

# WORK ZONE POSITIVE PROTECTION GUIDELINES

VICHIKA IRAGAVARAPU  
JERRY ULLMAN



# BACKGROUND

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- 23 CFR 630 Subpart K
- Available guidance is based on drop-off depth and location, not intrusion risk
- Lack of field data
- Limitations of earlier models



# OBJECTIVE

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- Work Zone Positive Protection Guidelines based on worker crash cost reduction
- Worksheets and spreadsheet tool for implementing these guidelines



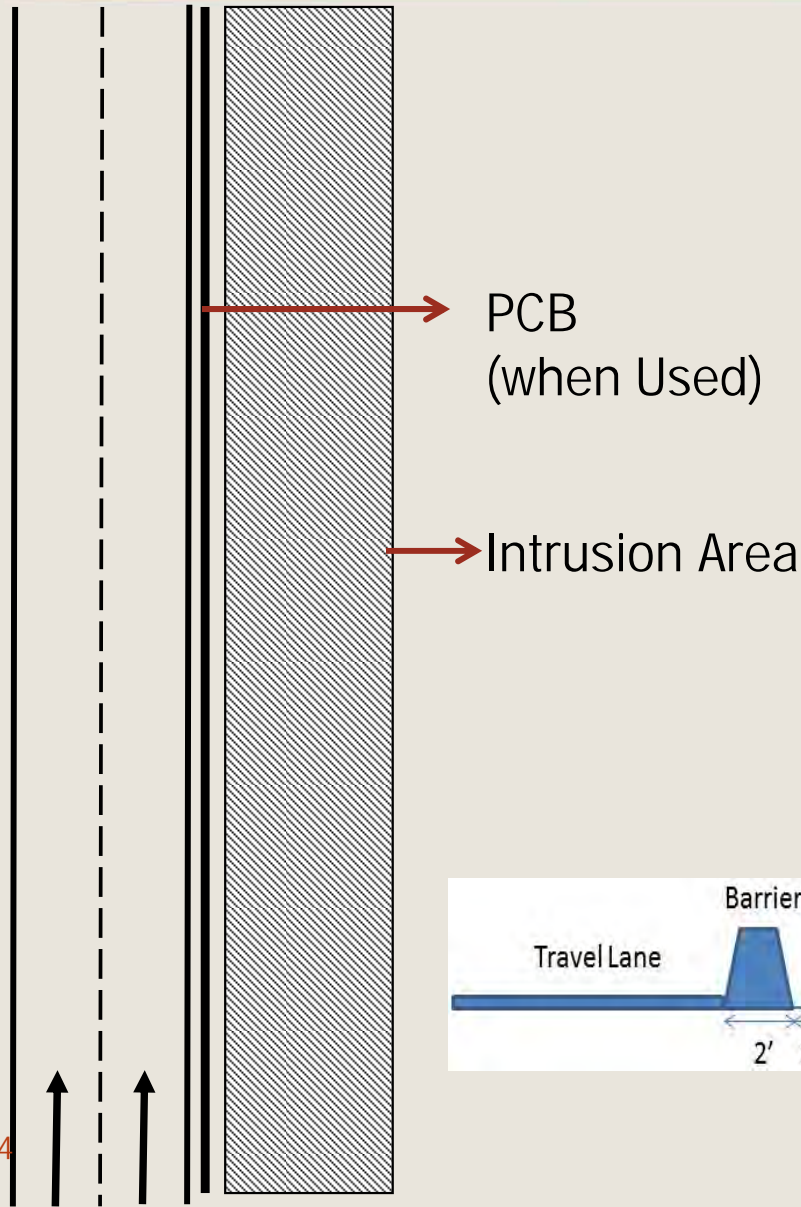
# STUDY APPROACH

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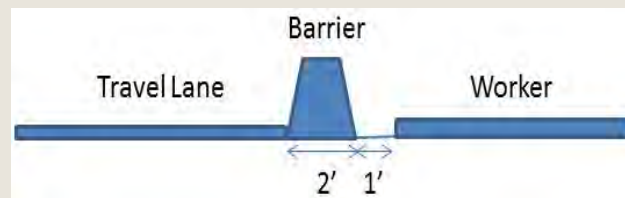
- Encroachment based hazard analysis
  - Roadside Safety Analysis Program (RSAPv3)
  - Based on series of conditionally independent probabilities:
    - Lateral Encroachment Model
    - Crash Prediction Model
    - Hazard Penetration Model
    - Crash Severity Model



# INTRUSION CRASH ANALYSIS



- Worker area modeled as a single hazard
- Hazard properties derived from NYSDOT work zone intrusion crash severity database (NCHRP 627)
- Encroachment Adjustment Factor: 1.4



# INTRUSION CRASH ANALYSIS

Highway Characteristics	Unit	Value
Posted Speed Limit	MPH	50 or 70
Terrain	F/M/R	F
Number of Lanes	-	4
Grade	%	0
Radius of curve	Feet	T
Median Width	Feet	30
Left Shoulder Width	Feet	10
Right Shoulder Width	Feet	0
Lane Width	Feet	12
Access /Density	Points/Mile	0
Rumble Strips	Yes/No	No
AADT	VPD	5000 – 60000
Worker Lateral Offset	Feet	6 - 24

F/M/R =  
 Flat/Mountainous/  
 Rolling  
 T = Tangent

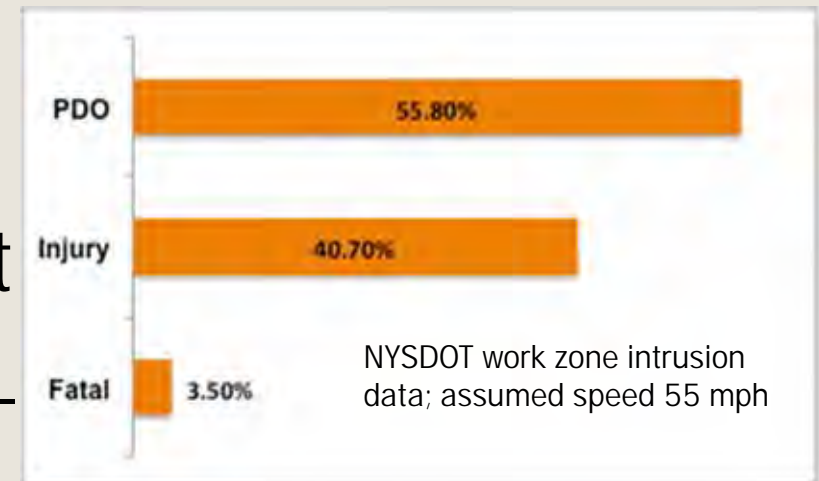
# INTRUSION CRASH ANALYSIS

- PCB Cost = \$53.76/ft  
(including removal)

Crash Type	Median Value	Low Value
PDO	\$3066	\$1752
Injury	\$204,758	\$117,004
Fatal	\$9.1 mil	\$5.2 mil

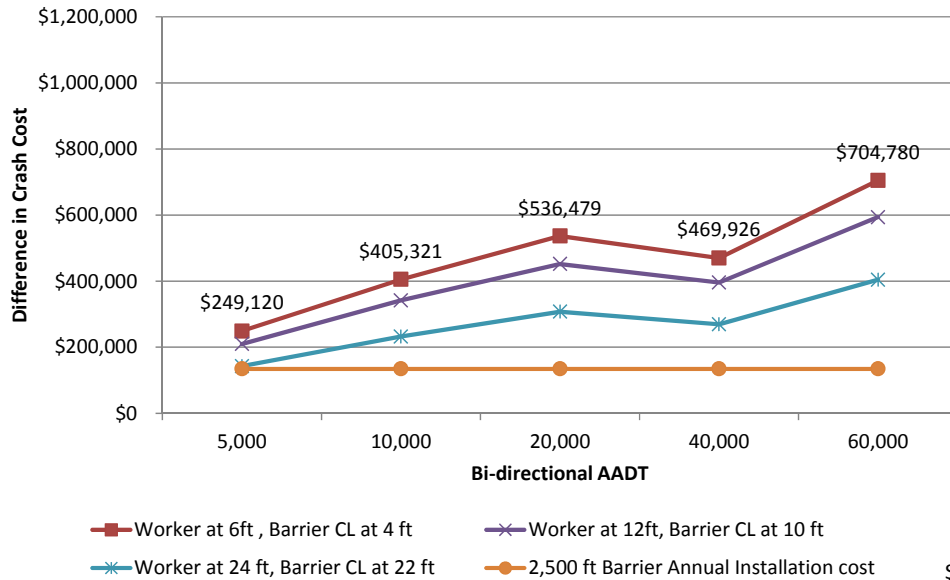
- Equivalent Fatal Crash Cost Ratio (EFCCR) for worker area =  $\frac{\text{Total Crash Cost}}{\text{Fatal Crash Cost}}$

- RSAPv3 requires EFCCR at 65 mph:  $EFCCR_{65} = \frac{EFCCR_{55} \times 65^3}{55^3}$

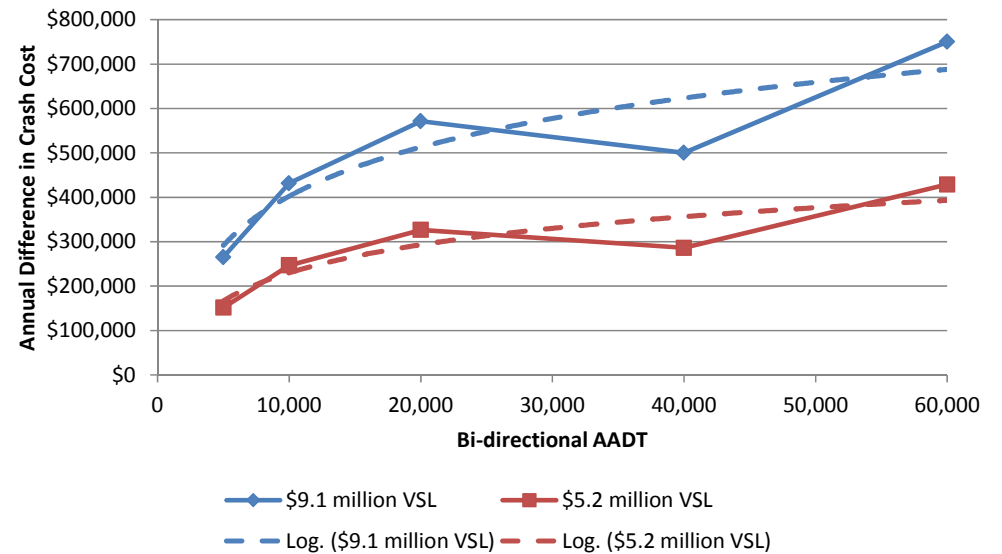


# RESULTS

4 Lane Divided Freeway with PSL of 70 mph (No Drop-Off, 1/2 mi Worker), VSL = \$9.1 million, Encroachment Rate = 1.4



4 Lane Divided Freeway with Work Space Next to Traffic and Operation Speed 70 mph





# RESULTS: EQUIVALENT EXPOSURE

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- Proportion of project duration with work activity
  - Typical Workday Factor
  - Allowable Workday Factor
  - Work Activity Location Factor
  - Actual Proportion of Work activity: 0.50 or 0.60
  - Actual Proportion of Work Area: Project-specific or 150 feet per work area



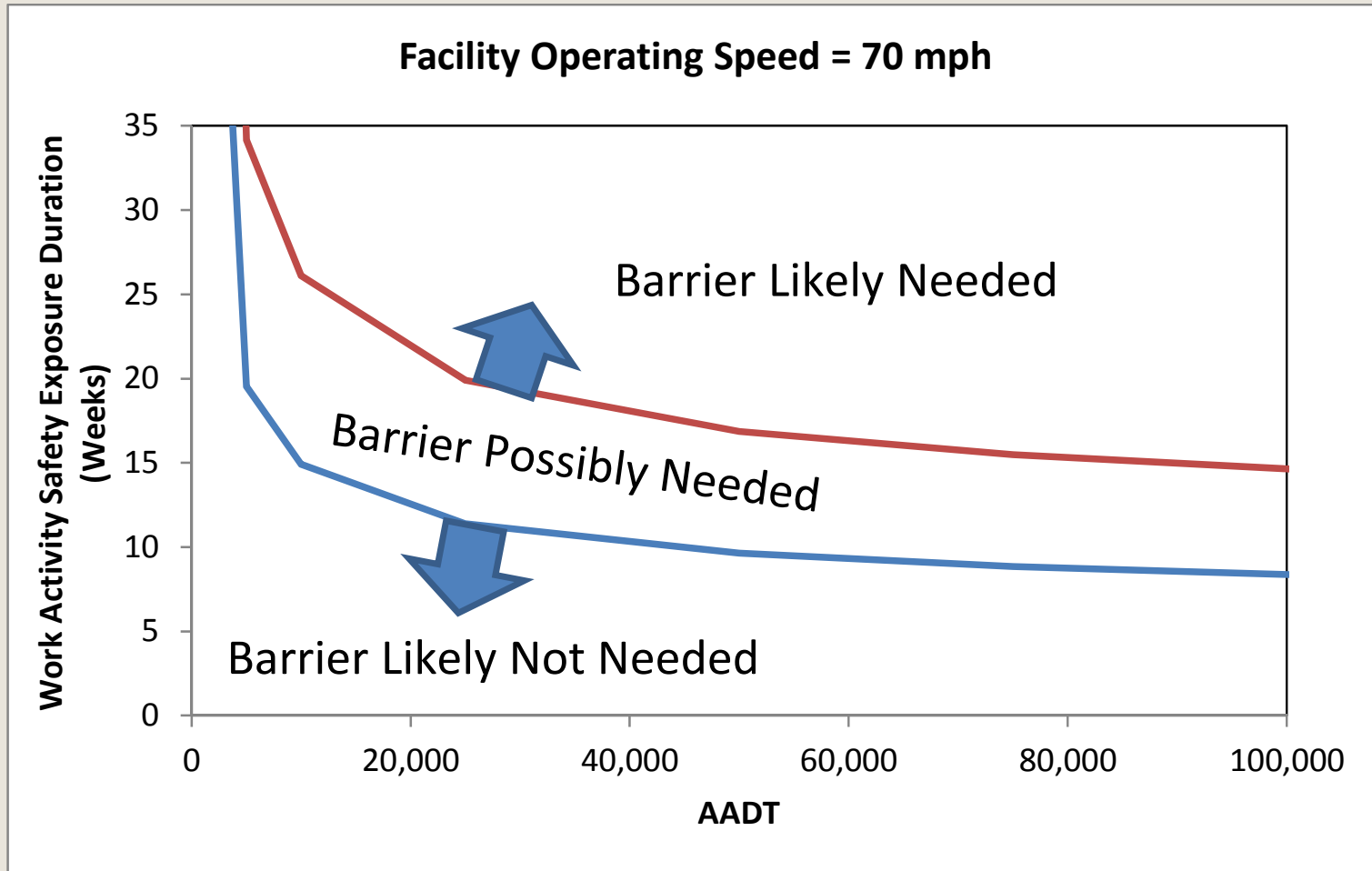
# RESULTS: EQUIVALENT EXPOSURE

Work Activity Duration	Typical Workday Factor
Continuously both day and night	1.0
Predominantly during the daytime or nighttime	0.5
Combination of both daytime and nighttime	Proportionate to each shift

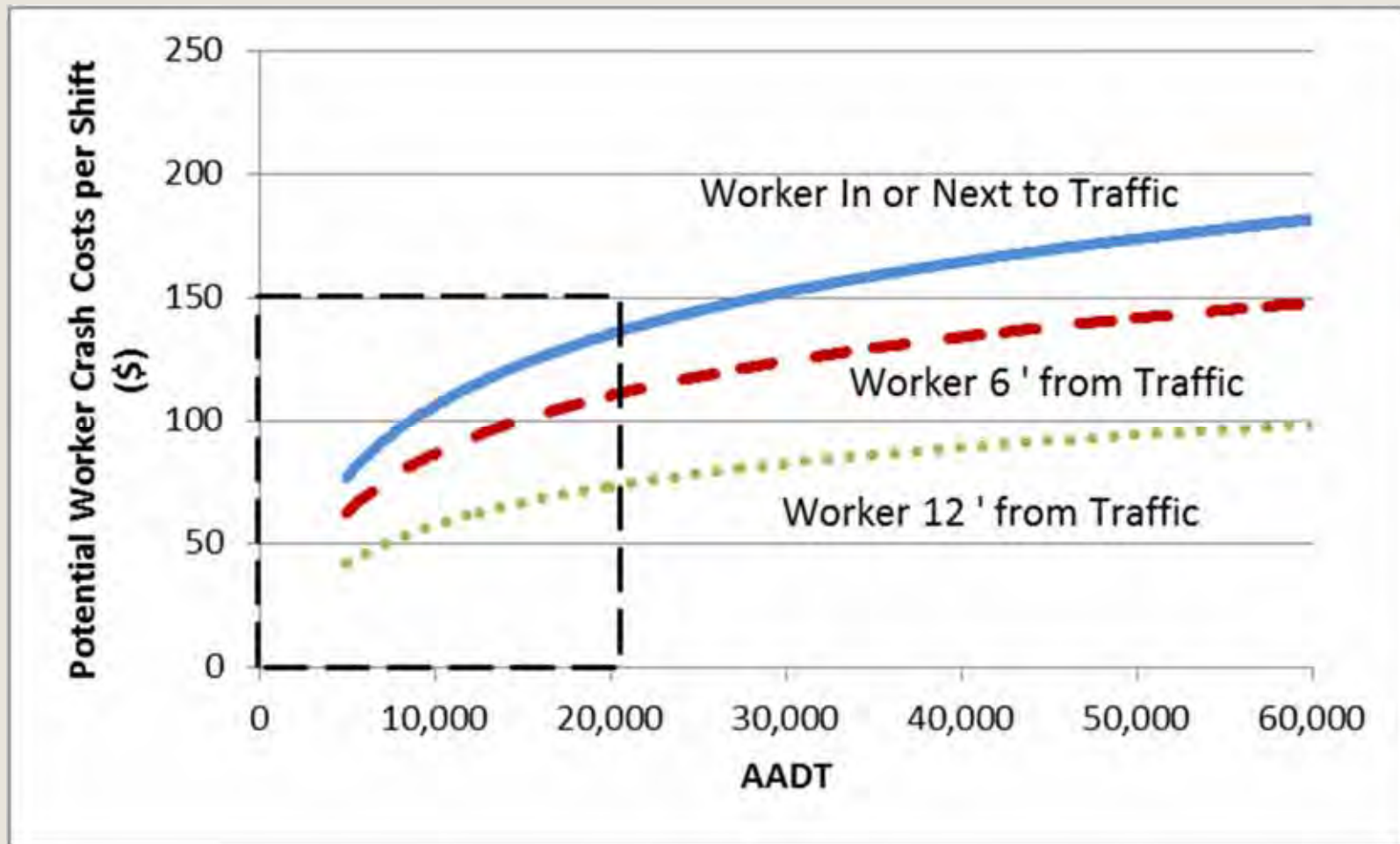
Work Activity Duration	Allowable Workday Factor
Monday thru Friday	0.78 (0.156 per workday)
Saturday	0.12
Sunday	0.10

Work Activity Distance from Travel Lane	Work Activity Location Factor
(<6 ft)	1.00
6 ft	0.94
12 ft	0.79
24 ft	0.54

# RESULTS: EXPOSURE EQUIVALENT



# RESULTS: PER SHIFT WORKER CRASH COST



# SPREADSHEET TOOL DEMO

## IDAHO DOT WORK ZONE POSITIVE PROTECTION GUIDANCE

### Positive Protection Needs Assessment Process

Project No:

Project Location  
and Description:

#### Step 1: Determine and categorize hazard locations and types present in each phase of the project

*The work zone designer should perform a systematic check of the entire project length for each phase to determine conditions where and when positive protection might be needed. Three hazard types exist which may warrant some type of positive protection:*

#### Step 2. Select Appropriate Worksheet(s) and Perform Analyses

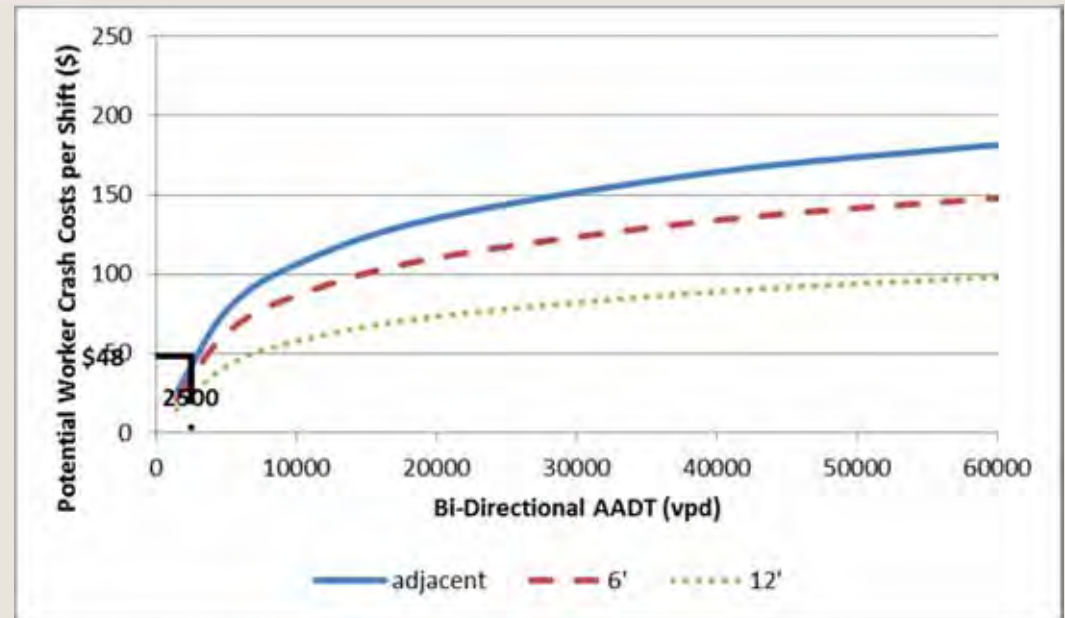
*A series of simple-to-use worksheets are provided to assist in determining whether the provision of positive protection would be justified on the basis of the safety benefits (reduced crash costs) expected. Worksheets are provided for each hazard type defined in step 1.\**

Hazard/ Worksheet	Description
1	No Worker Escape Operations and Locations
2a	Other Worker Activities near Traffic
2b	Temporary Roadside Hazards near Traffic

# SPREADSHEET TOOL DEMO

## No worker Escape Operations and Location

- Project Description
- Estimated AADT
- Estimated work activity distance from traffic
- Assumed Value of Statistical Life
- Estimated number of work shifts
- Total length of barrier needed
- Assumed cost of barrier



- 2500 AADT
- Work activity next to traffic
- Value of Statistical Life: \$9.1 million
- 60 Work shifts
- 900ft of barrier needed
- Cost of barrier: \$53.76/LF
- $B/C = 0.06$



# SPREADSHEET TOOL DEMO

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## General Work Activity

- Project Description
- Estimated AADT
- Expected Operating Speed
- Estimated work activity distance from traffic
- Estimated upper limit of Value of Statistical Life
- Estimated lower limit of Value of Statistical Life
- Assumed cost of barrier

## • Worker Exposure

- Time-of-day factor
- Allowable work days Factor
- Proportion of possible work days with work activity
- Proportion of work zone occupied by active work space
- Expected duration of project/phase

## • Temporary Roadside Hazard Exposure

- Estimated duration of roadside hazard presence



# SPREADSHEET TOOL DEMO

- **Project Description**

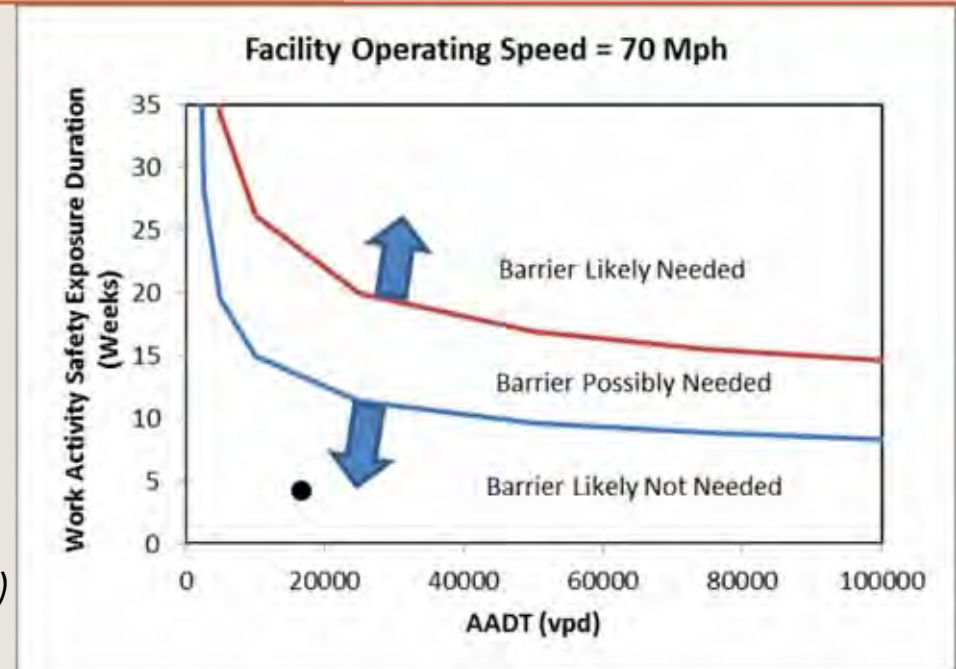
- 16,450 AADT
- 70 mph Operating Speed
- Work activity next to traffic
- Upper limit of VSL: \$9.1 mil
- Lower limit of VSL: \$5.2 mil
- Cost of barrier: \$53.76/LF

- **Worker Exposure**

- Time-of-day factor: Mostly Daytime (0.5)
- Allowable work days Factor: M-F (0.78)
- Proportion of possible work days with work activity: 0.50
- Proportion of work zone occupied by active work space: 1.0
- Expected duration of project/phase: 22 weeks

- **Temporary Roadside Hazard Exposure**

- Estimated duration of roadside hazard presence: 0 weeks





# SPREADSHEET TOOL DEMO

- **Project Description**

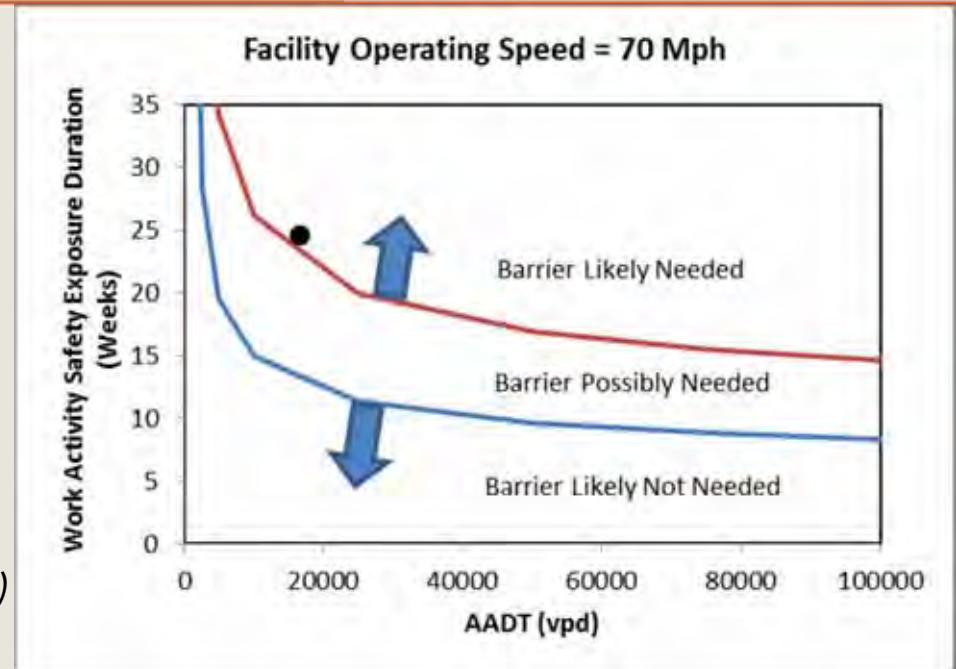
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- **Worker Exposure**

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- Allowable work days Factor: M-F (0.78)
- Proportion of possible work days with work activity: 0.50
- Proportion of work zone occupied by active work space: 1.0
- Expected duration of project/phase: 22 weeks

- **Temporary Roadside Hazard Exposure**

- Estimated duration of roadside hazard presence: 22 weeks





viragavarapu@brudis.com  
g-ullman@tamu.edu

