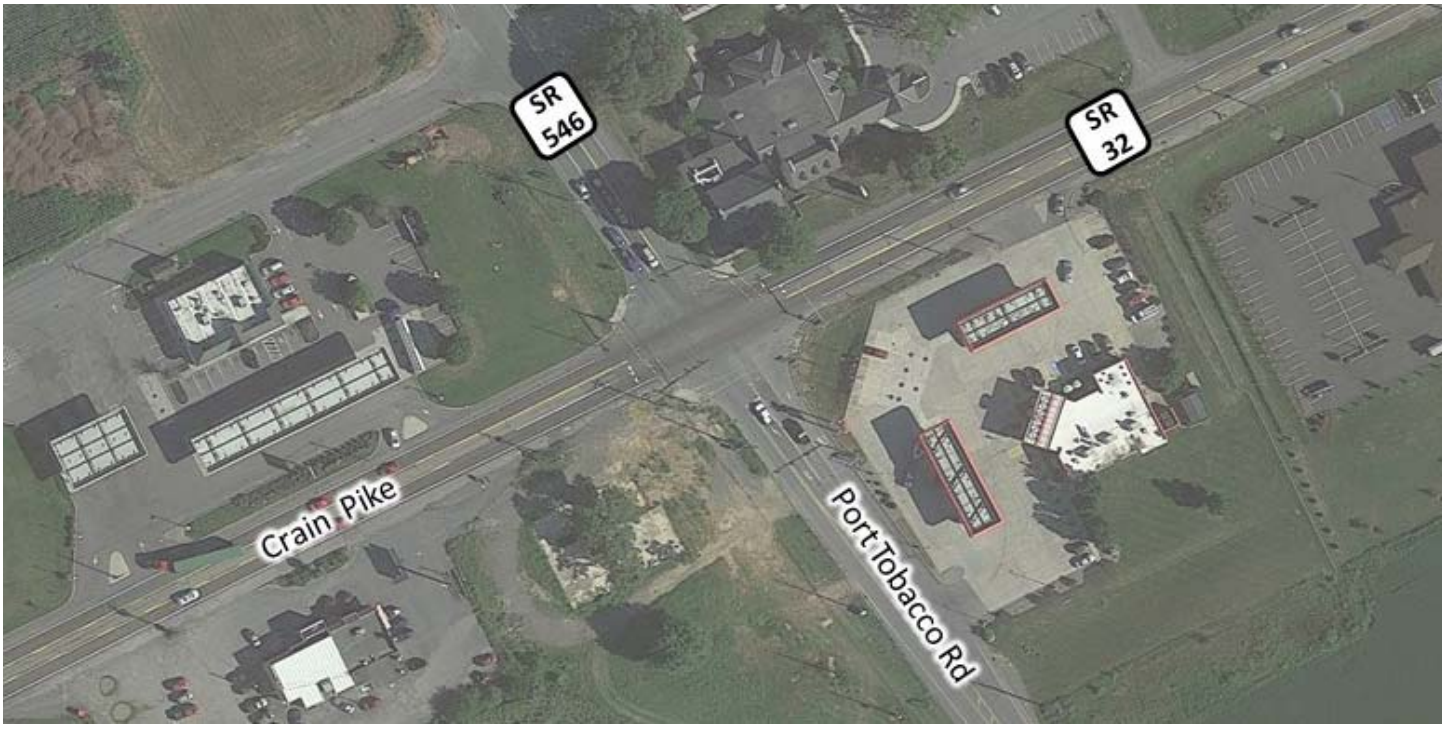
PENNDOT INTERSECTION CONTROL EVALUATION (ICE) POLICY CASE STUDY #4

PROJECT LOCATION



EXECUTIVE SUMMARY

Case Study #4 highlights the evaluation of an existing signalized intersection facing capacity issues. The purpose of the case study is to demonstrate a case where a multilane roundabout is implemented.

PROJECT DESCRIPTION

SR 32 corridor improvements have been long sought by York County's business and political leaders, who claimed that the lack of a good connection between Commerce City and Interstate 81 has hampered the region's economic growth. The intersection of SR 32 (Crain Pike) and SR 546 (Port Tobacco Road) has been a site of several injury crashes and is notorious for traffic jams. Crain Pike carries over 27,000 vehicles daily, and Port Tobacco Road carries over 5,000 vehicles daily in the vicinity of the study area. A recent operational analysis indicates the intersection currently operates at capacity with long eastbound and westbound queues during p.m. peak hour. With short storage lengths and only permissive phasing on Crain Pike, eastbound and westbound left-turns have queues spill back to block through traffic and create substantial delays on mainline approaches. The purpose of this project is to analyze potential mitigation strategies to help increase capacity and improve the intersection operation.

CONDUCTING AN ICE

The preliminary analyses indicate that many of the intersection control strategies would not be suitable for the two-lane, undivided segment of SR 32 at this intersection.

The feasible control strategies include:

- Roundabout
- Traffic Signal (***existing***)

Given the nature of the intersection, preliminary analyses shows signalized control (with added lanes) and a roundabout are the most viable control strategies. Without an operational analysis for the signal strategy, it is unknown which is preferred based upon delay, safety, right-of-way needs, and cost. Further analysis is warranted.

Stage 2 analysis was conducted by PennDOT's on-call consultants. The operational analyses indicate that a multi-lane roundabout outperforms traffic signal under existing and future anticipated traffic conditions. The roundabout was also projected to produce the greatest safety B/C ratio based on the results from the PennDOT HSM Analysis Tool. Replacing the intersection with a multi-lane roundabout will dramatically reduce the most serious types of crashes by forcing traffic to slow down and limiting the conflict points. The addition of left-turn lanes and protected-permissive phasing on SR 32 was estimated to cost less than the roundabout but still required property takes and utility relocations. As such, roundabout is recommended as the control strategy to be advanced. The recommendation was approved by the District 8 DTE.

Project Location: Fleetwood
County: Berks
PennDOT District: District 8
Project Type: Congestion Mitigation Project
Project Setting: Suburban
Existing Intersection Control: Signalized
Outcome: Multi-lane Roundabout
Stages: 2

Pennsylvania Department of Transportation
Intersection Control Evaluation (ICE) Form
Stage I: Screening

To fulfill the requirements of Stage 1 (Screening) of PennDOT's ICE procedures, complete the following form and append all supporting documentation. Completed forms can be submitted to the District Traffic Engineer (DTE) for the project's location.

Project Information

Project Name	Case Study #4	Project Setting	Suburban	Project ICE Reference Number	XXXX-XXXX
Submitted By	XXX	Agency/Company	PennDOT	Email	XXXX.XXXX@state.pa.us
Project Purpose and Goals (*What is the catalyst for this project and what are the intended outcomes?*)	The SR 32 overhaul has been long sought by Berks County's business and political leaders, who claimed that the lack of a good connection between the Reading area and Interstate 65 has hampered the region's economic growth. The intersection of SR 32 (Crain Pike) and SR 652 (Port Tobacco Road) has been a site of several injury crashes and is notorious for traffic jams. A recent operational analysis indicates the intersection currently operates at level-of-service (LOS) "F" during the weekday p.m. peak period, primarily as a result of the delay incurred on mainline approaches. With short storage lengths and only permissive phasing on Allentown Pike, eastbound and westbound left-turns have queues spillback to block through traffic and create substantial delays on mainline approaches. The purpose of this project is to analyze potential mitigation strategies to help increase capacity and improve the intersection operation, while maintaining access and mobility for pedestrian and bicyclists in the vicinity.				
Project Setting Description (*Describe the area surrounding the intersection*)	The SR 32 (Crain Pike)/SR 652 (Port Tobacco Road) intersection is located in Fleetwood. Curb-and-gutter line all four quadrants of the intersection with no sidewalks access to adjacent roadways.				
County	Berks	Project Locality (Township/Borough/City)	Fleetwood		
PennDOT District	District 5	Project Type (select most appropriate)	Congestion Mitigation Project		
Multimodal Context (*Describe pedestrian, bicycle, and transit activity in the area and the potential for activity based on surrounding land uses and development pattern*)	There are pedestrian crosswalks at all approaches of the intersection. No bicycle infrastructure is present in the immediate vicinity. Existing pedestrian and bicyclist volumes at the study intersection are low to nonexistent. No transit routes operate in the vicinity of the study intersection.				

Basic Intersection Information

Major Street

Major Street Route Number(s)	32	Major Street Route Name(s)	Crain Pike			SR Segment #	120	SR Offset	0
Primary Functional Classification	Minor Arterial	Secondary Functional Class. (if app.)				Existing AADT	27,350	Existing Control	Signalized
Major Street Ownership	PennDOT			Sidewalks are present along:	Neither side of the roadway				
Crosswalks? ☑	On-Street Bike Facilities? ☐	Multi-Use Path? ☐		Scheduled Bus Service? ☐		Bus stop at intersection? ☐			

Approach #1	Number of Lanes (Count Shared Lanes as Through):	Left-Turn		Through	1	Right-Turn		
	AM Peak Hour Traffic Volumes:	Left-Turn	110	Through	879	Right-Turn	108	
	PM Peak Hour Traffic Volumes:	Left-Turn	126	Through	925	Right-Turn	120	
Approach #2	Number of Lanes (Count Shared Lanes as Through):	Left-Turn		Through	1	Right-Turn		
	AM Peak Hour Traffic Volumes:	Left-Turn	105	Through	654	Right-Turn	144	
	PM Peak Hour Traffic Volumes:	Left-Turn	150	Through	756	Right-Turn	135	

Minor Street

Existing ☑ New ☐

Minor Street Route Number(s)	652	Minor Street Route Name(s)	Port Tobacco Road			SR Segment #	50	SR Offset	0
Primary Functional Classification	Urban Collector	Secondary Functional Class. (if app.)	Local Road			Existing AADT (if available)		5,650	
Minor Street Ownership	PennDOT			Sidewalks are present along:	Neither side of the roadway				
Crosswalks? ☐	On-Street Bike Facilities? ☐	Multi-Use Path? ☐		Scheduled Bus Service? ☐		Bus stop at intersection? ☐			

Approach #1	Number of Lanes (Count Shared Lanes as Through):	Left-Turn		Through	1	Right-Turn		
	AM Peak Hour Traffic Volumes:	Left-Turn	64	Through	152	Right-Turn	32	
	PM Peak Hour Traffic Volumes:	Left-Turn	75	Through	150	Right-Turn	25	
Approach #2	Number of Lanes (Count Shared Lanes as Through):	Left-Turn		Through	1	Right-Turn		
	AM Peak Hour Traffic Volumes:	Left-Turn	47	Through	122	Right-Turn	43	
	PM Peak Hour Traffic Volumes:	Left-Turn	50	Through	185	Right-Turn	60	
Approach #3	Number of Lanes (Count Shared Lanes as Through):	Left-Turn		Through		Right-Turn		
	AM Peak Hour Traffic Volumes:	Left-Turn		Through		Right-Turn		
	PM Peak Hour Traffic Volumes:	Left-Turn		Through		Right-Turn		

Crash History (Existing Intersections Only)

Append the most recent five-years of crash data for the intersection from the CDART. If the crash data evidences any issues relating to safety performance, discuss briefly here:

No crash history available in CDART.

Screening Evaluation

Provide a brief justification as to why each of the following control strategies should be advanced or not. Justification should consider potential environmental impacts.

Note: FHWA's CAP-X tool is helpful for assessing the viability of alternative intersection forms.

Control Strategy	Strategy Viable?	Justification	Strategy to be Advanced?
Two-way Stop-Controlled	No	The existing intersection is signalized. Converting the minor street approaches to stop-controlled would cause unnecessary increases to delay to northbound and southbound vehicles on Port Tobacco Road, and queuing would likely spill back to the upstream intersections.	No
All-way Stop-Controlled	No	The existing signalized intersection experiences long queues during the peak periods. Converting the intersection to all-way stop-controlled would likely increase the delays experienced by all vehicles at the intersection.	No
Signalized Control	Yes	Traffic signal remains a viable control strategy. Signal re-timing and alternative lane configurations would improve intersection operation. Further analysis should be conducted to evaluate potential modification strategies.	Yes
Roundabout	Yes	A roundabout would potentially help reduce delays incurred on the mainline approaches and enhance the safety performance of the intersection. The footprint required to accommodate this control strategy would have some impacts to the surrounding commercial properties and pedestrian infrastructure.	Yes
Median U-Turn	No	Developing the median required for a median U-turn would not be realistic given the density of the surrounding land uses, nor would it solve the operational issues present at the existing signalized intersection.	No
Restricted Crossing U-Turn (RCUT) Signalized	No	Developing the median required for a signalized RCUT would not be realistic given the density of the surrounding land uses, nor would it solve the operational issues present at the existing signalized intersection.	No
Restricted Crossing U-Turn (RCUT) Unsignalized	No	Developing the median required for an unsignalized RCUT would not be realistic given the density of the surrounding land uses, nor would it solve the operational issues present at the existing signalized intersection.	No

Jughandle	No	Constructing a jughandle ramp would have substantial impacts to the surrounding commercial properties.	No
Displaced Left-Turn	No	The infrastructure required to develop a displaced left-turn would have substantial impacts to the surrounding commercial properties and would increase the required number of crossings for pedestrians.	No
Continuous Green Tee	No	This control strategy is not applicable given the study intersection has four approach legs.	No
Quadrant Roadway	No	The construction of a quadrant roadway would have a substantial impact on the adjacent businesses.	No
Other			

Resolution				
To be filled out by PennDOT District Traffic Engineer or designee only.				
Project Determination				
Comments				
DTE or Designee Name *(Type)*		Signature		Date

Pennsylvania Department of Transportation
Intersection Control Evaluation (ICE) Form
Stage 2: Initial Control Strategy Assessment

To fulfill the requirements of Stage 2 (Intersection Control Strategy) of PennDOT's ICE procedures, complete the following form and append all supporting documentation. Completed forms can be submitted to the District Traffic Engineer (DTE) for the project's location.

Project Information

Project Name	Case Study #4	Project ICE Reference Number	XXXX-XXXX
Submitted By	XXX	Agency/Company	PennDOT	Email	XXXX.XXXX@state.pa.us

List all viable intersection control strategies identified in Phase 1 (Screening):

Signalized Control	Roundabout	

Operational Analysis

Summarize the results of the peak hour analysis performed for each control strategy. Select analysis year based on guidance in the ICE procedures document.

Overall Intersection Performance

Opening Year

Control Strategy	Analysis Year: 2017 — Peak Hour Analyzed: Weekday AM Peak — LOS	V/C	Delay (sec.)	All queues accommodated?	Peak Hour Analyzed: Weekday PM Peak — LOS	V/C	Delay (sec.)	All queues accommodated?
Signalized Control	B	0.74	15.1	Yes	C	1.00	25.6	No
Roundabout	B	0.61	10.7	Yes	B	0.72	14.0	Yes

Design Year

Control Strategy	Analysis Year: 2037 — Peak Hour Analyzed: Weekday AM Peak — LOS	V/C	Delay (sec.)	All queues accommodated?	Peak Hour Analyzed: Weekday PM Peak — LOS	V/C	Delay (sec.)	All queues accommodated?
Signalized Control	C	0.84	21.7	Yes	F	2.22	86.2	No
Roundabout	B	0.70	13.5	Yes	C	0.91	23.9	Yes

Provide any additional discussion necessary regarding the results of the operational analysis:

A multi-lane roundabout operates acceptably under year 2017 traffic volumes and can accommodate future design year growth.

Costs

Remaining cognizant of the current level of detail of each control strategy's conceptual design, provide a cost estimate for each. You may want to account for preliminary engineering, required right-of-way acquisitions, construction, and a contingency.

Control Strategy	Cost ($)	Estimate Includes:	Control Strategy	Cost ($)	Estimate Includes:
Signalized Control	$0	PE, ROW, Construction, Contingency			
Roundabout	$750,000	PE, ROW, & Construction			

Safety Performance

Apply the PennDOT HSM Analysis Tool and provide the "Safety B/C" ratio provided by the tool's output. You may wish to append the complete output to this form. For intersection types not accommodated in the tool, manually apply crash modification factors detailed in the ICE policy document or qualitatively describe safety impacts.

Control Strategy	Anticipated Impact on Safety Performance	Predicted Total Crashes	Predicted Fatal & Injury Crashes	Safety B/C
Signalized Control	No anticipated changes to safety performance.	4.31	2.68	1.00
Roundabout	Installing a roundabout would reduce the number and severity of conflict points, as well as promote lower speeds through the intersection. As a result, the number of high severity angle crashes would be anticipated to be reduced.	2.42	1.50	8.57

Multimodal Accommodations

Note the existing/anticipated level of pedestrian/bicyclist activity at the study intersection during the peak hours of the typical day.

	AM Peak Hour		PM Peak Hour	
	Major Street	**Minor Street**	**Major Street**	**Minor Street**
# of ped. crossings (both approaches, if app.):	0	0	0	0
# of bicyclists (both approaches, if app.):	0	0	0	0

Summarize the ability of each viable control strategy to accommodate the existing/anticipated level of:

Control Strategy	Pedestrians and Bicycles	Transit Services	Freight Needs
Signalized Control	Traffic signal includes phasing for pedestrian and bicyclist crossings, the low level of bike/ped volumes can easily	No existing or anticipated transit services in site vicinity.	A WB 67 is accommodate under the existing configuration
Roundabout	Pedestrian crossings would be located across the legs of the roundabout, which limits crossing distances to a single lane.	No existing or anticipated transit services in site vicinity.	A WB 67 is accommodate under the proposed roundabout design

Environmental, Utility, and Right-of-Way Impacts	
Summarize any issues related to environmental, utility, or right-of-way (to include relocations) impacts specific to each control strategy.	
Signalized Control	None. This is the existing control strategy, and no improvements would be required.
Roundabout	Given the large footprint of the existing intersection, a roundabout could be designed on the existing footprint with minor acquisitions of ROW.

Public Input/Feedback	
Summarize public input received or any stakeholder considerations regarding the control strategies:	Feedback from public and political side expressed interest in replacing the SR 32 and SR 652 intersection with a roundabout. A roundabout will keep traffic moving rather than forcing it to stop for periods of time (like a traffic light). It could dramatically reduce the most serious types of crashes by forcing traffic to slow down and limiting the points at which vehicles can collide. The public recognizes there's still a lot of apprehension about the roundabouts.

Benefit-Cost Analysis

Apply the PennDOT ICE Tool and provide the "Net Present Value" and "Benefit-Cost Ratio" from the "Output" tab for each control strategy. The "Benefit-Cost Ratio" is only applicable for improvements to an existing intersection.

Control Strategy	Net Present Value	Benefit-Cost Ratio
Signalized Control	$55,086,244	-
Roundabout	$20,978,651	51.62

Control Strategy Evaluation

Provide a brief justification as to why each of the following is either viable or not viable. If a single control strategy is recommended, select it as the only control strategy to be advanced.

Control Strategy	Strategy Viable?	Justification	Strategy to be Advanced?
Signalized Control	No	A traffic signal will not operate acceptably under future design year traffic volumes.	No
Roundabout	Yes	The installation of a multi-lane roundabout provides the greatest anticipated reduction to crashes at the intersection. Public and political staff expressed interest in a roundabout as a means of controlling vehicle speeds. The operational analysis indicates a roundabout is anticipated to operate acceptably under both existing and future conditions.	Yes

Resolution

To be filled out by PennDOT District Traffic Engineer or designee only

Project Determination	Identified Control Strategy Approved		
Comments			
DTE or Designee Name		Signature	Date