



STRATEGIC HIGHWAY INVESTMENT FORMULA FOR TOMORROW

BENEFIT COST FORMULA:

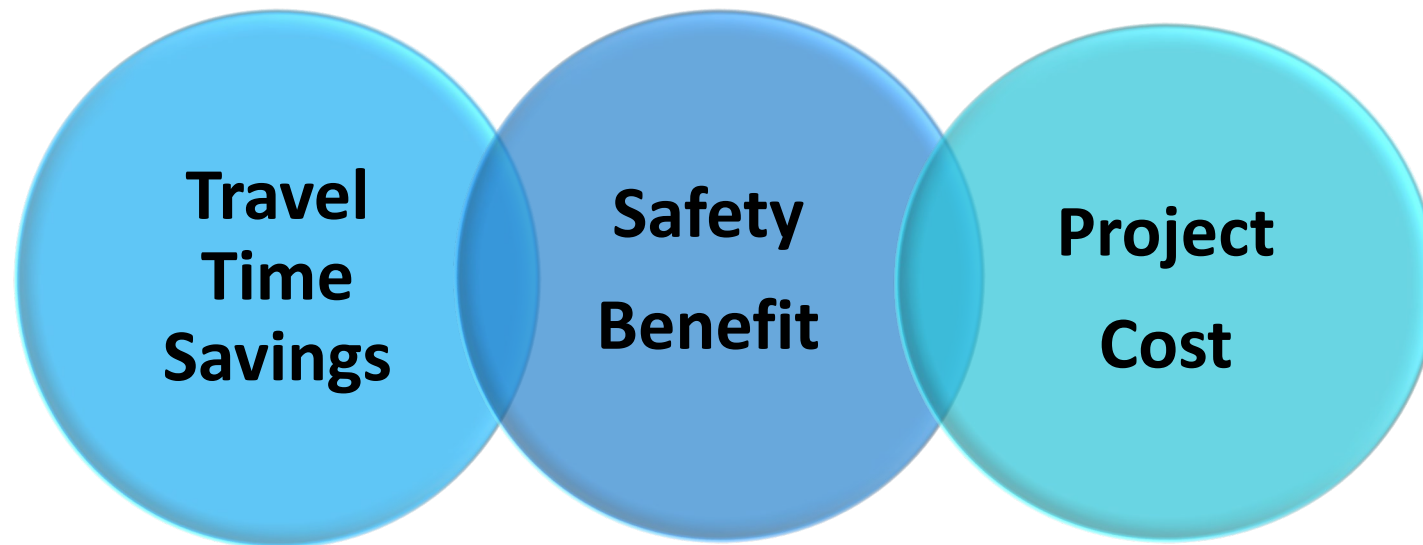
SAFETY BENEFIT & PROJECT COST





Formula Components

Look to evaluate the expected benefits in dollars of travel time savings and safety benefits against the project costs.



Component Highlights

Travel Time Savings

- Based on KY Statewide Traffic Modeling methods.
- The non-modeling travel time savings are based on Highway Capacity Manual (HCM) interactive formula.
- **B_{TTS} = Travel Time Savings Benefit \$ = Travel Time Savings * sum of delay costs by vehicle type**

Safety Benefit

- Based on North Carolina analysis methods.
- Is an estimate of the percent reduction in crashes expected for an Improvement Type.
- **B_{SAF} = Safety Benefit (\$) = $SBF (N_{KAB} * C_{KAB} + N_{CO} * C_{CO})$**

Project Cost

- The SHIFT development must rely on the currently available estimated project costs.
- **C_{PROJ} = Cost for R, U and C**

Benefit / Cost Score

Formulas

Statewide: 20%

Regional: 15%

Statewide Score = 20% * (Benefit / Cost) Measure (BCM) :

Regional Score = 15% * (Benefit / Cost) Measure (BCM) :

FORMULA: $B_{CM} = (B_{TTS} + B_{SAF}) / C_{PROJ}$ [Scaled]

Description	Summary Method	Data Source
C_{PROJ} : Family Project Cost (Phases R, U & C)	Summary	SYP CHAF
B_{SAF} : Safety Benefit Factor	Safety Benefit Factor of Specific Improvement Type	Crash Database CHAF
B_{TTS} : Travel Time Savings	TBA	TBA



Formula Tweaks: Project Cost?

- **Project Cost**

- We will continue to capture total project cost (R,U,C phases) for the 2020 B/C formula.
- Monitor the impact the improvements on the TTS and Safety criteria.

What we Considered

Project Cost

- The need to capture design costs.
- How to boost a project when other agencies provide a match.
- The challenges to address those projects that have previous funding authorized.
- The use of information gathered from the research KTC on the Project Estimating for D, R/W, U, & C?

Benefit / Cost Score

SHIFT 2018 Formula

$$B_{SAF} = SBF_{PROJ} * (N_{KAB} * C_{KAB} + N_{CO} * C_{CO})$$

Where,

B_{SAF} = Safety Benefit in \$

SBF_{PROJ} = Safety Benefit Factor for the Project Type

N_{KAB} = Number of fatal, severe, and minor injury crashes

C_{KAB} = Average cost of fatal, severe, and minor injury crashes

N_{CO} = Number of possible injury and property damage only crashes

C_{CO} = Average cost of possible injury and property damage only crashes

Benefit / Cost Score

SHIFT 2020 Formula

$$B_{SAF} = SBF_{PROJ} * (N_{KAB} * C_{KAB} + N_{CO} * C_{CO})$$

Where,

B_{SAF} = Safety Benefit in \$

SBF_{PROJ} = Incorporate Planning level CMFs (newly developed list by VHB)

N_{KAB} = Number of fatal, severe, and minor injury crashes

C_{KAB} = Average cost of fatal, severe, and minor injury crashes

N_{CO} = Number of possible injury and property damage only crashes

C_{CO} = Average cost of possible injury and property damage only crashes

Benefit / Cost Score

SHIFT 2020 Formula Update

- New SBF estimates will be more reflective of Crash Reduction
- In some cases the 2018 SBFs were overestimating Safety Benefit
 - e.g. Improvement Type 2 lane to 4 lane divided –Rural, used an SBF of 55, the CMF for KY is 0.64 which converts to an SBF of 36.
- In some cases the 2018 SBFs were underestimating Safety Benefit
 - e.g. Improvement Type Install Two-Way Left Turn Lane used an SBF of 20, the CMF for KY is 0.72 which converts to an SBF of 28.
- Propose to add 3-4 new improvement types to cover variance in SBF estimates
- Update project type definitions

Benefit / Cost Score

New Improvement Types

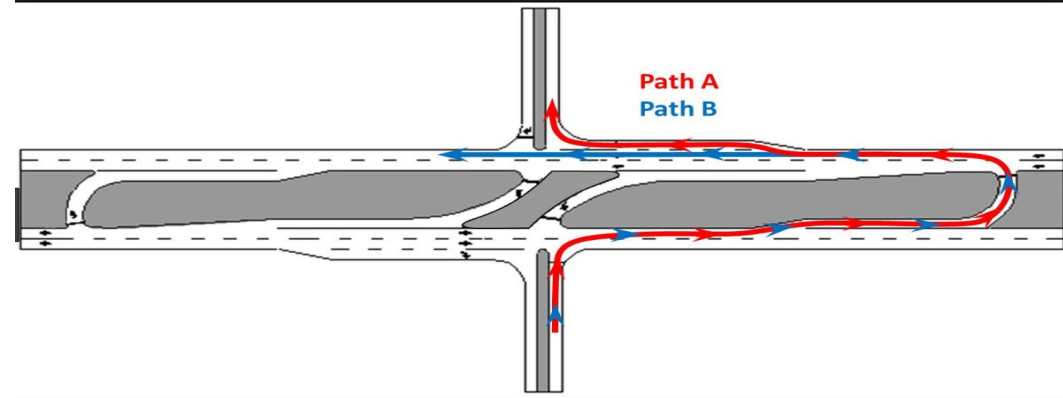
- **Create a new Improvement type: Improve Railroad Crossing**
 - This will separate basic railroad projects from grade separation railroad projects
 - Improve Railroad Crossing will have an SBF of 55
 - Grade Separation of Highway/Railroad Crossing will keep previous SBF of 90



Benefit / Cost Score

New Improvement Types

- Create a new Improvement type: Innovative Intersections
 - Projects looking to employ an Innovative intersection such as a roundabout or J Turn
 - Innovative Intersections have lower CMFs (i.e. Higher SBFs) than basic intersection improvements such as turn lane additions.



Benefit / Cost Score

New Improvement Types

- **Create a new Improvement type: Innovative Interchange**
 - Projects looking to employ an Innovative interchange such as a Diverging Diamond or SPUI
 - Innovative Interchanges have lower CMFs (i.e. Higher SBFs) than basic interchange improvements such as lengthening acceleration/deceleration ramps.



Benefit / Cost Score

New Improvement Types

- **Create a new Improvement type: Bike and Pedestrian Facilities**
 - In 2018 Shift the only applicable improvement type was called **Other Improvement Types**, which had an SBF of 0.
 - **New Bike/Ped SBF = 13**
 - **Will help bike and pedestrian related projects that previously received no safety benefit score.**



Benefit / Cost Score

Other Thoughts

- **Try to incorporate logic checks into data entry**

Examples:

- If project is grade separation of railroad but project costs is \$100,000... This cost is not reflect of such a project
- If project type is grade separation but length is 2 miles... this length is not reflective of such a project
- **Can the project description be checked against the improvement type?**
 - If innovative intersection is chosen as improvement type but the project description does not contain the terms: innovative, roundabout, j turn, RCUT, MUT, Green T, quadrant, jug handle, etc... could we flag this for follow up?

Team Members



**Travel
Time
Savings**

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- Jay Balaji
- Justin Harrod
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**Safety
Benefit**

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**Project
Cost**

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