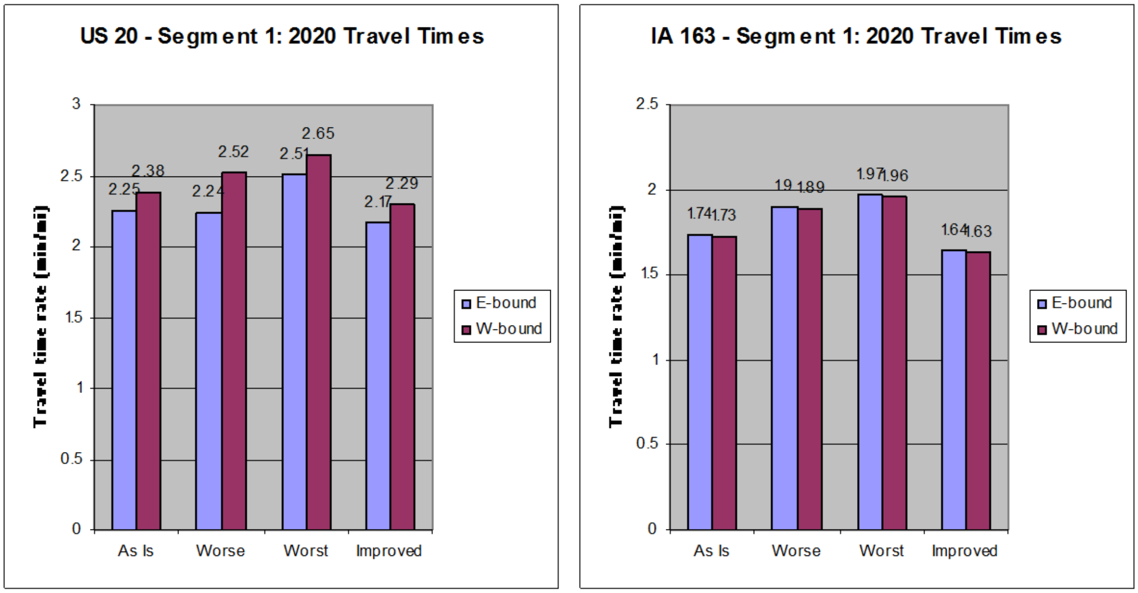




Figures 1 and 2. Travel times based on current traffic levels

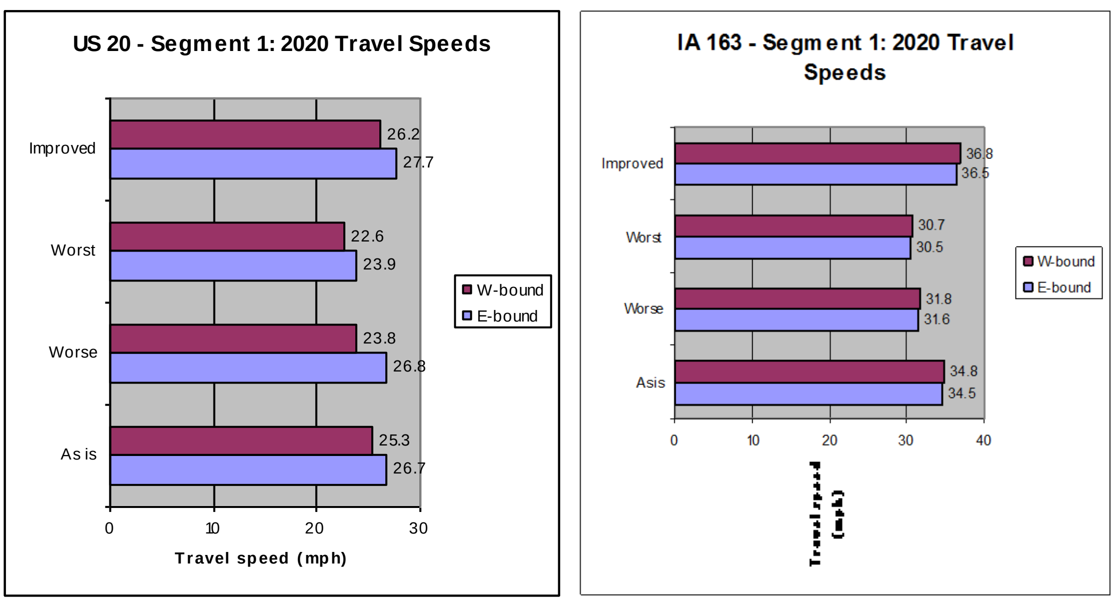
As shown, traffic volume on US 20 is generally greater than that on IA 163, with travel taking more than 2 min/mi on US 20 and more than 1.5 min/mi on IA 163. On both highways, though, travel time increases as more driveways and traffic signals are added, as shown by the Worse and Worst bars. Travel time decreases as driveways and signals are removed or consolidated, as shown by the Improved bar.

By looking at the increase in vehicle traffic from 1980 through 2000, it was possible to project the level of traffic that these two highway segments would experience in the year 2020. These new traffic volumes were used in the Impact Calculator to see how travel time would be affected by increased traffic in addition to changes to the number of driveways and signals in the segment. Figures 3 and 4 show that travel times would increase slightly in all scenarios as a result of increased vehicle volumes.



Figures 3 and 4. Travel times based on projected 2020 traffic levels

Travel speed is obviously inversely related to travel time. In cases where travel time increased, travel speed tended to decrease and, where travel time decreased, speed increased. Figures 5 and 6 show how travel speed in the year 2020 (using the increased traffic projections) would be affected by changes to the corridor.



Figures 5 and 6. Travel speeds based on projected 2020 traffic levels

As shown, increasing the level of traffic (congestion) on the corridor will cause a 2 to 3 mph decrease in travel speed, while removing traffic signals and reducing driveways will improve mean travel speed by approximately 1 mph.

User costs can be broken into two categories: operating and maintenance costs, and travel time. Operating and maintenance costs are minimal, unless they are aggregated for all the vehicles on the corridor. Changes in travel time are more noticeable to individual drivers and passengers.

The cost or value of travel time in terms of average wage lost while in the vehicle was used for measuring changes in user costs. For the US 20 corridor, it was calculated that drivers and passengers spent approximately 15.5 minutes in a vehicle on their way to or from work. The value of this time is $5.70 per trip, or $57.00 each week. On IA 163, this value varied from $9.01 on Segment 1 to $9.65 on segment 3. The reason for this is information on travel times was at the county level, and the US 20 corridor is entirely in Dubuque County, while the IA 163 corridor is in Polk and Jasper counties. The difference in travel time for vehicles in Polk versus Jasper County is due to vehicles in Jasper County have to travel longer distances to and from work, including if they are commuting into the Des Moines metropolitan area in Polk County. The end result is the value of the time these people spend in a car is slightly more.

Figure 7 shows the different travel time costs associated with traveling on IA 163.

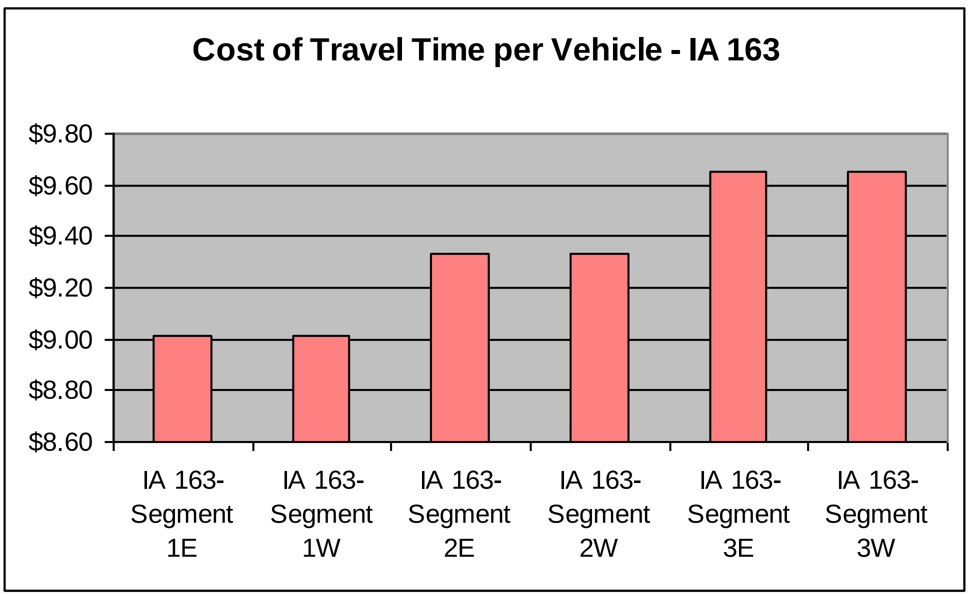
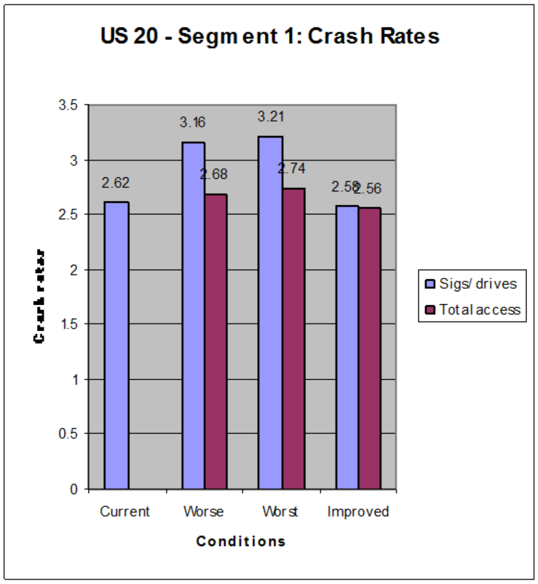
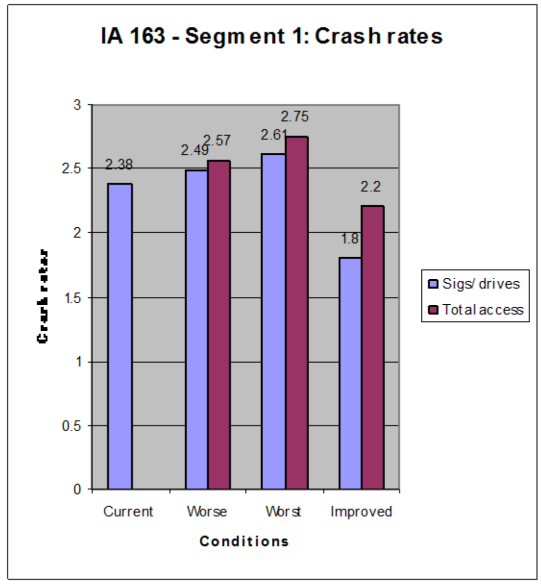


Figure 7. Cost of travel time for users of IA 163

Changes in travel time (and thus the value stream generated by the alignment) do vary with changes in the number of access features provided (e.g., traffic signals and driveways), but the variations are not large from the base "as is" case.

The cost of crashes on any highway segment is based on the volume of crashes and their severity. The Impact Calculator can calculate crash rate for a particular highway segment using information on the segments: average annual daily traffic (AADT), speed limit, length, number of traffic signals, and number of driveways. Comparing the resulting crash rates shows how additional growth may increase the number of vehicle crashes, while an access management project that removes traffic signals and/or reduces the density of private driveways will tend to decrease crashes, as shown in Figures 8 and 9.





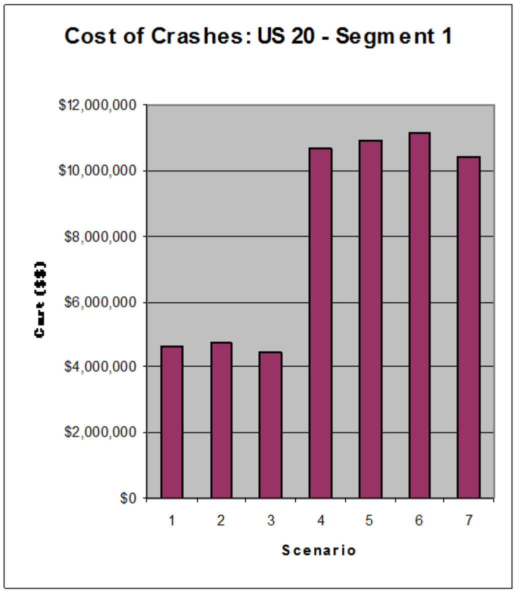
Figures 8 and 9. Changes in crash rates due to increased or decreased access

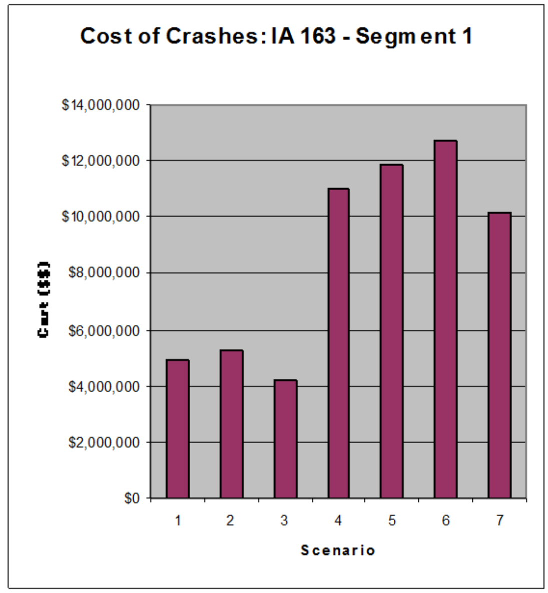
Using these crash rates, it is possible to develop future scenarios for each highway segment and to determine the cost of increased or decreased crashes. For this project, seven future scenarios were developed for the urban segments and five for suburban segments.

The seven scenarios for urban segments are same traffic volume with more driveways and traffic signals, same traffic volume with the most possible driveways and signals, same volume with fewer driveways and signals, increased traffic volume with more driveways and signals, increased volume with the most possible driveways and signals, and increased volume with fewer driveways and signals.

The five scenarios for suburban segments are the same as the seven for urban segment, without the two scenarios that reduce the number of driveways and signals. This is because the areas surrounding the suburban segments are still in early phases of development and can support a large amount of development and traffic growth.

Comparing the annual cost of crashes on the same segment for different scenarios involves increasing or decreasing the number of driveways and traffic signals, which can show how additional growth or an access management project will have an impact on the corridor. Figures 10 and 11 show how the cost of crashes on the urban segment (Segment 1) of US 20 in Dubuque and IA 163 in Des Moines vary by the scenario.





Figures 10 and 11. Cost of crashes on urban highway segments in Des Moines and Dubuque

These figures show how the scenarios with increased driveways and signals, as well as those with increased traffic, will have a higher crash cost each year. The cost of crashes for less well-managed scenarios can be double or triple that of scenarios that are closer to the baseline. This is because the additional access features (e.g., larger numbers of traffic signals and more private driveway accesses) substantially increases the crash rate along the corridor.

The Iowa DOT costs for constructing a new highway segment or rebuilding an existing segment can vary depending on the segment length and if a new right-of-way is needed. To look at these costs, 24 highway projects were selected from the Iowa DOT five-year improvement plan. A majority of the projects selected were either new construction or rebuild, with one modernization project. The corridors being worked on range in length from 2.2 to 19.9 miles. Figure 12, shows the average total project costs for the two main types of projects, as well as projects that involved purchase of ROW compared to those that did not.

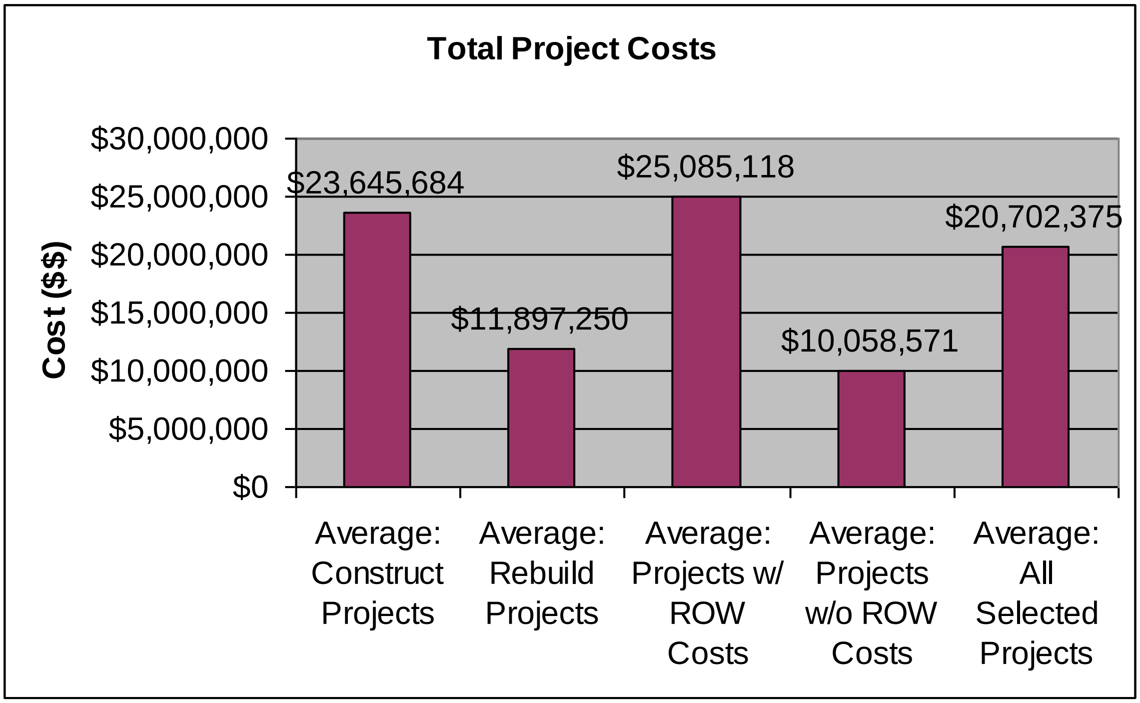


Figure 12. Average cost of Iowa DOT highway projects

The costs of additional ROW can vary by the amount of ROW required and the location where the land is needed. ROW in developed or developing areas costs more than in rural areas. On average, projects involving the purchase of additional right-of-way cost an additional $2,014,294, or $257,659 per mile, as shown in Figure 13.

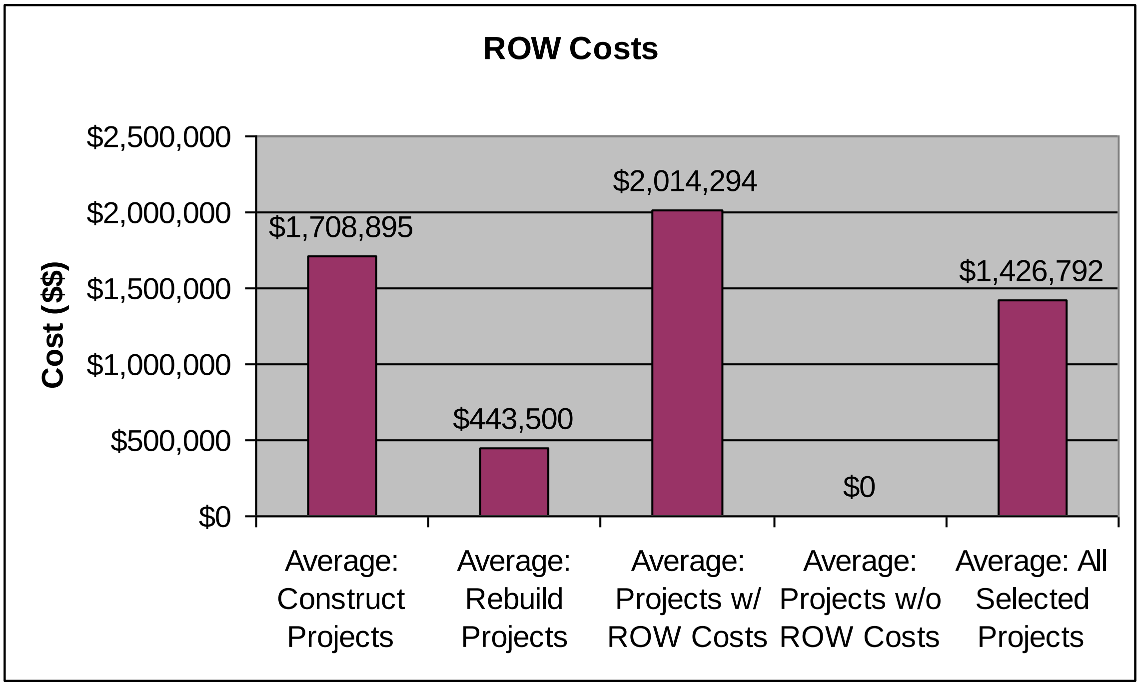


Figure 13. Average right-of-way costs for Iowa DOT highway projects

By breaking these costs down into an annual amount spread over the expected lifetime of the highway or ROW, these values can be compared to the annual cost of crashes on a specific segment. Figure 14 shows the annual cost of an average highway project in Iowa spread over the lifetime of the highway, which is assumed to be 25 years.

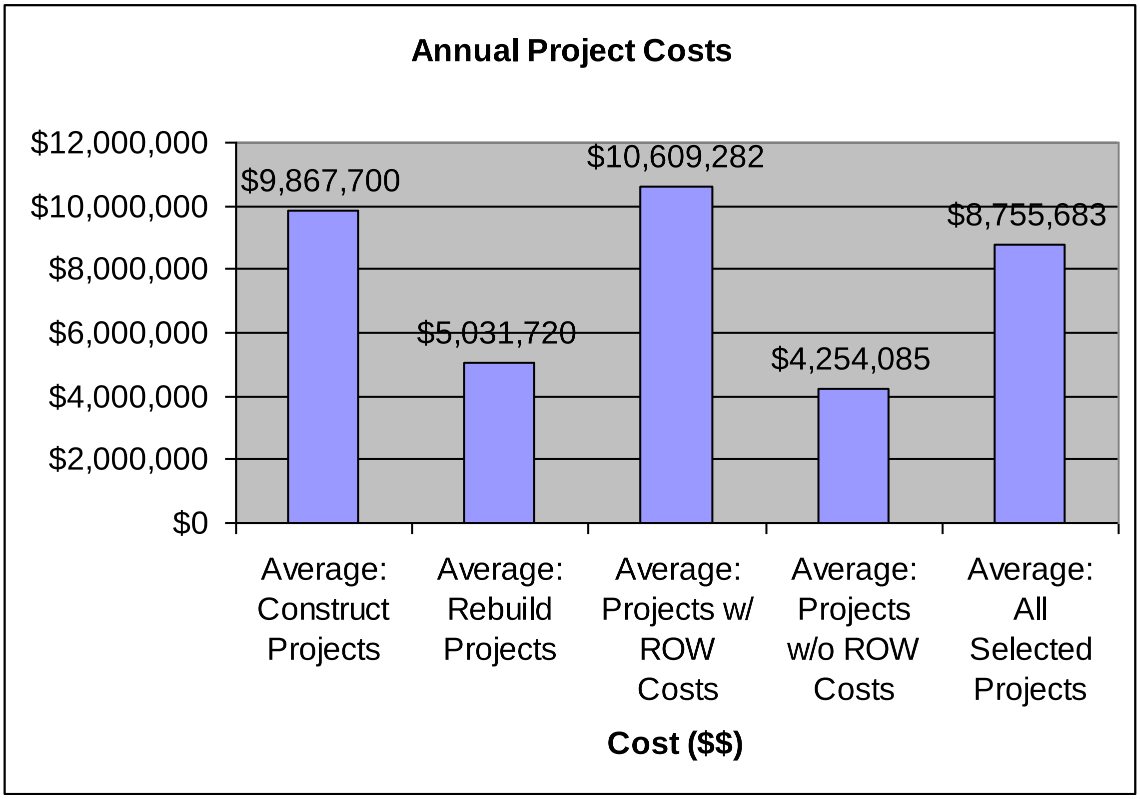


Figure 14. Project costs spread out over the average lifetime of a highway

Comparing these values to the annual costs of crashes on a specific highway segment may show when the benefit stream of the segment has depreciated to a significant degree. Looking back at Figures 10 and 11, the cost of crashes on US 20 and IA 163 with the current amount of traffic and increased (scenarios 1 and 2) or decreased (scenario 3) driveway and signal density is well below the average costs of constructing a highway segment or a project that involves the purchase of new ROW. However, these costs are roughly equal to or greater than the costs associated with rebuilding an existing segment.

Looking at the projected traffic for the year 2020 shows that the cost of crashes for all scenarios (4 through 7) will increase to the point where it is equal to or greater than the cost of constructing a new highway segment.

KEY CONCLUSIONS

This report represents an initial attempt to begin to put a value on an important yet often overlooked class of highway infrastructure assets, alignments. A highway alignment is an assembled set of right-of-way parcels that, together with the pavements and bridges built along it, delivers a stream of benefits that are of value to both the operating agency (such as a state DOT) and to highway users.

At least at first blush, valuing alignments (right of way) at book value or replacement value is less compelling than valuing them in terms of the stream of benefits they produce, similar to the way that commercial real estate is often valued for appraisal purposes. The main reason for this is, while the replacement value or book value of the alignment is a somewhat static number, it is clear from the analysis conducted for this report that the benefits stream produced by the alignment is dynamic.

Changes made along the alignment over time by the operating agency, such as adding access points to adjacent land parcels and the addition of traffic signals, can change the benefit stream in a negative direction. This is true for the travel time benefit stream, in that more delay occurs. It appears especially true for the safety benefit stream, as crash costs rise.

For the two case studies on expressways examined in suburban Iowa, US 20 and IA 163, the impact of changes in access features is clearly reflected more quickly in the stream of safety benefits than in the stream of travel time benefits. This may be the case because traffic volumes on the two case-study segments are relatively low by national standards. However, it does imply that “selling” corridor and access management in settings such as Iowa is best done on the basis of the safety benefits generated. Travel time savings are significantly less important.

This pilot effort was unable to address other benefit stream issues such as vehicle operating costs (such as energy usage) and travel time reliability. This is because the analysis tool utilized does not accommodate analysis of these factors. However, it is likely that travel time reliability savings are strongly related to savings in travel time.

As has been documented in other recent Iowa access management research and references, there are many possible approaches to maintaining the safety and travel time benefit streams on rural expressway alignments in Iowa. These approaches include the use of access management guidelines, intergovernmental corridor planning agreements that are possible through Iowa Code Chapter 28E, alternative at-grade intersection designs that allow for the use of fewer traffic signals, and more careful land use planning in commercial developments adjacent to major highway alignments (such as planning for “development nodes” versus “strip development”).

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APPENDIX: REVIEW OF THE VIRGINIA DEPARTMENT OF TRANSPORTATION'S GASB 34 INFRASTRUCTURE VALUATION

The Virginia Department of Transportation has valued the infrastructure asset inventory of the Commonwealth at $7,730,443,449 net of accumulated depreciation of $7,023,130,587 and including work in progress of $2,606,859,161. The Department of Transportation (VDOT) will use the Depreciation Method for infrastructure.

The Office of the Auditor of Public Accounts has reviewed VDOT's methodology and initial capitalization amounts for infrastructure and found them reasonable. A brief description of VDOT's methods follows below. More detailed information can be obtained from VDOT's website at www.virginiadot.org/business/gasb34-welcome.asp

Infrastructure Ownership

VDOT has determined that the Commonwealth will capitalize the primary road system, the secondary road system, the interstate road system, state maintained bridges (including culverts) and tunnels, and the value of the land under these systems (Right of Way). VDOT has jurisdiction, control and clear ownership over the primary and interstate road systems. While VDOT has the jurisdiction and control over the secondary road system, ownership is not clear in many cases. However, the Commonwealth will capitalize the secondary road system since VDOT has primary responsibility for the maintenance of these systems. VDOT based its determination of ownership on guidance from GASB. The GASB 34 Implementation Guide (p. 67 Q 286) states: "When ownership is unclear, the government with primary responsibility for managing an infrastructure asset should report the asset." VDOT will not capitalize the urban road system; the cities and towns should capitalize urban roads. Once construction is completed on an urban road it is deeded to the city or town. In addition, although VDOT provides funds for the maintenance of the urban system, the localities perform the actual maintenance. Therefore, VDOT will not capitalize the urban system. VDOT has provided information on their website under the Municipality Infrastructure section to assist localities in determining the value of their urban roads. The information includes mileage reports by locality for roads and structures. VDOT has also calculated the average cost per line mile of the urban road system which has been included on their website at www.virginiadot.org/business/Gasb34-methodology.asp. The remainder of this document focuses on VDOT's methodology for valuing inventory the Commonwealth will capitalize and report. However, the methodology can also be applied to the urban system.

Capitalization

VDOT has made the following decisions regarding the capitalization of infrastructure inventory: All infrastructure capitalized by the state is categorized into two networks.

Road Inventory Network

The Road Inventory network includes the following subsystems:

- Interstate Highway System
- Primary Road System
- Secondary Road System
- Tunnels and Bridges (including culverts)

VDOT valued total Road Inventory Network assets at $11,435,816,976 with accumulated depreciation of $7,023,130,587 for a net capitalizable value of $4,412,686,389 at June 30, 2000.

Right of Way Network

Right of Way represents the cost of the land under and beside the roads. It is real property not subject to depreciation and therefore is classified as a separate network. VDOT valued the Right of Way Network at $710,897,899 at June 30, 2000.

VDOT determined the historical value of all roads using lane miles. Where actual lane miles were not known, VDOT used an estimate based on a ratio of known lane miles to road miles. Going forward, VDOT will capitalize the actual costs of the roadway network. These costs are already captured and categorized in their financial information system.

VDOT established a capitalization policy for infrastructure. VDOT plans to capitalize all construction costs and those maintenance costs that are restorative in nature as defined by the activity code in VDOT's financial system. More information about VDOT's capitalization policy is available on their website at www.virginiadot.org/business/Gasb34-maintenace_capitalization.asp.

Initial Inventory Value

Road Inventory Network Valuation

VDOT's inventory valuation for the road systems is based on lane miles. Due to numerous federal reporting requirements, VDOT maintains detailed records on the Commonwealth's roads and bridges in their Highway Traffic Records Inventory System (HTRIS). VDOT used the information in this system as the basis for determining the number of lane miles of roads and the length of bridges and tunnels for the Roadway Network. We consider the data contained in HTRIS to be reliable.

For each of the road systems, VDOT began with a listing of miles added per year to the systems. The Mileage Tables, which VDOT publishes annually using HTRIS data, contain the accumulated mileage per year by surface widths (i.e. four lanes, three lanes, two lanes, etc.). To calculate the inventory per year, the miles of each lane type are multiplied by the applicable number of lanes and added together to arrive at cumulative lane miles per year. Cumulative lane miles for each year are subtracted from cumulative lane miles for the previous year to determine lane miles added per year. VDOT calculated road inventory value by subtracting bridge miles, which were included in the mileage data, and multiplying the number of lane miles added per year by a construction cost estimate (described below) and then deflating the cost for each year using a deflation factor based on the Consumer Price Index (CPI).

Example (Primary System):

1. There were 116 lane miles added to the Interstate system in 1962

2. Subtract bridge miles added: 116 - 2 = 114

3. Multiply result (2) by average construction cost: 114 x 768,627 = $87,623,478

4. Deflate using CPI deflation factor: 87,623,478 x .176334107 = $15,451,008

Primary system lane miles

VDOT used actual lane miles. VDOT has lane mile information dating back to 1938 for the primary system.

Interstate system lane miles

The Interstate system was created in 1957. VDOT mileage tables contain data on interstate miles from 1958 to 1999, but lane mile data is only available beginning in 1975. To arrive at an estimate of the number of lane miles added per year from 1958 until 1975, VDOT calculated the ratio of lane miles to road miles at 1975. Actual lane miles added each year between 1958 and 1975 are multiplied by the ratio to arrive at projected annual lane miles for those years.

Secondary system lane miles

The Byrd Act created the secondary system in 1932. VDOT has mileage data dating back to 1932, but lane mile information is only available beginning in 1975. As with the primary system lane miles, VDOT used a calculated ratio to project annual lane miles from 1932 to 1975.

Bridge Inventory Valuation

VDOT obtained bridge data from the Structure Inventory Database in the HTRIS system. To meet federal reporting requirements, VDOT must annually inspect and perform a condition assessment for each of Virginia's 12,419 bridges. As with Road Inventory, VDOT's federal funding is tied to the bridge data reported to the federal government. We consider the information contained in HTRIS (structure lengths and areas by year and by system by year) reliable.

To determine the average cost per square foot for bridges, VDOT gathered data on all bridges constructed during the period from 1990-2000 (over 600 bridges). VDOT chose this period due to the relatively stable economy and low inflation rate experienced during the decade. VDOT plotted the cost per square foot and determined an average cost of $75.00 per square foot. In addition, VDOT analyzed a project awarded in October 2000; the average cost per square foot was $77.29. VDOT used the same methods to determine culvert costs per square foot ($100).

VDOT multiplied the bridge and culvert lengths (in feet) obtained from HTRIS per road system per year by the cost estimates to arrive at a current value per year per system. VDOT then deflated these values using the appropriate CPI deflation factor per year. VDOT summed the deflated values to arrive at a total inventory value per year.

VDOT is valuing tunnels based on historical cost.

Right of Way Network Inventory Valuation

VDOT's first step in valuing Right of Way (ROW) was determining a weighted average assessed value per acre of land in the Commonwealth. VDOT asked each of its nine districts to provide an average assessed value per acre for each county within that district. These average values were used to compute a "weighted value per acre", which was then used to estimate the Right of Way Inventory value for the Commonwealth as a whole.

The VDOT District Right of Way Managers, or their designees, contacted the Commissioner of Revenue, the Circuit Court Clerk Offices, and Assessor's Office, as applicable. They obtained total land values from the Land Books for fiscal year 2000 by county. Square miles per county were obtained from VDOT's county roadway maps. The square miles were converted to acres (640 acres = one square mile) for total acres of land in the locality. The total dollar land value obtained from the land books was then divided by the acres of land to arrive at the average assessed value per acre. (See Right of Way Land Values.xls).

VDOT obtained the secondary system miles per county (broken down by district) from the December 31, 1999 Mileage Tables. To arrive at a weighted average figure for FY 00, VDOT multiplied the number of secondary road miles per county times the average assessed value per acre. This was done for each county. The assessed values were then totaled and divided by the total number of miles in the secondary system to arrive at the weighted value per acre of $13,608 for the Commonwealth.

As part of our review, we recalculated the weighted value per acre using acres, rather than miles, as the multiplier. The result was the same value per acre. Because the miles were used as a weight factor, and not to obtain "true" values per acre, as long as the weight factor remains in proportion, the average weighted value per acre does not change. The method and the resulting average weighted value appear reasonable.

The other assumption VDOT used to calculate the ROW inventory value is the average width of ROW for the primary, secondary, and interstate systems. The Right of Way widths used in these calculations are based on averages. All of the Right of Way in the Commonwealth is recorded, so although VDOT can obtain actual figures, the cost and time involved to obtain the right of way widths for each road would not be cost-beneficial. Each road is unique, and right of way widths are based on the needs of that particular road. The Byrd Act of 1932 guaranteed a 30-ft right of way for secondary roads, but right of ways can be as much as 300 feet.

VDOT's Right of Way width varies depending on the roadway, terrain, and the type of design used. In order to get an initial capitalization value, VDOT derived averages for each of the three road systems (Interstate, Primary, Secondary). VDOT has detailed engineering plans for their roads, and used these, as well as information from the Byrd Act, to determine appropriate averages. VDOT determined the average right of way width to be 265 feet for Interstate roads, 90 feet for the Primary roads, 50 feet for Secondary roads constructed after 1932, and 30 feet for Secondary roads brought in under the Byrd Act in 1932.

VDOT calculated the Right of Way inventory value per system (Interstate, Primary, Secondary) as follows:

1. Start with Road Miles (NOT lane miles) added per year (separate calculation for each system)

2. Convert to area of square feet - multiply miles added each year in (1) by 5,280

3. Multiply result in (2) by applicable ROW width (30, 50, 90, or 265)

4. Convert to acres - divide (3) by 43,560

5. Multiply result in (4) by average weighted land value

6. Deflate using appropriate CPI factor

Example (Primary System):

1. In 1960, there were 73 road miles added to the Interstate system

2. 73 X 5,280 = 385,440

3. 385,440 X 90 = 34,689,600

4. 34,689,600 / 43,560 = 796

5. 796 X $13,608 = $10,836,867

6. $10,836,867 X .172853828 = $1,873,193.92 = Current Value for 1963 ROW added

This provides the ROW value per year and cumulative ROW per system. The total per system is the amount capitalized by VDOT for FY 2000.

For all new Right of Way added to the system after initial capitalization, VDOT will use the actual right of way value. These averages are solely for the purpose of initial capitalization value.

Work in Progress

VDOT is also tracking and valuing construction expenditures that represent work in progress on the Commonwealth's roads and bridges. These expenditures represent the actual cost of the road, and in the future, will become the amount capitalized per year as additions.

VDOT includes construction expenditures in its financial statements as Highway System Acquisition and Construction. The expenditures are classified by road system (interstate, primary, secondary, urban). VDOT estimates that it takes approximately two years to build a road and, therefore, will record two years of construction expenditures in construction in progress (CIP). Each year, VDOT will capitalize the oldest CIP amount (in FY 01, the FY 99 amount will be capitalized), removing it from CIP, and will add a new year (in FY 01, FY 01 expenditures will be added) of CIP.

VDOT will include construction in progress for the Urban System in CIP, but VDOT will track it separately. VDOT has included the Urban System as part of construction in progress because the construction expenditures are initially recorded by VDOT and are presented in their financial statements. When an urban road is completed, VDOT will provide the city with a package including the actual cost of the infrastructure asset and will remove the expenditures from their records.

When VDOT constructs a road that they then turn over to a local government, GASB 33 defines this as a voluntary non-exchange transaction. The state (VDOT) and locality should record the transaction when the title passes. These journal entries are located on the Auditor of Public Accounts GASB 34 website under Local Government/Guidance in the Recording the Receipt of Highway Maintenance Funds and Assets file.

Construction Costs

VDOT maintains a system called Trns*Port that contains all cost data for all construction contracts for the past five years. The data includes the quantities of materials used in a typical mile of each type of road surface in each of the road systems. To estimate construction costs, VDOT developed a typical road mile for each system and surface type, and then determined an average construction cost for each typical mile. "Real property" right of way (separate network) and bridges and tunnels (separate subsystem) are not included.

VDOT included the following categories in pricing the typical miles:

Temporary Safety Items	Shoulders and Medians
Grading	Roadside Development
Drainage	Stormwater Management
Pavement (wearing surface)	Utilities
Signs and Signals	Surveys and Mobilization

VDOT further divided these 10 item categories into 50 items that comprise a typical road.

VDOT's Construction Division first determined road types. VDOT divided each of the three systems (secondary, primary, and interstate) into four different road types, e.g. rural aggregate, rural asphalt paved, urban concrete, etc; these 12 road types represent "typical miles". The typical miles were priced separately for each district, then summed, and divided by nine (the number of districts) to arrive at an average cost per road type for the Commonwealth. VDOT has provided the prices for the 12 typical roadway miles for each of the nine districts separately (Construction Average.xls).

VDOT used a sample of actual road contracts awarded within the period June 1999 through June 2000 to establish current material types, design, and costs. VDOT selected their samples from projects in all districts to establish the typical lane miles of roadway. Each sampling consisted of no less than 10 lane miles of projects. Projects with exceptional characteristics or non-standard aspects were rejected.

From the samplings, VDOT determined the quantities of items needed to construct a typical mile for the four road types included in each of the three systems, i.e. 12 different “typical lane miles.” VDOT derived statistical prices using this data. In addition to the statistical prices, VDOT performed a "reality check" using current data. They obtained a "low bid history as of October 2000" from Trns*Port for each district to determine a cost-based estimate. VDOT compared the cost-based estimate to the statistical cost estimates to determine if the prices were reasonable in today's market. All statistical prices were reasonable.

The result is the estimated construction costs per district for each of the 12 different "typical lane miles". Using these estimates, VDOT obtained the weighted average construction costs per mile for the Interstate, Primary and Secondary road systems. The statewide averages are:

Interstate:	$1,874,055
Primary:	$ 768,627
Secondary:	$ 237,208

Depreciation

VDOT has chosen to use the straight-line method of depreciation for the Roadway Network assets. The Right of Way Network represents real property and is not subject to depreciation. VDOT assigned all roads a useful life of 30 years, regardless of surface type or system (see below for justification). VDOT will depreciate bridges and tunnels over 50 years.

VDOT computed accumulated depreciation for roads back to 1932 and for bridges back to 1930. VDOT has separately calculated depreciation each year going forward and will continue to do this in the future. As construction in progress is capitalized each year (beginning in 2001), that value will become the road/bridge inventory value for that year. Depreciation will be applied to each year separately so the assets will eventually become fully depreciated.

Useful Life Justification

VDOT designs its road pavements and bridges for a 30-year and 50-year life, respectively, based on their current life-cycle design.

For roads, VDOT uses a 30-year life-cycle cost analysis when designing the road and in determining whether to use asphalt or concrete. Although asphalt generally lasts 10-12 years, while concrete lasts 30, VDOT engineers factor in two overlays to the cost of an asphalt road for a 30-year useful life expectancy. This allows them to determine the most cost efficient road surface. VDOT also considers the expected traffic volume and weight so that the life-cycle design is still 30 years whether the road is urban or rural.

VDOT uses the same reasoning and life cycle cost analysis when designing bridges. Because the roadways and bridges are designed for a specific useful life, VDOT felt that this would be the best indicator of useful life, as well as the simplest.