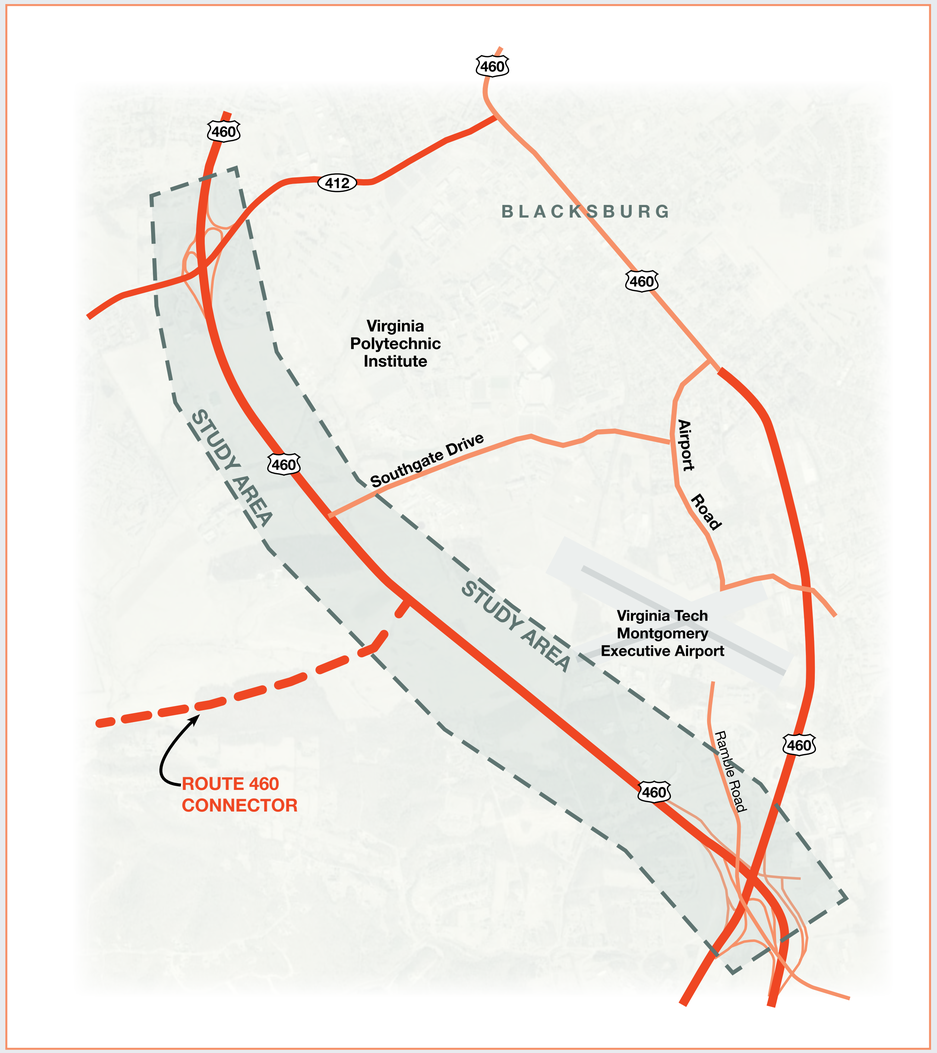
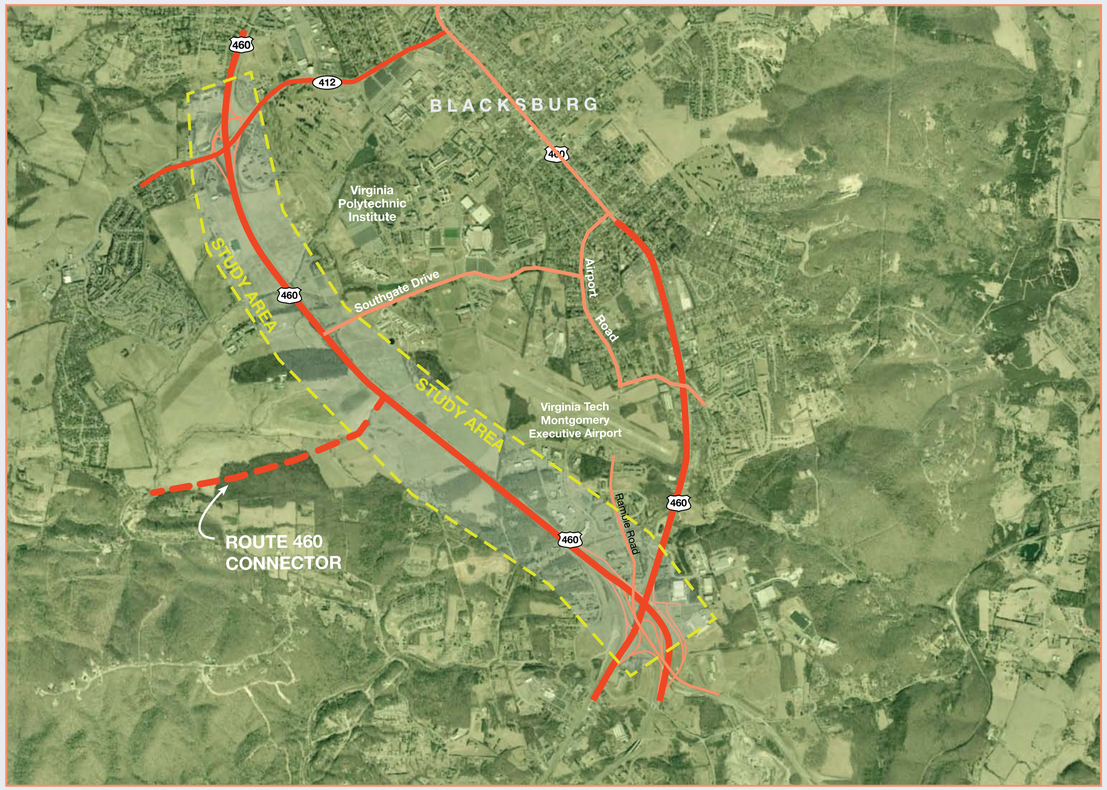


Southgate Drive currently intersects with the predominantly grade-separated US Route 460 Bypass at an at-grade intersection. As shown in the map, access on the US Route 460 Bypass both to the south (at South Main Street/US Route 460 Business) and to the north (at Prices Fork Road) takes place at grade-separated interchanges. The at-grade configuration at Southgate Drive creates potential congestion and safety issues and also limits regional accessibility to existing and proposed traffic generators such as Virginia Tech, the Corporate Research Center, and the Virginia Tech Montgomery Executive Airport. Constructing an interchange at Southgate Drive is a regional transportation priority and is included in the region's currently adopted transportation plan (*Blacksburg/ Christiansburg/ Montgomery Area 2030 Transportation Plan*).

The Southgate Drive interchange is proposed to be constructed south of the current Southgate Drive at-grade intersection and to ultimately tie into the proposed Route 460 Connector. The Route 460 Connector (which is fully documented in the April 2008 *Route 460 Connector Corridor Study*) is proposed to extend from the US Route 460 Bypass westward and tie into Prices Fork Road south of the community of Prices Fork.

STUDY BACKGROUND AND PURPOSE

This study is being performed to identify the best configuration for a new interchange at relocated Southgate Drive and US Route 460 Bypass. The interchange would also provide connections to the proposed Route 460 Connector and to proposed roadway improvements to facilitate access to Virginia Tech, the airport, and the Corporate Research Center (including relocating Tech Center Drive). This study included:

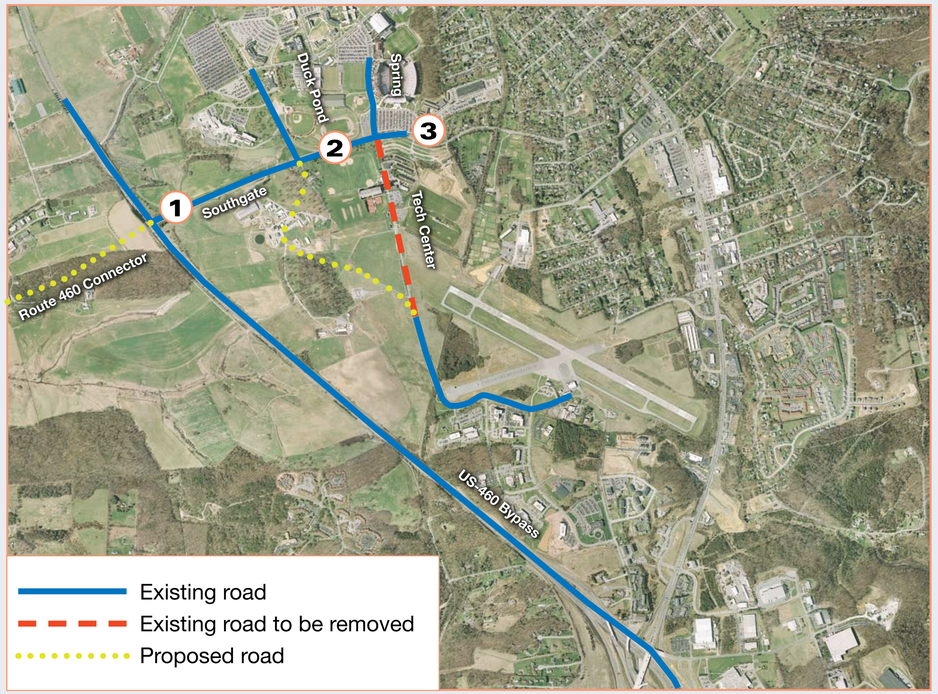


- Traffic counts and field reviews
- Development of traffic forecasts to the year 2040
- Development of preliminary and refined alternatives
- Analysis of the traffic and safety operations of the alternatives
- Consideration of impacts of the alternatives on adjacent interchanges on US Route 460 Bypass and on Southgate Drive and Southgate Drive Relocated
- Consideration of the impacts of alternatives on bicycle and pedestrian travel
- Garnering input from the public on the alternatives
- Selection of a recommended alternative

Thank you for attending this meeting. Your input is important to the process in terms of identifying issues and concerns and to assist the study team and local officials in proposing the best solution to carry forward for further consideration and study. Members of the study team are available at this meeting to answer questions and take your comments.

CURRENT/PLANNED ROADWAY GEOMETRY

BASELINE ROADWAY CONFIGURATION

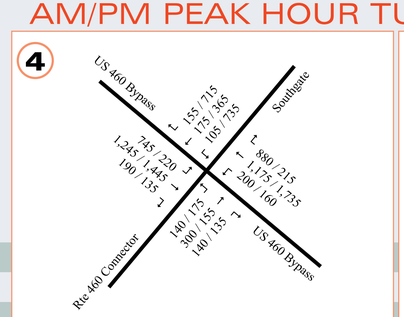


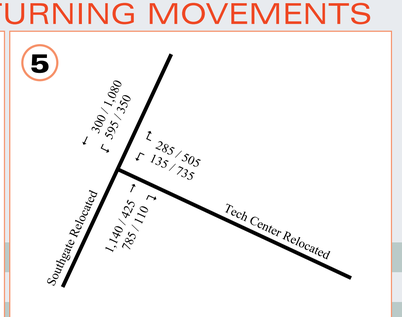
LOCATION	DESCRIPTION	AM/PM LEVEL OF SERVICE 2010 (EXISTING CONFIGURATION)	AM/PM LEVEL OF SERVICE 2040 (BASELINE CONFIGURATION)
1	US 460 Bypass and Southgate	B/C	F/F
2	Intersection of Southgate and Duck Pond (existing) or Southgate and Duck Pond and Tech Center (future)	C/E	E/F
3	Intersection of Southgate and Spring/Tech Center (existing) or Southgate and Spring (future)	B/C	C/B

This study assumes that certain roadway improvements and land uses will be in place by the year 2040 or before, and the improvements being assessed would tie into and work integrally with these other plans. From a land use standpoint, Phase II of the Corporate Research Center is anticipated to be open and occupied, and the proposed improvements to the Virginia Tech Montgomery Executive Airport (including the runway extension and roadway relocations) would be implemented. Assumed roadway improvements in the future Baseline scenario (shown in the map above) include the relocation of Tech Center Drive, which currently intersects Southgate Drive at Spring Road, to accommodate the runway extension, to tie in to Southgate Drive at its intersection with Duck Pond Road. The study also assumes that the previously studied Route 460 Connector will intersect with the US Route 460 Bypass at its intersection with Southgate Drive.

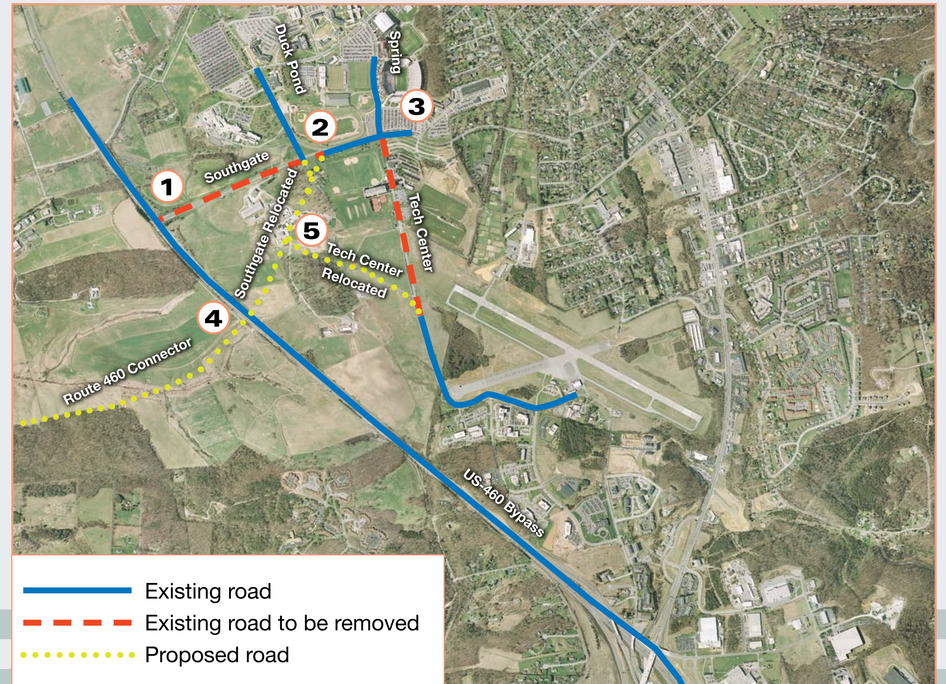
The map to the right (Proposed Roadway Configuration) shows modifications to the baseline scenario, including relocating Southgate Drive to the south of the existing intersection and constructing its access to US Route 460 Bypass as a grade-separated interchange, modifying Tech Center Drive Relocated so that it ties into the relocated Southgate Drive (as a T-intersection), and shifting the location of the proposed Route 460 Connector so that it also ties into the relocated Southgate Drive. Projected year 2040 traffic (turning movements) are shown in the diagram to the right.

YEAR 2040 FORECAST
AM/PM PEAK HOUR TURNING MOVEMENTS



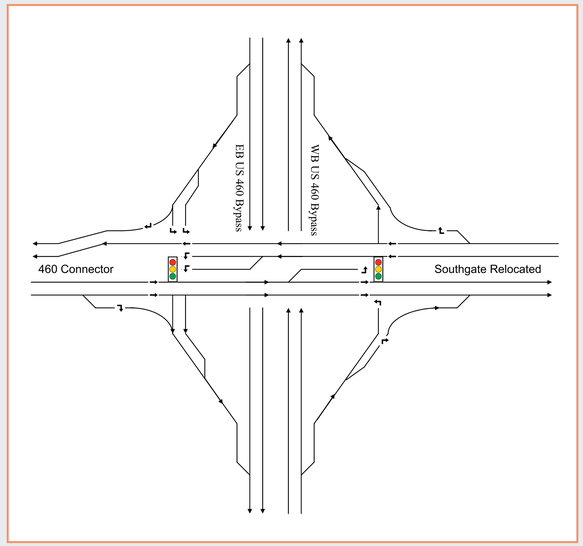


PROPOSED ROADWAY CONFIGURATION



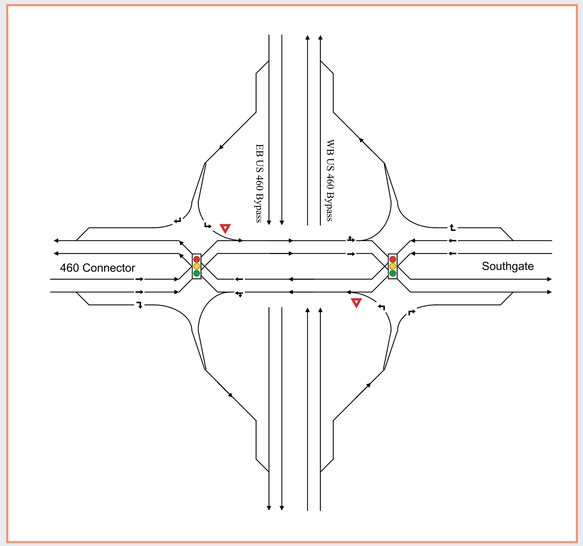
SUMMARY OF ALTERNATIVES

ALTERNATIVE 1
STANDARD DIAMOND INTERCHANGE



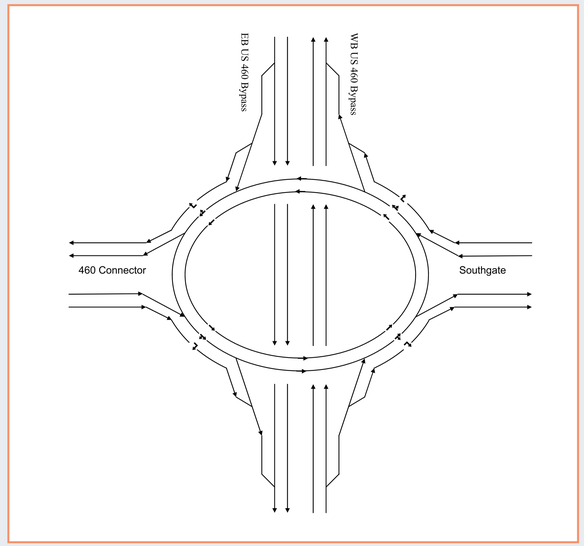
Standard diamond interchange design with a single ramp from and to each direction of the highway. Signalized intersections at each ramp terminus split access between the cross-street and the exit ramps. Estimated construction cost (2010 dollars, does not include rights-of-way): $20.1 million*

ALTERNATIVE 2
DIVERGING DIAMOND INTERCHANGE



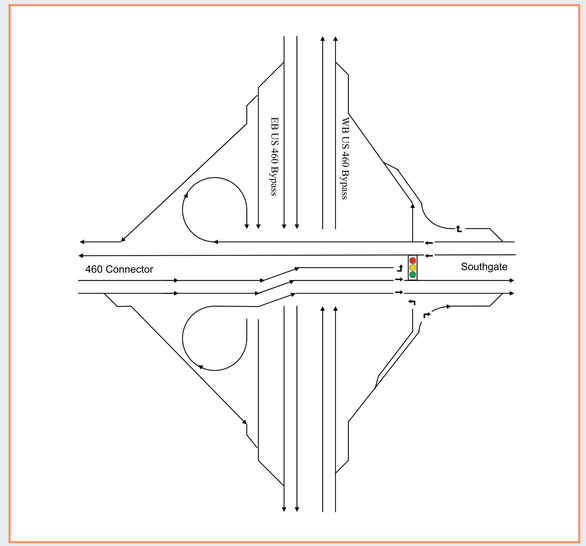
Adaptation of standard diamond interchange design where signalized intersections include a cross-over to allow traffic to switch to the left-hand side of the road, where traffic from exit ramps is able to merge without a true “turning movement”. With traffic on the left-hand side, left turns are conducted without conflict onto the Bypass on-ramps. Through traffic crosses back over to the righthand side at the signalized intersection on the opposite side of the diamond. Estimated construction cost (2010 dollars, does not include rights-of-way): $20.1 million*

ALTERNATIVE 3
ROTARY INTERCHANGE



Large oblong driving circle provides access between freeway and cross street without the use of traffic signals, allowing for free-flowing movements inside the rotary. Estimated construction cost (2010 dollars, does not include rights-of-way): $17.6 million*

ALTERNATIVE 4
PARTIAL CLOVERLEAF INTERCHANGE

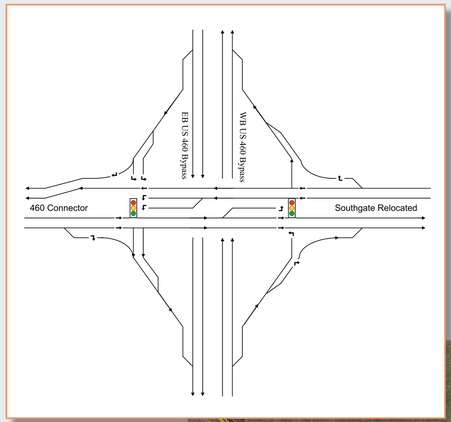


Combination of standard diamond interchange and a cloverleaf interchange provides unsignalized access to and from Eastbound US 460 Bypass, along with signalized treatment and a smaller footprint for ramps associated with WB US 460 Bypass. Estimated construction cost (2010 dollars, does not include rights-of-way): $20.8 million*

** All alternatives assume that a portion of the Route 460 Bypass could be depressed (final determination would be based on more detailed design studies) to allow interchange features to be at or near existing grade.*

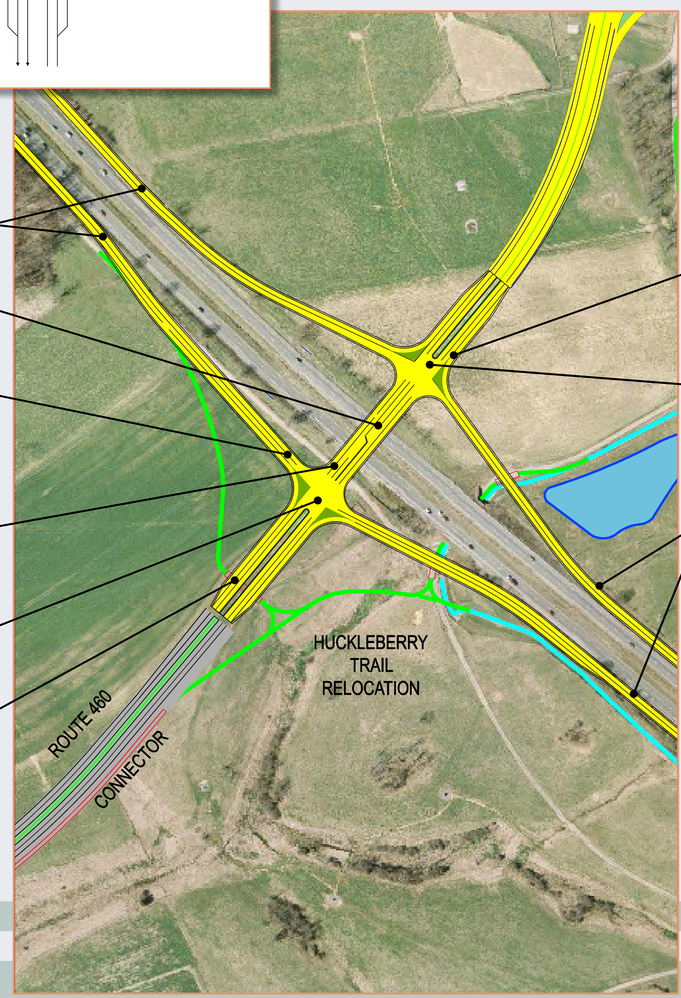
STANDARD DIAMOND INTERCHANGE

ALTERNATIVE 1



Features

- Signalized intersections would be located on both the west and east sides of diamond.
- The bridge over Route 460 Bypass would be five lanes.



Ramps taper to single lane at junction with 460 Bypass

Five lane bridge

Two left turn lanes from eastbound 460 Bypass exit to accommodate morning traffic

Two left turn lanes on southwest-bound Southgate to accommodate evening traffic

Signalized intersection LOS: C/C

Merge section to accommodate free right turn traffic from eastbound 460 Bypass

Merge section required to accommodate free right-turn traffic from westbound 460 Bypass

Signalized intersection LOS: B/B

Ramps taper to single lane at junction with 460 Bypass

Advantages

- This represents a traditional configuration, easily recognized and navigated by drivers.
- The relatively low volume of traffic going through the interchange between relocated Southgate Drive and the Route 460 Connector allows for the majority of signal time in the a.m. peak to be given to the eastbound Route 460 Bypass exit approach which is a heavy left turn movement (725 vehicles).

Disadvantages

- Increased demand beyond that which is forecasted for going through the interchange between relocated Southgate Drive and the Route 460 Connector could result in over-capacity conditions since the signal's operation assumes a large proportion of green time is given to the movement cited above (the left turn from eastbound Route 460 Bypass to Southgate Drive Relocated in the a.m. peak).
- The heavy Southgate Drive Relocated to eastbound Route 460 Bypass movement in p.m. peak requires double left turn lanes, forcing the through movement to the Route 460 Connector to either a single lane or a shared left-through lane plus a dedicated through lane.
- Traffic from westbound Route 460 Bypass going right onto Southgate Drive Relocated should be a free-flow movement in order to avoid potentially long delays that would occur if this traffic needed to go through the traffic signal.
- A minimum of five lanes would be required on the bridge.

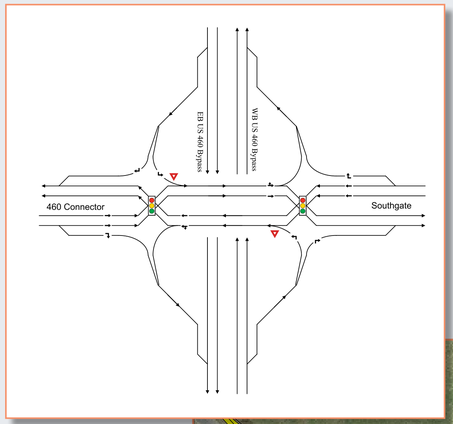
Level of Service (based on Synchro analysis of the two signalized intersections):

- LOS on the western intersection (eastbound Route 460 Bypass exit/entrance) – AM: C, PM: C
- LOS on the eastern intersection (westbound Route 460 Bypass exit/entrance) – AM: B, PM: B

MOVEMENT														
	EB 460 Connector to WB US 460 Bypass	EB 460 Connector to EB Southgate	EB 460 Connector to EB US 460 Bypass	EB US 460 Bypass to EB Southgate	EB US 460 Bypass to EB US 460 Bypass	EB US 460 Bypass to WB 460 Connector	WB Southgate to EB US 460 Bypass	WB Southgate to WB 460 Connector	WB Southgate to WB US 460 Bypass	WB US 460 Bypass to WB 460 Connector	WB US 460 Bypass to WB US 460 Bypass	WB US 460 Bypass to EB Southgate	Average All Vehicles	Average of all movements except through movements on the US 460 Bypass
TRAVEL TIME														
ALTERNATIVE 1 STANDARD DIAMOND	138 / 128	67 / 78	48 / 53	105 / 111	59 / 59	51 / 49	158 / 123	67 / 75	51 / 61	124 / 117	58 / 59	55 / 52	70 / 73	80 / 87
ALTERNATIVE 2 DIVERGING DIAMOND	86 / 78	62 / 86	48 / 49	83 / 80	59 / 59	50 / 48	96 / 78	66 / 58	49 / 51	87 / 85	58 / 59	51 / 48	63 / 62	66 / 65
ALTERNATIVE 3 ROTARY	80 / 80	52 / 52	52 / 53	84 /89	58 / 59	54 / 53	77 / 102	49 / 73	53 / 82	88 / 77	59 / 59	55 / 53	62 / 69	65 / 79
ALTERNATIVE 4 PARTIAL CLOVERLEAF	89 / 80	46 / 52	53 / 53	97 / 90	59 / 59	51 / 42	109 / 102	62 / 73	51 / 70	88 / 77	58 / 59	55 / 53	65 / 68	70 / 76

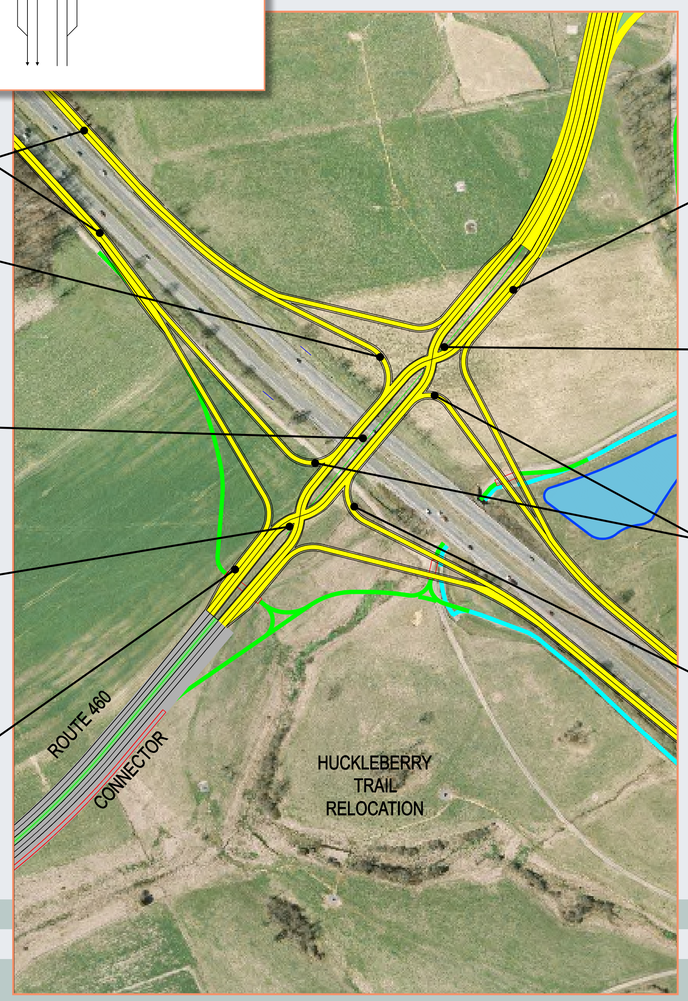
DIVERGING DIAMOND INTERCHANGE

ALTERNATIVE 2



Features

- Provides a significant capacity improvement as compared to standard diamond interchanges because traffic crosses landside (narrowing bridge structure requirements) and traffic turning left onto ramps does not have to stop for oncoming traffic.
- Through movements criss-cross at signals, meaning traffic appears to be driving on the left hand side while crossing the bridge.
- With traffic on the left-hand side, left turns from exit ramps are made through a yield sign in to the traffic stream, (and, as noted above, left turns to Route 460 Bypass entrances have no conflicts).
- Bridge can be four lanes.



Ramps taper to single lane at junction with 460 Bypass

Left-turning traffic destined for westbound 460 Bypass performs turn from left side of bridge, and therefore without conflict

Four lane bridge with traffic driving on the left-hand side

Signalized intersection allowing traffic to cross over to opposite side of the road LOS: A/B

Merge section to accommodate free right turn traffic from eastbound 460 Bypass

Merge section required to accommodate free right-turn traffic from westbound 460 Bypass

Signalized intersection allowing traffic to cross over to opposite side of the road. LOS: B/B

Yield-controlled ramps from 460 Bypass integrates traffic into flow on bridge

As with left-turns onto westbound 460 Bypass, left-turns onto the eastbound Bypass are made freely from the left-hand side of the bridge

Advantages

- Left turns are made without conflict, substantially reducing overall delay.
- Signals are provide only to allow traffic streams to criss-cross, therefore a simple two-phase signal plan is all that is required. This reduces overall delays and lost time.
- Turns from exit are yield controlled, keeping them away from the signals, which reduces delay and demand for other movements at the signal.

Disadvantages

- Drivers will be unfamiliar with concept (one of these is in place in the mid-west, multiple other state DOTs are considered and/or designing this type of interchange), and driving on the left-hand side may initially cause confusion.

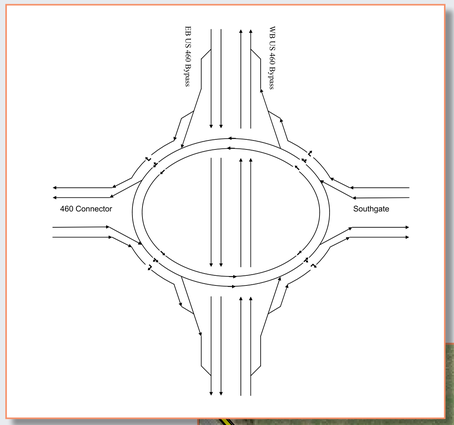
Level of Service (based on Synchro analysis of the two signalized intersections):

- LOS on the western intersection (eastbound traffic crosses to left-hand side prior to bridge) – AM: B, PM: A
- LOS on the eastern intersection (westbound traffic crosses to left-hand side prior to bridge) – AM: B, PM: B

MOVEMENT														
	EB 460 Connector to WB US 460 Bypass	EB 460 Connector to EB Southgate	EB 460 Connector to EB US 460 Bypass	EB US 460 Bypass to EB Southgate	EB US 460 Bypass to EB US 460 Bypass	EB US 460 Bypass to WB 460 Connector	WB Southgate to EB US 460 Bypass	WB Southgate to WB 460 Connector	WB Southgate to WB US 460 Bypass	WB US 460 Bypass to WB 460 Connector	WB US 460 Bypass to WB US 460 Bypass	WB US 460 Bypass to EB Southgate	Average All Vehicles	Average of all movements except through movements on the US 460 Bypass
TRAVEL TIME														
ALTERNATIVE 1 STANDARD DIAMOND	138 / 128	67 / 78	48 / 53	105 / 111	59 / 59	51 / 49	158 / 123	67 / 75	51 / 61	124 / 117	58 / 59	55 / 52	70 / 73	80 / 87
ALTERNATIVE 2 DIVERGING DIAMOND	86 / 78	62 / 86	48 / 49	83 / 80	59 / 59	50 / 48	96 / 78	66 / 58	49 / 51	87 / 85	58 / 59	51 / 48	63 / 62	66 / 65
ALTERNATIVE 3 ROTARY	80 / 80	52 / 52	52 / 53	84 /89	58 / 59	54 / 53	77 / 102	49 / 73	53 / 82	88 / 77	59 / 59	55 / 53	62 / 69	65 / 79
ALTERNATIVE 4 PARTIAL CLOVERLEAF	89 / 80	46 / 52	53 / 53	97 / 90	59 / 59	51 / 42	109 / 102	62 / 73	51 / 70	88 / 77	58 / 59	55 / 53	65 / 68	70 / 76

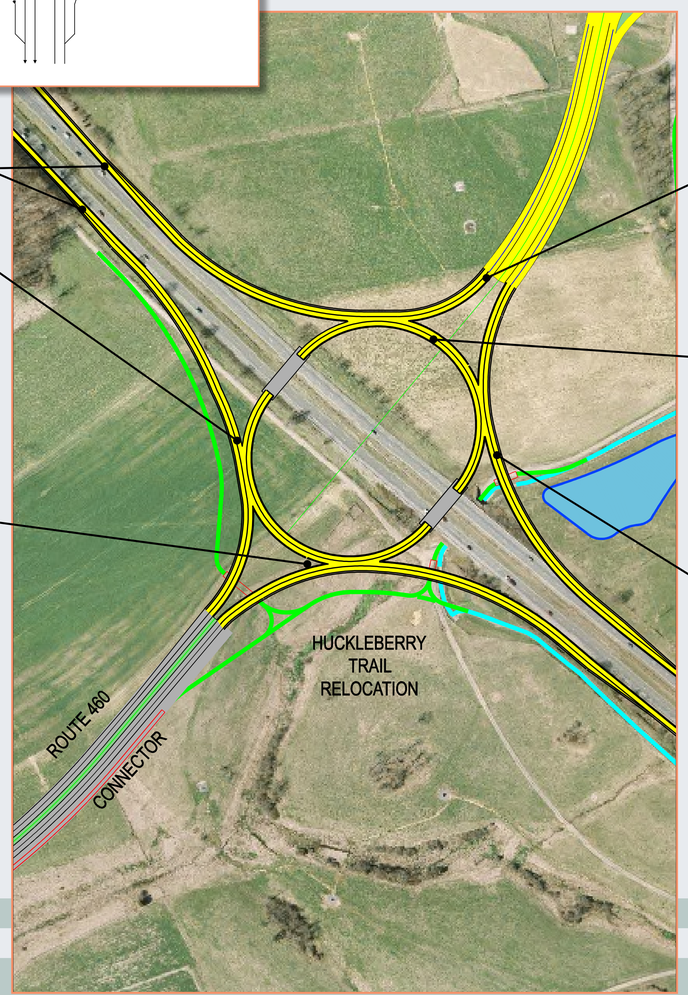
ROTARY INTERCHANGE

ALTERNATIVE 3



Features

- Two lane rotary interchange.
- Two lane access and egress points between interchange and US 460 ramps, Southgate Drive Relocated and the Route 460 Connector.
- Rotary is expanded to three lane segment in the four "corners" between an entrance and exit from rotary.



Ramps taper to single lane at junction with 460 Bypass

Unsignalized turns onto rotary from eastbound 460 Bypass exit

LOS: F/D

(Yield controlled, unsignalized analysis)

Unsignalized turns onto rotary from Route 460 Connector

LOS: E/F

(Yield controlled, unsignalized analysis)

Without control on rotary, evening peak period traffic will have difficulty accessing interchange from Southgate Drive

Unsignalized turns onto rotary from Southgate Drive

LOS: B/F

(Yield controlled, unsignalized analysis)

Unsignalized turns onto rotary from westbound 460 Bypass exit

LOS: C/B

(Yield controlled, unsignalized analysis)

Advantages

- Constant movement of traffic in interchange under uncongested conditions
- Without traffic signals, there will be minimal delays for traffic accessing rotary, assuming interchange is not congested.
- Movement from westbound Route 460 Bypass to eastbound Southgate Drive Relocated only has to use one quadrant of interchange (forecasted to be a heavy a.m. peak movement in 2035).

Disadvantages

- Heavy forecasted p.m. peak westbound Southgate Drive Relocated to eastbound Route 460 Bypass movement must navigate three-quarters of rotary, which will delay vehicles accessing the rotary from the eastbound Route 460 Bypass exit and from the Route 460 Connector.
- Two-lane rotary must be expanded to three-lane cross section in the "corners" to allow a right-turn only lane on the approaches to the interchange.
- The high number of conflict points in this design creates potential safety concerns, and lack of signals to stop traffic creates potential pedestrian and bicycle safety issues.
- Capacity of this configuration is based on spacing requirements (i.e., weaving distances in each quadrant of the rotary) – adding capacity in the future is severely limited by the fact that options for enlarging the radius of the rotary would be cost-prohibitive.

MOVEMENT														
	EB 460 Connector to WB US 460 Bypass	EB 460 Connector to EB Southgate	EB 460 Connector to EB US 460 Bypass	EB US 460 Bypass to EB Southgate	EB US 460 Bypass to EB US 460 Bypass	EB US 460 Bypass to WB 460 Connector	WB Southgate to EB US 460 Bypass	WB Southgate to WB 460 Connector	WB Southgate to WB US 460 Bypass	WB US 460 Bypass to WB 460 Connector	WB US 460 Bypass to WB US 460 Bypass	WB US 460 Bypass to EB Southgate	Average All Vehicles	Average of all movements except through movements on the US 460 Bypass
TRAVEL TIME														
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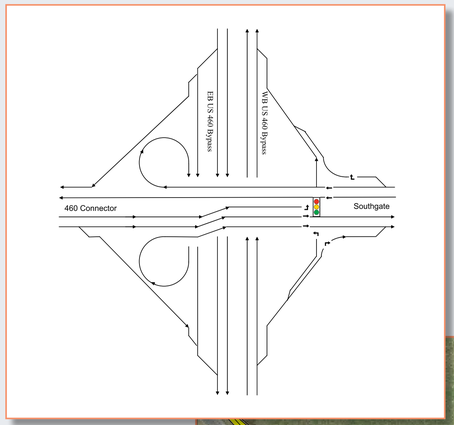
ALTERNATIVE 2 DIVERGING DIAMOND	86 / 78	62 / 86	48 / 49	83 / 80	59 / 59	50 / 48	96 / 78	66 / 58	49 / 51	87 / 85	58 / 59	51 / 48	63 / 62	66 / 65
ALTERNATIVE 3 ROTARY	80 / 80	52 / 52	52 / 53	84 /89	58 / 59	54 / 53	77 / 102	49 / 73	53 / 82	88 / 77	59 / 59	55 / 53	62 / 69	65 / 79
ALTERNATIVE 4 PARTIAL CLOVERLEAF	89 / 80	46 / 52	53 / 53	97 / 90	59 / 59	51 / 42	109 / 102	62 / 73	51 / 70	88 / 77	58 / 59	55 / 53	65 / 68	70 / 76

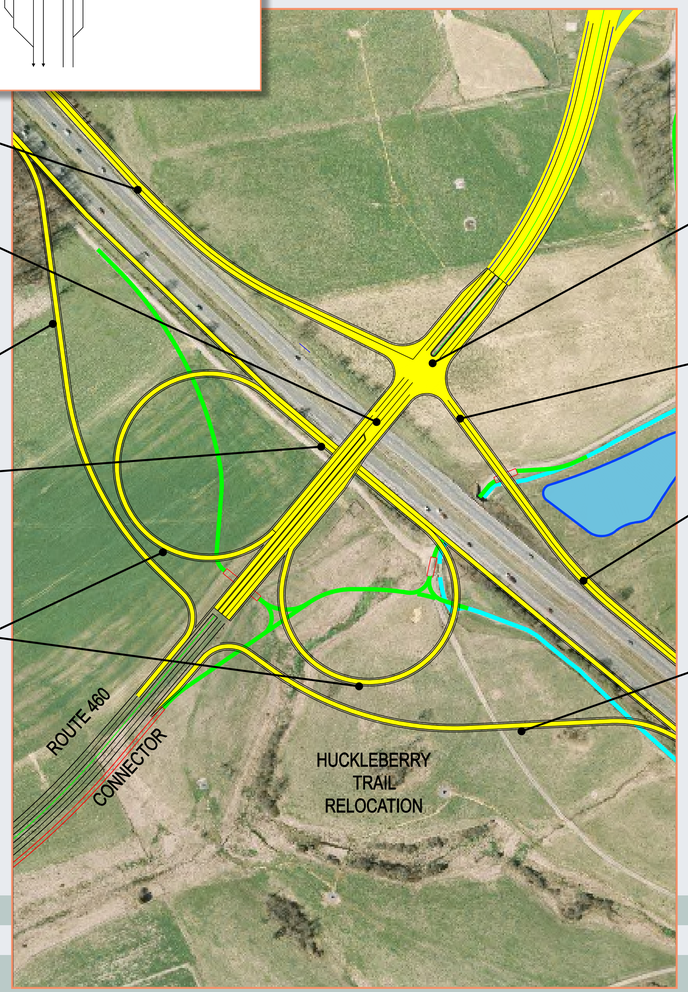
PARTIAL CLOVERLEAF INTERCHANGE

ALTERNATIVE 4



Features

- Collector-distributor type road for exits and entrances to eastbound Route 460 Bypass
- Loop ramps provide higher-capacity, uninterrupted flow for the heaviest forecasted traffic movements: westbound Southgate Drive Relocated to eastbound Route 460 Bypass, and eastbound Route 460 Bypass to eastbound Southgate Drive Relocated.
- Half diamond configuration for movements to and from westbound Route 460 Bypass.



Ramps taper to single lane at junction with 460 Bypass

Bridge requires 5 lanes of width to accommodate through and turning lanes

Single lane ramp for collector-distributor road from eastbound 460 Bypass

Weave section on eastbound 460 Bypass collector-distributor road

LOS: C/C

Loop ramps provide uninterrupted flow to and from collector-distributor road

Signalized intersection

LOS: C/C

Merge section required to accommodate free right-turn traffic from westbound 460 Bypass

Ramps taper to single lane at junction with 460 Bypass

Single lane ramp for collector-distributor road to eastbound 460 Bypass

- Single continuous lane provided westbound from Southgate Drive Relocated to the Route 460 Connector, which could be increased to two continuous lanes to allow for growth in traffic to the west. Two continuous lanes provided in the eastbound direction.

Advantages

- Heavy a.m. peak movement from eastbound Route 460 Bypass to eastbound Southgate Drive Relocated is accommodated on a loop ramp, allowing for less overall delay. Likewise, the heavy p.m. peak movement from westbound Southgate Drive Relocated to eastbound Route 460 Bypass is also performed via a loop ramp.
- Collector-distributor road keeps the weave between the loop ramps off eastbound Route 460 Bypass.

Disadvantages

- Signalization of east side of interchange is required to allow for left turns from the Route 460 Connector to the westbound Route 460 Bypass entrance ramp.
- Widening the Route 460 Bypass increases impacts and costs; allowing for sufficient spacing to ensure adequate weaving distances on the collector-distributor road may increase footprint and costs.

MOVEMENT														
	EB 460 Connector to WB US 460 Bypass	EB 460 Connector to EB Southgate	EB 460 Connector to EB US 460 Bypass	EB US 460 Bypass to EB Southgate	EB US 460 Bypass to EB US 460 Bypass	EB US 460 Bypass to WB 460 Connector	WB Southgate to EB US 460 Bypass	WB Southgate to WB 460 Connector	WB Southgate to WB US 460 Bypass	WB US 460 Bypass to WB 460 Connector	WB US 460 Bypass to WB US 460 Bypass	WB US 460 Bypass to EB Southgate	Average All Vehicles	Average of all movements except through movements on the US 460 Bypass
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ALTERNATIVE 2 DIVERGING DIAMOND	86 / 78	62 / 86	48 / 49	83 / 80	59 / 59	50 / 48	96 / 78	66 / 58	49 / 51	87 / 85	58 / 59	51 / 48	63 / 62	66 / 65
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ALTERNATIVE 4 PARTIAL CLOVERLEAF	89 / 80	46 / 52	53 / 53	97 / 90	59 / 59	51 / 42	109 / 102	62 / 73	51 / 70	88 / 77	58 / 59	55 / 53	65 / 68	70 / 76