

Table D.1 - Evaluation Measures

Criterion	Measure	Units of Measurement / Scale	most preferred level	least preferred level
Accessibility During Construction				
	Access to South Whiskey Island (3)	complexity to maintain	low	high
Cost, Total				
	Project Cost (4)	millions of dollars	40	180
	Long Term O&M Cost (5)	thousands of dollars	850	9,000
Design Considerations				
	Aesthetics	opportunity for aesthetic enhancement	high	low
	Bridge Design	complexity	low	very high
	Geotechnical Design	complexity	low	high
	Roadway Geometry (6)	deviation from design criteria	exceeded	minimum met
	Site Security (7)	Complexity to provide	low	high
Environmental Impact				
	Air Quality	change		
	Ecological Resources: bat habitat	acres		
	Ecological Resources: streams	linear feet		
	Ecological Resources: wetlands	acres		
	Environmental Justice (8)	Residents of underserved populations affected	low	high
	Historic and Architectural Resources	impact on Coast Guard Station	no	yes
	Noise (9)	Residents within 400 ft offset	low	High
	Regulated Materials (10)	parcels with RM impact	0	3
	Recreational Facilities	acres of Wendy Park impacted		
Implementation Schedule				
	Improvement Implementation (11)	complexity	low	very high
Life Expectancy of Alternative				
	Design Life	years	100	25
Major Area Industrial Businesses Impact				
	Operations and Efficiency (12)	post construction operations efficiency	unchanged, unchanged, unchanged	decreased, decreased, decreased
Multi Modal Transportation Access (1)				
	Bike and Pedestrian (13)	provided	yes	no
	Rail	impact		
	Vehicular and Maritime (14)	potential delay	low	high

Criterion	Measure	Units of Measurement / Scale	most preferred level	least preferred level
Railroad Impact				
	Acceptance by Norfolk Southern	approval	yes	no
Safety (2)				
	Conflict Points, Truck Traffic	change from current conditions	improved	Unchanged
Stakeholder Considerations				
	Economic Development (15)	opportunity	high	Low

Red – These were deemed non-negotiable. They were treated as pre-screening criteria for the proposed alternatives. Any alternative which rated “yes” on the measure “Impact on Coast Guard Station”, rated “no” on “providing bike and pedestrian access” or rated “no” on the measure “Acceptance by Norfolk Southern” were not included in the MCDA evaluation.

Purple – These had identical ratings on each of the five alternatives under consideration. As a result, these measures do not affect the ranking of the alternatives and, for simplification, were eliminated from the analysis.

- (1) Once alternative is in place, degree to which it provides access in and around South Whiskey Island for vehicles, pedestrians, bikes, rail and maritime.
- (2) Movements/Conflict Points and Trucks through Neighborhoods, including Lakeview Terrace and the mixed-use area to the northeast (Mulberry Avenue, Center Street and Elm Avenue from the Shoreway to River Road), where there are businesses/pedestrians and a possibility of residences being added in the future. Includes all modes of transportation.
- (3) Includes all modes of transportation.
- (4) Includes Construction, Preliminary Engineering, Construction Engineering, Right of Way Acquisition, Utility Relocation and inflation (assuming construction in 2024).
- (5) Present Value assumed 3% inflation and the number of years correspond with the design life. The Future Values for operations and maintenance are assumed to be \$300,000 per year for Alternatives 4, 15, and 16 and \$30,000 for Alternative 36.
- (6) Deviations from design criteria - steep grades, sharp curves.
- (7) Site security considerations include Maritime Security (MARSEC), gates and fencing per US Coast Guard and Department of Homeland Security, and cameras and monitoring at moveable bridge gatehouses.
- (8) Number of residents classified as part of underserved populations within 150 feet of the proposed alternative.
- (9) Number of sensitive receptors (residents) within 400ft of the proposed alternative.
- (10)Asbestos, lead, brownfields, etc. - number of parcels with regulated material (RM) issues impacted.
- (11)Considers permitting, right-of-way acquisition and construction.
- (12)Post Construction operations and efficiency at Cargill, Ontario Stone and CSI (formerly known as Sand Products).
- (13)Access to bike / pedestrians from Centennial Trail to Wendy Park.
- (14)Potential vehicular and maritime delay for ANY stakeholder.
- (15)Opportunities for economic development within the neighborhoods defined as the Detroit Shoreway, Ohio City, Lakeview Terrace and the mixed-use area to the northeast (Mulberry Avenue, Center Street and Elm Avenue from the Shoreway to River Road).

The structure of the alternative evaluation problem, after elimination of measures as explained in the preceding paragraphs, is illustrated next. The overall objective – Best Long-Term Solution for the Willow Avenue Bridge – appears on the left. Goals are represented by rectangles, and the measures selected to evaluate each goal by ovals.

Figure D.1 – Decision Model Hierarchical Structure

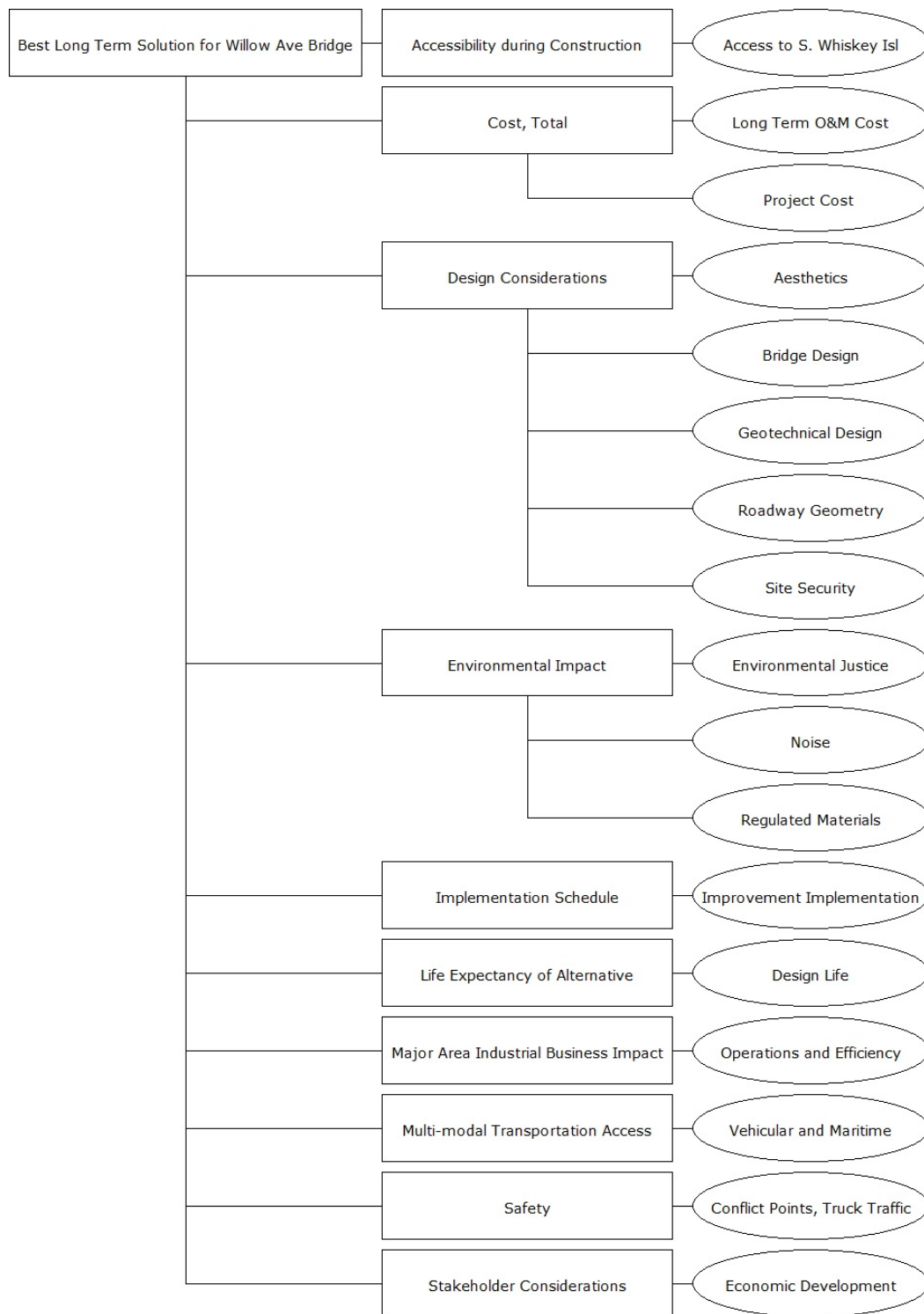


Table D.2 – Ratings of Project Alternatives for Each Measure

Title:	South Whiskey Island Access					
Number of Alternatives	4					
Number of Measures	17					
Criterion	Measure	Units of Measurement / Scale	WILLOW AVE. LIFT BRIDGE REHABILITATION	ADJACENT LIFT BRIDGE	MULBERRY AVE. BASCULE BRIDGE	STATE ST. BRIDGE
Accessibility During Construction	Access to S. Whiskey Island	complexity to maintain	High	Low	Low	Low
Cost, Total	Project Cost	millions of dollars	53.05	166.88	53.24	51.88
	Long Term O&M Cost	thousands of dollars	5223	7719	7719	891
Design Considerations	Aesthetics	opportunity for aesthetic enhancement	Low	Medium	Medium	High
	Bridge Design	complexity	Very High	Very High	Very High	Medium
	Geotechnical Design	complexity	Low	Medium	Medium	High
	Roadway Geometry	deviation from design criteria	Minimum met	Exceeded	Exceeded	Minimum met
	Site Security	Complexity to provide	Medium	Medium	Medium	Low
Environmental Impact	Environmental Justice	residents of underserved populations affected	High	High	High	Medium
	Noise	residents within 400 ft offset	High	High	High	Medium
	Regulated Materials	parcels with RM impact	0	0	1	2
Implementation Schedule	Improvement implementation	complexity	Low	Very High	High	Medium
Life Expectancy of Alternative	Design Life	years	25	50	50	75
Major Area Industrial Businesses Impact	Operations and Efficiency	post construction operations efficiency	unchanged, unchanged, unchanged	unchanged, unchanged, unchanged	slightly decreased, decreased, slightly decreased	decreased, decreased, decreased
Multi Modal Transportation Access	Vehicular and Maritime	potential delay	High	High	High	Low
Safety	Conflict points, Truck traffic	change from current conditions	Unchanged	Unchanged	Unchanged	Slightly improved
Stakeholder Considerations	Economic Development	opportunity	Low	Low	Low	Medium

Utility Functions

- 1. Accessibility During Construction
 - 1.1 Access to South Whiskey Island



Figure D.1: Satisfaction histogram for Access to South Whiskey Island

- 2. Cost, Total
 - 2.1 Project Cost

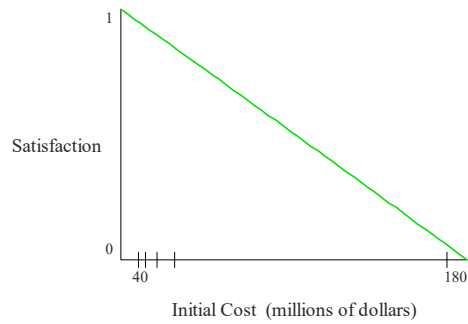


Figure D.2: Utility function for Project Cost

- 2.2 Long Term O&M Cost

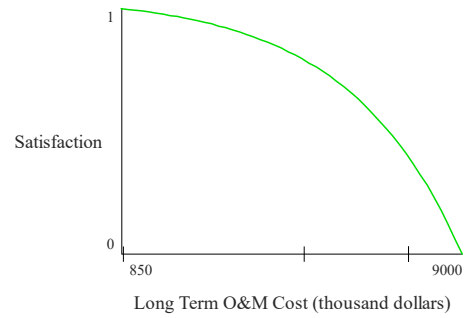
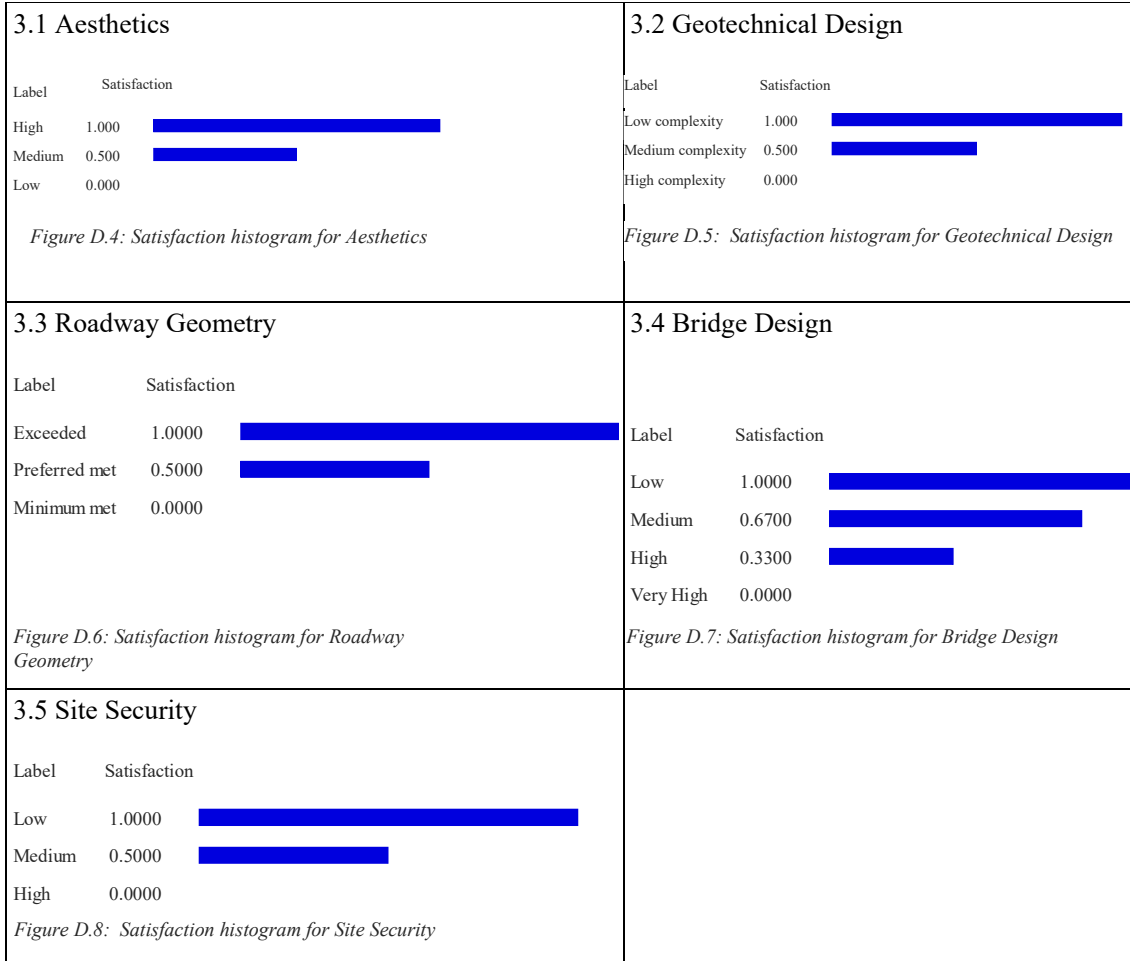
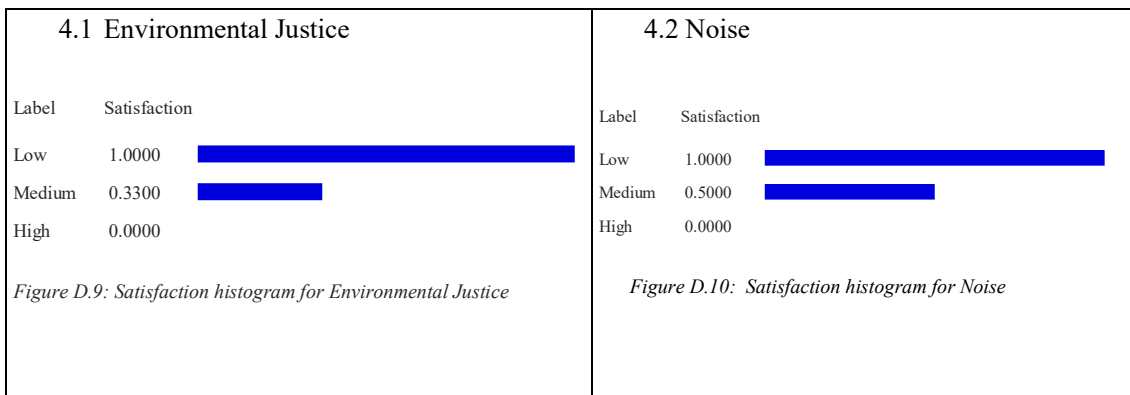


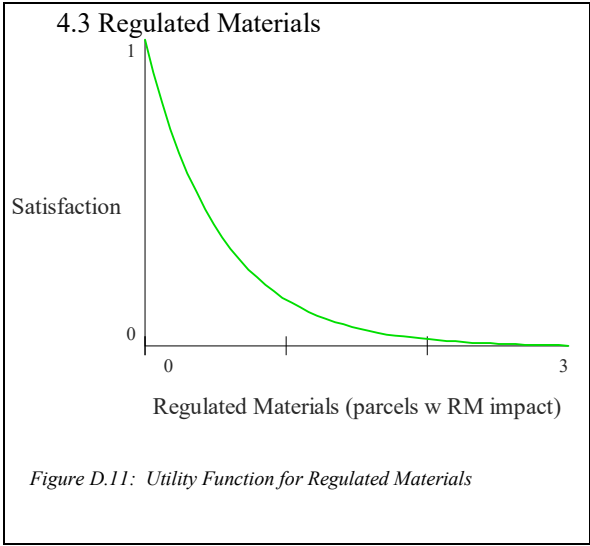
Figure D.3: Utility function for Long Term Operations and Maintenance Cost

3. Design Considerations



4. Environmental Impact





5. Implementation Schedule

5.1 Improvement Implementation

Label	Satisfaction
Low	1.0000
Medium	0.6667
High	0.3333
Very High	0.0000

Figure D.12: Satisfaction histogram for Improvement Implementation

6. Life Expectancy of Alternative

6.1 Design Life

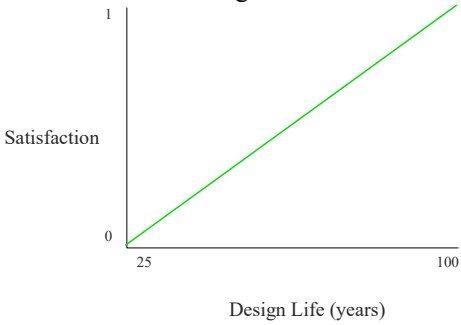


Figure D.13: Utility Function for Design Life

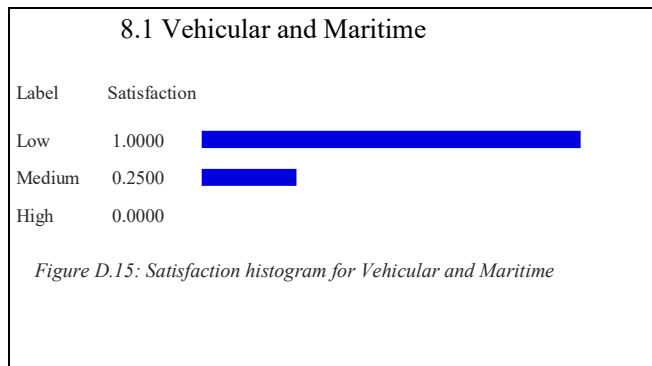
7. Major Area Industrial Businesses Access

7.1 Operations and Efficiency

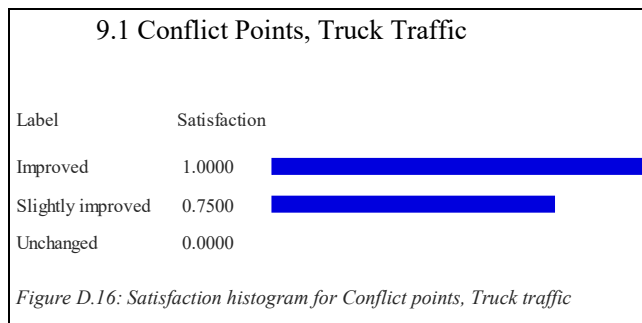
Label	Satisfaction
unchanged, unchanged, unchanged	1.0000
unchanged, unchanged, slightly decreased	0.8800
unchanged, slightly decreased, slightly decreased	0.7700
slightly decreased, slightly decreased, slightly decreased	0.6600
unchanged, unchanged, decreased	0.5500
unchanged, slightly decreased, decreased	0.4400
unchanged, decreased, decreased	0.3300
slightly decreased, slightly decreased, decreased	0.2200
slightly decreased, decreased, decreased	0.1100
decreased, decreased, decreased	0.0000

Figure D.14: Satisfaction histogram for Operations and Efficiency

8. Multi-Modal Transportation Access



9. Safety



10. Stakeholders Considerations

