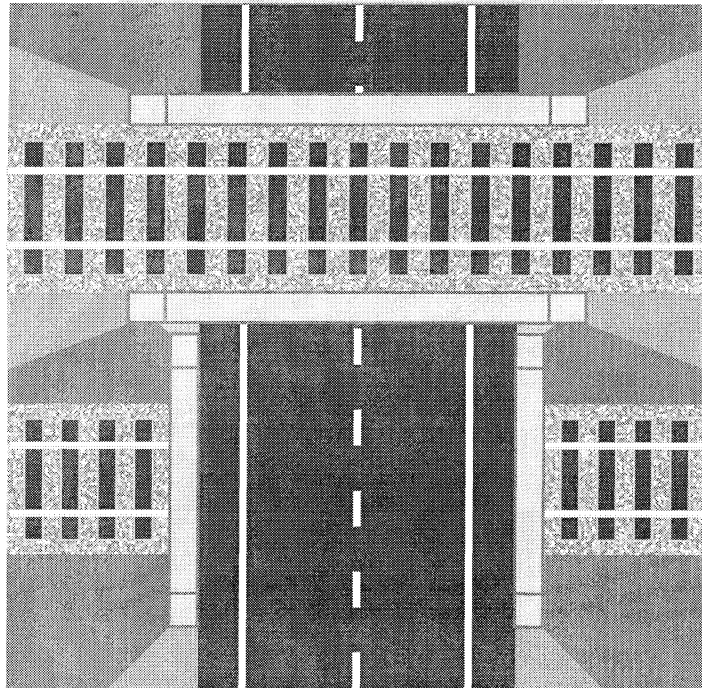


FINAL REPORT

INVESTIGATION OF OWNERSHIP AND MAINTENANCE RESPONSIBILITIES FOR STRUCTURES SEPARATING HIGHWAY AND RAILROAD TRAFFIC



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Senior Research Scientist



VIRGINIA TRANSPORTATION RESEARCH COUNCIL

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(The opinions, findings, and conclusions expressed in this
report are those of the author and not necessarily
those of the sponsoring agencies.)

Virginia Transportation Research Council
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EXECUTIVE SUMMARY

Background and Purpose

One of the goals defined in *Virginia Connections: Strategic Plan for Transportation* is to “reduce or eliminate obsolete state laws governing transportation providers.”¹ In response to this goal, then Secretary of Transportation Robert Martineau established a Rail Issues Legislative Task Force and charged them with reviewing the laws and regulations governing railroads. The task force raised the issue of the maintenance responsibility for structures that carry highway traffic over railroads (overpasses) and structures that carry railroads over highway traffic (underpasses).

There are 1,041 overpasses and underpasses in the Commonwealth. In general, the entity responsible for the traffic on a structure also owns and maintains it. In other words, overpasses are predominantly owned and maintained by the state or locality, and underpasses are predominantly owned and maintained by the railroad that uses them.

Exceptions exist. According to the Virginia Department of Transportation’s (VDOT) Structure & Bridge Division, 69 overpasses are maintained by a railroad (the responsibility for 11 of these is being transferred to VDOT), and 32 underpasses are maintained by VDOT or a municipality. The purpose of this study was to identify the issues, including the costs of improvements and maintenance, regarding the possible conveyance of overpass ownership and maintenance from the railroads to VDOT and underpass ownership and maintenance from VDOT to the railroads for the 90 structures under consideration. The intent of this study was not to provide recommendations to VDOT or the Virginia Department of Rail and Public Transportation (VDRPT) but rather to present the potential consequences to VDOT and affected jurisdictions of the various alternatives considered.

Literature and Legislative Findings

According to the *Federal Aid Program Guide*, reconstructing and rehabilitating grade-separated structures involving railroads and highways are eligible for federal aid. However, should federal funds be used for these purposes, the railroad company is under no obligation to participate in any portion of the cost, provided there is no contractual agreement to the contrary. Thus, if Virginia transferred ownership and maintenance responsibilities for the structures under consideration without an appropriate contractual agreement, the state could face a significant expenditure of public funds.

Many of Virginia’s neighboring states prescribe ownership, maintenance, and cost share responsibilities for overpasses and underpasses. In many cases, the responsibilities are clear: the state or county is responsible for structures that carry highway traffic over the railroad’s tracks. Conversely, where roadways pass under a railroad’s track, the railroad is responsible for maintaining the structure supporting its tracks and abutments. However, the allocation of cost

share responsibilities for reconstructing an overpass differs. For example, in North Carolina and West Virginia, the railroad's share is 10 percent; in Maryland, 25 percent; and in Kentucky, between 10 and 50 percent.

The *Code of Virginia* does not allocate cost share responsibilities for reconstructing an overpass or underpass. The *Code* does establish the ownership and maintenance responsibilities for constructed or reconstructed overpasses and underpasses. VDOT is responsible for overpasses, and the railroad is responsible for underpasses, with one exception: When an underpass is constructed and an at-grade crossing is not eliminated, the railroad is not required to maintain the underpass. This could be expensive for the Commonwealth. VDOT and VDRPT have been slowly eliminating the number of railroad-owned and maintained overpasses but not the number of VDOT-maintained underpasses. In fact, given the provision in the *Code*, VDOT could acquire maintenance responsibilities for additional underpasses if grade crossings are not eliminated when such underpasses are constructed. Only a change in the *Code* could eliminate the potential for VDOT to own and maintain additional nonhighway facilities.

Condition of Overpasses and Underpasses Under Consideration

Most of the overpasses are in poor condition, which should be of concern to VDOT. The average age of an overpass is 70 years, and more than 60 percent have a weight restriction of 10 tons or less. In contrast, the underpasses are in good condition. The average age is 35 years, and none of them has a weight restriction. Given these facts, a simple "swap" of responsibilities could have serious financial ramifications for VDOT's Salem, Culpeper, and Lynchburg districts.

Conveyance Alternatives and Associated Costs

The researcher explored six alternatives for conveying ownership and maintenance responsibilities for the 58 overpasses and 32 underpasses under consideration. Each alternative has three parts:

- A: VDOT acquires and maintains overpasses and the underpasses are not considered
- B: VDOT acquires and maintains the overpasses and maintains the underpasses
- C: VDOT acquires and maintains the overpasses, and the railroads acquire and maintain the underpasses.

With Alternative 1, VDOT and VDRPT continue their current process of conveying ownership and maintenance responsibilities of the overpasses over time. Historically, 5 overpasses, on average, are transferred to VDOT each year. If this trend continues, VDOT will own all 58 overpasses in 12 years. The railroads maintain the overpasses until they are replaced, and then VDOT assumes ownership and maintenance responsibility. The railroads pay a percentage of the initial replacement costs.

With Alternative 2, the overpasses are replaced immediately and their maintenance is turned over to VDOT. The railroads pay a percentage of the initial replacement costs.

With Alternatives 3 through 6, the overpasses are replaced immediately and their maintenance is turned over to VDOT. The railroads pay a percentage of the initial replacement costs and continue to pay maintenance costs for a fixed number of years, ranging from 5 to 25.

Findings and Conclusions

- *Grade-separated structures involving railroads and highways are eligible for federal aid.* However, in the absence of a contractual agreement to the contrary, railroads are under no obligation to pay any portion of replacement or rehabilitation costs. It might be in the Commonwealth's best interest to negotiate a contract with the railroads to enable the use of federal funds.
- *The codes of many neighboring states allocate replacement costs between the state and the railroad: the railroad pays from 10 to 50 percent of the cost of the project.*
- *Section 56-368.1 of the Code of Virginia specifies that if VDOT constructs a new underpass without eliminating a railroad-highway grade crossing, the subsequent maintenance of the underpass is not the responsibility of the railroad.* Unless this statute is changed, VDOT could acquire maintenance responsibility for additional underpasses.
- *The overpasses maintained by the railroads are in generally poor condition, requiring substantial public investment to comply with VDOT's current standards and specifications, whereas the underpasses maintained by VDOT are in generally good condition.* Therefore, VDOT will need compensation from the railroads to make the transference of ownership and maintenance responsibilities a reality.
- *Should VDOT acquire the 58 overpasses*, the cost to VDOT could range from approximately \$15 to \$40 million, and the costs to the railroads from approximately \$2 to \$18 million, depending on the alternative selected.
- *Should VDOT acquire the 58 overpasses and continue to maintain the 32 underpasses*, the costs to VDOT could range from approximately \$20 to \$45 million, and the costs to the railroads from approximately \$2 to \$18 million, depending on the alternative selected.
- *Should VDOT acquire the 58 overpasses and relinquish the 32 underpasses*, the costs to VDOT could range from approximately \$11 to \$36 million, and the costs to the railroads from approximately \$6 to \$22 million, depending on the alternative selected.
- *Transferring maintenance responsibilities for underpasses in the near future might be in the Commonwealth's best interest in the long term.* The cost of replacing an underpass is nearly twice that of replacing an overpass. The costs of subsequently maintaining each type of structure are almost equal. However, over time, the underpasses under consideration will

require a significant amount of work to maintain their load-carrying capabilities. The Commonwealth will probably be liable to perform this work expeditiously so as not to interfere with interstate commerce. Eventually, these underpasses will require serious rehabilitation and possibly replacement, and the cost of replacing one could exceed the cost of replacing two overpasses.

Recommendations

1. *Section 56.368.1 of the Code of Virginia should be modified so that the railroads are responsible for all newly constructed underpasses.*
2. *VDOT and VDRPT should state that one of their continuing efforts is to eliminate unnecessary and redundant highway-railroad grade crossings.*
3. *VDOT and VDRPT should arrive at concise replacement cost estimates for overpasses.*
4. *VDOT and VDRPT should work with the railroads to relinquish control of all underpasses as soon as possible.*

INVESTIGATION OF OWNERSHIP AND MAINTENANCE RESPONSIBILITIES FOR STRUCTURES SEPARATING HIGHWAY AND RAILROAD TRAFFIC

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INTRODUCTION

One of the goals defined in *Virginia Connections, Strategic Plan for Transportation* is to “reduce or eliminate obsolete state laws governing transportation providers.”¹ In response to this goal, then Secretary of Transportation Robert Mart~~a~~nez established a Rail Issues Legislative Task Force and charged them with reviewing the laws and regulations governing railroads. One of the issues raised by the task force was the maintenance responsibility for structures that carry highway traffic over railroads (overpasses) and for structures that carry railroads over highway traffic (underpasses).

There are 1,041 overpasses and underpasses in the Commonwealth that either carry highway traffic over a railroad or carry railroad traffic over a highway. In general, the entity responsible for the traffic on a particular structure also owns and maintains the structure. In other words, overpasses are predominantly owned and maintained by the state or locality in which they are located, and underpasses are predominantly owned and maintained by the railroad company that uses them.

Exceptions to this general rule exist. According to the Virginia Department of Transportation’s (VDOT) Structure & Bridge Division, 69 overpasses are maintained by a railroad (the maintenance responsibilities for 11 of these are being transferred to VDOT) and 32 underpasses are maintained by VDOT or a municipality. As a result of the findings of the task force, Virginia’s Secretary of Transportation Shirley J. Ybarra (then Virginia’s Deputy Secretary of Transportation), requested that research be undertaken to investigate transferring the maintenance responsibilities for these structures to the entity that carries traffic across them.

PURPOSE AND SCOPE

The purpose of this study was to identify the issues, including the costs of improvements and maintenance, regarding the possible conveyance of overpass ownership and maintenance from the railroads to VDOT and underpass ownership and maintenance from VDOT to the railroads for the 101 structures identified previously. This study was not intended to provide recommendations to VDOT or the Virginia Department of Rail and Public Transportation (VDRPT) but rather to present the potential consequences to VDOT and affected jurisdictions of the various alternatives considered.

METHODS

The researcher conducted several tasks to accomplish the objectives of the study.

1. *Review the literature regarding conveying ownership and maintenance responsibilities for overpasses and underpasses, applicable legislation, and practices of neighboring states.*
2. *Identify the overpasses and underpasses under consideration.* Staff from VDOT's Structure & Bridge Division assisted in this task. Queries were developed using the SuperNatural system to identify the structures under consideration in the Highway and Traffic Records Information System (HTRIS) database. This list was refined based on additional information available, and the lists of structures were sent to each district structure and bridge engineer for verification. Advertised replacement projects with a provision stating that maintenance responsibility would be transferred to the entity that carried traffic across the structure were excluded from the list and from any further consideration.
3. *Compile pertinent data for each structure identified in Task 2.* The compiled information included:
 - *Administrative, geographical and classification identification:* location, features carried and intersected, maintenance jurisdiction, current maintenance responsibility, current ownership, functional classification, route number
 - *Type of structure*
 - *Age of structure and service characteristics:* year built, type of service on and under the structure, average daily traffic, weight restrictions, lanes on and under the structure, structure condition
 - *Geometric characteristics:* structure length, width, lateral/vertical clearances for both highway and railroad requirements
 - *Needed and/or proposed improvements:* average maintenance costs, anticipated repairs, projected year of replacement.
4. *Conduct case studies of previously transferred overpasses.* The maintenance responsibilities for a number of identified structures were recently transferred. Using a case study approach, the researcher investigated the issues and costs associated with these conveyances and developed generalized cost figures.
5. *Develop cost figures relating to overpass replacement costs, annual maintenance costs of new replacement overpasses, and annual maintenance costs of underpasses.*

6. *Develop transference alternatives.* The researcher developed six alternatives for consideration by VDOT and VDRPT.

REVIEW OF LITERATURE, LEGISLATION, AND PRACTICES OF NEIGHBORING STATES

The researcher reviewed the literature in an attempt to identify the practices of other states regarding ownership and maintenance responsibilities for underpasses and overpasses. No significant information was located through this effort. Therefore, the researcher reviewed federal policies, the codes and statutes of neighboring states, and *the Code of Virginia* to identify the requirements for railroads and governmental entities related to the replacement or rehabilitation and future maintenance responsibilities for underpasses and overpasses. In addition, the researcher identified one state that recently undertook a similar program of transferring overpass maintenance responsibilities.

Federal Aid Policy Guide

Section 646.200 of the *Federal Aid Policy Guide* specifies the policies relating to federal aid projects that involve railroad facilities. Projects eligible for funding under this section include the elimination of railroad-highway crossing hazards and other projects that use railroad properties or involve adjustments required by highway construction to any railroad facilities. Section 646.206 clarifies the types of projects: “projects for the elimination of hazards, to both vehicles and pedestrians, or railroad-highway crossings may include but are not limited to grade crossing elimination, reconstruction of existing grade separations, and grade crossing improvements.”²

Section 646.208³ states that federal funds can be used to replace or rehabilitate any railroad-highway bridge carrying highway traffic regardless of who owns or maintains the bridge, provided the bridge is on a public road. In addition, the state must secure jurisdictional interest for the construction, operation, and maintenance of the project, and the state and railroad must execute an agreement to maintain the facility. As for the railroad’s share of the project costs, “projects for the reconstruction of existing grade separations are deemed to generally be of no ascertainable net benefit to the railroad and there shall be no required railroad share of the costs, unless the railroad has a specific contractual obligation with the State or its political subdivision to share in the costs.”⁴

Codes and Statutes of Neighboring States

North Carolina

In North Carolina, a city can require that a grade crossing be eliminated and replaced by a railroad bridge or underpass.⁵ In such an event, the city is responsible for 90 percent of the costs,

and the railroad company for 10 percent. The same cost ratio holds whenever widening, improving, or otherwise changing a street requires a railroad bridge to be “relocated, enlarged, heightened, or otherwise reconstructed”⁶

Cities must pay the costs of maintaining street bridges that cross over railroads. Railroad companies must pay the costs of maintaining railroad bridges over streets, except that cities must pay the costs of maintaining street pavement, sidewalks, street drainage, and street lighting where streets cross under railroads.⁵

The cost of eliminating or safeguarding grade crossings and inadequate underpasses or overpasses must be allocated between the railroad and the department of transportation. This allocation is in the same ratio as the net benefits received by the party. However, in no case can the net benefit to any railroad company be deemed to be more than 10 percent of the total benefits resulting from the project.⁷

Maryland

In Maryland, 25 percent of any railroad grade separation project or maintenance costs is paid by the railroads that benefit from the separation and 75 percent is paid by the state.⁸

Tennessee

In Tennessee, the railroad must maintain, in good and safe condition, and repair all overpasses and underpasses and their approaches on the railroad’s right of way. The railroad must also maintain and repair any part of the overpass or approach not supported by fill, whether on its right of way or not, except for the surface of the highway.⁹

The commissioner of transportation must maintain, in good and safe repair, “any fill, approach to any such crossing not on the railroad’s right-of-way, and also the entire surface of the highway at all points.”⁹

In 1949, a court ruling on the maintenance of an overpass indicated that if the railroad undertakes not only to construct but also to maintain and care for an overpass, the railroad also assumes a duty to the traveling public to keep the overpass and its approaches in reasonably safe condition.

West Virginia

In West Virginia, unless otherwise agreed upon, the railroad is liable for 10 percent of the total cost of constructing a new grade separation structure that replaces an existing grade crossing.¹⁰ Once the grade separation structure is built, when the highway is carried over the railroad, the state must maintain the highway and the structure supporting it, including the drainage. When a highway passes under the railroad, the state must maintain the highway and its

drainage. The railroad must maintain its tracks and roadbed and the structure supporting them.¹¹ The same cost and maintenance provisions apply to relocating and reconstructing grade-separation structures.¹²

Kentucky

In Kentucky, with regard to state roadways, the state may order, for reasons of public safety, any railroad operating in the state to change any existing overhead or underpass structure where any public road crosses the railroad's tracks.¹³ The railroad must wholly pay for preparing the plans, specifications, cost estimates and soliciting bids. The state must pay 50 percent of the cost of the work within the railroad's right of way, extended across the highway, and the railroad must pay the other 50 percent. The state must pay 100 percent of the work outside the railroad's right of way.¹⁴

Two provisions apply to county roadways. With regard to costs for reconstructing overpasses or underpasses that cross a county road, the railroad must pay 15 percent and the county must pay 85 percent. These costs include preparing plans and specifications; acquiring necessary property; and constructing approaches, drainage structures, and street and pavements.¹⁵ For grade separation constructed under KRS 178.350 to 178.385, the county is responsible for maintaining the roadway and associated sidewalks. Further, if the road crosses over the railroad tracks, the county must maintain the bridge or the structure and its approaches. If the road passes under the railroad, the railroad must maintain the structure supporting its tracks and its abutments.¹⁶

The entire cost for eliminating grade crossings and reconstructing grade separation structures is allocated between the railroad and the governmental unit.¹⁷ The distribution of costs is the ratio of the net benefit received by the railroad from the project and the net benefit accruing to the public using the highway. However, in no case shall the net benefit to any railroad be deemed more than 10 percent. The costs to be allocated include the cost of preparing the plans and specifications; supervising the improvement, acquiring necessary property; constructing approaches, drainage structures, roadways and pavements; accommodating public utilities, and paying damages to abutting property owners.

Code of Virginia

The *Code of Virginia* has three sections related to maintaining underpasses and overpasses. Section 56-366.1 states that the Commonwealth Transportation Commissioner may agree with the railroad involved on such items and conditions as to "plans and specifications, the method and manner of construction, and the division of costs and maintenance responsibility of any such grade separation structure" that is in need of widening, strengthening, remodeling, relocating, or replacing.¹⁸

Section 56-366.3¹⁹ states that when it becomes necessary to alter, rebuild, or replace an overpass that is maintained by the railroad, it is the railroad's responsibility to notify the

Commissioner of such needs. The Commissioner will determine whether it is in the Commonwealth's best interest to upgrade such a structure. If the Commissioner determines it is not in the Commonwealth's best interest, all costs of the necessary work, including the formulation of plans, are to be borne by the railroad. If the Commissioner determines it is in the Commonwealth's best interest, the Commissioner may execute plans for such work in consultation with the railroad. In cases where it is necessary only to repair any overpass maintained by the railroad, all work and costs associated with the repairs are borne by the railroad.¹⁹

Section 56-368.1 states that upon completion of any work specified in these sections, the future maintenance, including drainage, of any underpass shall be the sole responsibility of the railroad, excluding the pavement. The maintenance of any overpass thereafter constructed is the sole responsibility of VDOT. However, if any underpass is constructed without eliminating a grade crossing, the railroad is not required to maintain the structure and VDOT is responsible for maintenance, including highway drainage.²⁰

South Carolina's Overpass Program

The South Carolina DOT, in cooperation with CSX-Transportation and the Norfolk Southern Corporation, recently completed a report entitled *Review of Railroad Owned and Maintained Highway Bridges: Phase I-State Highway System*.²¹ In May 1997, a technical review committee consisting of engineering representatives from the DOT, CSX, and Norfolk Southern was formed to review 32 structures owned and maintained by the railroad that connect roads on South Carolina's state highway system.

The purpose of the review was to determine a course of action for each of the 32 structures. Five actions were considered: (1) replace with a new bridge; (2) remove the structure and re-route traffic to an alternate crossing; (3) remove the structure and construct an at-grade crossing in its place; (4) maintain, repair, and rehabilitate the structure; and (5) take no action. In cases where more than one action was considered, the actions were prioritized and the recommended action was then noted.

The committee recommended the following: take no action with 6 structures, accept certain of these structures into the road system with specific agreements, remove 11 structures, and replace 15 structures. The committee developed cost estimates for each structure. Replacing all 32 structures, including any roadway improvements, would cost approximately \$33.5 million.

Cost agreements between the state and the railroad companies were developed based on the structures that crossed over their tracks. In each case, the railroad tentatively agreed to pay 10

percent of the total cost. It is interesting to note that this 10 percent figure includes the replacement cost for the new structure as well as the cost of any roadwork required for the approaches.

OVERPASSES AND UNDERPASSES UNDER CONSIDERATION AND PERTINENT DATA

Overpasses

There are approximately 660 overpasses in Virginia. Of these, 69 are maintained by a railroad. Of these, 11 are being reconstructed and their ownership and maintenance responsibilities transferred to the state or municipality. Therefore, the researcher considered only 58 overpasses in this study. Appendix A provides a detailed summary of these structures.

Geographic Distribution

Figure 1 depicts the geographic distribution of the 58 overpasses. As indicated, the Salem District would receive 14, nearly 25 percent, of the overpasses. Of these 14 bridges, Bedford County would acquire 93 percent. The Culpeper District would receive 22 percent of the structures under consideration, with Albemarle County and the City of Charlottesville receiving 85 percent of these. The remaining seven districts have a more even distribution of overpasses.

Maintenance Responsibilities

Norfolk Southern is currently responsible for 45 (78%) overpasses, and CSX-Transportation is responsible for 13 (22%).

Age

Table 1 shows that 88 percent of the overpasses are 57 years old or older. Many of these are reported to have been built in 1932. However, the 1932 date simply indicates when Virginia took over the secondary road system, so these structures may be older.

Table 1. Age of Overpasses

Year Built	Number of Structures	Percentage
Before 1900	3	5
1900-1919	13	23
1920-1939	35	60
1940-1960	5	9
After 1960	2	3

Sufficiency Rating

An indication of the condition of an overpass is its sufficiency rating. The sufficiency rating of a structure is a calculated numeric value of four factors: (1) structural adequacy and safety, (2) serviceability and functional obsolescence, (3) how essential the structure is for public use, and (4) a factor for special reductions. The sufficiency rating indicates the bridge's sufficiency to remain in service. A bridge with a sufficiency rating of 100 is entirely sufficient, and one with a sufficiency rating of 0 is entirely insufficient. As indicated in Table 2, the vast majority of the structures, 84 percent, have a sufficiency rating of less than 50, and 20 percent have a rating less than 20.

Table 2. Sufficiency Ratings of Overpasses

Sufficiency Rating	Number of Structures	Percentage
0-19	12	20
20-49	37	64
50-79	8	14
80-100	1	2

Number of Lanes

Sixty-nine percent of the overpasses are single-lane structures (Table 3). VDOT's policy does not allow the construction of one-lane bridges. Thus, if these single-lane structures require reconstruction, they must be reconstructed as (at least) a two-lane structure before they can be considered for inclusion in the state system. It may be plausible, however, to increase the capacity of certain single-lane structures to a load rating sufficient, at a minimum, to carry school bus traffic unimpeded.

Table 3. Number of Lanes for Overpasses

Number of Lanes	Number of Structures	Percentage
1	40	69
2	14	24
3	2	3.5
4	2	3.5

Posted Weight Limits

More than half of the overpasses (62%) have a posted weight limit of less than 11 tons, and of these 36 structures, approximately one third have a posted weight limit of less than 8 tons (Table 4). Only 5 have no posted weight restriction.

Table 4. Posted Weight Limits for Overpasses

Posting Information	Posted Loads (tons)	Number of Structures	Percentage
Posted	Less than 5	6	10
	5-< 8	7	12
	8 -<11	23	40
	11-<15	9	15
	15-<19	8	14
Open		5	9

Vertical Underclearance

Vertical underclearance is of concern to the railroads as more railroad traffic becomes intermodal and double-stacking becomes the norm. The majority, 83 percent, is below the ideal height of 23 feet (Table 5). Some may need to be raised to comply with railroad standards.

Table 5. Vertical Underclearance of Overpasses

Vertical Underclearance (ft)	Number of Structures	Percentage
Less than 20	13	23
>20-22	29	50
>22-23	6	10
Greater than 23	10	17

Type of Material

Sixty-two percent of the overpasses are constructed of steel, 26 percent of timber, and 10 percent of concrete (Table 6).

Table 6. Type of Material of Overpasses

Material	Number of Structures	Percentage
Concrete	3	5
Concrete continuous	3	5
Steel	34	59
Steel continuous	2	3
Timber	15	26
Aluminum, wrought iron, or cast iron	1	2

Historic Significance

The historic significance of some overpasses could affect the costs of rehabilitating or replacing them. As shown in Table 7, most of the structures are not eligible for inclusion on the National Register of Historic Places and would not require special treatment. However, 2 are listed on the National Register: No. 062-6052 in Nelson County and 076-6023 in Prince William County. Both structures will probably need to be fully evaluated, dismantled, and stored, with

the concomitant costs. A third structure, No. 107-8002 in Covington, is eligible for placement on the National Register. This structure will likely also require special treatment.

Table 7. Historic Significance of Overpasses

Historic Significance	Number of Structures	Percentage
On National Register	2	3
Eligible for National Register	1	2
Possibly eligible for National Register	0	0
Not determinable	2	3
Not eligible for National Register	53	92

Underpasses

There are approximately 380 underpasses in Virginia. Of these, 42 are maintained by a public road authority, and of these, 9 are maintained by either the Richmond Metropolitan Authority, the National Park Service, or the U.S. Government. Another structure, No. 030-1133 in Fauquier County, was constructed and the railroad abandoned the line. This structure currently serves as a pedestrian/bicycle path. Since these 10 structures can be eliminated from further consideration (see Appendix C), the researcher considered only 32 underpasses in this study. A detailed summary of these underpasses is presented in Appendix B.

Geographic Distribution

Figure 2 depicts the geographic distribution of the underpasses under consideration. As shown, the Bristol District will be relieved of nearly one third of the total number of underpasses being considered. The remaining underpasses are predominately located in cities, with the exception of the Salem and Staunton districts. These underpasses in these districts combined, excluding cities, will account for another 22 percent of the underpasses to be returned to the railroads.

Maintenance Responsibilities

Norfolk Southern will receive 21 (66%) of the underpasses, and CSX will receive 10 (31%). Structure 116-1800 in Hopewell carries both CSX and Norfolk Southern traffic, and the maintenance responsibilities will most likely be shared between the two railroads.

Age

Table 8 indicates that the age of the underpasses under consideration is relatively low. More than half, 60 percent, are less than 30 years old, and 85 percent are less than 50 years old.

Table 8. Age of Underpasses

Year Built	Number of Structures	Percentage
Before 1900	0	0
1900-1929	2	6
1930-1949	3	9
1950-1969	8	25
1970-1979	13	41
1980-Present	6	19

Posted Weight Restrictions

None of the underpasses had a sufficiency rating. A surrogate measure of their condition might be their posted weight restrictions. Since none of the structures has a posted weight restriction and they continue to carry train traffic, they would seem to be in relatively good condition. In addition, these types of structures are not typically subjected to de-icing chemicals or road salts that would cause deterioration.

Type of Material

The majority of the underpasses are made of steel (84 percent), and the remaining are made of concrete (Table 9).

Table 9. Type of Material of Underpasses

Material	Number of Structures	Percentage
Concrete	5	16
Concrete continuous	0	0
Steel	20	62
Steel continuous	7	22

Historic Significance

The historic significance of the underpasses is not an issue since most of them are less than 50 years old. In fact, all of the underpasses have been determined to be ineligible for inclusion on the National Register.

Summary

In summary, the number of overpasses to be acquired by VDOT or a municipality versus the number of underpasses to be turned over to the railroads is in the order of 2 to 1. In all, VDOT and its municipalities would experience a net gain of 26 structures, with the most overpasses being acquired in the Salem District (see Table 10).

Table 10. Summary of Structures Under Consideration

District	Independent City	Overpasses	Underpasses	Gain (Loss) of Structures
Bristol		2	9	(7)
Culpeper		11	-	11
	Charlottesville	2	-	2
Fredericksburg		1	-	1
Lynchburg		9	2	7
	Alta Vista	-	1	(1)
	Danville	1	1	0
	Lynchburg	1	1	0
Northern Virginia		2	-	2
	Alexandria	-	2	(2)
Richmond		-	2	(2)
	Hopewell	-	2	(2)
	Petersburg	1	1	0
	Richmond	4	0	4
Salem		14	3	11
Staunton		4	4	0
	Covington	1	-	1
	Harrisonburg	1	-	1
	Staunton	1	2	(1)
Suffolk		1	-	1
	Emporia	1	-	1
	Newport News	-	1	(1)
	Norfolk	-	1	(1)
	Williamsburg	1	-	1
Total		58	32	26

CASE STUDIES OF PREVIOUSLY TRANSFERRED OVERPASSES

As stated previously, the ownership and maintenance responsibilities of 11 overpasses have either recently been transferred or are in the process of being so. Agreements between the Commonwealth and the railroad exist with regard to 6. Table 11 provides information regarding these structures. The total cost of replacement shown includes the cost of dismantling and removing the structure, engineering and contingencies, work under the railway force account (RFA), and the new replacement structure. In each case, the structure was upgraded from a single-lane to a two-lane facility.

In each case, the railroad agreed to contribute 10 percent of the total replacement cost with the provision that the railroad would be relieved of all future maintenance. This provision is consistent with Section 56-368.1 of the *Code of Virginia*. The cost associated with dismantling and removing the structures varied, from \$7,500 to \$21,153. The average cost was \$15,630. The cost of engineering and contingencies was 22 percent of the cost of dismantling the existing structure and the cost of the new replacement structure. Engineering accounted for 10 percent, and the contingencies line item was 12 percent.

Table 11
Recently Transferred Overpasses

Structure Number	District	County	Agreement Date	Cost of Replacement (\$)
006-6073	Lynchburg	Appomattox	February 26, 1996	549,282
015-6068	Lynchburg	Campbell	August 14, 1996	384,370
009-6083	Salem	Bedford	November 3, 1995	497,115
009-6095	Salem	Bedford	July 31, 1995	590,529
007-6449	Staunton	Augusta	January 18, 1996	513,615
093-6025	Staunton	Warren	June 8, 1995	388,000

All of the agreements had a line item for the RFA. The RFA varied from 9 to 21 percent of the total costs of dismantling the existing structure, the engineering and contingencies, and the cost for the new structure. The average was 12.5 percent.

To determine a cost for a new replacement structure that included all other costs and line items, the researcher calculated an average square foot cost for each structure, as shown in Table 12. The average replacement cost of \$278.85 per square foot may appear high. However, this figure represents the cost of replacing one-lane structures with wider overpasses, not the cost of the replacement bridge itself.

Table 12
Average Square Foot Replacement Costs for Overpasses

Bridge	Total Cost (\$)	Area of Bridge Replaced (sq ft)	Cost/Square Foot (\$)
006-6073	549,282	2387	230.11
015-6068	384,370	961	399.97
009-6083	497,115	2192	226.79
009-6095	590,529*	2070	285.28
	472,968		228.49
007-6449	513,615	1408	364.78
093-6025	388,000	1792	216.52
Average square foot replacement cost			278.85

**Note: There was some dispute between the railroad and VDRPT regarding the anticipated costs. Therefore, both the railroad's estimate and VDRPT's estimate are used here in the calculation of the average square foot replacement cost.*

DEVELOPMENT OF COST FIGURES

Limitations

Although the researcher made every effort to locate the actual annual maintenance costs for each structure, for various reasons, the attempts were futile. Therefore, the cost figures presented are based on conservative assumptions made by the researcher. These assumptions might either overstate or understate the true cost of a project to transfer maintenance

responsibility. The costs presented for the overpasses are only for the structure and not for any work required for the geometric realignment of the roadway or its approaches.

Assumptions

The researcher selected a 50-year analysis period with a corresponding 5 percent interest rate in an effort to present the costs in a normalized fashion, namely in net present worth. The net present worth analysis for overpasses includes the estimated cost of constructing a new structure (including costs for dismantling and removing the existing structure, engineering and contingencies, and the RFA) that complies with VDOT's current standards and specifications, the approximated annual maintenance costs, and the cost to perform annual and biannual bridge inspections. The researcher assumed that a new structure would not require annual inspections for the first 35 years of its service. For the remaining 15 years, the structure would be inspected annually. The researcher recognized that this is a strong assumption and that there are many reasons why a structure may or may not be inspected more frequently earlier or later in its useful life. However, to provide uniformity in developing generalized costs, this assumption was necessary.

The net present worth analysis for the underpasses includes only the estimated annual maintenance costs for the structure and the cost associated with biannual bridge inspections. Since the majority of these structures are relatively new and do not require significant maintenance, the researcher assumed that a biannual bridge inspection would be sufficient over the analysis period.

Overpass Replacement Costs

As discussed previously, the researcher calculated the average cost for dismantling and removing an existing overpass structure as \$15,630. Engineering and contingencies accounted for 22 percent of the dismantling fee and the cost for a new structure. The average RFA was 12.5 percent of the total costs. The average square foot cost to replace structures was \$278.85. This cost is for the area of the existing structure, not the area of the proposed new structure.

The researcher also identified costs associated with the construction of a new overpass. In a number of agreements between VDOT and railroad companies, reference was made to a new structure costing \$90 per square foot. VDOT's Structure & Bridge Division supplied a cost of \$75 per square foot for a new bridge and \$105 per square foot for a new bridge with road improvements associated with the project.

Annual Maintenance Costs of New Replacement Overpasses

The researcher developed annual maintenance costs for the new replacement structures based on the following assessment. Based on VDOT's bridge inventory, the average bridge area is 6,000 square feet, and the cost associated with constructing a new facility is approximately

\$105 per square foot. Based on these two values, the cost for constructing a structure this size would be approximately \$630,000. The average annual maintenance cost for a new structure is typically between 0.7 percent and 2 percent of the cost of a new structure.²² Therefore, at 0.7 percent, the annual maintenance would be \$4,410, and at 2 percent, the annual maintenance would be \$12,600.

The environment in which the bridge resides will also affect the annual maintenance cost. A bridge in a “good” environment with limited use of de-icing chemicals and road salts will have a lower annual maintenance cost than a bridge in a “bad” environment with extensive use of de-icing chemicals and road salts. After rounding the two maintenance costs estimated previously (\$4,410 and \$12,600), the researcher assumed that a structure in a good environment could have an annual maintenance cost of \$5,000, and a structure in a bad environment could have an annual maintenance cost of \$10,000. For the purposes of this study, structures on rural roadways were listed as being in a good environment, and structures in urban settings were listed as being in a bad environment. Thus, approximately 76 percent of the structures under consideration are located in a good environment.

Annual Maintenance Costs of Underpasses

Information on the maintenance costs for underpasses was nearly nonexistent. The researcher made every effort to locate the actual annual maintenance costs for each underpass VDOT maintains, but none was available because of VDOT’s current accounting system. The researcher also asked both CSX and Norfolk Southern to identify their average annual maintenance costs for underpasses. CSX staff stated that because of their accounting system, they would not be able to supply this level of information.²³ However, because of a recent systemwide survey of their underpasses, Norfolk Southern staff found that the annual maintenance costs for their structures was \$6,400 per structure per year.²⁴ This figure is for only the substructure and superstructure (not the tracks and ballast), which is the portion for which VDOT or another public road authority is now responsible for maintaining.

DEVELOPMENT OF TRANSFERENCE ALTERNATIVES

Based on the assumptions used to develop the cost figures, the researcher developed six transference alternatives:

1. Allow the existing process of conveying ownership and maintenance responsibilities of overpasses to correct itself over time.
2. Replace all of the overpasses immediately, with VDOT assuming ownership and maintenance responsibilities.

3. Replace all of the overpasses immediately, with VDOT assuming ownership and maintenance responsibilities and the railroads paying 10 percent of the initial replacement costs plus a fixed number of years of future anticipated maintenance.
4. Effect the provisions of Alternative 3, except that the railroads pay 15 percent of the initial replacement costs.
5. Effect the provisions of Alternative 3, except that the railroads pay 20 percent of the initial replacement costs.
6. Effect the provisions of Alternative 3, except that the railroads pay 25 percent of the initial replacement costs.

Each alternative has three parts:

- *Part A* investigates only the costs associated with VDOT acquiring the overpasses without consideration of maintaining or relinquishing the underpasses.
- *Part B* investigates the costs associated with VDOT acquiring the overpasses and continuing to retain and maintain the underpasses.
- *Part C* investigates the cost of VDOT acquiring the overpasses and immediately relinquishing the ownership and maintenance responsibilities for the underpasses.

To give a range of magnitude and a complete overview, the researcher decided to use the four previously estimated replacement costs with the alternatives:

1. *\$75/square foot:* the estimate of VDOT's Structure & Bridge Division for a new bridge
2. *\$90/square foot:* the figure specified in a number of agreements between VDOT and the railroads
3. *\$105/square foot:* the estimate of VDOT's Structure & Bridge Division for a new bridge and the necessary road improvements
4. *\$278.85/square foot:* average cost for replacing the previous 6 structures (includes dismantling and removing existing structure, engineering and contingencies, work under the RFA, and the cost of replacement with a wider overpass).

Appendix D provides a table of the overpasses under consideration and the anticipated replacement costs based on the four unit cost figures. Appendices E through J provide the full cost tables developed for Alternatives 1 through 6, respectively. The following sections summarize the results of each alternative and provide a range of costs. Because of rounding, the figures may differ slightly from those in the appendices.

Alternative 1

Alternative 1 assumes that VDOT's and VDRPT's existing process of conveying ownership and maintenance responsibilities of the overpasses will correct itself over time. On average, 5 overpasses are transferred to VDOT each year. If this trend continues, the structures under consideration will be transferred in approximately 12 years. This alternative also assumes that the railroads will maintain the overpasses until they are ready for replacement.

This alternative considers a range of initial construction (replacement) cost percentages that would be paid by the railroads. After the replacement of the structure, 100 percent of the future maintenance will be the responsibility of VDOT. Only a percentage of the initial replacement cost will be paid by the railroad, as is done now.

Table 13 depicts the costs associated with Alternative 1. The cost to the state could range from \$10.6 to \$35.2 million, and the cost to the railroads from \$1.9 to \$18.4 million. Total project costs would range from \$24.5 to \$38.0 million.

Table 13
Costs for Alternative 1 (in millions)

	Percentage of Overpass Replacement Cost Paid by Railroad					
	10%	15%	20%	30%	40%	50%
1A: VDOT Acquires Overpasses Over Time						
State	22.6–30.7	21.7–29.3	20.8–28.0	18.9–25.2	17.0–22.4	15.2–19.7
Railroad	1.9–2.8	2.8–4.2	3.7–5.5	5.6–8.3	7.5–11.1	9.3–13.8
Total	24.5–33.5					
1B: VDOT Acquires Overpasses and Maintains Underpasses						
State	27.2–35.2	26.3–33.9	25.3–32.5	23.5–29.7	21.6–27.0	19.7–24.2
Railroad	1.9–2.8	2.8–4.1	3.8–5.5	5.6–8.3	7.5–11.0	9.4–13.8
Total	29.1–38.0					
1C: VDOT Acquires Overpasses and Railroads Acquire Underpasses						
State	18.1–26.2	17.2–24.8	16.2–23.4	14.4–20.7	12.5–17.9	10.6–15.1
Railroad	6.4–7.3	7.3–8.7	8.3–10.1	10.1–12.8	12.0–15.6	13.9–18.4
Total	24.5–33.5					

Alternative 2

With Alternative 2, the overpasses are replaced immediately and their maintenance is turned over to VDOT. The railroads pay a percentage of the initial replacement costs.

Table 14 depicts costs for Alternative 2. The cost to the state could range from \$15.6 to \$44.7 million, and the cost to the railroads from \$2.4 to \$22.4 million. Total project costs would range from \$32.2 to \$48.3 million.

Table 14
Alternative 2 Costs (in millions)

	Percentage of Overpass Replacement Cost Paid by Railroad					
	10%	15%	20%	30%	40%	50%
2A: VDOT Acquires Overpasses						
State	29.8-40.2	28.6-38.5	27.4-36.7	25.0-33.1	22.6-29.5	20.2-26.0
Railroad	2.4-3.6	3.6-5.3	4.8-7.1	7.2-10.7	9.6-14.3	12.0-17.8
Total	32.2-43.8					
2B: VDOT Acquires Overpasses and Maintains Underpasses						
State	34.4-44.7	33.2-43.0	32.0-41.2	29.6-37.6	27.2-34.1	24.7-30.5
Railroad	2.4-3.6	3.6-5.3	4.8-7.1	7.2-10.7	9.6-14.2	12.1-17.8
Total	36.8-48.3					
2C: VDOT Acquires Overpasses and Railroads Acquire Underpasses						
State	23.3-35.7	24.1-33.9	22.9-32.1	20.5-28.6	18.1-25.0	15.6-21.4
Railroad	6.9-8.1	8.1-9.9	9.3-11.7	11.7-15.2	14.1-18.8	16.6-22.4
Total	32.2-43.8					

Alternative 3

With Alternative 3, the overpasses are replaced immediately, their maintenance responsibilities are turned over to VDOT, and the railroads pay 10 percent of the initial replacement costs plus a fixed number of years of maintenance costs. VDOT would perform the maintenance.

Table 15 depicts the costs of Alternative 3. The cost to the state could range from \$19.2 to \$42.9 million, and the cost to the railroads from \$4.2 to \$14.2 million. Total costs would range from \$32.2 to \$48.3 million.

Table 15
Alternative 3 Costs (in millions)
Railroads Pay 10% of Overpass Replacement Costs

	Years of Overpass Maintenance Paid by Railroads				
	5	10	15	20	25
3A: VDOT Acquires Overpasses					
State	28.0-38.4	26.5-36.9	25.3-35.8	24.4-34.8	23.7-34.1
Railroad	4.2-5.4	5.7-6.9	6.9-8.0	7.8-9.0	8.5-9.7
Total	32.2-43.8				
3B: VDOT Acquires Overpasses and Maintains Underpasses					
State	32.6-42.9	31.0-41.4	30.0-40.3	29.0-39.3	28.3-38.6
Railroad	4.2-5.4	5.8-6.9	6.8-8.0	7.8-9.0	8.5-9.7
Total	36.8-48.3				
3C: VDOT Acquires Overpasses and Railroads Acquire Underpasses					
State	23.5-33.9	21.9-32.3	20.8-31.2	19.9-30.3	19.2-29.6
Railroad	8.7-9.9	10.3-11.5	11.4-12.6	12.3-13.5	13.0-14.2
Total	32.2-43.8				

Alternative 4

Alternative 4 is identical with Alternative 3 except the railroads pay 15 percent of the initial replacement costs of the overpasses.

Table 16 depicts the costs of Alternative 4. The cost to the state could range from \$18.0 to \$41.1 million, and the cost to the railroads from \$5.4 to \$16.0 million. Total project costs would range from \$32.2 to \$48.3 million.

Table 16
Alternative 4 Costs (in millions)
Railroads Pay 15% of Overpass Replacement Costs

	Years of Maintenance Paid by Railroads				
	5	10	15	20	25
4A: VDOT Acquires Overpasses					
State	26.8-36.6	25.3-35.1	24.1-34.0	23.2-33.0	22.5-32.3
Railroad	5.4-7.2	6.9-8.7	8.1-9.8	9.0-10.8	9.7-11.5
Total			32.2-43.8		
4B: VDOT Acquires Overpasses and Maintains Underpasses					
State	31.4-41.1	29.8-39.6	28.7-38.5	27.8-37.5	27.1-36.9
Railroad	5.4-7.2	7.0-8.7	8.1-9.8	9.0-10.8	9.7-11.4
Total			36.8-48.3		
4C: VDOT Acquires Overpasses and Railroads Acquire Underpasses					
State	22.3-32.1	20.7-30.6	19.6-29.4	18.7-28.5	18.0-27.8
Railroad	9.9-11.7	11.5-13.2	12.6-14.4	13.5-15.3	14.2-16.0
Total			32.2-43.8		

Alternative 5

Alternative 5 is identical with Alternative 3 except that the railroads pay 20 percent of the initial replacement costs of the overpasses.

Table 17 depicts the costs for Alternative 5. The cost to the state could range from \$16.8 to \$39.4 million, and the cost to the railroads from \$6.6 to \$17.8 million. Total project costs would range from \$32.2 to \$48.3 million.

Table 17
Alternative 5 Costs (in millions)
Railroads Pay 20% of Overpass Replacement Costs

	Years of Maintenance Paid by Railroads				
	5	10	15	20	25
5A: VDOT Acquires Overpasses					
State	25.6-34.8	24.0-33.3	22.9-32.2	22.0-31.2	21.3-30.6
Railroad	6.6-9.0	8.2-10.5	9.3-11.6	10.2-12.6	10.9-13.2
Total			32.2-43.8		
5B: VDOT Acquires Overpasses and Maintains Underpasses					
State	30.1-39.4	28.6-37.8	27.5-36.7	26.6-35.8	25.9-35.1
Railroad	6.7-8.9	8.2-10.5	9.3-11.6	10.2-12.5	10.9-13.2
Total			36.8-48.3		
5C: VDOT Acquires Overpasses and Railroads Acquire Underpasses					
State	21.1-30.3	19.5-28.8	18.4-27.7	17.5-26.7	16.8-26.0
Railroad	11.1-13.5	12.7-15.0	13.8-16.1	14.7-17.1	15.4-17.8
Total			32.2-43.8		

Alternative 6

Alternative 6 is identical with Alternative 3 except that the railroads pay 25 percent of the initial replacement costs of the overpasses.

Table 18 depicts the costs of Alternative 6. The cost to the state could range from \$15.6 to \$37.6 million, and cost to the railroad from \$7.8 to \$19.6 million. Total costs would range from \$32.2 to \$48.3 million.

Table 18
Alternative 6 Costs (in millions)
Railroads Pay 25% of Overpass Replacement Costs

	Years of Maintenance Paid by Railroads				
	5	10	15	20	25
6A: VDOT Acquires Overpasses					
State	24.4-33.1	22.8-31.5	21.7-30.4	20.8-29.5	20.1-28.8
Railroad	7.8-10.7	9.4-12.3	10.5-13.4	11.4-14.3	12.1-15.0
Total			32.2-43.8		
6B: VDOT Acquires Overpasses and Maintains Underpasses					
State	28.9-37.6	27.4-36.0	26.3-34.9	25.3-34.0	24.7-33.3
Railroad	7.9-10.7	9.4-12.3	10.5-13.4	11.5-14.3	12.1-15.0
Total			36.8-48.3		
6C: VDOT Acquires Overpasses and Railroads Acquire Underpasses					
State	19.8-28.5	18.3-27.0	17.2-25.9	16.2-24.9	15.6-24.2
Railroad	12.4-15.3	13.9-16.8	15.0-17.9	16.0-18.9	16.6-19.6
Total			32.2-43.8		

DISCUSSION

Literature and Legislative Findings

The *Federal Aid Policy Guide* specifies that reconstructing and rehabilitating grade-separated structures involving railroads and highways are projects eligible for federal aid. However, should federal funds be used for these purposes, the railroad company is under no obligation to participate in any portion of the project cost. This is provided that no contractual agreement to the contrary exists between the state and the railroad company. If Virginia moves forward with the transference of ownership and maintenance responsibilities for the structures under consideration, but does not have a contractual agreement with the railroads, the state could be faced with a significant expenditure of public funds.

Many of Virginia's neighboring states have statutes that prescribe maintenance, ownership, and cost share responsibilities for overpass and underpasses. In many cases, these responsibilities are clear: overpasses are the responsibility of the state or county, and underpasses are the responsibility of the railroad.

States are different, however, with regard to the allocation of cost share responsibilities. For example, in North Carolina and West Virginia, the railroad bears 10 percent of the cost of reconstructing an overpass. But in Maryland, the railroad's share is 25 percent, and in Kentucky, 10 to 50 percent.

The Code of Virginia does not prescribe the distribution of costs relative to the reconstruction of an overpass or underpass. However, the *Code* does establish the maintenance and ownership responsibilities of constructed or reconstructed overpasses and underpasses. In the case of an overpass, VDOT is responsible, and in the case of an underpass, the railroad is responsible, with one exception: Whenever an underpass is constructed and an at-grade crossing is not eliminated, the railroad is not required to maintain the underpass. This could be expensive for the Commonwealth. VDOT and VDRPT have been slowly eliminating the number of railroad-owned and maintained overpasses but not the number of VDOT-maintained underpasses. In fact, given the provision in the *Code*, VDOT could acquire maintenance responsibilities for additional underpasses if grade crossings are not eliminated when such underpasses are constructed. Only a change in the *Code* could eliminate the potential for VDOT to own and maintain additional nonhighway facilities.

South Carolina has taken the lead in transferring the maintenance responsibilities for overpasses. This program will be a multiphase, multiyear program. The state is also using the 10 percent cost share from the railroads to advance its program. It is interesting to note that this

10 percent figure includes not only the cost of the structures but also the cost of any necessary roadway improvements.

Financial Ramifications of Conveying Ownership and Maintenance Responsibilities

Although the total number of overpasses and underpasses being considered is quite small, the financial implications for VDOT and the railroads could be large. Most of the overpasses are in poor condition. The average age is 70 years, and more than 60 percent have a weight restriction of 10 tons or less. In contrast, the underpasses are in good condition. The average age is 35 years, and none has a weight restriction. Given these facts, it is apparent that a simple “swap” of responsibilities could have serious financial ramifications for VDOT’s Salem, Culpeper, and Lynchburg districts with regard to their 6-year plans and construction money.

Advantages and Disadvantages of the Six Alternatives

Each alternative would have different financial impacts on VDOT and the railroads, and each alternative has advantages and disadvantages.

Alternative 1 reflects the replacement trend currently used by VDOT and VDRPT and thus provides for an easy transition of maintenance responsibilities. With this alternative, VDOT would not be responsible for maintaining the overpasses until they were replaced. In addition, VDOT and VDRPT could stagger replacements rather than paying a lump sum to replace all structures immediately. The disadvantages might, however, outweigh the advantages. The issue and problems currently being felt by both the state and the railroads would linger for 12 years. Although the underpasses are in good shape and do not require significant attention, the public will probably demand better overpasses before all of them are brought under the control of VDOT or a municipality.

Alternative 2 calls for an immediate transfer of the overpasses. Although this option would eliminate any further confusion regarding ownership and maintenance responsibilities, it would not come without a price. Replacing 58 structures immediately would result in a financial drain on the budgets of some VDOT districts. In addition, a significant amount of coordination would be required among the state, localities, and the railroads. This cooperation period would extend from contract preparation through construction inspections.

Alternatives 3 through 6 have the same advantages and disadvantages as *Alternative 2*, with one exception. Depending on the number of years of future maintenance paid for by the railroads, the future costs to the state would be lessened.

FINDINGS AND CONCLUSIONS

- *Grade-separated structures involving railroads and highways are eligible for federal aid.* However, in the absence of a contractual agreement to the contrary, should one of these structures be replaced or rehabilitated with federal funds, the railroad company is under no

obligation to pay any portion of the costs. It might be in the Commonwealth's best interest to negotiate a contract with the railroads beforehand to enable the use of federal funds.

- *The codes of many neighboring states specify the allocation of replacement costs between the state and the railroad. The railroad pays from 10 to 50 percent of the project's cost.*
- *Section 56-368.1 of the Code of Virginia specifies that if VDOT or the public road authority constructs a new underpass without eliminating a railroad-highway grade crossing, the subsequent maintenance of that underpass is the responsibility of VDOT or the public road authority. Unless this statute is changed, VDOT could acquire maintenance responsibility for additional underpasses.*
- *The overpasses currently maintained by the railroads are in generally poor condition, requiring substantial public investment to comply with VDOT's standards and specifications, whereas the underpasses currently maintained by VDOT are in generally good condition, requiring little annual maintenance. Therefore, it will be necessary to have monetary compensation from the railroads to make the transference of ownership and maintenance responsibilities a reality.*
- *Should VDOT acquire the 58 overpasses, the costs to VDOT could range from approximately \$15 to \$40 million, and the costs to the railroads from approximately \$2 to \$18 million, depending on the alternative selected.*
- *Should VDOT acquire the 58 overpasses and continue to maintain the 32 underpasses, the costs to VDOT could range from approximately \$20 to \$45 million, and the costs to the railroads from approximately \$2 to \$18 million, depending on the alternative selected.*
- *Should VDOT acquire the 58 overpasses and relinquish the 32 underpasses, the costs to VDOT could range from approximately \$11 to \$36 million, and the costs to the railroads from approximately \$6 to \$22 million, depending on the alternative selected.*
- *Transferring maintenance responsibilities for underpasses in the near future might be in the Commonwealth's best interest in the long term. The cost of replacing an underpass is nearly twice that of replacing an overpass. The cost of subsequently maintaining each type of structure is almost equal. However, over time, the underpasses under consideration will require a significant amount of work to maintain their load-carrying capabilities. The Commonwealth will probably be liable to perform this work expeditiously so as not to interfere with interstate commerce. Eventually these underpasses will require serious rehabilitation and possibly replacement, and the cost of replacing one could exceed the cost of two new overpasses.*

RECOMMENDATIONS

The researcher offers four recommendations that will eliminate the potential for VDOT to maintain additional underpasses and delineate what would be required for VDOT to assume ownership of and maintenance responsibilities for overpasses.

1. *Section 56.368.1 of the Code of Virginia should be modified as follows:*

§56-368.1. Subsequent maintenance of underpasses and overpasses.

After the work specified in §§56-366.1 and 56-366.3 regarding underpasses and overpasses has been done, the maintenance, including drainage, of any underpass hereafter so constructed, except the pavement thereof, shall be the sole responsibility of the railroad company and the maintenance of any overpass hereafter so constructed shall be the sole responsibility of the Department of Transportation or the public road authority; provided, that the railroad company shall not be responsible for any damage to an underpass caused by operations on the highway, and the Department of Transportation or the public road authority shall not be responsible for any damage to an overpass caused by the operations of the railroad company; and further provided, that the provisions herein as to maintenance of overpasses and underpasses shall also be construed as applicable in the case of those structures previously built on the primary system under agreement between the railroad company and the Department of Transportation or the public road authority. ~~; and further provided that the provisions herein as to maintenance by a railroad company shall not be applicable in the case of any underpass hereafter constructed without eliminating a crossing of a railroad and a highway grade, but the maintenance of such structures, including highway drainage and pavement therefor, shall be the sole responsibility of the Department of Transportation or the public road authority.~~

2. *VDOT and VDRPT should state that one of their continuing efforts is to eliminate and close unnecessary and redundant highway-railroad grade crossings.*
3. *VDOT and VDRPT should undertake a comprehensive review of overpasses to arrive at concise replacement cost estimates. Upon completion of these estimates, a decision could be made as to which structures should be replaced, which could be retrofitted and their integrity brought up to standards acceptable to VDOT, which should be permanently closed, and which could be brought into VDOT's road network without modification. An engineering field review team; consisting of representatives from each railroad affected, VDOT, and VDRPT, should review each overpass structure that is being considered for inclusion in VDOT's road system. This engineering review should provide VDRPT, VDOT, and the participating railroads with a more accurate assessment of the true costs associated with the possible transference of maintenance responsibilities.*

4. *VDOT and VDRPT should work with the railroads to relinquish control of all underpasses as soon as possible.*

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Appendix A

OVERPASSES UNDER CONSIDERATION

|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|

Appendix B

UNDERPASSES UNDER CONSIDERATION

District	City/County	Structure Number	Facility Carried	Feature Intersected	Year Built	Vertical Underclearance	Maintenance Resp State	ADT - Under	Deck GCR	Superstructure GCR	Culvert GCR	Sufficiency Rating	Route	Type	Width Curb to Curb	Width Out to Out	Length	Area	Owner	Type Service On	Lanes On	Lanes Under	Historical Significance	Open/Posted/Closed	Posted Capacity	Proposed Improvement Type	Scheduled for Advertisement
1	25	1012	SBD SYSTEM RAILROAD	RTE. 63	1977	1407	25	3045 n	6	7	7	63	4.02	196	27	2	1	0	2	5	A						
		1	521013	SBD SYSTEM RAILROAD	RTE. 63	1977	1407	25	3045 n	6	7	63	4.02	189	27	2	1	0	2	5	A						
1	52	6004	SOU RAILWAY	RTE. 606	1972	1501	52	1682 n	8	7	7	606	4.02	104	27	2	1	0	2	5	A						
1	52	6008	SOU RAILWAY	RTE. 606	1972	1701	52	1165 n	7	7	7	606	4.02	101	27	2	1	0	2	5	A						
1	84	1001	SOU RAILWAY	RTE. 23	1937	1611	84	7900 n	7	7	7	23	4.02	200	27	2	1	0	4	5	A						
1	92	1085	N&W RAILWAY	RTE 19 & 460	1952	1606	92	11000 n	7	5	7	19	4.02	211	27	2	1	0	4	5	A				35.1		
1	92	6042	N&W RAILWAY	RTE. 627	1973	1501	92	1099 n	7	7	7	627	3.02	101	27	2	1	0	2	5	A						
1	95	6010	N&W RAILWAY	RTE. 609	1979	1407	95	2934 n	8	7	7	609	4.02	121	27	2	1	0	2	5	A						
1	95	6085	PED	RTE. 728	1932	4805	NPS	29				728	3.03	533	66	2	1	0	1	5	A						
1	97	1132	N&W RAILWAY	RTE. 63	1985	1406	97	6700 n	7	7	7	63	3.02	81	1	2	1	0	2	5	A						
2	35	1007	N&W RAILWAY	RTE. 61	1941	1402	35	1100	8	8	8	61	3.02	52	1	2	1	0	2	5	A						
2	35	6014	N&W RAILWAY	RTE. 622	1928	907	35	286	8	8	8	622	1.11	37	1	2	1	0	1	5	A						
2	77	1014	N & S RAILWAY	RTE. 100	1941	1311	USG	18000				100	3.02	100	60	2	1	0	4	5	A						
2	80	1053	N&W RAILWAY	RTE. 419	1970	1607	80	30000	8	8	8	419	3.02	112	15.3	213	3258.9	1	2	1	0	4	5	A			
3	19	1034	SOU RAILWAY	RTE 15 360	1965	1508	19	3710	7	8	8	15	3.02	118	1	2	1	0	4	5	A						
3	73	1007	N&W RAILWAY	RTE. 460	1971	1601	73	12000	7	7	8	460	3.02	139	1	2	1	0	4	5	A						
3	108	1134	SOU RAILWAY	RTE 265 BP & QUARRY ROAD	1984	1605	108	6200	7	8	7	265	3.02	276	4	2	1	0	6	5	A						
3	118	1872	N&W RAILWAY	LYNCH EXP RTE. 29	1976	1605	118	13810				291	3.02	235	4	2	1	0	4	5	A						
3	162	6214	N&W RAILWAY	RTE. 668	1966	1610	162	4375				668	3.02	50	4	2	1	0	2	5	A						
4	42	2020	CSX TRANSPORTATION	RTE. 295	1978	1608	42	50000	7	7	7	295	3.03	276	1	2	1	0	8	5	A						
4	58	2006	NF&D RAILWAY	RTE. 85	1965	1604	58	15275				85	3.03	247	1	2	1	0	4	5	A						
4	116	1800	N&W RY & CSX TRAN	RTE. 10	1966	1406	116	10420				3.02		82	4	2	1	0	4	5	A						
4	116	8003	PERRYMONT & N&W RR	CABIN CREEK (CULVERT)	1991		74	500			8	100	0.19	54	1	4	5	2	0	5	A						
4	123	8018	HALIFAX RD & CSXT	DEFENSE ROAD	1936	1108	123	1066	7	7	7	88.7	0.111	86.3	89.3	36	3214.8	4	4	1	2	2	5	A			
4	127	1823	SOU RAILWAY	POWWHITE PKWY - RTE. 76	1972	1606	RMA	73000	6	7	8	76	3.02	437	32	2	6	0	7	5	A						
4	127	1851	CSXT RR	POWWHITE PKWY - RTE. 76	1972	1700	RMA	73000	8	7	8	76	3.03	169	32	2	1	0	2	5	A						
4	127	1852	CSXT RR	POWWHITE PKWY - RTE. 76	1972	1702	RMA	73000	7	7	8	76	3.03	169	32	2	1	0	2	5	A						
4	127	1853	CSXT RR NB TRACK	RTE. 146	1972	1410	RMA	25000	8	7	8	146	3.03	151	32	2	1	0	2	5	A						
4	127	1854	CSXT RR SB TRACK	RTE. 146	1972	1409	RMA	25000	7	7	8	146	3.03	151	32	2	1	0	2	5	A						
5	121	8012	CSX RAILROAD	HARBOR ACC RD	1976	1606	121	800	5	7	6	0	3.02	186	4	2	1	0	2	5	A						
5	122	1839	N & W RAILWAY	RTE. 58	1962	1403	EPT		8	8	8	58	1.01	39	1	2	1	0	2	5	A						
5	137	5200	C & O RAILROAD	COLONIAL PARKWAY	1936	1310	NPS		7	7	6	1	2.11	44	47.5	142	6745	66	2	1	1	2	5	A			
7	30	1123	RAILWAY R/W (ABAD)	ROUTE 15/29 N.B. & S.B.L	1988	1802	30	14000	8	8	8	15	3.03	190	1	2	1	0	4	5	A				0		
8	3	1127	C&O RAILWAY	RTE. 311	1965	1310	3	660 n	n	n	5	311	3.19	17	1	2	1	0	1	5	A						
8	3	2054	C&O RY & LONGDALE	RTE. 64	1959	1707	3	9080	7	6	7	64	3.03	178	1	2	1	0	4	5	A						
8	85	6389	SOU RAILWAY	RTE 651	1971	1700	85	4969	8	8	8	651	3.02	127	1	2	1	0	2	5	A						
8	93	1007	N&W RAILWAY	RTE. 340	1974	2203	93	4800	8	8	8	340	3.02	240	1	2	1	0	2	5	A						
8	132	1807	C & O RAILWAY	MIDDLEBROOK AVE	1993	1408	132	3130	9	9	9	252	3.03	112	4	2	1	0	4	5	A						
8	132	1808	C & O RAILWAY	MIDDLEBROOK AVE	1993	1509	132	3130	9	9	9	252	1.02	121	4	2	1	0	4	5	A						
A	29	1003	PRIVATE RAILROAD	RTE. 1	1935		USG	28000				1	3.02	100	2	1	0	4	5								
A	100	8013	RF&P	EISENHOWER AVE	1985	1607	100	18000				0	3.02	210	26	2	1	0	4	5	A						
A	100	8015	RF&P	BRADDOCK RD	1905	1111	100					0	3.02	45	4	2	1	0	2	5	A						
				UNDERPASSES ELIMINATED FROM FURTHER CONSIDERATION																							

Appendix C

UNDERPASSES ELIMINATED FROM FURTHER CONSIDERATION

Nine underpasses are maintained by agencies other than state and municipal governments, and the realignment of their maintenance responsibilities was not considered. There are only three such agencies: the National Park Service, the Richmond Metropolitan Authority, and the U.S. Government. One other structure is located along an abandoned railway line and is maintained by VDOT. These structures, their current maintenance responsibility, and their location are as follows:

National Park Service

Structure 095-6085, in Washington County (Bristol District)
Structure 137-5200, in Williamsburg (Suffolk District)

Richmond Metropolitan Authority

Structure 127-1823, in Richmond (Richmond District)
Structure 127-1861, in Richmond (Richmond District)
Structure 127-1862, in Richmond (Richmond District)
Structure 127-1863, in Richmond (Richmond District)
Structure 127-1864, in Richmond (Richmond District)

United States Government (USG)

Structure 029-1003, in Fairfax (Northern Virginia District)
Structure 077-1014, in Pulaski County (Salem District)

Virginia Department of Transportation (VDOT)

Structure 030-1133, in Fauquier County (Culpeper District)

Appendix D

OVERPASS REPLACEMENT COSTS

City/County	Structure Number	Activity Carried	ADT	Area Width	Length	Area (Sq Ft)	Functional Class	Replacement of Existing Structure	Replacement Costs @ \$75/sq. ft.	12% Engineering & 10% Contingencies	Total Cost @ \$75/sq. ft. w/12.5% Highway Force Account	Replacement Costs @ \$178.45/sq. ft.	Replacement Costs @ \$105/sq. ft.	12% Engineering & 10% Contingencies	Total Cost @ \$105/sq. ft. w/12.5% Highway Force Account	Average Annual Maintenance for New Structure	Present Worth of Annual Maintenance Costs
1	009	6061 ROUTE 0661	71	31.33	88	1258.4	Rural Local	\$15,630.00	\$236,776.50	\$45,461.16	\$303,170.57	\$303,170.57	\$246,133.00	\$54,589.39	\$303,170.57	\$5,000.00	\$118,729.68
1	009	6066 ROUTE 0610	463	33.33	109	2060.1	Rural Local	\$15,630.00	\$272,472.75	\$59,944.01	\$330,787.72	\$330,787.72	\$326,967.30	\$71,932.61	\$330,787.72	\$5,000.00	\$118,729.68
2	009	6016 ROUTE 0608	36	43.33	96	1546	2 Rural Major Arterial	\$15,630.00	\$279,178.50	\$61,465.27	\$407,535.74	\$407,535.74	\$330,374.20	\$73,763.32	\$407,535.74	\$5,000.00	\$118,729.68
2	009	6004 ROUTE 0622	220	31.33	104	1404	Rural Local	\$15,630.00	\$244,374.00	\$53,762.28	\$300,900.00	\$300,900.00	\$293,248.80	\$64,514.74	\$300,900.00	\$5,000.00	\$118,729.68
2	009	6066 ROUTE 0643	51	31.33	108	1636	Rural Local	\$15,630.00	\$253,773.00	\$55,830.06	\$371,604.83	\$371,604.83	\$304,527.50	\$66,996.07	\$371,604.83	\$5,000.00	\$118,729.68
2	009	6077 ROUTE 0654	264	31.33	97	1746	2 Rural Local	\$15,630.00	\$227,925.75	\$50,143.67	\$338,698.47	\$338,698.47	\$273,510.50	\$60,172.40	\$338,698.47	\$5,000.00	\$118,729.68
2	009	6022 ROUTE 0620	142	31.33	72	878.4	Rural Local	\$15,630.00	\$188,142.00	\$37,220.04	\$253,756.00	\$253,756.00	\$203,018.40	\$44,664.05	\$253,756.00	\$5,000.00	\$118,729.68
2	009	6083 ROUTE 0661	3701	33.33	137	2162	Rural Local	\$15,630.00	\$342,465.75	\$75,342.47	\$504,041.14	\$504,041.14	\$410,958.00	\$90,410.96	\$504,041.14	\$5,000.00	\$118,729.68
2	009	6066 ROUTE 0666	600	33.33	91	1092	Rural Local	\$15,630.00	\$227,477.25	\$50,040.00	\$332,360.25	\$332,360.25	\$270,691.20	\$59,952.00	\$332,360.25	\$5,000.00	\$118,729.68
2	009	6066 ROUTE 0666	135	43.33	96	1152	Rural Local	\$15,630.00	\$279,478.50	\$61,465.27	\$407,535.74	\$407,535.74	\$330,374.20	\$73,763.32	\$407,535.74	\$5,000.00	\$118,729.68
2	009	6061 ROUTE 0666	900	43.33	86	1376	Rural Major Arterial	\$15,630.00	\$448,465.50	\$98,962.41	\$603,862.41	\$603,862.41	\$494,158.00	\$118,384.88	\$603,862.41	\$5,000.00	\$118,729.68
2	009	6065 ROUTE 0671	775	43.33	138	2070	Rural Local	\$15,630.00	\$330,112.75	\$77,024.81	\$500,020.06	\$500,020.06	\$420,135.30	\$92,429.77	\$500,020.06	\$5,000.00	\$118,729.68
2	009	6105 ROUTE 0689	160	31.33	148	2384	Rural Local	\$15,630.00	\$294,319.75	\$62,950.35	\$414,269.52	\$414,269.52	\$341,183.70	\$75,060.41	\$414,269.52	\$5,000.00	\$118,729.68
2	009	6121 ROUTE 0715	400	31.33	121	1936	Rural Local	\$15,630.00	\$220,876.50	\$48,592.83	\$295,627.81	\$295,627.81	\$242,975.70	\$53,454.62	\$295,627.81	\$5,000.00	\$118,729.68
2	009	6138 ROUTE 0737	36	31.33	94	1862	2 Rural Local	\$15,630.00	\$202,479.75	\$44,546.56	\$300,177.46	\$300,177.46	\$240,921.00	\$59,402.75	\$300,177.46	\$5,000.00	\$118,729.68
2	009	6155 ROUTE 0755	1100	33.33	81	1468	2 Rural Local	\$15,630.00	\$300,168.00	\$66,168.96	\$437,219.35	\$437,219.35	\$360,921.00	\$79,402.75	\$437,219.35	\$5,000.00	\$118,729.68
2	009	6178 ROUTE 0805	350	31.33	128	2304	2 Rural Minor Collector	\$15,630.00	\$287,473.25	\$58,844.12	\$350,768.66	\$350,768.66	\$283,773.00	\$65,830.06	\$350,768.66	\$5,000.00	\$118,729.68
3	033	6183 ROUTE 0775	541	33.33	107	1476.6	Rural Local	\$15,630.00	\$211,477.50	\$46,525.05	\$295,627.81	\$295,627.81	\$240,921.00	\$59,402.75	\$295,627.81	\$5,000.00	\$118,729.68
3	009	6011 ROUTE 0609	78	31.33	94	1512	Rural Local	\$15,630.00	\$202,479.75	\$44,546.56	\$300,177.46	\$300,177.46	\$240,921.00	\$59,402.75	\$300,177.46	\$5,000.00	\$118,729.68
3	009	6073 ROUTE 0685	210	31.33	154	2387	Rural Local	\$15,630.00	\$327,861.50	\$79,600.53	\$443,233.80	\$443,233.80	\$360,611.00	\$82,531.44	\$443,233.80	\$5,000.00	\$118,729.68
3	015	6053 ROUTE 0660	273	31.33	163	4775.8	2 Rural Local	\$15,630.00	\$363,099.25	\$84,262.04	\$501,181.91	\$501,181.91	\$404,781.40	\$93,191.91	\$501,181.91	\$5,000.00	\$118,729.68
3	015	6068 ROUTE 0664	605	43.33	62	961	Rural Major Arterial	\$15,630.00	\$201,484.50	\$44,326.58	\$281,373.18	\$281,373.18	\$224,968.40	\$56,364.00	\$281,373.18	\$5,000.00	\$118,729.68
3	015	6104 ROUTE 0711	208	31.33	172	3233.6	Rural Local	\$15,630.00	\$404,157.00	\$88,914.54	\$581,373.18	\$581,373.18	\$484,968.40	\$106,697.45	\$581,373.18	\$5,000.00	\$118,729.68
3	019	6062 ROUTE 0707	79	31.33	120	2160	Rural Local	\$15,630.00	\$239,197.00	\$52,033.40	\$311,006.60	\$311,006.60	\$250,364.00	\$60,640.00	\$311,006.60	\$5,000.00	\$118,729.68
3	041	6138 ROUTE 0724	58	31.33	90	1440	Rural Local	\$15,630.00	\$211,477.50	\$46,525.05	\$295,627.81	\$295,627.81	\$240,921.00	\$59,402.75	\$295,627.81	\$5,000.00	\$118,729.68
3	062	6052 ROUTE 0653	58	31.33	138	2076	Rural Local	\$15,630.00	\$304,265.50	\$71,336.41	\$409,841.91	\$409,841.91	\$328,118.00	\$80,600.00	\$409,841.91	\$5,000.00	\$118,729.68
3	062	6057 ROUTE 0655	450	33.33	131	2764.1	2 Rural Local	\$15,630.00	\$327,467.25	\$72,042.80	\$474,446.77	\$474,446.77	\$382,960.70	\$90,465.35	\$474,446.77	\$5,000.00	\$118,729.68
3	073	6018 ROUTE 0622	167	31.33	116	1632.8	Rural Local	\$15,630.00	\$272,571.00	\$59,895.62	\$397,904.71	\$397,904.71	\$327,065.20	\$71,965.74	\$397,904.71	\$5,000.00	\$118,729.68
3	073	6018 ROUTE 0623	102	31.33	132	2072.4	Rural Local	\$15,630.00	\$310,167.00	\$68,294.27	\$450,324.27	\$450,324.27	\$372,200.40	\$78,184.08	\$450,324.27	\$5,000.00	\$118,729.68
3	073	6020 ROUTE 0623	102	31.33	107	1797.6	Rural Local	\$15,630.00	\$251,423.25	\$55,312.12	\$309,416.70	\$309,416.70	\$250,797.90	\$58,375.74	\$309,416.70	\$5,000.00	\$118,729.68
3	073	6037 ROUTE 0633	407	33.33	128	2022.4	Rural Local	\$15,630.00	\$319,968.00	\$70,392.96	\$453,986.67	\$453,986.67	\$363,961.60	\$90,471.55	\$453,986.67	\$5,000.00	\$118,729.68
3	108	6138 WATER STREET	251	35.33	128	2342.4	2 Urban Local	\$15,630.00	\$330,168.00	\$74,616.96	\$404,784.96	\$404,784.96	\$407,601.60	\$98,540.35	\$404,784.96	\$5,000.00	\$118,729.68
3	118	1828 ROUTE 0000	10152	59.33	30	1620	3 Urban Minor Arterial	\$15,630.00	\$133,462.50	\$29,368.35	\$203,968.54	\$203,968.54	\$160,191.00	\$35,242.02	\$203,968.54	\$10,000.00	\$210,009.31
															\$278,440.22	\$10,000.00	\$210,009.31

4	123	6004 HALIFAX ROAD	2	Urban Collector	1723.8	51	35.33	943	\$15,630.00	\$135,137.25	\$28,730.20	\$208,262.75	\$162,164.70	\$35,676.23	\$243,696.78	\$400,981.63	\$189,192.15	\$41,622.27	\$291,850.77	\$10,000.00	\$210,009.31
4	127	1850 MAIN STREET	2	Urban Minor Arterial	1667.2	32	59.33	6460	\$15,630.00	\$142,382.00	\$31,326.24	\$218,367.86	\$170,870.40	\$37,591.48	\$296,106.01	\$480,866.72	\$199,348.80	\$43,856.74	\$356,812.04	\$10,000.00	\$210,009.31
4	127	1850 NORTH BOULEVARD	4	Urban Minor Arterial	1757.6	250	71.33	24248	\$15,630.00	\$1,342,787.25	\$295,413.20	\$1,680,056.84	\$1,611,344.70	\$354,455.63	\$2,254,537.78	\$4,590,394.50	\$1,879,902.15	\$413,578.47	\$3,268,063.97	\$10,000.00	\$210,009.31
4	127	801 PLATINUM ROAD	1	Urban Local	2139	138	35.33	40	\$15,630.00	\$365,865.50	\$80,446.41	\$227,705.04	\$438,798.00	\$96,535.65	\$630,673.48	\$608,480.15	\$511,931.70	\$112,624.97	\$731,541.91	\$10,000.00	\$210,009.31
4	127	8088 LOMBARD STREET	4	Urban Collector	7631.2	156	67.33	9440	\$15,630.00	\$787,761.00	\$173,307.42	\$1,110,226.77	\$946,313.20	\$207,968.50	\$1,305,686.55	\$2,183,780.12	\$1,102,865.42	\$242,830.38	\$1,655,972.33	\$10,000.00	\$210,009.31
5	087	6042 TUCKER SWAMP ROAD	1	Rural Local	2296.2	126	31.33	331	\$15,630.00	\$303,117.75	\$66,686.91	\$440,485.61	\$363,741.30	\$80,023.05	\$526,022.16	\$640,265.37	\$424,354.85	\$93,360.27	\$600,546.71	\$10,000.00	\$210,009.31
5	109	6070 SUNNYSIDE ROAD	1	Urban Collector	1543.8	93	35.33	530	\$15,630.00	\$246,426.75	\$54,213.88	\$391,492.15	\$226,712.10	\$65,050.66	\$430,170.01	\$400,488.59	\$344,997.45	\$75,689.44	\$468,687.87	\$5,000.00	\$118,729.68
5	137	8001 CAPITAL LANDING RD	2	Urban Local	3052.5	111	35.33	2146	\$15,630.00	\$294,122.25	\$64,706.50	\$427,853.31	\$352,846.70	\$77,842.27	\$509,971.42	\$581,186.53	\$411,771.15	\$90,580.65	\$591,669.48	\$10,000.00	\$210,009.31
6	068	6028 ROUTE 0630	1	Rural Local	1764	98	33.33	485	\$15,630.00	\$244,975.50	\$53,894.61	\$359,426.70	\$293,970.60	\$64,673.53	\$427,741.87	\$481,981.40	\$342,965.70	\$75,462.45	\$458,065.03	\$5,000.00	\$118,729.68
7	002	6066 BROOKLEY ROAD	1	Rural Local	1248.2	79	33.33	875	\$15,630.00	\$197,480.25	\$43,445.66	\$263,208.75	\$236,976.30	\$52,134.78	\$348,275.53	\$348,080.97	\$278,472.35	\$60,923.92	\$403,344.31	\$5,000.00	\$118,729.68
7	002	6064 DURY ROAD	1	Rural Local	1450.7	88	33.33	775	\$15,630.00	\$222,477.75	\$48,945.11	\$309,060.41	\$266,973.30	\$59,734.13	\$360,068.92	\$404,527.70	\$311,468.85	\$68,323.15	\$462,136.43	\$5,000.00	\$118,729.68
7	002	6017 BLACK CAT ROAD	2	Rural Minor Collector	3066	146	33.33	520	\$15,630.00	\$349,865.00	\$76,992.36	\$505,814.06	\$419,866.00	\$92,380.76	\$603,464.30	\$688,850.00	\$485,951.00	\$107,789.22	\$700,644.54	\$5,000.00	\$118,729.68
7	002	6028 COVE GARDEN ROAD	1	Rural Local	1614.4	108	31.33	215	\$15,630.00	\$253,773.00	\$55,830.06	\$309,603.06	\$304,527.60	\$68,596.07	\$370,870.50	\$370,870.50	\$355,282.20	\$78,162.08	\$453,000.58	\$5,000.00	\$118,729.68
7	002	6041 GILBERT STATION R	1	Rural Local	1330	95	31.33	85	\$15,630.00	\$223,226.25	\$49,109.78	\$259,104.83	\$267,871.50	\$58,931.73	\$391,352.26	\$370,870.50	\$312,516.75	\$68,753.88	\$453,000.58	\$5,000.00	\$118,729.68
7	002	6046 BURLEY STATION R	1	Rural Local	1556.2	98	31.33	225	\$15,630.00	\$230,275.50	\$50,865.61	\$339,392.70	\$276,330.60	\$60,792.73	\$403,146.07	\$404,504.07	\$322,385.70	\$70,624.85	\$497,360.63	\$5,000.00	\$118,729.68
7	002	6048 PROFIT ROAD	1	Rural Major Arterial	2075	125	43.33	2278	\$15,630.00	\$406,218.75	\$89,386.13	\$584,247.96	\$487,462.50	\$107,241.75	\$697,624.66	\$676,815.75	\$568,706.25	\$125,115.38	\$810,001.86	\$5,000.00	\$118,729.68
7	002	6105 WHEELER ROAD	1	Rural Local	1504	94	31.33	51	\$15,630.00	\$220,076.50	\$48,992.83	\$226,827.81	\$205,051.80	\$58,311.40	\$387,420.80	\$419,350.43	\$309,227.10	\$68,029.99	\$449,013.76	\$5,000.00	\$118,729.68
7	002	6106 WHEELER ROAD	1	Rural Local	1593.9	99	31.33	104	\$15,630.00	\$232,625.25	\$51,177.56	\$342,208.92	\$279,130.30	\$61,413.07	\$407,078.13	\$444,459.02	\$325,675.35	\$71,148.58	\$471,947.95	\$5,000.00	\$118,729.68
7	002	6124 CAPITAL ROAD	1	Rural Local	2417.8	154	33.33	403	\$15,630.00	\$384,981.50	\$84,881.50	\$564,000.16	\$461,953.00	\$101,623.84	\$661,469.44	\$674,203.00	\$538,346.10	\$115,568.14	\$799,307.71	\$5,000.00	\$118,729.68
7	068	6024 GREENWOOD ROAD	1	Rural Local	1712	107	31.33	77	\$15,630.00	\$251,423.25	\$55,313.12	\$306,418.70	\$301,707.90	\$66,375.74	\$438,529.87	\$477,301.20	\$351,992.55	\$77,638.35	\$558,641.04	\$5,000.00	\$118,729.68
7	068	6045 DOLLY MADISON ROAD	1	Rural Local	1712	107	31.33	63	\$15,630.00	\$251,423.25	\$55,313.12	\$306,418.70	\$301,707.90	\$66,375.74	\$438,529.87	\$477,301.20	\$351,992.55	\$77,638.35	\$558,641.04	\$5,000.00	\$118,729.68
7	104	6013 ROUTE 0000	3	Urban Minor Arterial	3744	72	59.33	11170	\$15,630.00	\$320,382.00	\$70,484.04	\$464,588.90	\$384,468.40	\$84,560.85	\$653,907.71	\$1,044,014.40	\$448,534.80	\$98,077.68	\$643,248.52	\$10,000.00	\$210,009.31
7	104	1811 ROUTE 0250	2	Urban Minor Arterial	6537.9	111	65.33	15466	\$15,630.00	\$403,922.25	\$108,662.90	\$512,585.15	\$462,706.70	\$130,368.47	\$643,075.17	\$691,481.15	\$152,728.05	\$490,347.12	\$1,133,823.27	\$10,000.00	\$210,009.31
7	104	8012 ROUTE 0000	2	Urban Collector	3296.7	99	43.33	13310	\$15,630.00	\$321,725.25	\$70,778.56	\$466,432.76	\$386,070.30	\$84,935.47	\$558,166.16	\$619,284.60	\$460,415.35	\$99,091.38	\$646,370.65	\$10,000.00	\$210,009.31
8	007	6063 ROUTE 0984	58	31.33	68	883.2	31.33	58	\$15,630.00	\$162,132.75	\$35,668.21	\$243,922.23	\$194,559.30	\$42,803.05	\$266,134.15	\$249,280.32	\$226,585.85	\$49,536.88	\$334,245.68	\$5,000.00	\$118,729.68
8	007	6448 ROUTE 0876	147	31.33	88	1405	31.33	88	\$15,630.00	\$206,778.00	\$45,481.16	\$246,133.00	\$246,133.00	\$54,568.35	\$300,689.20	\$389,489.20	\$63,887.62	\$300,689.20	\$389,489.20	\$5,000.00	\$118,729.68
8	008	6124 ROUTE 0665	32	31.33	58	938.1	31.33	58	\$15,630.00	\$138,835.25	\$30,489.76	\$211,180.01	\$166,392.30	\$36,589.71	\$248,819.44	\$261,686.19	\$154,069.35	\$42,699.06	\$308,478.87	\$5,000.00	\$118,729.68
8	068	6034 ROUTE 0655	47	31.33	141	2566.2	31.33	141	\$15,630.00	\$331,314.75	\$72,880.25	\$470,810.26	\$387,577.70	\$87,467.02	\$672,190.76	\$715,584.87	\$463,840.65	\$122,044.34	\$894,689.25	\$5,000.00	\$118,729.68
8	081	6135 ROUTE 0754	42	31.33	74	740	31.33	42	\$15,630.00	\$173,881.50	\$38,253.93	\$260,303.35	\$206,657.60	\$45,904.72	\$306,791.45	\$200,346.00	\$243,434.10	\$53,555.50	\$357,279.55	\$5,000.00	\$118,729.68
8	083	6025 ROUTE 0638	1405	33.33	99	1791.9	33.33	99	\$15,630.00	\$247,475.25	\$54,444.56	\$317,118.02	\$257,555.70	\$65,333.47	\$375,968.08	\$619,487.55	\$300,481.05	\$66,105.98	\$436,580.13	\$5,000.00	\$118,729.68
8	107	6002 E HAWTHORN ST	1200	35.33	81	1863	35.33	81	\$15,630.00	\$214,629.75	\$47,210.55	\$261,840.30	\$214,629.75	\$56,662.25	\$375,968.08	\$619,487.55	\$300,481.05	\$66,105.98	\$436,580.13	\$10,000.00	\$210,009.31
8	115	6010 WEBB STREET	2500	35.33	58	1711	35.33	58	\$15,630.00	\$153,885.50	\$33,810.61	\$222,144.36	\$184,422.00	\$40,571.87	\$275,000.85	\$477,112.35	\$215,159.70	\$47,335.13	\$317,665.94	\$10,000.00	\$210,009.31
8	132	8005 NATIONAL AVENUE	2500	35.33	60	590	35.33	2600	\$15,630.00	\$158,865.00	\$34,970.70	\$208,593.97	\$180,782.00	\$41,972.04	\$265,867.07	\$276,081.50	\$222,570.00	\$48,997.38	\$328,201.95	\$10,000.00	\$210,009.31
8	136	8012 ROUTE 0000	1965	35.33	138	2760	35.33	138	\$15,630.00	\$368,315.25	\$81,029.36	\$449,344.61	\$441,978.30	\$97,233.23	\$545,641.35	\$515,641.35	\$113,441.10	\$385,461.45	\$659,488.68	\$10,000.00	\$210,009.31
9	029	6007 GUNSTON COVE ROAD	2055	33.33	111	1542.9	33.33	111	\$15,630.00	\$277,472.25	\$61,043.90	\$340,738.45	\$332,966.70	\$73,252.67	\$462,113.97	\$400,237.67	\$338,481.15	\$85,461.45	\$509,488.68	\$5,000.00	\$118,729.68
9	076	6025 ADEN ROAD	2891	43.33	76	1246	43.33	76	\$15,630.00	\$253,460.50	\$55,765.71	\$337,287.10	\$304,176.80	\$66,918.85	\$441,971.85	\$348,004.90	\$354,872.70	\$78,071.99	\$512,669.79	\$5,000.00	\$118,729.68
										\$24,081,268.13	\$28,680,312.51	\$35,622,620.19	\$33,299,357.10	\$6,206.90	\$8,164,236.34	\$41,463,593.44	\$360,000.00	\$140,762.70			
										\$32,245,504.47	\$36,854,548.95	\$48,737,156.53									

Appendix E

COST TABLES FOR ALTERNATIVE 1

Alternative 1A

Consideration for the Acquisition of Overpass Structures Only
(No Consideration for Underpass Maintenance)

State's Cost for Alternative 1A (Assume approx 5 structures per year over 12 years)				
	(12 years w/10%RR)	(12 years w/15%RR)	(12 years w/20%RR)	(12 years w/30%RR)
NPW-\$75	\$22,663,568.85	\$21,729,882.08	\$20,796,195.30	\$18,928,821.75
NPW-\$90	\$25,880,229.60	\$24,767,839.45	\$23,655,449.30	\$21,430,669.00
NPW-\$278	\$30,718,509.36	\$29,337,325.89	\$27,956,142.42	\$25,193,775.48
NPW-\$105	\$29,096,890.34	\$27,805,771.51	\$26,514,703.29	\$23,932,516.24
(These figures include the added maintenance expenditure for each structure brought in over 50 years)				
(No percentage of maintenance costs are picked-up by the railroad)				

(12 years w/40%RR)	(12 years w/50%RR)
\$17,061,448.20	\$15,194,074.65
\$19,205,888.70	\$16,981,108.40
\$22,431,408.54	\$19,669,041.60
\$21,350,329.19	\$18,768,142.14

Railroad's fees for Alternative 1A

	10% over 12 years	15% over 12 years	20% over 12 years	30% over 12 years	40% over 12 years	50% over 12 years
NPW-\$75	\$1,867,373.55	\$2,801,060.33	\$3,734,747.10	\$5,602,120.65	\$7,469,494.20	\$9,336,867.75
NPW-\$90	\$2,224,780.30	\$3,337,170.45	\$4,449,560.60	\$6,674,340.90	\$8,899,121.20	\$11,123,901.50
NPW-\$278	\$2,762,366.94	\$4,143,550.41	\$5,524,733.88	\$8,287,100.82	\$11,049,467.76	\$13,811,834.70
NPW-\$105	\$2,582,187.05	\$3,873,280.57	\$5,164,374.10	\$7,746,561.15	\$10,328,748.20	\$12,910,935.24

Total Costs for Alternative 1A (Includes initial construction costs, maintenance, and railroad's share)

	10% over 12 years	15% over 12 years	20% over 12 years	30% over 12 years	40% over 12 years	50% over 12 years
NPW-\$75	\$24,530,942.40	\$24,530,942.40	\$24,530,942.40	\$24,530,942.40	\$24,530,942.40	\$24,530,942.40
NPW-\$90	\$28,105,009.90	\$28,105,009.90	\$28,105,009.90	\$28,105,009.90	\$28,105,009.90	\$28,105,009.90
NPW-\$278	\$33,480,876.29	\$33,480,876.29	\$33,480,876.29	\$33,480,876.29	\$33,480,876.29	\$33,480,876.29
NPW-\$105	\$31,679,077.39	\$31,679,052.09	\$31,679,077.39	\$31,679,077.39	\$31,679,077.39	\$31,679,077.39

Consideration for the Acquisition of Overpass Structures and the Continued Maintenance of Underpasses

48

Alternative 1C

Consideration for the Acquisition of Overpass Structures Over 12 Years and the Immediate Relinquishing of Maintenance Responsibilities for Underpasses

State's Cost for Alternative 1C (Assume approx 5 structures per year over 12 years)					
	(12 years w/10%RR)	(12 years w/15%RR)	(12 years w/20%RR)	(12 years w/30%RR)	(12 years w/40%RR)
NPW-\$75	\$18,131,705.09	\$17,198,018.32	\$16,264,331.54	\$14,396,957.99	\$12,529,584.44
NPW-\$90	\$21,348,365.84	\$20,235,975.69	\$19,123,585.54	\$16,898,805.24	\$14,674,024.94
NPW-\$278	\$26,186,645.60	\$24,805,462.13	\$23,424,278.66	\$20,661,911.72	\$17,899,544.78
NPW-\$105	\$24,565,026.58	\$23,273,907.75	\$21,982,839.53	\$19,400,652.48	\$16,818,465.43
(These figures include the added maintenance expenditure for each structure brought in over 50 years)					
(No percentage of maintenance costs are picked-up by the railroad)					
(12 years w/50%RR)					
					\$10,662,210.89
					\$12,449,244.64
					\$15,137,177.84
					\$14,236,278.38
Railroad's fees for Alternative 1C					
	10% over 12 years	15% over 12 years	20% over 12 years	30% over 12 years	40% over 12 years
NPW-\$75	\$6,399,237.31	\$7,332,924.09	\$8,266,610.86	\$10,133,984.41	\$12,001,357.96
NPW-\$90	\$6,756,644.06	\$7,869,034.21	\$8,981,424.36	\$11,206,204.66	\$13,430,984.96
NPW-\$278	\$7,294,230.70	\$8,675,414.17	\$10,056,597.64	\$12,818,964.58	\$15,581,331.52
NPW-\$105	\$7,114,050.81	\$8,405,144.33	\$9,696,237.86	\$12,278,424.91	\$14,860,611.96
					\$13,868,731.51
					\$15,655,765.26
					\$18,343,698.46
					\$17,442,799.00
Total Costs for Alternative 1C (Includes initial overpass construction costs, overpass and underpass maintenance, and railroad's share)					
	10% over 12 years	15% over 12 years	20% over 12 years	30% over 12 years	40% over 12 years
NPW-\$75	\$24,530,942.40	\$24,530,942.40	\$24,530,942.40	\$24,530,942.40	\$24,530,942.40
NPW-\$90	\$28,105,009.90	\$28,105,009.90	\$28,105,009.90	\$28,105,009.90	\$28,105,009.90
NPW-\$278	\$33,480,876.29	\$33,480,876.29	\$33,480,876.29	\$33,480,876.29	\$33,480,876.29
NPW-\$105	\$31,679,077.39	\$31,679,052.09	\$31,679,077.39	\$31,679,077.39	\$31,679,077.39
					\$28,105,009.90
					\$33,480,876.29
					\$31,679,077.39
					\$24,530,942.40
					\$28,105,009.90
					\$33,480,876.29
					\$31,679,077.39

Appendix F

COST TABLES FOR ALTERNATIVE 2

Alternative 2A

Alternative 2A

(Underpass Maintenance Not Considered)

State's Cost

All overpasses replaced year 0 with various percentages of initial costs picked-up by the railroads (no maintenance picked-up)

	RR = 10%	RR=15%	RR=20%	RR=30%	RR=40%	RR=50%
NPW-\$75	\$29,837,377.66	\$28,633,314.25	\$27,429,250.84	\$25,021,124.03	\$22,612,997.22	\$20,204,870.40
NPW-\$90	\$33,985,517.69	\$32,551,002.06	\$31,116,486.43	\$28,247,455.17	\$25,378,423.91	\$22,509,392.65
NPW-\$278	\$40,224,864.51	\$38,443,718.50	\$36,662,572.49	\$33,100,280.47	\$29,537,988.45	\$25,975,696.43
NPW-\$105	\$38,133,657.73	\$36,468,689.87	\$34,803,722.02	\$31,473,786.31	\$28,143,850.60	\$24,813,914.89

Railroad's Cost

	RR = 10%	RR=15%	RR=20%	RR=30%	RR=40%	RR=50%
NPW-\$75	\$2,408,126.81	\$3,612,190.22	\$4,816,253.63	\$7,224,380.44	\$9,632,507.25	\$12,040,634.07
NPW-\$90	\$2,869,031.26	\$4,303,546.89	\$5,738,062.52	\$8,607,093.78	\$11,476,125.05	\$14,345,156.31
NPW-\$278	\$3,562,292.02	\$5,343,438.03	\$7,124,584.04	\$10,686,876.06	\$14,249,168.08	\$17,811,460.10
NPW-\$105	\$3,329,935.71	\$4,994,903.56	\$6,659,871.42	\$9,989,807.13	\$13,319,742.84	\$16,649,678.55

Alternative 2A - Total Project Costs

	RR = 10%	RR=15%	RR=20%	RR=30%	RR=40%	RR=50%
NPW-\$75	\$32,245,504.47	\$32,245,504.47	\$32,245,504.47	\$32,245,504.47	\$32,245,504.47	\$32,245,504.47
NPW-\$90	\$36,854,548.95	\$36,854,548.95	\$36,854,548.95	\$36,854,548.95	\$36,854,548.95	\$36,854,548.95
NPW-\$278	\$43,787,156.53	\$43,787,156.53	\$43,787,156.53	\$43,787,156.53	\$43,787,156.53	\$43,787,156.53
NPW-\$105	\$41,463,593.44	\$41,463,593.44	\$41,463,593.44	\$41,463,593.44	\$41,463,593.44	\$41,463,593.44

Alternative 2B

Alternative 2B

(Acquisition of Overpasses and Continued Maintenance of Underpasses)

State's Cost

All overpasses replaced year 0 with various percentages of initial costs picked-up by the railroads (no maintenance picked-up)

	RR = 10%	RR=15%	RR=20%	RR=30%	RR=40%	RR=50%
NPW-\$75	\$34,369,241.42	\$33,165,178.01	\$31,961,114.60	\$29,552,987.79	\$27,144,860.98	\$24,736,734.16
NPW-\$90	\$38,517,381.45	\$37,082,865.82	\$35,648,350.19	\$32,779,318.93	\$29,910,287.67	\$27,041,256.41
NPW-\$278	\$44,756,728.27	\$42,975,582.26	\$41,194,436.25	\$37,632,144.23	\$34,069,852.21	\$30,507,560.19
NPW-\$105	\$42,665,521.49	\$41,000,553.63	\$39,335,585.78	\$36,005,650.07	\$32,675,714.36	\$29,345,778.65

Railroad's Cost

	RR = 10%	RR=15%	RR=20%	RR=30%	RR=40%	RR=50%
NPW-\$75	\$2,408,126.81	\$3,612,190.22	\$4,816,253.63	\$7,224,380.44	\$9,632,507.25	\$12,040,634.07
NPW-\$90	\$2,869,031.26	\$4,303,546.89	\$5,738,062.52	\$8,607,093.78	\$11,476,125.05	\$14,345,156.31
NPW-\$278	\$3,562,292.02	\$5,343,438.03	\$7,124,584.04	\$10,686,876.06	\$14,249,168.08	\$17,811,460.10
NPW-\$105	\$3,329,935.71	\$4,994,903.56	\$6,659,871.42	\$9,989,807.13	\$13,319,742.84	\$16,649,678.55

Alternative 2B - Total Project Costs

	RR = 10%	RR=15%	RR=20%	RR=30%	RR=40%	RR=50%
NPW-\$75	\$36,777,368.23	\$36,777,368.23	\$36,777,368.23	\$36,777,368.23	\$36,777,368.23	\$36,777,368.23
NPW-\$90	\$41,386,412.71	\$41,386,412.71	\$41,386,412.71	\$41,386,412.71	\$41,386,412.71	\$41,386,412.71
NPW-\$278	\$48,319,020.29	\$48,319,020.29	\$48,319,020.29	\$48,319,020.29	\$48,319,020.29	\$48,319,020.29
NPW-\$105	\$45,995,457.20	\$45,995,457.20	\$45,995,457.20	\$45,995,457.20	\$45,995,457.20	\$45,995,457.20

Alternative 2C

Alternative 2C

(Acquisition of Overpasses and Relinquishing Control of Underpass Maintenance)

State's Cost

All overpasses replaced year 0 with various percentages of initial costs picked-up by the railroads (no maintenance picked-up)

	RR = 10%	RR=15%	RR=20%	RR=30%	RR=40%	RR=50%
NPW-\$75	\$25,305,513.90	\$24,101,450.49	\$22,897,387.08	\$20,489,260.27	\$18,081,133.46	\$15,673,006.64
NPW-\$90	\$29,453,653.93	\$28,019,138.30	\$26,584,622.67	\$23,715,591.41	\$20,846,560.15	\$17,977,528.89
NPW-\$278	\$35,693,000.75	\$33,911,854.74	\$32,130,708.73	\$28,568,416.71	\$25,006,124.69	\$21,443,832.67
NPW-\$105	\$33,601,793.97	\$31,936,826.11	\$30,271,858.26	\$26,941,922.55	\$23,611,986.84	\$20,282,051.13

Railroad's Cost

	RR = 10%	RR=15%	RR=20%	RR=30%	RR=40%	RR=50%
NPW-\$75	\$6,939,990.57	\$8,144,053.98	\$9,348,117.39	\$11,756,244.20	\$14,164,371.01	\$16,572,497.83
NPW-\$90	\$7,400,895.02	\$8,835,410.65	\$10,269,926.28	\$13,138,957.54	\$16,007,988.81	\$18,877,020.07
NPW-\$278	\$8,094,155.78	\$9,875,301.79	\$11,656,447.80	\$15,218,739.82	\$18,781,031.84	\$22,343,323.86
NPW-\$105	\$7,861,799.47	\$9,526,767.32	\$11,191,735.18	\$14,521,670.89	\$17,851,606.60	\$21,181,542.31

Alternative 2C - Total Project Costs

	RR = 10%	RR=15%	RR=20%	RR=30%	RR=40%	RR=50%
NPW-\$75	\$32,245,504.47	\$32,245,504.47	\$32,245,504.47	\$32,245,504.47	\$32,245,504.47	\$32,245,504.47
NPW-\$90	\$36,854,548.95	\$36,854,548.95	\$36,854,548.95	\$36,854,548.95	\$36,854,548.95	\$36,854,548.95
NPW-\$278	\$43,787,156.53	\$43,787,156.53	\$43,787,156.53	\$43,787,156.53	\$43,787,156.53	\$43,787,156.53
NPW-\$105	\$41,463,593.44	\$41,463,593.44	\$41,463,593.44	\$41,463,593.44	\$41,463,593.44	\$41,463,593.44

Appendix G

COST TABLES FOR ALTERNATIVE 3

Alternative 3A

Alternative 3A (No Consideration for Underpass Maintenance)						
State's Costs						
	10% from RR	5 years RR Maint. Paid	10 years RR Maint. Paid	15 years RR Maint. Paid	20 years RR Maint. Paid	25 years RR Maint. Paid
NPW-\$75	\$21,673,141.32	\$28,012,865.26	\$26,478,522.37	\$25,358,430.02	\$24,416,476.59	\$23,728,837.05
NPW-\$90	\$25,821,281.35	\$32,161,005.29	\$30,626,662.40	\$29,506,570.06	\$28,564,616.62	\$27,876,977.09
NPW-\$278	\$32,060,628.17	\$38,400,352.11	\$36,866,009.22	\$35,745,916.88	\$34,803,963.44	\$34,116,323.90
NPW-\$105	\$29,969,421.39	\$36,309,145.33	\$34,774,802.44	\$33,654,710.09	\$32,712,756.66	\$32,025,117.12
Railroad's Costs						
	10% from RR	5 years RR Maint. Paid	10 years RR Maint. Paid	15 years RR Maint. Paid	20 years RR Maint. Paid	25 years RR Maint. Paid
NPW-\$75	\$2,408,126.81	\$4,232,639.21	\$5,766,982.10	\$6,887,074.45	\$7,829,027.88	\$8,516,667.42
NPW-\$90	\$2,869,031.26	\$4,693,543.66	\$6,227,886.55	\$7,347,978.90	\$8,289,932.33	\$8,977,571.87
NPW-\$278	\$3,562,292.02	\$5,386,804.42	\$6,921,147.31	\$8,041,239.65	\$8,983,193.09	\$9,670,832.62
NPW-\$105	\$3,329,935.71	\$5,154,448.11	\$6,688,791.00	\$7,808,883.34	\$8,750,836.78	\$9,438,476.31
Total Costs for Alternative 3A						
	10% from RR	5 years RR Maint. Paid	10 years RR Maint. Paid	15 years RR Maint. Paid	20 years RR Maint. Paid	25 years RR Maint. Paid
NPW-\$75	\$24,081,268.13	\$32,245,504.47	\$32,245,504.47	\$32,245,504.47	\$32,245,504.47	\$32,245,504.47
NPW-\$90	\$28,690,312.61	\$36,854,548.95	\$36,854,548.95	\$36,854,548.95	\$36,854,548.95	\$36,854,548.95
NPW-\$278	\$35,622,920.19	\$43,787,156.53	\$43,787,156.53	\$43,787,156.53	\$43,787,156.53	\$43,787,156.53
NPW-\$105	\$33,299,357.10	\$41,463,593.44	\$41,463,593.44	\$41,463,593.44	\$41,463,593.44	\$41,463,593.44

Alternative 3B

Alternative 3B (Consideration for the Acquisition of Overpass Structures and the Continued Maintenance of Underpasses)						
State's Costs						
	10% from RR	5 years RR Maint. Paid	10 years RR Maint. Paid	15 years RR Maint. Paid	20 years RR Maint. Paid	25 years RR Maint. Paid
NPW-\$75	\$26,205,005.08	\$32,544,729.02	\$31,010,386.13	\$29,890,293.78	\$28,948,340.35	\$28,260,700.81
NPW-\$90	\$30,353,145.11	\$36,692,869.05	\$35,158,526.16	\$34,038,433.82	\$33,096,480.38	\$32,408,840.85
NPW-\$278	\$36,592,491.93	\$42,932,215.87	\$41,397,872.98	\$40,277,780.64	\$39,335,827.20	\$38,648,187.66
NPW-\$105	\$34,501,285.15	\$40,841,009.09	\$39,306,666.20	\$38,186,573.85	\$37,244,620.42	\$36,556,980.88
Railroad's Costs						
	10% from RR	5 years RR Maint. Paid	10 years RR Maint. Paid	15 years RR Maint. Paid	20 years RR Maint. Paid	25 years RR Maint. Paid
NPW-\$75	\$2,408,126.81	\$4,232,639.21	\$5,766,982.10	\$6,887,074.45	\$7,829,027.88	\$8,516,667.42
NPW-\$90	\$2,869,031.26	\$4,693,543.66	\$6,227,886.55	\$7,347,978.90	\$8,289,932.33	\$8,977,571.87
NPW-\$278	\$3,562,292.02	\$5,386,804.42	\$6,921,147.31	\$8,041,239.65	\$8,983,193.09	\$9,670,832.62
NPW-\$105	\$3,329,935.71	\$5,154,448.11	\$6,688,791.00	\$7,808,883.34	\$8,750,836.78	\$9,438,476.31
Total Costs for Alternative 3B						
	10% from RR	5 years RR Maint. Paid	10 years RR Maint. Paid	15 years RR Maint. Paid	20 years RR Maint. Paid	25 years RR Maint. Paid
NPW-\$75	\$28,613,131.89	\$36,777,368.23	\$36,777,368.23	\$36,777,368.23	\$36,777,368.23	\$36,777,368.23
NPW-\$90	\$33,222,176.37	\$41,386,412.71	\$41,386,412.71	\$41,386,412.71	\$41,386,412.71	\$41,386,412.71
NPW-\$278	\$40,154,783.95	\$48,319,020.29	\$48,319,020.29	\$48,319,020.29	\$48,319,020.29	\$48,319,020.29
NPW-\$105	\$37,831,220.86	\$45,995,457.20	\$45,995,457.20	\$45,995,457.20	\$45,995,457.20	\$45,995,457.20

Alternative 3C

Alternative 3C (Consideration for the Acquisition of Overpass Structures and the Relinquishing of Maintenance for Underpasses)						
State's Costs						
	10% from RR	5 years RR Maint. Paid	10 years RR Maint. Paid	15 years RR Maint. Paid	20 years RR Maint. Paid	25 years RR Maint. Paid
NPW-\$75	\$17,141,277.56	\$23,481,001.50	\$21,946,658.61	\$20,826,566.26	\$19,884,612.83	\$19,196,973.29
NPW-\$90	\$21,289,417.59	\$27,629,141.53	\$26,094,798.64	\$24,974,706.30	\$24,032,752.86	\$23,345,113.33
NPW-\$278	\$27,528,764.41	\$33,868,488.35	\$32,334,145.46	\$31,214,053.12	\$30,272,099.68	\$29,584,460.14
NPW-\$105	\$25,437,557.63	\$31,777,281.57	\$30,242,938.68	\$29,122,846.33	\$28,180,892.90	\$27,493,253.36
Railroad's Costs						
	10% from RR	5 years RR Maint. Paid	10 years RR Maint. Paid	15 years RR Maint. Paid	20 years RR Maint. Paid	25 years RR Maint. Paid
NPW-\$75	\$6,939,990.57	\$8,764,502.97	\$10,298,845.86	\$11,418,938.21	\$12,360,891.64	\$13,048,531.18
NPW-\$90	\$7,400,895.02	\$9,225,407.42	\$10,759,750.31	\$11,879,842.66	\$12,821,796.09	\$13,509,435.63
NPW-\$278	\$8,094,155.78	\$9,918,668.18	\$11,453,011.07	\$12,573,103.41	\$13,515,056.85	\$14,202,696.38
NPW-\$105	\$7,861,799.47	\$9,686,311.87	\$11,220,654.76	\$12,340,747.10	\$13,282,700.54	\$13,970,340.07
Total Costs for Alternative 3C						
	10% from RR	5 years RR Maint. Paid	10 years RR Maint. Paid	15 years RR Maint. Paid	20 years RR Maint. Paid	25 years RR Maint. Paid
NPW-\$75	\$24,081,268.13	\$32,245,504.47	\$32,245,504.47	\$32,245,504.47	\$32,245,504.47	\$32,245,504.47
NPW-\$90	\$28,690,312.61	\$36,854,548.95	\$36,854,548.95	\$36,854,548.95	\$36,854,548.95	\$36,854,548.95
NPW-\$278	\$35,622,920.19	\$43,787,156.53	\$43,787,156.53	\$43,787,156.53	\$43,787,156.53	\$43,787,156.53
NPW-\$105	\$33,299,357.10	\$41,463,593.44	\$41,463,593.44	\$41,463,593.44	\$41,463,593.44	\$41,463,593.44

Appendix H

COST TABLES FOR ALTERNATIVE 4

Alternative 4A

Alternative 4A (No Consideration for Underpass Maintenance)						
State's Costs						
	15% from RR	5 years RR Maint. Paid	10 years RR Maint. Paid	15 years RR Maint. Paid	20 years RR Maint. Paid	25 years RR Maint. Paid
NPW-\$75	\$20,469,077.91	\$26,808,801.85	\$25,274,458.96	\$24,154,366.62	\$23,212,413.18	\$22,524,773.65
NPW-\$90	\$24,386,765.72	\$30,726,489.66	\$29,192,146.77	\$28,072,054.43	\$27,130,100.99	\$26,442,461.46
NPW-\$278	\$30,279,482.16	\$36,619,206.10	\$35,084,863.21	\$33,964,770.87	\$33,022,817.43	\$32,335,177.89
NPW-\$105	\$28,304,453.53	\$34,644,177.47	\$33,109,834.58	\$31,989,742.24	\$31,047,788.80	\$30,360,149.27
Railroad's Costs						
	15% from RR	5 years RR Maint. Paid	10 years RR Maint. Paid	15 years RR Maint. Paid	20 years RR Maint. Paid	25 years RR Maint. Paid
NPW-\$75	\$3,612,190.22	\$5,436,702.62	\$6,971,045.51	\$8,091,137.85	\$9,033,091.29	\$9,720,730.82
NPW-\$90	\$4,303,546.89	\$6,128,059.29	\$7,662,402.18	\$8,782,494.53	\$9,724,447.96	\$10,412,087.50
NPW-\$278	\$5,343,438.03	\$7,167,950.43	\$8,702,293.32	\$9,822,385.66	\$10,764,339.10	\$11,451,978.63
NPW-\$105	\$4,994,903.56	\$6,819,415.96	\$8,353,758.86	\$9,473,851.20	\$10,415,804.64	\$11,103,444.17
Total Costs for Alternative 4A						
	15% from RR	5 years RR Maint. Paid	10 years RR Maint. Paid	15 years RR Maint. Paid	20 years RR Maint. Paid	25 years RR Maint. Paid
NPW-\$75	\$24,081,268.13	\$32,245,504.47	\$32,245,504.47	\$32,245,504.47	\$32,245,504.47	\$32,245,504.47
NPW-\$90	\$28,690,312.61	\$36,854,548.95	\$36,854,548.95	\$36,854,548.95	\$36,854,548.95	\$36,854,548.95
NPW-\$278	\$35,622,920.19	\$43,787,156.53	\$43,787,156.53	\$43,787,156.53	\$43,787,156.53	\$43,787,156.53
NPW-\$105	\$33,299,357.10	\$41,463,593.44	\$41,463,593.44	\$41,463,593.44	\$41,463,593.44	\$41,463,593.44

Alternative 4B

Alternative 4B (Consideration for the Acquisition of Overpass Structures and the Continued Maintenance of Underpasses)						
State's Costs						
	15% from RR	5 years RR Maint. Paid	10 years RR Maint. Paid	15 years RR Maint. Paid	20 years RR Maint. Paid	25 years RR Maint. Paid
NPW-\$75	\$25,000,941.67	\$31,340,665.61	\$29,806,322.72	\$28,686,230.38	\$27,744,276.94	\$27,056,637.41
NPW-\$90	\$28,918,629.48	\$35,258,353.42	\$33,724,010.53	\$32,603,918.19	\$31,661,964.75	\$30,974,325.22
NPW-\$278	\$34,811,345.92	\$41,151,069.86	\$39,616,726.97	\$38,496,634.63	\$37,554,681.19	\$36,867,041.65
NPW-\$105	\$32,836,317.29	\$39,176,041.23	\$37,641,698.34	\$36,521,606.00	\$35,579,652.56	\$34,892,013.03
Railroad's Costs						
	15% from RR	5 years RR Maint. Paid	10 years RR Maint. Paid	15 years RR Maint. Paid	20 years RR Maint. Paid	25 years RR Maint. Paid
NPW-\$75	\$3,612,190.22	\$5,436,702.62	\$6,971,045.51	\$8,091,137.85	\$9,033,091.29	\$9,720,730.82
NPW-\$90	\$4,303,546.89	\$6,128,059.29	\$7,662,402.18	\$8,782,494.53	\$9,724,447.96	\$10,412,087.50
NPW-\$278	\$5,343,438.03	\$7,167,950.43	\$8,702,293.32	\$9,822,385.66	\$10,764,339.10	\$11,451,978.63
NPW-\$105	\$4,994,903.56	\$6,819,415.96	\$8,353,758.86	\$9,473,851.20	\$10,415,804.64	\$11,103,444.17
Total Costs for Alternative 4B						
	15% from RR	5 years RR Maint. Paid	10 years RR Maint. Paid	15 years RR Maint. Paid	20 years RR Maint. Paid	25 years RR Maint. Paid
NPW-\$75	\$28,613,131.89	\$36,777,368.23	\$36,777,368.23	\$36,777,368.23	\$36,777,368.23	\$36,777,368.23
NPW-\$90	\$33,222,176.37	\$41,386,412.71	\$41,386,412.71	\$41,386,412.71	\$41,386,412.71	\$41,386,412.71
NPW-\$278	\$40,154,783.95	\$48,319,020.29	\$48,319,020.29	\$48,319,020.29	\$48,319,020.29	\$48,319,020.29
NPW-\$105	\$37,831,220.86	\$45,995,457.20	\$45,995,457.20	\$45,995,457.20	\$45,995,457.20	\$45,995,457.20

Alternative 4C

Alternative 4C (Consideration for the Acquisition of Overpass Structures and the Relinquishing of Maintenance for Underpasses)									
State's Costs									
	15% from RR	5 years RR Maint. Paid	10 years RR Maint. Paid	15 years RR Maint. Paid	20 years RR Maint. Paid	25 years RR Maint. Paid			
NPW-\$75	\$15,937,214.15	\$22,276,938.09	\$20,742,595.20	\$19,622,502.86	\$18,680,549.42	\$17,992,909.89			
NPW-\$90	\$19,854,901.96	\$26,194,625.90	\$24,660,283.01	\$23,540,190.67	\$22,598,237.23	\$21,910,597.70			
NPW-\$278	\$25,747,618.40	\$32,087,342.34	\$30,552,999.45	\$29,432,907.11	\$28,490,953.67	\$27,803,314.13			
NPW-\$105	\$23,772,589.77	\$30,112,313.71	\$28,577,970.82	\$27,457,878.48	\$26,515,925.04	\$25,828,285.51			
Railroad's Costs									
	15% from RR	5 years RR Maint. Paid	10 years RR Maint. Paid	15 years RR Maint. Paid	20 years RR Maint. Paid	25 years RR Maint. Paid			
NPW-\$75	\$8,144,053.98	\$9,968,566.38	\$11,502,909.27	\$12,623,001.61	\$13,564,955.05	\$14,252,594.58			
NPW-\$90	\$8,835,410.65	\$10,659,923.05	\$12,194,265.94	\$13,314,358.29	\$14,256,311.72	\$14,943,951.26			
NPW-\$278	\$9,875,301.79	\$11,699,814.19	\$13,234,157.08	\$14,354,249.42	\$15,296,202.86	\$15,983,842.39			
NPW-\$105	\$9,526,767.32	\$11,351,279.72	\$12,885,622.62	\$14,005,714.96	\$14,947,668.40	\$15,635,307.93			
Total Costs for Alternative 4C									
	15% from RR	5 years RR Maint. Paid	10 years RR Maint. Paid	15 years RR Maint. Paid	20 years RR Maint. Paid	25 years RR Maint. Paid			
NPW-\$75	\$24,081,268.13	\$32,245,504.47	\$32,245,504.47	\$32,245,504.47	\$32,245,504.47	\$32,245,504.47			
NPW-\$90	\$28,690,312.61	\$36,854,548.95	\$36,854,548.95	\$36,854,548.95	\$36,854,548.95	\$36,854,548.95			
NPW-\$278	\$35,622,920.19	\$43,787,156.53	\$43,787,156.53	\$43,787,156.53	\$43,787,156.53	\$43,787,156.53			
NPW-\$105	\$33,299,357.10	\$41,463,593.44	\$41,463,593.44	\$41,463,593.44	\$41,463,593.44	\$41,463,593.44			

Appendix I

COST TABLES FOR ALTERNATIVE 5

Alternative 5A

Alternative 5A (No Consideration for Underpass Maintenance)						
State's Costs						
	20% from RR	5 years RR Maint. Paid	10 years RR Maint. Paid	15 years RR Maint. Paid	20 years RR Maint. Paid	25 years RR Maint. Paid
NPW-\$75	\$19,265,014.51	\$25,604,738.45	\$24,070,395.55	\$22,950,303.21	\$22,008,349.77	\$21,320,710.24
NPW-\$90	\$22,952,250.09	\$29,291,974.03	\$27,757,631.14	\$26,637,538.80	\$25,695,585.36	\$25,007,945.83
NPW-\$278	\$28,498,336.15	\$34,838,060.09	\$33,303,717.20	\$32,183,624.86	\$31,241,671.42	\$30,554,031.89
NPW-\$105	\$26,639,485.68	\$32,979,209.62	\$31,444,866.73	\$30,324,774.38	\$29,382,820.95	\$28,695,181.41
Railroad's Costs						
	20% from RR	5 years RR Maint. Paid	10 years RR Maint. Paid	15 years RR Maint. Paid	20 years RR Maint. Paid	25 years RR Maint. Paid
NPW-\$75	\$4,816,253.63	\$6,640,766.02	\$8,175,108.92	\$9,295,201.26	\$10,237,154.70	\$10,924,794.23
NPW-\$90	\$5,738,062.52	\$7,562,574.92	\$9,096,917.81	\$10,217,010.16	\$11,158,963.59	\$11,846,603.13
NPW-\$278	\$7,124,584.04	\$8,949,096.44	\$10,483,439.33	\$11,603,531.67	\$12,545,485.11	\$13,233,124.64
NPW-\$105	\$6,659,871.42	\$8,484,383.82	\$10,018,726.71	\$11,138,819.05	\$12,080,772.49	\$12,768,412.02
Total Costs for Alternative 5A						
	20% from RR	5 years RR Maint. Paid	10 years RR Maint. Paid	15 years RR Maint. Paid	20 years RR Maint. Paid	25 years RR Maint. Paid
NPW-\$75	\$24,081,268.13	\$32,245,504.47	\$32,245,504.47	\$32,245,504.47	\$32,245,504.47	\$32,245,504.47
NPW-\$90	\$28,690,312.61	\$36,854,548.95	\$36,854,548.95	\$36,854,548.95	\$36,854,548.95	\$36,854,548.95
NPW-\$278	\$35,622,920.19	\$43,787,156.53	\$43,787,156.53	\$43,787,156.53	\$43,787,156.53	\$43,787,156.53
NPW-\$105	\$33,299,357.10	\$41,463,593.44	\$41,463,593.44	\$41,463,593.44	\$41,463,593.44	\$41,463,593.44

Alternative 5B

Alternative 5B (Consideration for the Acquisition of Overpass Structures and the Continued Maintenance of Underpasses)						
State's Costs						
	20% from RR	5 years RR Maint. Paid	10 years RR Maint. Paid	15 years RR Maint. Paid	20 years RR Maint. Paid	25 years RR Maint. Paid
NPW-\$75	\$23,796,878.27	\$30,136,602.21	\$28,602,259.31	\$27,482,166.97	\$26,540,213.53	\$25,852,574.00
NPW-\$90	\$27,484,113.85	\$33,823,837.79	\$32,289,494.90	\$31,169,402.56	\$30,227,449.12	\$29,539,809.59
NPW-\$278	\$33,030,199.91	\$39,369,923.85	\$37,835,580.96	\$36,715,488.62	\$35,773,535.18	\$35,085,895.65
NPW-\$105	\$31,171,349.44	\$37,511,073.38	\$35,976,730.49	\$34,856,638.14	\$33,914,684.71	\$33,227,045.17
Railroad's Costs						
	20% from RR	5 years RR Maint. Paid	10 years RR Maint. Paid	15 years RR Maint. Paid	20 years RR Maint. Paid	25 years RR Maint. Paid
NPW-\$75	\$4,816,253.63	\$6,640,766.02	\$8,175,108.92	\$9,295,201.26	\$10,237,154.70	\$10,924,794.23
NPW-\$90	\$5,738,062.52	\$7,562,574.92	\$9,096,917.81	\$10,217,010.16	\$11,158,963.59	\$11,846,603.13
NPW-\$278	\$7,124,584.04	\$8,949,096.44	\$10,483,439.33	\$11,603,531.67	\$12,545,485.11	\$13,233,124.64
NPW-\$105	\$6,659,871.42	\$8,484,383.82	\$10,018,726.71	\$11,138,819.05	\$12,080,772.49	\$12,768,412.02
Total Costs for Alternative 5B						
	20% from RR	5 years RR Maint. Paid	10 years RR Maint. Paid	15 years RR Maint. Paid	20 years RR Maint. Paid	25 years RR Maint. Paid
NPW-\$75	\$28,613,131.89	\$36,777,368.23	\$36,777,368.23	\$36,777,368.23	\$36,777,368.23	\$36,777,368.23
NPW-\$90	\$33,222,176.37	\$41,386,412.71	\$41,386,412.71	\$41,386,412.71	\$41,386,412.71	\$41,386,412.71
NPW-\$278	\$40,154,783.95	\$48,319,020.29	\$48,319,020.29	\$48,319,020.29	\$48,319,020.29	\$48,319,020.29
NPW-\$105	\$37,831,220.86	\$45,995,457.20	\$45,995,457.20	\$45,995,457.20	\$45,995,457.20	\$45,995,457.20

Alternative 5C

Alternative 5C

(Consideration for the Acquisition of Overpass Structures and the Relinquishing of Maintenance for Underpasses)

State's Costs

	20% from RR	5 years RR Maint. Paid	10 years RR Maint. Paid	15 years RR Maint. Paid	20 years RR Maint. Paid	25 years RR Maint. Paid
NPW-\$75	\$14,733,150.75	\$21,072,874.69	\$19,538,531.79	\$18,418,439.45	\$17,476,486.01	\$16,788,846.48
NPW-\$90	\$18,420,386.33	\$24,760,110.27	\$23,225,767.38	\$22,105,675.04	\$21,163,721.60	\$20,476,082.07
NPW-\$278	\$23,966,472.39	\$30,306,196.33	\$28,771,853.44	\$27,651,761.10	\$26,709,807.66	\$26,022,168.13
NPW-\$105	\$22,107,621.92	\$28,447,345.86	\$26,913,002.97	\$25,792,910.62	\$24,850,957.19	\$24,163,317.65

Railroad's Costs

	20% from RR	5 years RR Maint. Paid	10 years RR Maint. Paid	15 years RR Maint. Paid	20 years RR Maint. Paid	25 years RR Maint. Paid
NPW-\$75	\$9,348,117.39	\$11,172,629.78	\$12,706,972.68	\$13,827,065.02	\$14,769,018.46	\$15,456,657.99
NPW-\$90	\$10,269,926.28	\$12,094,438.68	\$13,628,781.57	\$14,748,873.92	\$15,690,827.35	\$16,378,466.89
NPW-\$278	\$11,656,447.80	\$13,480,960.20	\$15,015,303.09	\$16,135,395.43	\$17,077,348.87	\$17,764,988.40
NPW-\$105	\$11,191,735.18	\$13,016,247.58	\$14,550,590.47	\$15,670,682.81	\$16,612,636.25	\$17,300,275.78

Total Costs for Alternative 5C

	20% from RR	5 years RR Maint. Paid	10 years RR Maint. Paid	15 years RR Maint. Paid	20 years RR Maint. Paid	25 years RR Maint. Paid
NPW-\$75	\$24,081,268.13	\$32,245,504.47	\$32,245,504.47	\$32,245,504.47	\$32,245,504.47	\$32,245,504.47
NPW-\$90	\$28,690,312.61	\$36,854,548.95	\$36,854,548.95	\$36,854,548.95	\$36,854,548.95	\$36,854,548.95
NPW-\$278	\$35,622,920.19	\$43,787,156.53	\$43,787,156.53	\$43,787,156.53	\$43,787,156.53	\$43,787,156.53
NPW-\$105	\$33,299,357.10	\$41,463,593.44	\$41,463,593.44	\$41,463,593.44	\$41,463,593.44	\$41,463,593.44

Appendix J

COST TABLES FOR ALTERNATIVE 6

Alternative 6A

Alternative 6A (No Consideration for Underpass Maintenance)						
State's Costs						
	25% from RR	5 years RR Maint. Paid	10 years RR Maint. Paid	15 years RR Maint. Paid	20 years RR Maint. Paid	25 years RR Maint. Paid
NPW-\$75	\$18,060,951.10	\$24,400,675.04	\$22,866,332.15	\$21,746,239.80	\$20,804,286.37	\$20,116,646.83
NPW-\$90	\$21,517,734.46	\$27,857,458.40	\$26,323,115.51	\$25,203,023.17	\$24,261,069.73	\$23,573,430.19
NPW-\$278	\$26,717,190.14	\$33,056,914.08	\$31,522,571.19	\$30,402,478.85	\$29,460,525.41	\$28,772,885.88
NPW-\$105	\$24,974,517.82	\$31,314,241.76	\$29,779,898.87	\$28,659,806.53	\$27,717,853.09	\$27,030,213.56
Railroad's Costs						
	25% from RR	5 years RR Maint. Paid	10 years RR Maint. Paid	15 years RR Maint. Paid	20 years RR Maint. Paid	25 years RR Maint. Paid
NPW-\$75	\$6,020,317.03	\$7,844,829.43	\$9,379,172.32	\$10,499,264.67	\$11,441,218.10	\$12,128,857.64
NPW-\$90	\$7,172,578.15	\$8,997,090.55	\$10,531,433.44	\$11,651,525.79	\$12,593,479.22	\$13,281,118.76
NPW-\$278	\$8,905,730.05	\$10,730,242.45	\$12,264,585.34	\$13,384,677.68	\$14,326,631.12	\$15,014,270.65
NPW-\$105	\$8,324,839.27	\$10,149,351.67	\$11,683,694.57	\$12,803,786.91	\$13,745,740.35	\$14,433,379.88
Total Costs for Alternative 6A						
	25% from RR	5 years RR Maint. Paid	10 years RR Maint. Paid	15 years RR Maint. Paid	20 years RR Maint. Paid	25 years RR Maint. Paid
NPW-\$75	\$24,081,268.13	\$32,245,504.47	\$32,245,504.47	\$32,245,504.47	\$32,245,504.47	\$32,245,504.47
NPW-\$90	\$28,690,312.61	\$36,854,548.95	\$36,854,548.95	\$36,854,548.95	\$36,854,548.95	\$36,854,548.95
NPW-\$278	\$35,622,920.19	\$43,787,156.53	\$43,787,156.53	\$43,787,156.53	\$43,787,156.53	\$43,787,156.53
NPW-\$105	\$33,299,357.10	\$41,463,593.44	\$41,463,593.44	\$41,463,593.44	\$41,463,593.44	\$41,463,593.44

Alternative 6B

Alternative 6B (Consideration for the Acquisition of Overpass Structures and the Continued Maintenance of Underpasses)						
State's Costs						
	25% from RR	5 years RR Maint. Paid	10 years RR Maint. Paid	15 years RR Maint. Paid	20 years RR Maint. Paid	25 years RR Maint. Paid
NPW-\$75	\$22,592,814.86	\$28,932,538.80	\$27,398,195.91	\$26,278,103.56	\$25,336,150.13	\$24,648,510.59
NPW-\$90	\$26,049,598.22	\$32,389,322.16	\$30,854,979.27	\$29,734,886.93	\$28,792,933.49	\$28,105,293.95
NPW-\$278	\$31,249,053.90	\$37,588,777.84	\$36,054,434.95	\$34,934,342.61	\$33,992,389.17	\$33,304,749.64
NPW-\$105	\$29,506,381.58	\$35,846,105.52	\$34,311,762.63	\$33,191,670.29	\$32,249,716.85	\$31,562,077.32
Railroad's Costs						
	25% from RR	5 years RR Maint. Paid	10 years RR Maint. Paid	15 years RR Maint. Paid	20 years RR Maint. Paid	25 years RR Maint. Paid
NPW-\$75	\$6,020,317.03	\$7,844,829.43	\$9,379,172.32	\$10,499,264.67	\$11,441,218.10	\$12,128,857.64
NPW-\$90	\$7,172,578.15	\$8,997,090.55	\$10,531,433.44	\$11,651,525.79	\$12,593,479.22	\$13,281,118.76
NPW-\$278	\$8,905,730.05	\$10,730,242.45	\$12,264,585.34	\$13,384,677.68	\$14,326,631.12	\$15,014,270.65
NPW-\$105	\$8,324,839.27	\$10,149,351.67	\$11,683,694.57	\$12,803,786.91	\$13,745,740.35	\$14,433,379.88
Total Costs for Alternative 6B						
	25% from RR	5 years RR Maint. Paid	10 years RR Maint. Paid	15 years RR Maint. Paid	20 years RR Maint. Paid	25 years RR Maint. Paid
NPW-\$75	\$28,613,131.89	\$36,777,368.23	\$36,777,368.23	\$36,777,368.23	\$36,777,368.23	\$36,777,368.23
NPW-\$90	\$33,222,176.37	\$41,386,412.71	\$41,386,412.71	\$41,386,412.71	\$41,386,412.71	\$41,386,412.71
NPW-\$278	\$40,154,783.95	\$48,319,020.29	\$48,319,020.29	\$48,319,020.29	\$48,319,020.29	\$48,319,020.29
NPW-\$105	\$37,831,220.86	\$45,995,457.20	\$45,995,457.20	\$45,995,457.20	\$45,995,457.20	\$45,995,457.20

Alternative 6C

Alternative 6C (Consideration for the Acquisition of Overpass Structures and the Relinquishing of Maintenance for Underpasses)						
State's Costs						
	25% from RR	5 years RR Maint. Paid	10 years RR Maint. Paid	15 years RR Maint. Paid	20 years RR Maint. Paid	25 years RR Maint. Paid
NPW-\$75	\$13,529,087.34	\$19,868,811.28	\$18,334,468.39	\$17,214,376.04	\$16,272,422.61	\$15,584,783.07
NPW-\$90	\$16,985,870.70	\$23,325,594.64	\$21,791,251.75	\$20,671,159.41	\$19,729,205.97	\$19,041,566.43
NPW-\$278	\$22,185,326.38	\$28,525,050.32	\$26,990,707.43	\$25,870,615.09	\$24,928,661.65	\$24,241,022.12
NPW-\$105	\$20,442,654.06	\$26,782,378.00	\$25,248,035.11	\$24,127,942.77	\$23,185,989.33	\$22,498,349.80
Railroad's Costs						
	25% from RR	5 years RR Maint. Paid	10 years RR Maint. Paid	15 years RR Maint. Paid	20 years RR Maint. Paid	25 years RR Maint. Paid
NPW-\$75	\$10,552,180.79	\$12,376,693.19	\$13,911,036.08	\$15,031,128.43	\$15,973,081.86	\$16,660,721.40
NPW-\$90	\$11,704,441.91	\$13,528,954.31	\$15,063,297.20	\$16,183,389.55	\$17,125,342.98	\$17,812,982.52
NPW-\$278	\$13,437,593.81	\$15,262,106.21	\$16,796,449.10	\$17,916,541.44	\$18,858,494.88	\$19,546,134.41
NPW-\$105	\$12,856,703.03	\$14,681,215.43	\$16,215,558.33	\$17,335,650.67	\$18,277,604.11	\$18,965,243.64
Total Costs for Alternative 6C						
	25% from RR	5 years RR Maint. Paid	10 years RR Maint. Paid	15 years RR Maint. Paid	20 years RR Maint. Paid	25 years RR Maint. Paid
NPW-\$75	\$24,081,268.13	\$32,245,504.47	\$32,245,504.47	\$32,245,504.47	\$32,245,504.47	\$32,245,504.47
NPW-\$90	\$28,690,312.61	\$36,854,548.95	\$36,854,548.95	\$36,854,548.95	\$36,854,548.95	\$36,854,548.95
NPW-\$278	\$35,622,920.19	\$43,787,156.53	\$43,787,156.53	\$43,787,156.53	\$43,787,156.53	\$43,787,156.53
NPW-\$105	\$33,299,357.10	\$41,463,593.44	\$41,463,593.44	\$41,463,593.44	\$41,463,593.44	\$41,463,593.44