I-64 WB MM 105 - 99
Operations Analysis

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Introduction

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Perceived Problem
I-64 WB MM 105 - 99

- ✓ Speed Differential
- ✓ Lane Utilization
- ✓ Crashes
- ✓ Grades

Data For I – 64 WB MM 105 - 99

- ✓ Volume Data
- ✓ Speed Data
- ✓ Crash Density
- ✓ AASHTO Climbing Lane for Multi-lane Highways Criteria

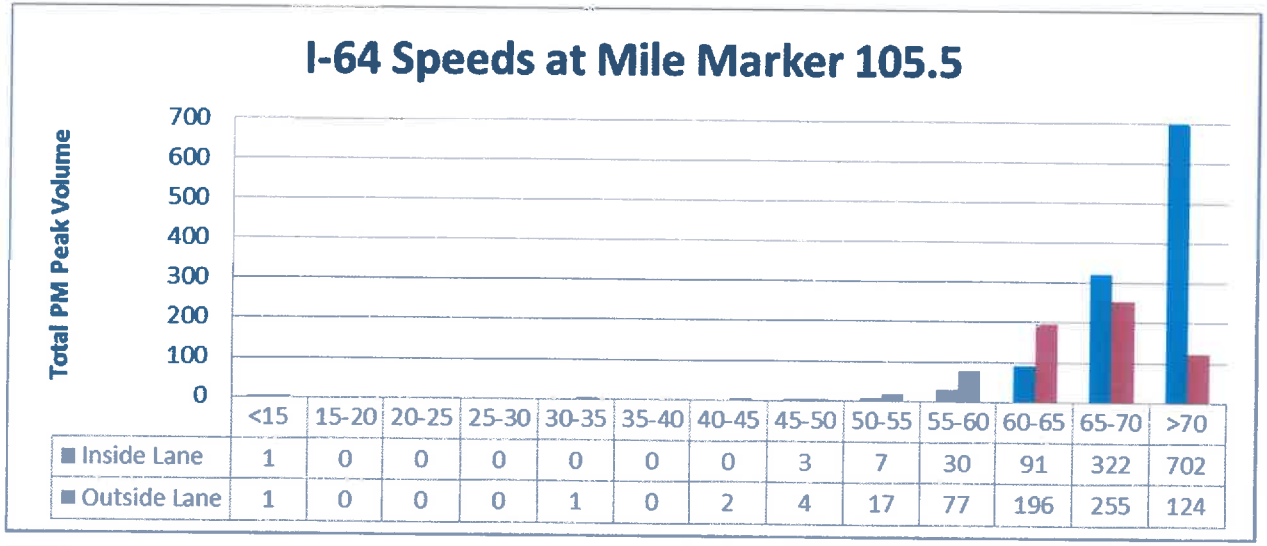
Volume Data

- ✓ Volume, Class and Speed were collected at Mile Markers 105.5, 104, 102, and 100.2
- ✓ ADT
  - 18,700 vehicles, 14% Trucks
- ✓ PM Peak Period
  - Between 5 PM and 6 PM
  - 1,840 vehicles, 9% Trucks
  - At Mile Marker 104
    - 73% (1,350) of vehicles are using the inside/left lane

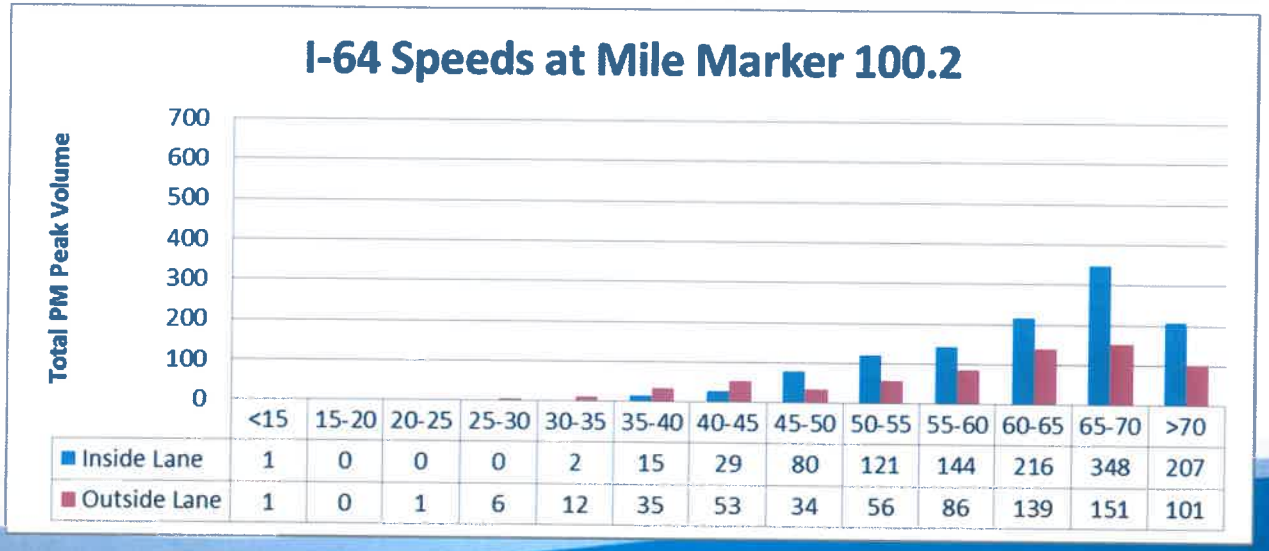
Speed Data

- ✓ Posted Speed Limit: 65 mph
- ✓ 85th percentile speed: +71mph at each location for the entire day
- ✓ The overall travel speeds decrease as vehicles travel uphill from Mile Marker 105.5 to 100.2
  - Mile Marker 105.5, 77% of vehicles were traveling above the posted speed limit of 65 mph
  - Mile Marker 100.2, 44% of vehicles are travel at or above the posted speed limit of 65 mph
  - Mile Marker 100.2, 21% of vehicles traveling in the right/outer lane are traveling at speeds lower then 50 mph

Speed Comparison



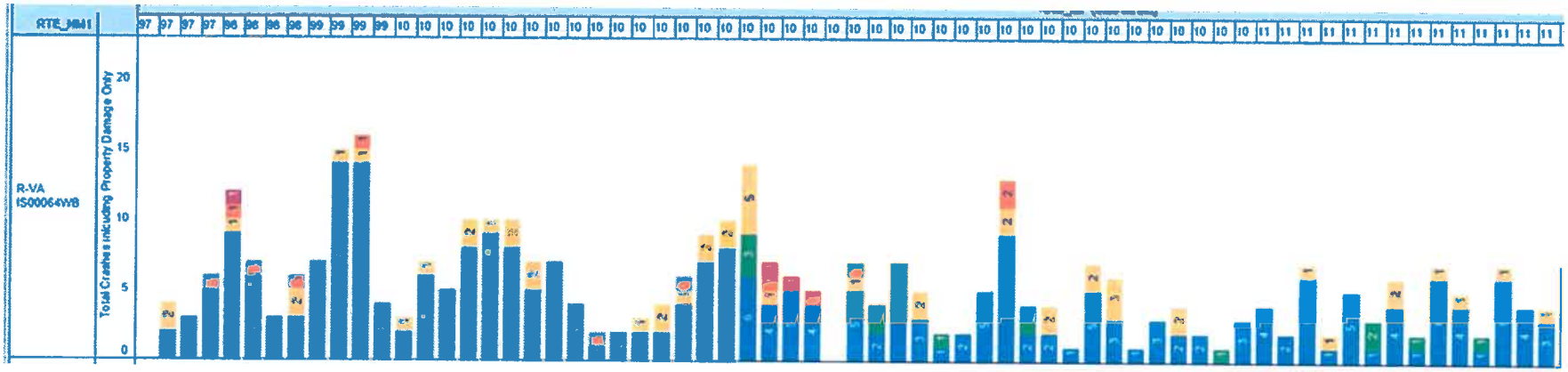
	<15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65	65-70	>70
Inside Lane	1	0	0	0	0	0	0	3	7	30	91	322	702
Outside Lane	1	0	0	0	1	0	2	4	17	77	196	255	124



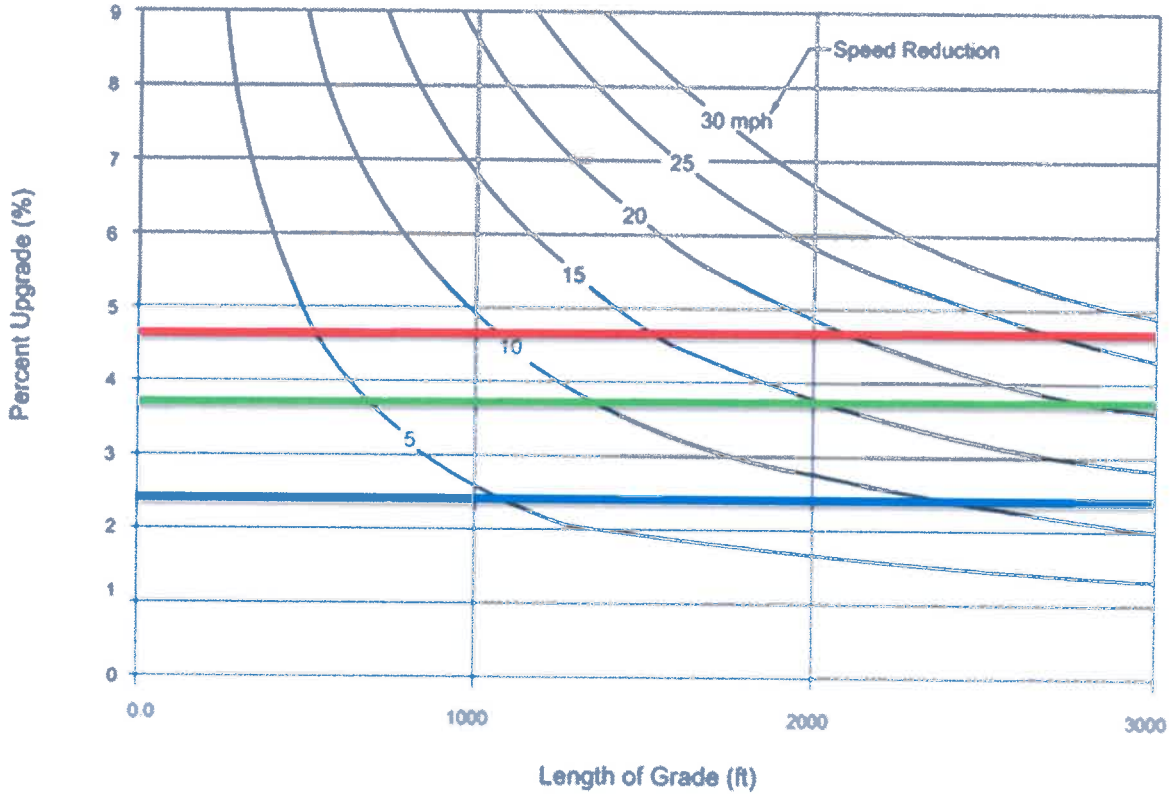
	<15	15-20	20-25	25-30	30-35	35-40	40-45	45-50	50-55	55-60	60-65	65-70	>70
Inside Lane	1	0	0	0	2	15	29	80	121	144	216	348	207
Outside Lane	1	0	1	6	12	35	53	34	56	86	139	151	101

Data 105 - 99

Crash Density



Critical Length of Grade



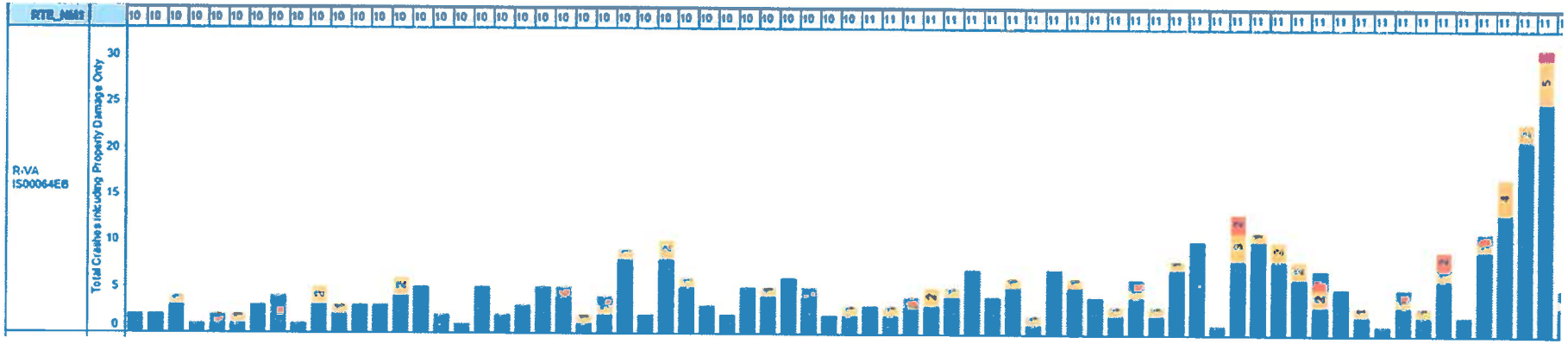
- Mile Marker 104.8 to 104 (4,224 ft) Upgrade of 2.5%
- Mile Marker 104 to 102.5 (7,920 ft) Upgrade of 4.8%
- Mile Marker 102.5 to 99 (18,480 ft) Upgrade of 3.8%

Data I - 64 EB MM 114 - 118

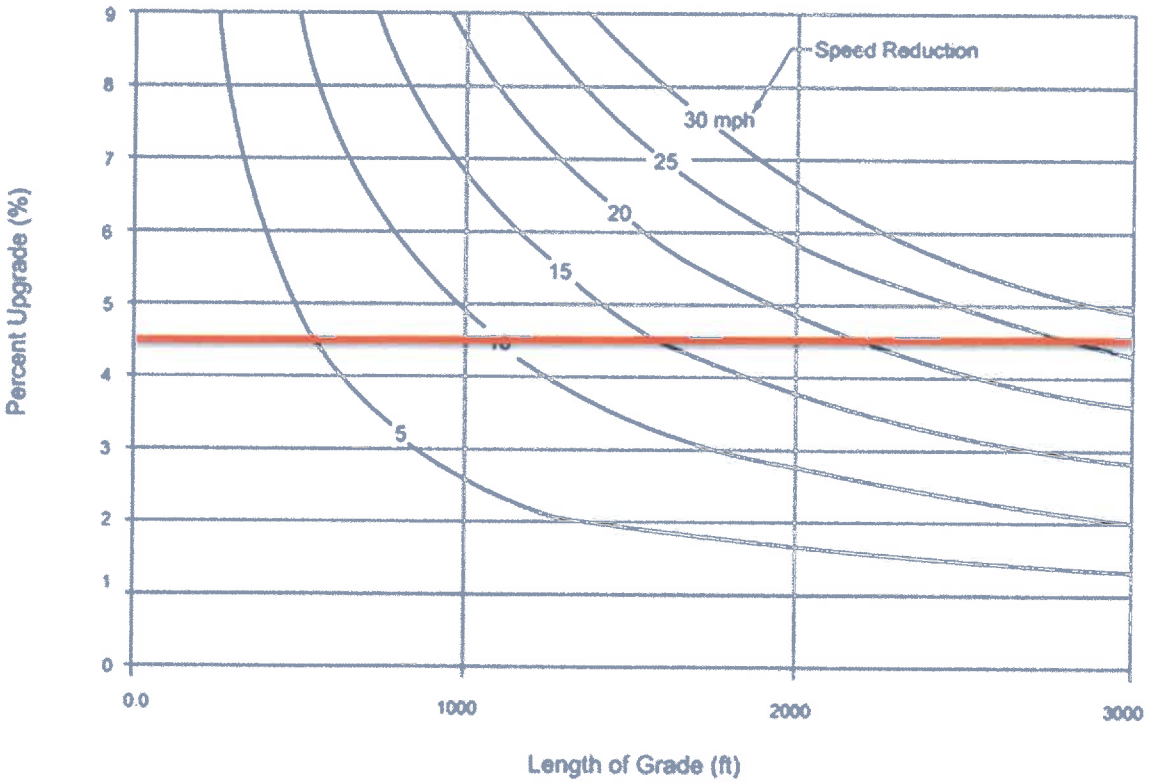
- ✓ Crash Density
- ✓ Critical Grades

Data 114-118

Crash Density



Critical Length of Grade



- Mile Marker 114.5 to 115.5 (5,400 ft) Upgrade of 4.5%

5-Year Crash Analysis

- Primary Study Segment:
  - I-64 WB - MM 104 - 99
- Comparison Locations:
  - I-64 EB - MM 113 - 119
  - I-64 EB - MM 94 - 99
  - I-77 NB - MM 1 - 8

Results

- I-64 WB - MM 104 - 99
  - 76 total crashes from 2010 - 2014
    - 52.05 crashes per 100 Million VMT
      - » +2.64% from Culpeper District Average
      - » +20.28% from Staunton District Average
  - About 41% Rear-End crashes

Rear-End Crash Comparisons

- Study Segment: I-64 WB from MM 104 - 99
  - 31 Rear-End Collisions (Most recent - 5 years)
    - 21.22 per 100 Million VMT
- I-64 EB from MM 113 - 119
  - 51 Rear-End Collisions (Most recent - 5 years)
    - 22.70 per 100 Million VMT

Contrasting Situation

- I-64 EB from MM 94 - 99
  - 10 Rear-End Collisions (Most recent - 5 years)
    - 6.08 per 100 Million VMT
      - 3.5x lower than Study Segment
- I-77 NB 3-lane Section (Truck Climbing Lane)
  - 27 Rear-End Collisions (Most recent - 5 years)
    - 11.73 per 100 Million VMT
      - About half of Study Segment

Survey

- A survey was sent to different areas in the mid-Atlantic region for the implementation of hard shoulder running for truck climbing lane.
  - Respondents were: Two districts in western Maryland, North Carolina Department of Transportation and two districts in Western Pennsylvania
  - AASHTO criteria evaluated as part of this study is what these states use as well and no other measures were recommended or provided
  - No states surveyed had studied the use of hard shoulder running for truck climbing lanes

AASHTO Climbing Lane for Multi-Lane Highways

- If one of the following principles is satisfied, consideration of truck climbing is warranted:
  - Critical Length of Grade: Length of grade exceeds the critical length of grade. Segment meets criteria
  - Service Flow Volume: Service flow volume is greater than 1,000 vehicles per hour per lane(vphpl) but less then 1,700 vphpl. Segment meets criteria
  - Operational Assessment-Level of Service: Existing level of service exceeds LOS D and would be improved one grade level with the addition of a truck climbing lane. Segment does not meet criteria

Service Flow Volume

- Climbing lanes are generally not warranted on four lane highways with volumes below 1,000 vplph regardless of the percentage of trucks
- When the service volumes including trucks reach 1,700 vplph the capacity of the segment is approached and an increase in the number of lanes throughout the segment would represent a better investment then a truck climbing lane
- PM Peak: 1,840 vehicles utilizing two lanes
- Lane Utilization: Found that far more vehicles were using the inside/left lane
  - At Mile Marker 104 - 1,350 of the 1,850 vehicles were using the inside/left lane
  - Falling between 1,000 vplph and 1,700 vplph consideration of a truck climbing lane is warranted

Operational Assessment

- The Highway Capacity methodology provides different options for analyzing uphill terrain:
  - The most conservative of "worse case" approach was to use the highest grade within the study area
    - Upgrade of 4.8% between 104 and 102.5
    - LOS B and Density of 16.5 vehicles/mile/lane
  - Using the terrain type of mountainous
    - LOS B and Density of 16.5 vehicles/mile/lane
  - Composite Grade approach
    - LOS B and Density of 15.8 vehicles/mile/lane

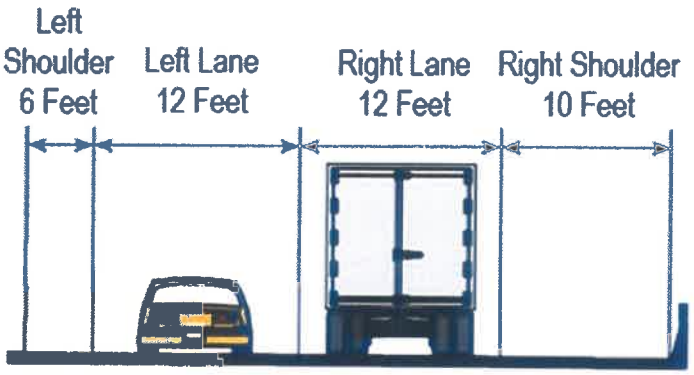
Potential Solutions

- Temporary Solution - FHWA Hard Shoulder Running
- http://ops.fhwa.dot.gov/publications/fhwahop10023/chap4.htm
- Project Conceptualization
- Prior to use of shoulder or breakdown lanes, the DOT has to seek approval from FHWA to implement the strategy as a temporary measure until funding and approval are obtained for widening
- The intent is for these facilities to be temporary in nature and not a permanent fixture for long-term capacity provision

Temporary Solutions

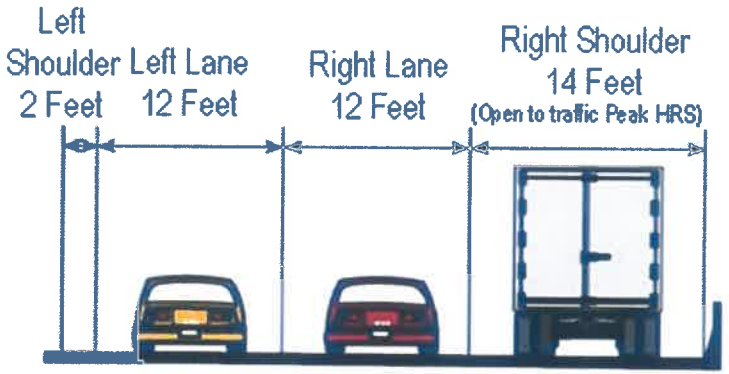
- Temporary Use of Shoulder for Truck Climbing
- Use of shoulder for General Purpose traffic with trucks using existing left lane

Potential Temporary Solution



I-64 Existing Westbound Lanes

Proposed cross-section for milepost 105 to milepost 99

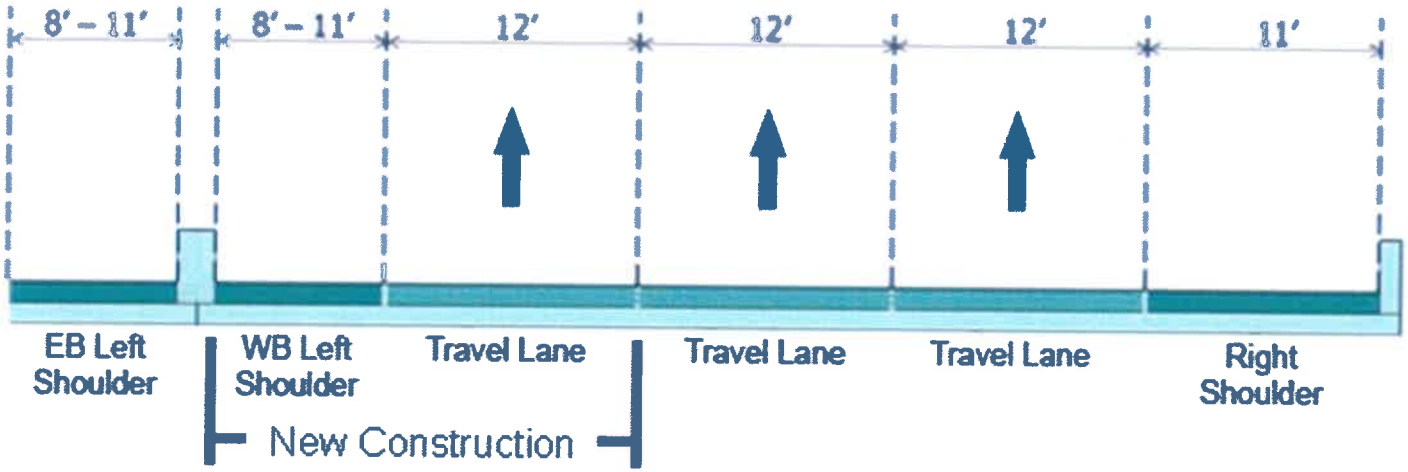


I-64 Proposed Westbound Lanes

Proposed cross-section for milepost 105 to milepost 99

Potential Permanent Solution

- Add a lane into the median with the addition of barrier wall
  - This strategy is reversible for critical grades in EB and WB direction



Benefit from Crash Reduction

- HSIP Methodology
  - Assumed 50% crash reduction based on I-77 comparison and percentage of existing Rear-End/Low Speed Collisions
- Temporary Solution (10 Year Service Life)
  - $1.48 Million Present Value of Benefit
- Permanent Solution (20 Year Service Life)
  - $2.58 Million Present Value of Benefit

Next Steps

- ✓ Develop Typical Section
  - Temporary
  - Permanent
- ✓ Identify Elements Needed
- ✓ Estimate Costs
  - Resurface and restripe
  - Widen to the median
  - Add median barrier