

19th and Louisiana Intersection Study

Outline

November 8, 2005

Problems:

1. Geometry: Turning movements of vehicles and the lack of room to make the movements have caused wrecks.
2. Efficiency: Operational analysis of existing Peak PM conditions indicates intersection overall LOS E, some approaches/movements operate at a LOS F.
3. Storage: There is inadequate storage for average queues and 95th percentile queues.
4. Crashes/Safety: There have been 31 crashes at this intersection from 2002 through 2004. Alcohol contributed to 2 crashes in 2003, which reduces the number of crashes related to the 19th and Louisiana intersection to 29.
 - Estimated Average Daily Traffic (ADT) = 23,000 for the 3-year period
 - Crash rate = 11.51 c/tmev (crashes per ten-million entering vehicles).
 - Statewide average crash rate for intersections of this type is 8 c/tmev.
 - Statewide critical crash rate for intersections of this type is 11.69 c/tmev.
 - Comparison to other intersections in Lawrence:

<u>Intersection</u>	<u>Crash Rate (c/tmev)</u>	<u>Improvements Completed</u>
7 th & Kentucky	15.49	Yes
19 th & Barker	12.56	Yes
Kasold & Peterson	10.78	Yes
31 st & Nieder	8.00	Yes
Legends & Wakarusa	6.53	No
Harvard & Wakarusa	3.82	No
Bob Billings Pkwy. & Wakarusa	0.95	Yes

Of the 29 crashes, 5 assigned fault to a driver 18 years or younger. 2 additional crashes involved a driver 18 years or younger with an unknown fault.

Significant crash patterns:

- a. There are a significant number of angle accidents from left turn vehicles not yielding the right-of-way during a permitted left-turn movement (9 crashes due to WB Left-turn failing to yield to EB Thru).
- b. There are a significant number of rear-end collisions. A total of 10 crashes have been rear-end type collisions. Signalized intersections will typically have rear-end crash patterns due to the development of queue lengths during red-light conditions.

Solutions:

1. **Geometry:** Increase radii on the corners to accommodate turn-movement patterns.
2. **Efficiency:**
 - a. Change the signal timing. Add more time to unit-extension for WB/EB approaches. This will result in a little more delay on Louisiana for the minor movements, but will decrease the likelihood of a second platoon of vehicles getting stopped EB/WB due to a small gap between first platoon and second platoon. This will not “fix” all the problems, but could alleviate some of the inefficiency.
 - b. Add more lanes and adjust signal timing.
 1. Adding double-left turn lanes does not eliminate LOS E approaches. Queues are still excessive.
 2. Adding two through lanes for EB and for WB does not eliminate LOS E approaches. Queues are still excessive.
 3. Adding two through lanes for EB and WB and adding a double left-turn lane for WB will get everything operating in the LOS D or better range. Overall intersection LOS = D. Queues are significant, but manageable.
 - c. Construct the multi-lane roundabout as presented. The intersection will operate during peak hours at approximately 70% of capacity. At 85% of capacity, delays will become noticeable. Disadvantage: there isn't a lot of room for traffic growth during the peak hour. However, traffic flow greater than 85% during 15 minutes of the peak hour isn't necessarily detrimental to the intersection.
3. **Storage:** Requires geometric improvements to the intersection. For the multi-lane roundabout, storage is provided for the 95th percentile queues. For the signalized intersection, eliminating the permitted left-turns results in larger queues on the east leg (traffic coming from Tenn/Kent). Average queues can be stored by adding two through lanes (EB/WB), adding double left-turn for WB and by adjusting the signal timing.

During the design and initial operation of either improvement (roundabout or geometric improvement), the timing for the signals at Tennessee and Kentucky should be analyzed and adjusted to prevent queues from those intersections from spilling back into the 19th and Louisiana intersection.

4. Crashes/Safety:

- a. Eliminate permitted left-turns from 19th Street onto Louisiana. Provide additional capacity to reduce the length of queues and/or store the queues in the respective lane. This could help reduce the possibility of rear-end collisions.
- b. Construct a roundabout with sufficient capacity to reduce queues, eliminate the conflict points and reduce the severity of collisions.

5. Pedestrian Safety: Sidewalks along the corridor should be constructed to encourage pedestrians to travel to the nearest crosswalk to cross the street. Crosswalks should be marked and the length of the crosswalk should be minimized to prevent exposure of pedestrians to vehicular traffic. The following table summarizes the crossing distances for the Geometric Improvement option and the Multi-lane Roundabout option.

<u>Leg of Intersection</u>	<u>Crossing Distance in feet (Pedestrian Exposed to Vehicular Traffic)</u>	
	<u>Geometric Improvements</u>	<u>Multi-lane Roundabout</u>
North Leg	77	34
East Leg	98	46
South Leg	115	50
West Leg	97	52

6. Reduce the volume of vehicles entering the intersection by providing another route.

Improvement Options:

1. Geometric Improvements as presented in the attached drawings.
2. Multi-lane Roundabout as presented in the attached drawings.

Temporary/Short-Term Considerations:

1. Reconstruct the southeast corner of the intersection to provide a larger turning radius to better facilitate turning movements.
2. Remove permitted left-turn phase for 19th Street and provide a longer storage lane east of Louisiana. This improvement requires widening of 19th Street at the Ohio Street intersection to accommodate a 3-lane section. Restricting traffic on Ohio Street to right-in/right-out only should be considered with this improvement.
3. Site improvements at Lawrence High School to provide enough parking on-site for entire student population. This will reduce pedestrian movements at 19th and Louisiana.

4. Additional access points for ingress/egress onto school property. Consider 21st Street access point(s) and additional Louisiana Street access point.
5. Consider changes in school policy which will reduce pedestrian movements through the 19th and Louisiana intersection.
6. Add a bus turn-out lane south of the intersection to better facilitate traffic flow during loading and unloading of buses.
7. Widen 19th Street west of Louisiana to provide a center turn lane.

Geometric Improvements:

Pros:

1. Public perception of the improvement may be better than a roundabout, but could be negative because of the impact on the surrounding properties.
2. The intersection could be constructed under traffic.
3. Increased safety due to the elimination of permitted left-turns from 19th Street.
4. Decreased delay due to more efficient conveyance of traffic.
5. A traffic signal will create platoons of vehicles by queuing vehicles at a red light, which could result in larger gaps for traffic to enter 19th or Louisiana from adjacent intersections.
6. A traffic signal will assign pedestrians a time to cross the road.

Cons:

1. There are more conflict points than a roundabout.
2. The potential for right angle collisions is still present with this improvement. These types of collisions increase the potential for injury accidents.
3. The traffic control device (traffic signal) is passive and will not calm traffic speeds. In addition, it will not prevent a driver from running a red light.
4. The delay at the signalized intersection is greater than the delay expected from a multi-lane roundabout.
5. The adjacent streets downstream of the intersection (to the west and south) are single lane streets and will require traffic to merge.
6. The intersection footprint is large and will require more right-of-way acquisition and building removal than the roundabout requires.
7. The construction and property acquisition cost estimate is larger than the multi-lane roundabout.
8. Pedestrians have to cross more lanes of traffic than the current configuration and the multi-lane roundabout option.
9. Maintenance and utility costs (electricity) are higher than a roundabout.

Multi-Lane Roundabout:

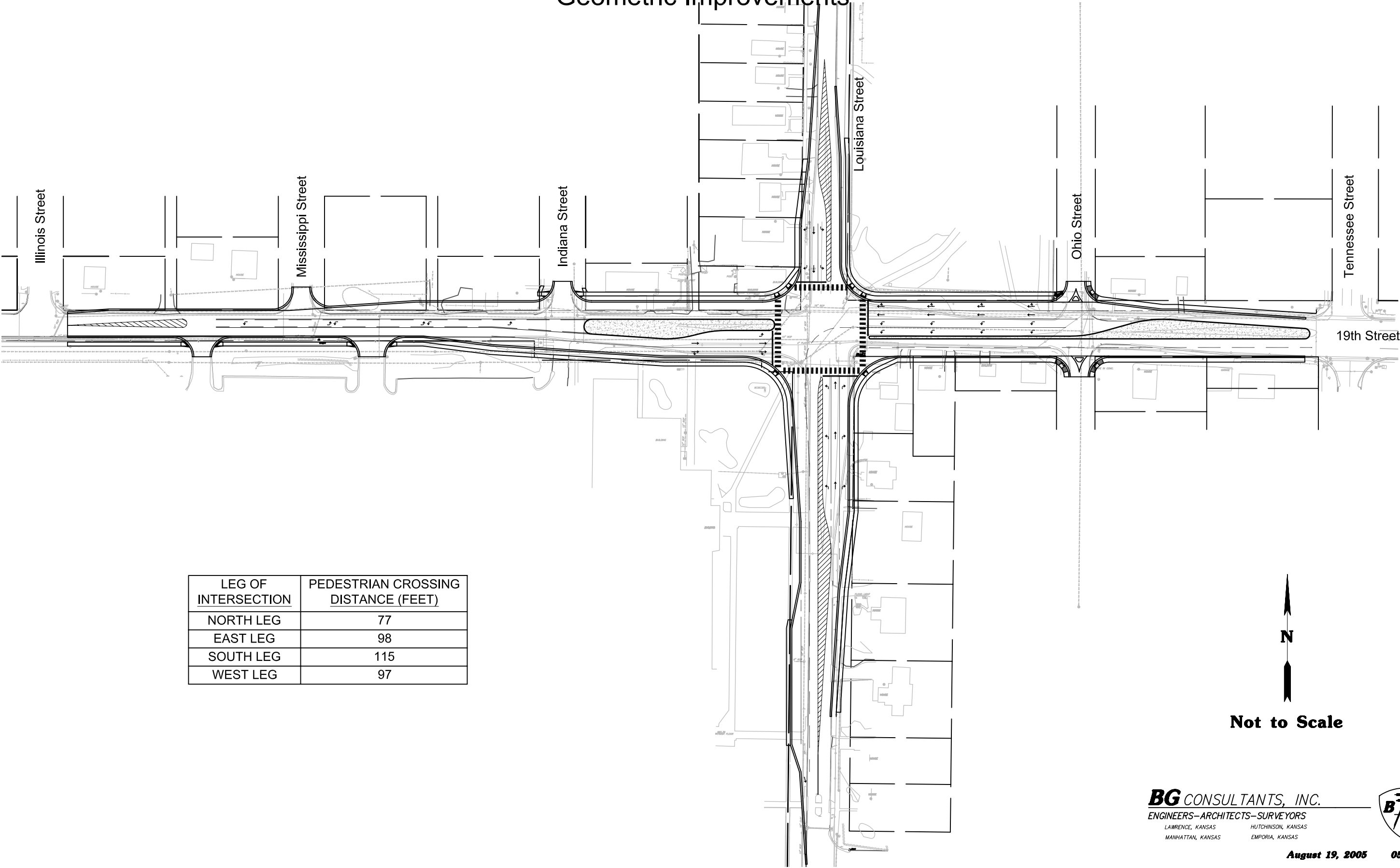
Pros:

1. Increased safety due to reduced conflict points.
2. The angles of collisions are more likely to result in property damage accidents rather than injury accidents (as compared to the signalized intersection).
3. Traffic speeds through the intersection will be reduced, reducing the severity of vehicle-to-vehicle collisions and increasing the survivability of pedestrians in a vehicle-to-pedestrian collision.
4. The expected delay is significantly smaller than the signalized intersection option due to the increased capacity and the type of operations at the intersection (12.4 seconds at the roundabout vs. 37.2 seconds at signalized intersection).
5. Drivers at adjacent intersections, upstream of the roundabout can use the roundabout to make a left turn (U-turn) rather than waiting for a gap in traffic to turn left (Example: a vehicle going westbound on 21st Street, stopped at Louisiana Street wanting to turn left could turn right and go through the roundabout to go south on Louisiana).
6. The footprint of the intersection requires less right-of-way acquisition and building removal than the geometric improvement.
7. The construction and property acquisition cost estimate is smaller than the geometric improvement option (\$1,492,915 for the roundabout vs. \$2,270,943 for the geometric improvement).
8. Pedestrians have a shorter distance to cross traffic and the splitter islands provide refuge for pedestrians.
9. Maintenance and utility costs (electricity) are lower than a signalized intersection.

Cons:

1. Public perception.
2. Construction will require the intersection to be closed to traffic.
3. More than one lane (entering and circulating) results in additional conflict points and could cause increased confusion.
4. There may be some crashes during the first few months that the roundabout is in operation as traffic becomes comfortable.
5. The intersection could spread out/break up traffic platoons, resulting in smaller gaps for adjacent intersections.
6. The intersection does not assign pedestrians a time to cross the street as would a traffic signal.

City of Lawrence
19th and Louisiana
Geometric Improvements

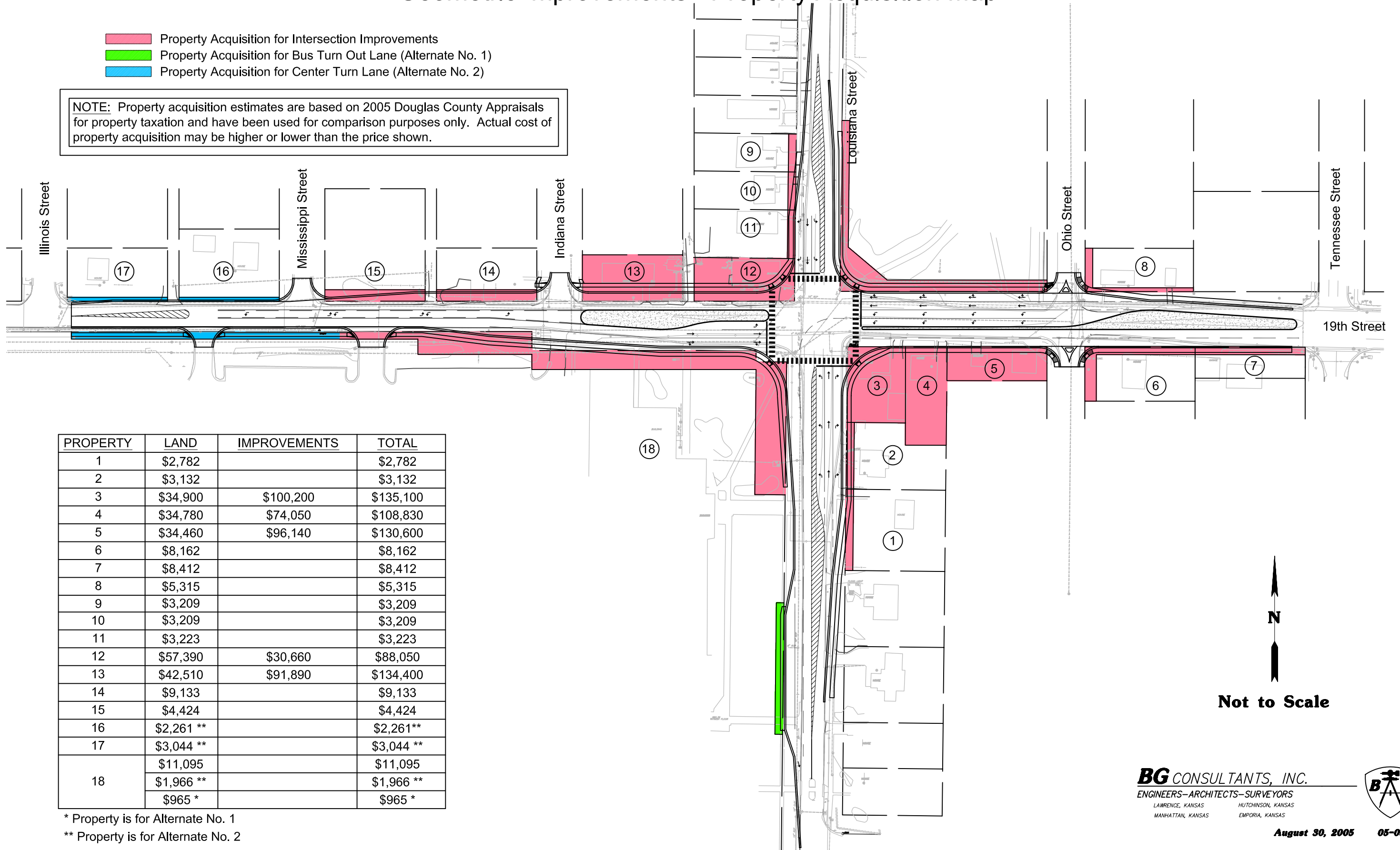


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Not to Scale

City of Lawrence
19th and Louisiana
Geometric Improvements - Property Acquisition Map

- Property Acquisition for Intersection Improvements
- Property Acquisition for Bus Turn Out Lane (Alternate No. 1)
- Property Acquisition for Center Turn Lane (Alternate No. 2)

NOTE: Property acquisition estimates are based on 2005 Douglas County Appraisals for property taxation and have been used for comparison purposes only. Actual cost of property acquisition may be higher or lower than the price shown.



PROPERTY	LAND	IMPROVEMENTS	TOTAL
1	\$2,782		\$2,782
2	\$3,132		\$3,132
3	\$34,900	\$100,200	\$135,100
4	\$34,780	\$74,050	\$108,830
5	\$34,460	\$96,140	\$130,600
6	\$8,162		\$8,162
7	\$8,412		\$8,412
8	\$5,315		\$5,315
9	\$3,209		\$3,209
10	\$3,209		\$3,209
11	\$3,223		\$3,223
12	\$57,390	\$30,660	\$88,050
13	\$42,510	\$91,890	\$134,400
14	\$9,133		\$9,133
15	\$4,424		\$4,424
16	\$2,261 **		\$2,261**
17	\$3,044 **		\$3,044 **
18	\$11,095		\$11,095
	\$1,966 **		\$1,966 **
	\$965 *		\$965 *

* Property is for Alternate No. 1
** Property is for Alternate No. 2

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Not to Scale

19th and Louisiana - Geometric Improvements
Opinion of Probable Project Costs
BG Consultants, Inc. Project #05-035L
September 29, 2005

No.	Description	Quantity	Units	Unit Price	Total Price
1.	Clearing and Grubbing	1	L.S.	\$ 25,000.00	\$ 25,000.00
2.	Removal of Existing Structures	1	L.S.	\$ 35,000.00	\$ 35,000.00
3.	Rock Excavation	500	C.Y.	\$ 12.00	\$ 6,000.00
4.	Common Excavation	3,800	C.Y.	\$ 7.50	\$ 28,500.00
5.	Type B Compaction (MR-90)	3,000	C.Y.	\$ 5.00	\$ 15,000.00
6.	Milling	7400	S.Y.	\$ 3.00	\$ 22,200.00
7.	6" AB-3 Base	7,600	S.Y.	\$ 6.00	\$ 45,600.00
8.	2" Asphalt Overlay (BM-2)	1650	Tons	\$ 55.00	\$ 90,750.00
9.	8" Concrete Pavement for Widening (A.E.)	5200.0	S.Y.	\$ 62.50	\$ 325,000.00
10.	7" Concrete Pavement (Reinforced)(A.E.)	350	S.Y.	\$ 45.00	\$ 15,750.00
11.	6" Concrete Pavement (Reinforced)(A.E.)	275	S.Y.	\$ 40.00	\$ 11,000.00
12.	6" Exposed Aggregate Concrete (A.E.)	1,200	S.Y.	\$ 70.00	\$ 84,000.00
13.	Concrete Curb and Gutter (A.E.)	4,200	L.F.	\$ 17.00	\$ 71,400.00
14.	8" Concrete Protection Curb (A.E.)	1,700	L.F.	\$ 15.00	\$ 25,500.00
15.	Concrete Sidewalk (4")(A.E.)	1,600	S.Y.	\$ 25.00	\$ 40,000.00
16.	Access Ramp	14	Each	\$ 1,500.00	\$ 21,000.00
17.	Traffic Signal Installation	1	L.S.	\$ 95,000.00	\$ 95,000.00
18.	Video Detection	1	L.S.	\$ 30,000.00	\$ 30,000.00
19.	Curb Inlet (Precast)	9	Each	\$ 2,750.00	\$ 24,750.00
20.	18" Storm Sewer (RCP)	655	L.F.	\$ 85.00	\$ 55,675.00
21.	Permanent Signing	1	L.S.	\$ 5,000.00	\$ 5,000.00
22.	Pavement Markings	1	L.S.	\$ 17,500.00	\$ 17,500.00
23.	Silt Fence	5,000	L.F.	\$ 2.00	\$ 10,000.00
24.	Temporary Curb Inlet Sediment Barrier	9	Each	\$ 150.00	\$ 1,350.00
25.	Temporary Seeding	1	L.S.	\$ 1,000.00	\$ 1,000.00
26.	Traffic Control	1	L.S.	\$ 35,000.00	\$ 35,000.00
27.	Construction Staking	1	L.S.	\$ 8,500.00	\$ 8,500.00
28.	Seeding, Fertilizing and Mulching	1	L.S.	\$ 3,500.00	\$ 3,500.00
29.	Mobilization	1	L.S.	\$ 45,000.00	\$ 45,000.00
Construction Subtotal =					\$ 1,193,975.00
+10% Contingency =					\$ 119,398.00
+ Engineering Design and Inspection =					\$ 298,494.00
Construction Total =					\$ 1,611,867.00
30.	Property Acquisition	1	L.S.	\$ 659,076.00	\$ 659,076.00
Property Acquisition Total =					\$ 659,076.00
Project Total =					\$ 2,270,943.00

Alternate No. 1 - Bus Turnout Lane (Southbound Louisiana Street)

1.	Unclassified Excavation	150	C.Y.	\$ 15.00	\$ 2,250.00
2.	Type B Compaction (MR-90)	85	C.Y.	\$ 5.00	\$ 425.00
3.	6" AB-3 Base	255	S.Y.	\$ 6.00	\$ 1,530.00
4.	7" Concrete Pavement (Reinforced)(A.E.)	190	S.Y.	\$ 45.00	\$ 8,550.00
5.	Concrete Curb and Gutter (A.E.)	235	L.F.	\$ 15.00	\$ 3,525.00
6.	Concrete Sidewalk (4")(A.E.)	100	S.Y.	\$ 25.00	\$ 2,500.00
7.	Pavement Markings	1	L.S.	\$ 500.00	\$ 500.00
Construction Subtotal =					\$ 19,280.00
+10% Contingency =					\$ 1,928.00
+ Engineering Design and Inspection =					\$ 4,820.00
Construction Total =					\$ 26,028.00
8.	Property Acquisition	1	L.S.	\$ 965.00	\$ 965.00
Property Acquisition Total =					\$ 965.00
Alternate No. 1 Project Total =					\$ 26,993.00

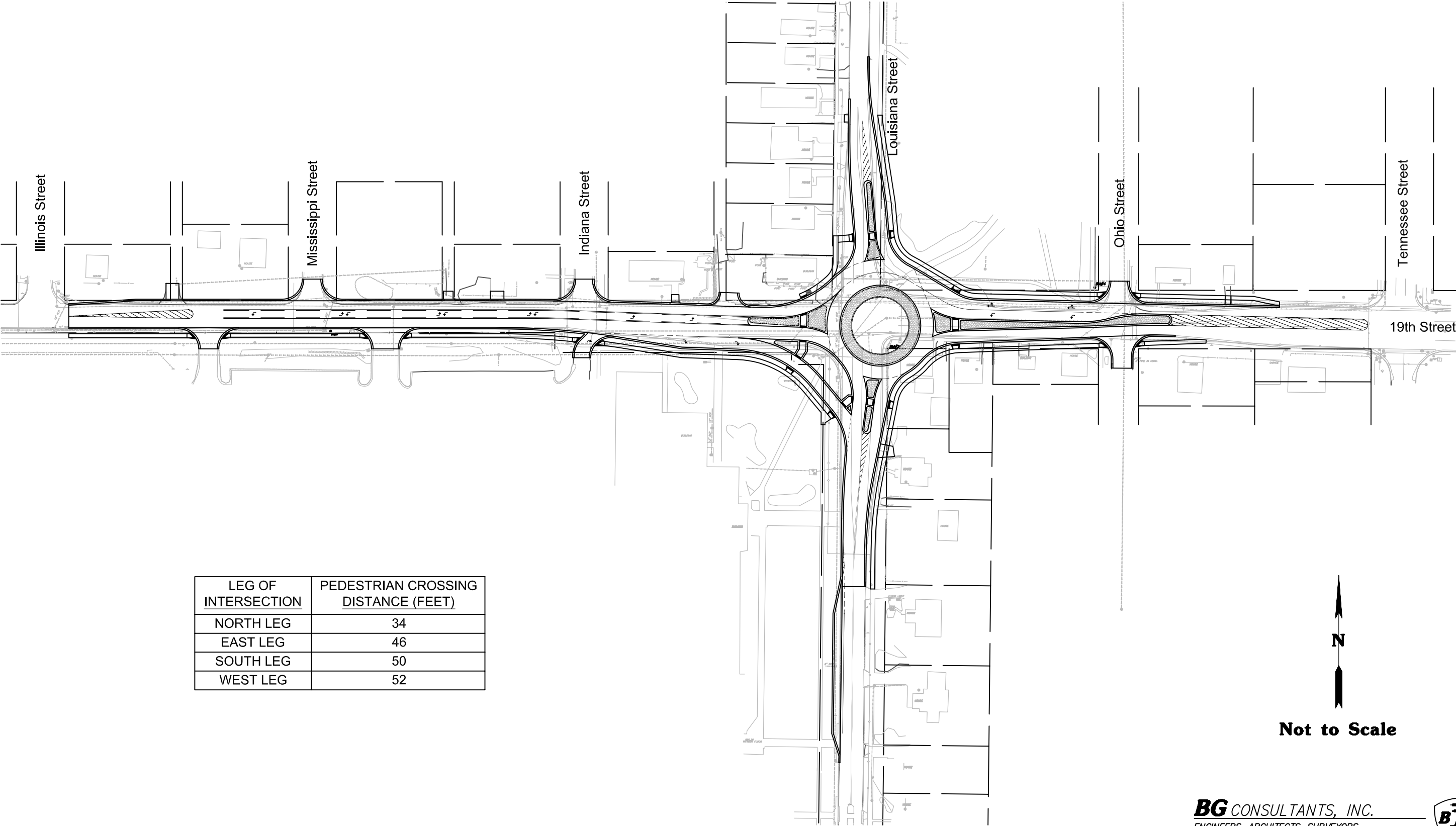
Alternate No. 2 - Two-Way-Left-Turn-Lane on 19th Street (West of Louisiana Street)

1.	Unclassified Excavation	175	C.Y.	\$ 20.00	\$ 3,500.00
2.	Type B Compaction (MR-90)	100	C.Y.	\$ 5.00	\$ 500.00
3.	Milling	815	S.Y.	\$ 3.00	\$ 2,445.00
4.	6" AB-3 Base	305	S.Y.	\$ 6.00	\$ 1,830.00
5.	8" Concrete Pavement for Widening (A.E.)	160.0	S.Y.	\$ 62.50	\$ 10,000.00
6.	6" Concrete Pavement (Reinforced)(A.E.)	100.0	S.Y.	\$ 45.00	\$ 4,500.00
7.	2" Asphalt Overlay (BM-2)	130	Tons	\$ 45.00	\$ 5,850.00
8.	Concrete Curb and Gutter (A.E.)	535	L.F.	\$ 15.00	\$ 8,025.00
9.	Concrete Sidewalk (4")(A.E.)	120	S.Y.	\$ 25.00	\$ 3,000.00
10.	Access Ramp	2	Each	\$ 1,500.00	\$ 3,000.00
11.	Pavement Markings	1	L.S.	\$ 1,500.00	\$ 1,500.00
12.	Traffic Control	1	L.S.	\$ 2,500.00	\$ 2,500.00
13.	Construction Staking	1	L.S.	\$ 1,000.00	\$ 1,000.00
14.	Seeding, Fertilizing and Mulching	1	L.S.	\$ 750.00	\$ 750.00
Construction Subtotal =					\$ 48,400.00
+10% Contingency =					\$ 4,840.00
+ Engineering Design and Inspection =					\$ 12,100.00
Construction Total =					\$ 65,340.00
15.	Property Acquisition	1	L.S.	\$ 7,271.00	\$ 7,271.00
Property Acquisition Total =					\$ 7,271.00
Alternate No. 2 Project Total =					\$ 72,611.00

Grand Total =	\$ 2,370,547.00
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Notes: 1. Landscaping has not been included.
2. Utility relocations have not been included.
3. Property acquisition estimates are based on 2005 Douglas County Appraisals for property taxation and have been used for comparison purposes only. Actual cost of property acquisition may be higher or lower than the price shown.
4. Restoration/improvements to property acquired for construction have not been included (structure removal, filling basements, utility removal, etc.).

City of Lawrence
19th and Louisiana
Multi-Lane Roundabout

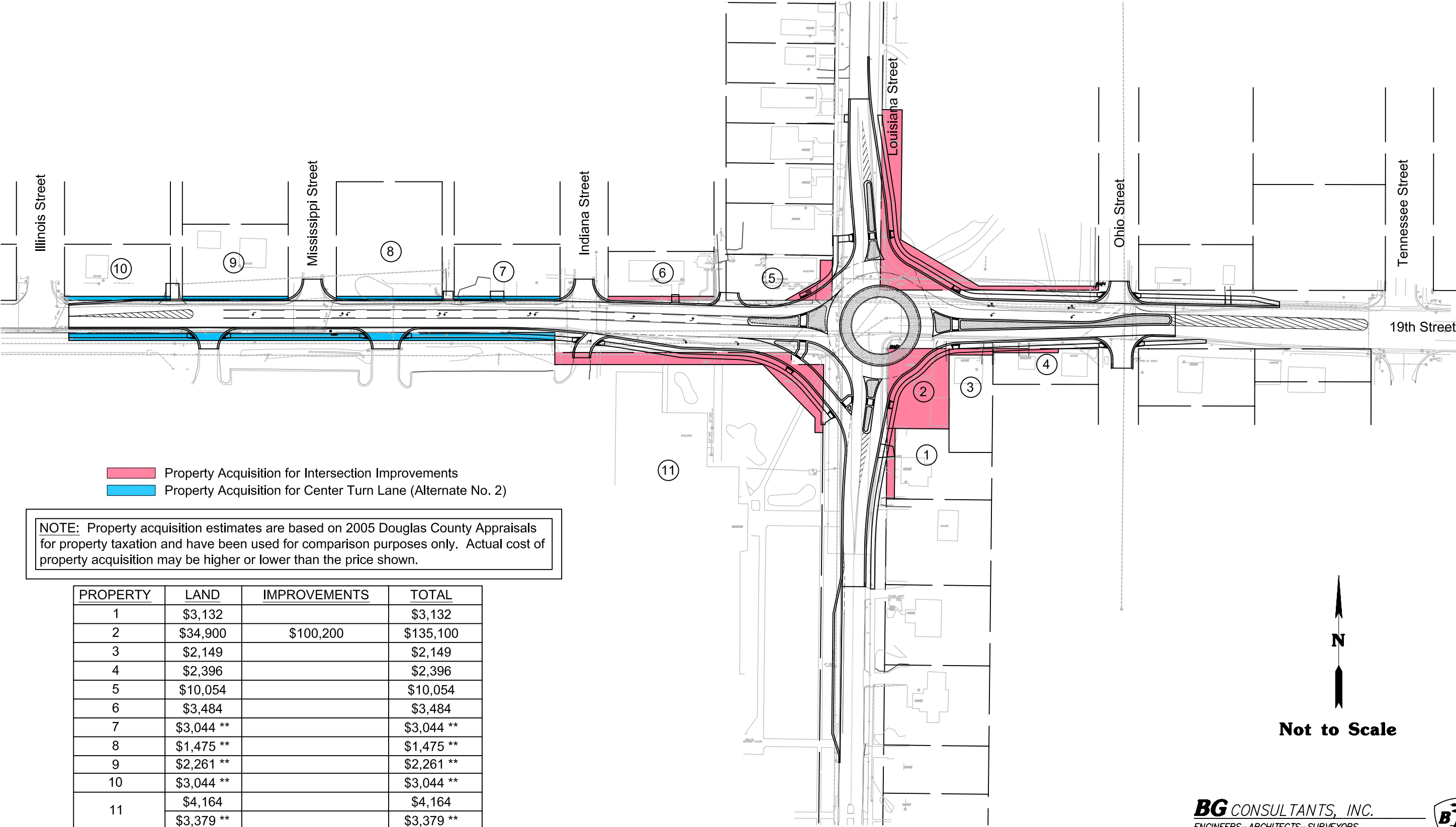


LEG OF INTERSECTION	PEDESTRIAN CROSSING DISTANCE (FEET)
NORTH LEG	34
EAST LEG	46
SOUTH LEG	50
WEST LEG	52

N
Not to Scale



City of Lawrence
19th and Louisiana
Multi-Lane Roundabout - Property Acquisition Map



** Property is for Alternate No. 2

N
Not to Scale



19th and Louisiana - Multi-lane Roundabout
Opinion of Probable Project Costs
BG Consultants, Inc. Project #05-035L
September 29, 2005

No.	Description	Quantity	Units	Unit Price		Total Price
1.	Clearing and Grubbing	1	L.S.	\$	25,000.00	\$ 25,000.00
2.	Removal of Existing Structures	1	L.S.	\$	50,000.00	\$ 50,000.00
3.	Rock Excavation	2,350	C.Y.	\$	12.00	\$ 28,200.00
4.	Common Excavation	1,200	C.Y.	\$	7.50	\$ 9,000.00
5.	Type B Compaction (MR-90)	2,500	C.Y.	\$	5.00	\$ 12,500.00
6.	6" AB-3 Base	871	S.Y.	\$	6.00	\$ 5,226.00
7.	9" Fly Ash Stabilization	7,244	S.Y.	\$	4.00	\$ 28,976.00
8.	10" Concrete Pavement (NRDJ)(A.E.)	6,005	S.Y.	\$	62.50	\$ 375,312.50
9.	7" Concrete Pavement (Reinforced)(A.E.)	340	S.Y.	\$	45.00	\$ 15,300.00
10.	6" Concrete Pavement (Reinforced)(A.E.)	275	S.Y.	\$	40.00	\$ 11,000.00
11.	8" Exposed Aggregate Concrete (Reinforced)(A.E.)	356	S.Y.	\$	75.00	\$ 26,700.00
12.	6" Exposed Aggregate Concrete (A.E.)	515	S.Y.	\$	70.00	\$ 36,050.00
13.	Concrete Curb and Gutter (A.E.)	4,500	L.F.	\$	17.00	\$ 76,500.00
14.	8" Concrete Protection Curb (A.E.)	225	L.F.	\$	15.00	\$ 3,375.00
15.	Concrete Sidewalk (4")(A.E.)	963	S.Y.	\$	25.00	\$ 24,075.00
16.	Access Ramp	14	Each	\$	1,500.00	\$ 21,000.00
17.	Median Ramp Crossing	6	Each	\$	2,250.00	\$ 13,500.00
18.	Curb Inlet (Precast)	9	Each	\$	2,750.00	\$ 24,750.00
19.	18" Storm Sewer (RCP)	655	L.F.	\$	85.00	\$ 55,675.00
20.	Keystone Compaq Retaining Wall	920	S.F.	\$	25.00	\$ 23,000.00
21.	Permanent Signing	1	L.S.	\$	5,000.00	\$ 5,000.00
22.	Pavement Markings	1	L.S.	\$	10,000.00	\$ 10,000.00
23.	Silt Fence	5,000	L.F.	\$	2.00	\$ 10,000.00
24.	Temporary Curb Inlet Sediment Barrier	9	Each	\$	150.00	\$ 1,350.00
25.	Temporary Seeding	1	L.S.	\$	1,000.00	\$ 1,000.00
26.	Lighting	1	L.S.	\$	40,000.00	\$ 40,000.00
27.	Traffic Control	1	L.S.	\$	7,500.00	\$ 7,500.00
28.	Construction Staking	1	L.S.	\$	8,500.00	\$ 8,500.00
29.	Seeding, Fertilizing and Mulching	1	L.S.	\$	3,500.00	\$ 3,500.00
30.	Mobilization	1	L.S.	\$	35,000.00	\$ 35,000.00
Construction Subtotal =					\$	986,989.50
+10% Contingency =					\$	98,699.00
+ Engineering Design and Inspection =					\$	246,748.00
Construction Total =					\$	1,332,436.50
31.	Property Acquisition	1	L.S.	\$	160,479.00	\$ 160,479.00
Property Acquisition Total =					\$	160,479.00
Project Total =					\$	1,492,915.50

Alternate No. 1 - Bus Turnout Lane (Southbound Louisiana Street)

1.	Unclassified Excavation	150	C.Y.	\$	15.00	\$ 2,250.00
2.	Type B Compaction (MR-90)	85	C.Y.	\$	5.00	\$ 425.00
3.	6" AB-3 Base	255	S.Y.	\$	6.00	\$ 1,530.00
4.	7" Concrete Pavement (Reinforced)(A.E.)	190	S.Y.	\$	45.00	\$ 8,550.00
5.	Concrete Curb and Gutter (A.E.)	235	L.F.	\$	15.00	\$ 3,525.00
6.	Concrete Sidewalk (4")(A.E.)	100	S.Y.	\$	25.00	\$ 2,500.00
7.	Pavement Markings	1	L.S.	\$	500.00	\$ 500.00
Construction Subtotal =					\$	19,280.00
+10% Contingency =					\$	1,928.00
+ Engineering Design and Inspection =					\$	4,820.00
Construction Total =					\$	26,028.00
8.	Property Acquisition	1	L.S.	\$	-	\$ -
Property Acquisition Total =					\$	-
Alternate No. 1 Project Total =					\$	26,028.00

Alternate No. 2 - Two-Way-Left-Turn-Lane on 19th Street (West of Louisiana Street)

1.	Unclassified Excavation	350	C.Y.	\$	20.00	\$ 7,000.00
2.	Type B Compaction (MR-90)	150	C.Y.	\$	5.00	\$ 750.00
3.	Milling	1725	S.Y.	\$	3.00	\$ 5,175.00
4.	6" AB-3 Base	800	S.Y.	\$	6.00	\$ 4,800.00
5.	8" Concrete Pavement for Widening (A.E.)	500.0	S.Y.	\$	62.50	\$ 31,250.00
6.	2" Asphalt Overlay (BM-2)	250	Tons	\$	55.00	\$ 13,750.00
7.	7" Concrete Pavement (Reinforced)(A.E.)	100	S.Y.	\$	45.00	\$ 4,500.00
8.	6" Concrete Pavement (Reinforced)(A.E.)	230	S.Y.	\$	40.00	\$ 9,200.00
9.	Concrete Curb and Gutter (A.E.)	1075	L.F.	\$	15.00	\$ 16,125.00
10.	Concrete Sidewalk (4")(A.E.)	230	S.Y.	\$	25.00	\$ 5,750.00
11.	Access Ramp	4	Each	\$	1,500.00	\$ 6,000.00
12.	Pavement Markings	1	L.S.	\$	2,500.00	\$ 2,500.00
13.	Traffic Control	1	L.S.	\$	2,500.00	\$ 2,500.00
14.	Construction Staking	1	L.S.	\$	1,000.00	\$ 1,000.00
15.	Seeding, Fertilizing and Mulching	1	L.S.	\$	750.00	\$ 750.00
Construction Subtotal =					\$	111,050.00
+10% Contingency =					\$	11,105.00
+ Engineering Design and Inspection =					\$	27,763.00
Construction Total =					\$	149,918.00
16.	Property Acquisition	1	L.S.	\$	13,203.00	\$ 13,203.00
Property Acquisition Total =					\$	13,203.00
Alternate No. 2 Project Total =					\$	163,121.00

Grand Total =	\$	1,682,064.50
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Notes: 1. Landscaping has not been included.
2. Utility relocations have not been included.
3. Property acquisition estimates are based on 2005 Douglas County Appraisals for property taxation and have been used for comparison purposes only. Actual cost of property acquisition may be higher or lower than the price shown.
4. Restoration/improvements to property acquired for construction have not been included (structure removal, filling basements, utility removal, etc.).

Public Input from the Public Meeting held Monday May 16, 2005

Public questions:

1. What is the problem? Is there a problem?
2. What is the traffic impact of improvements at this intersection on the adjacent intersections, Tennessee and Kentucky especially?
3. What is the traffic impact at 21st and Louisiana? (Gap acceptance)
4. How will high school students negotiate a roundabout?
5. Land acquisition?
6. Is the crash rate really a problem? When do these crashes occur and what are the ages of the drivers? Many people feel that it is not a problem. Compare this rate with statewide and national average rates.
7. How will improvements handle ball game traffic?
8. Why look at just the intersection when all of 19th Street needs to be addressed? There needs to be a 19th Street corridor study.

Public perceived problems:

1. Pedestrian crossing along 19th and/or Louisiana Street in this corridor is dangerous.
2. There is not enough parking at the High School. 1,400 people go to Lawrence High everyday, yet there are only 400 parking spaces. People have to park in neighborhoods around the school and then walk across 19th Street and Louisiana Street to get to the school.
3. The side streets connecting to 19th and Louisiana Streets have become parking lots for the high school. (Parking traffic encroaching on the neighborhood)
4. Buses create obstacles on Louisiana Street because there is no place to turn off. Buses and parents need a turnout/dropoff point on Louisiana Street.
5. Merging eastbound traffic after the intersection (on the east leg).
6. Traffic exiting the high school parking lot is unable to find a gap to enter 19th Street. Drivers usually won't let you in.
7. The large volumes of traffic are seen from 7:30 AM to about 8:30 or 9:00 AM, and from 2:30 PM to 5:30 PM.
8. Multiple comments regarding: There are not enough gaps and it is unsafe to turn left from 19th Street, onto the adjacent streets (Maine Street to the East in particular). What about a two-way-left-turn-lane?
9. Bike traffic has trouble maneuvering this intersection safely. One citizen will go out of her way to avoid this intersection on her bike.
10. The Police Department does not enforce speeds or traffic laws in this area. There are a lot of police along Louisiana, South of this intersection, but they never see them along 19th Street.
11. The students loiter and litter in the front yards of the neighbors. Would improvements help deter this?
12. The lanes are mis-matched and are not aligned the way they need to be. Turning off of 19th Street can be a surprise (SB to EB).

13. Lighting on Louisiana Street is a problem. It is too dark.
14. Right angle accidents are very dangerous for pedestrians crossing the intersection.
15. There is too much traffic on Louisiana Street.
16. Lack of signal coordination (with Tenn. and Kent. Signals)

Public Comments/Ideas:

1. The police need to enforce the current laws.
2. Send out a survey to get public comments about problems.
3. A few comments suggesting that nothing be done to the intersection. It is fine the way it is. Comments received from public about how a traffic signal calms traffic by making them stop, traffic signals allow gaps for adjacent streets to get in (21st and Louisiana, although one person said it took her 22 minutes to turn from that intersection once), traffic signals allow pedestrians a chance to cross.
4. Show of hands against a roundabout had a lot of people raising their hands against, a few in favor. One person commented how that is an unfair question for this meeting. (question was raised by public)
5. The problem lies with the school, not the intersection.
6. The intersection is schizophrenic; it changes its personality as a function of time during the day.
7. Consider changes with the school traffic policy (drop-offs, age that they can drive, where they park and more parking)
8. Put in a pedestrian bridge for people to cross the intersection.
9. Make the signalized intersection stop in all directions to accommodate pedestrians.
10. Put in signals at the High School entrance and coordinate them with 19th and Louisiana.
11. Accommodate bike traffic.
12. Make left-turns at 21st and Louisiana Street easier.
13. Install speed bumps on all legs approaching the intersection to help slow traffic.

Accident Report Tabulation

Date	Time	Day	PDO/Injury	Type	Direction of Travel			Driver Age (years)			Fault	Infraction	Road Cond.	Comments
					Driver 1	Driver 2	Driver 3	Driver 1	Driver 2	Driver 3				
3/29/2002	7:53 PM	Fri	I	Rear-end	NB (T)	NB (T)	NB	43	15	45	D2		Dry	Alcohol Present
9/30/2002	8:53 PM	Mon	I	Angle	EB (T)	WB (L)		21	53		D2	Failed to Yield	Dry	
1/1/2002	2:30 PM	Tues	PDO	Rear-end	NB (T)	NB (T)		18	39		D2	Innatentive	Dry	
2/15/2002	6:27 PM	Fri	PDO	Rear-end	EB (T)	EB (T)		28	25		D1	Following too Close	Dry	
5/10/2002	12:20 PM	Fri	PDO	Angle	WB (T)	NB (L)		24	17		D1	Disobey Signal	Dry	
5/20/2002	10:58 AM	Mon	PDO	Angle	EB (T)	WB (L)		20	24		D2	Failed to Yield	Dry	Geometry of SE corner
7/31/2002	3:44 PM	Wed	PDO	Rear-end	EB (T)	EB (T)		24	21		D1	Following too Close	Dry	
8/8/2002	3:40 PM	Thurs	PDO	Angle	SB (T)	WB (T)		56	20		D1	Disobey Signal	Dry	
8/15/2002	3:20 PM	Thurs	PDO	Rear-end	EB (T)	EB (T)		16	43		D1	Innatentive	Dry	
8/20/2002	5:50 PM	Tues	PDO	Angle	NB (R)	WB (T)		32	49		D1	Left of Center	Dry	
11/15/2002	6:50 PM	Fri	PDO	Angle	EB (L)	WB (T)		21	16		D1	Failed to Yield	Dry	Alcohol Present (D2)
12/8/2002	2:30 AM	Sun	PDO	Angle	SB (L)	EB (T)		39	56		D1	Failed to Yield	Dry	
12/23/2002	7:30 PM	Mon	PDO	Angle	WB (L)	EB (T)		15	?		?		Dry	
1/16/2003	6:10 PM	Thurs	PDO	Angle	EB (L)	WB (T)		17	38		?		Dry	Alcohol Contributed
5/11/2003	10:25 PM	Sun	PDO	Rear-end	EB (T)	EB (T)		39	21		D1	DUI	Dry	
5/22/2003	6:25 PM	Wed	PDO	Angle	WB (L)	EB (T)		28	41		D1	Failed to Yield	Dry	
7/7/2003	6:59 PM	Mon	PDO	Angle	WB (L)	NB (L)		23	37		D1	Speeding	Dry	Alcohol Contributed
7/20/2003	8:42 PM	Sun	PDO	Angle	NB	EB (T)		48	44		D2	Innatentive	Dry	
7/21/2003	11:58 PM	Mon	PDO	Angle	WB (L)	EB (T)		27	18		D1	Failed to Yield	Wet	
8/14/2003	3:20 PM	Thurs	PDO	Rear-end	EB (T)	EB (T)	EB (T)	19	16	18	D1	Innatentive	Dry	
9/30/2003	3:15 PM	Tues	PDO	Rear-end	NB (R)	EB (T)		21	21		D1		Wet	
10/25/2003	6:18 PM	Sat	PDO	Angle	WB (L)	EB (T)		16	25		D1	Failed to Yield	Dry	
1/8/2004	10:00 AM	Thurs	I	Rear-end	EB (T)	EB (T)		20	66		D1	Following too Close	Dry	Geometry of SE corner
6/25/2004	12:25 PM	Fri	I	Angle	EB (T)	WB (L)		19	52		?		Dry	
10/3/2004	1:29 AM	Sun	I	Angle	NB (T)	WB (T)		19	20		D1	Disobey Signal	Dry	
1/14/2004	3:00 PM	Wed	PDO	Angle	WB (L)	EB (T)		17	16		D1	Failed to Yield	Dry	
4/8/2004	1:45 PM	Thurs	PDO	Angle	NB (T)	WB (T)		?	33		D1	Disobey Signal	Dry	
4/10/2004	12:13 PM	Sat	PDO	Angle	NB (R)	WB (L)		39	18		D1	Left of Center	Wet	
5/10/2004	11:00 AM	Mon	PDO	Rear-end	WB (L)	WB (L)		79	23		D2	Speeding	Wet	
6/20/2004	9:31 PM	Sun	PDO	Angle	WB (L)	EB (L)		17	18		D1	Failed to Yield	Dry	
11/23/2004	11:36 AM	Tues	PDO	Angle	NB (R)	EB (T)		20	19		D1	Innatentive	Dry	

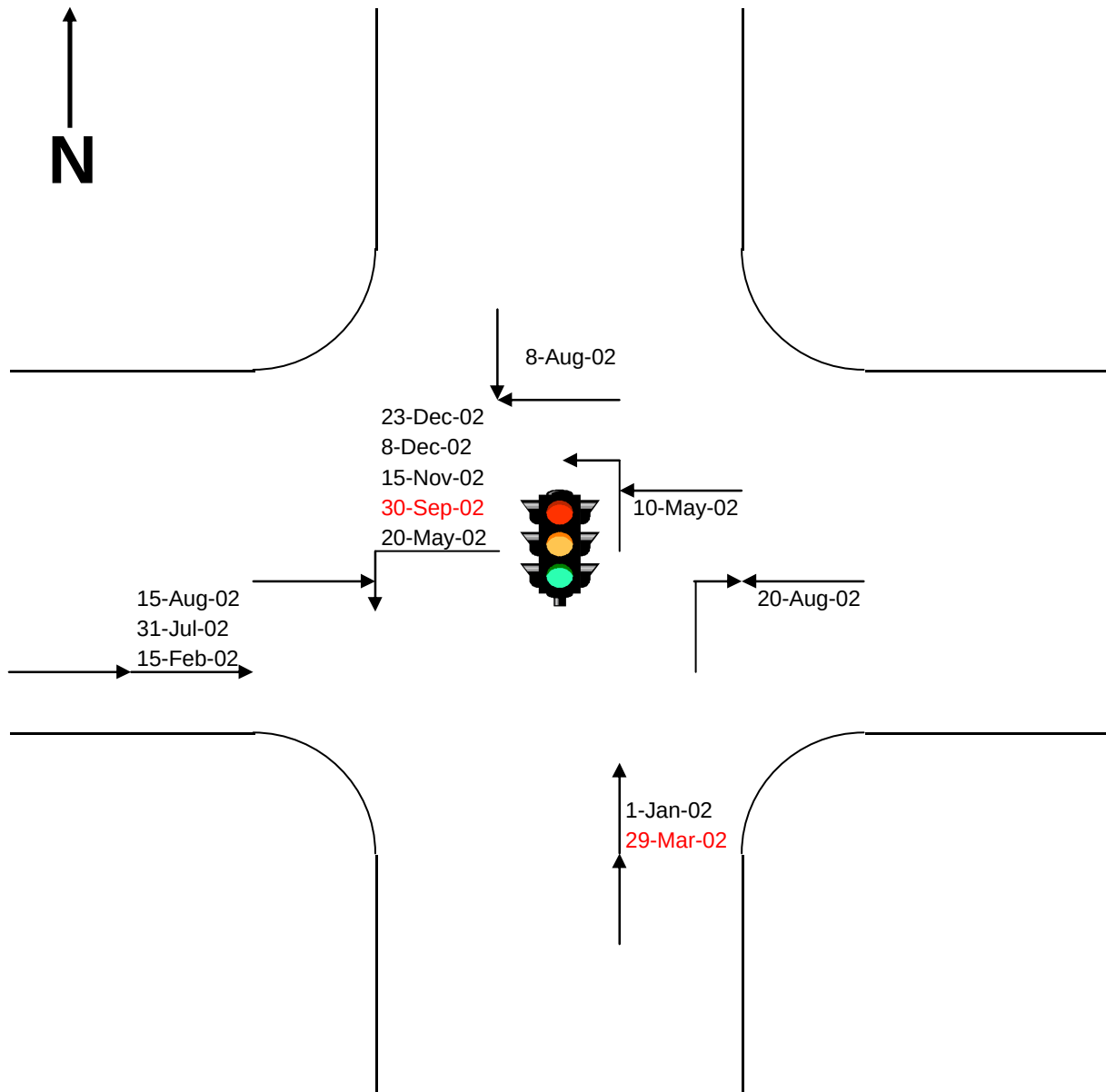


City of Lawrence, Kansas
Traffic Engineering Division
Crash Diagram



Location: **19th Street & Louisiana Street**

Date: **2002**

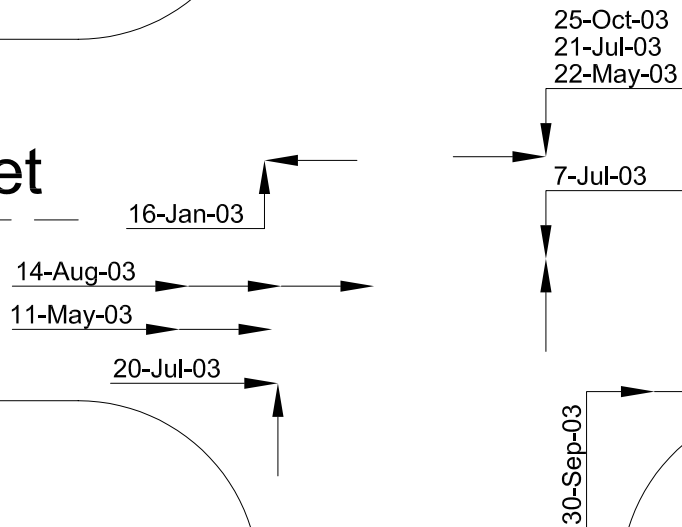


Notes: **Red indicates INJURY crash**

2002 cost of crashes based on state-wide averages = \$329,150

Louisiana Street

19th Street



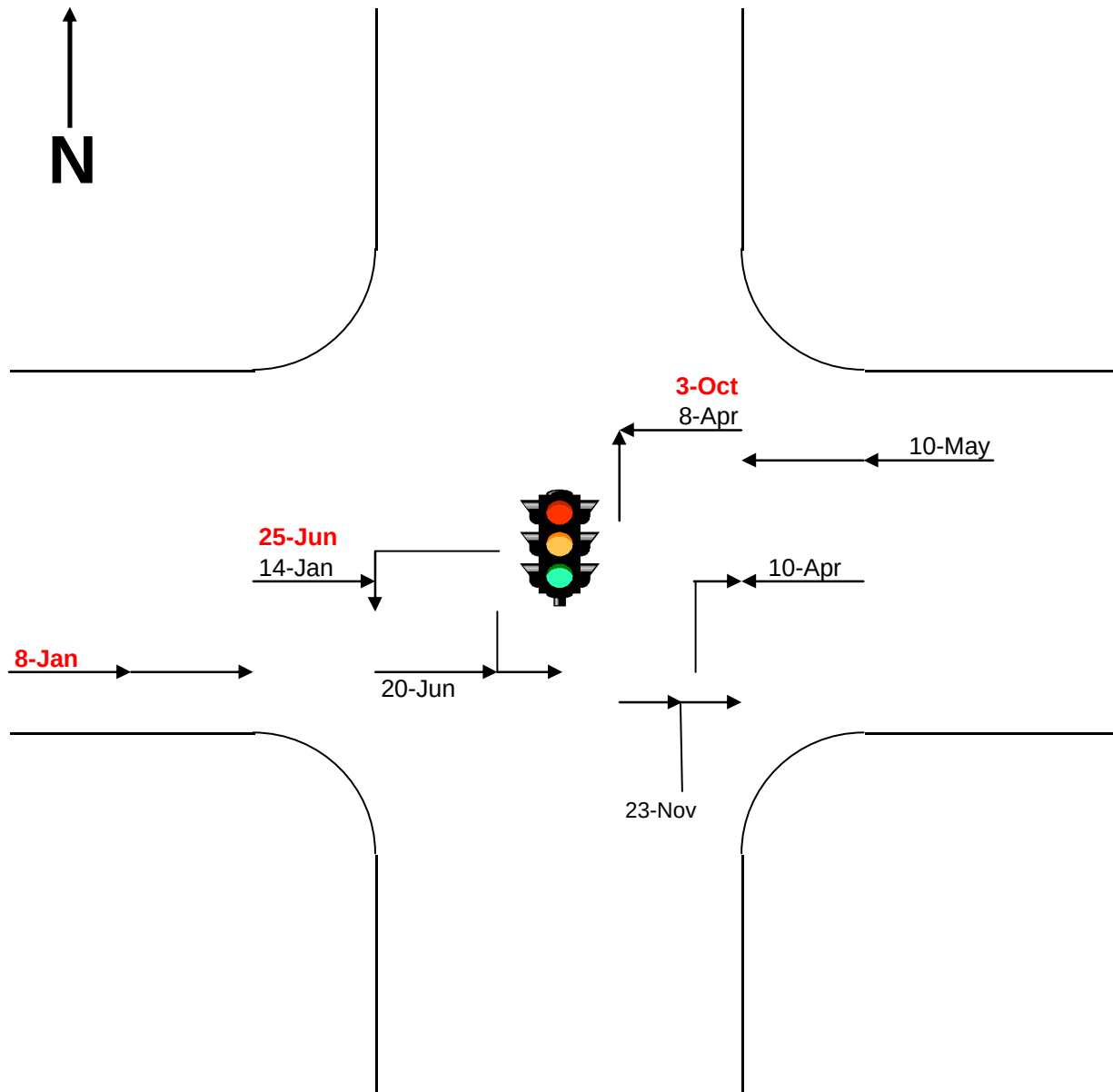


City of Lawrence, Kansas
Traffic Engineering Division
Crash Diagram



Location: 19th Street & Louisiana Street

Date: 2004



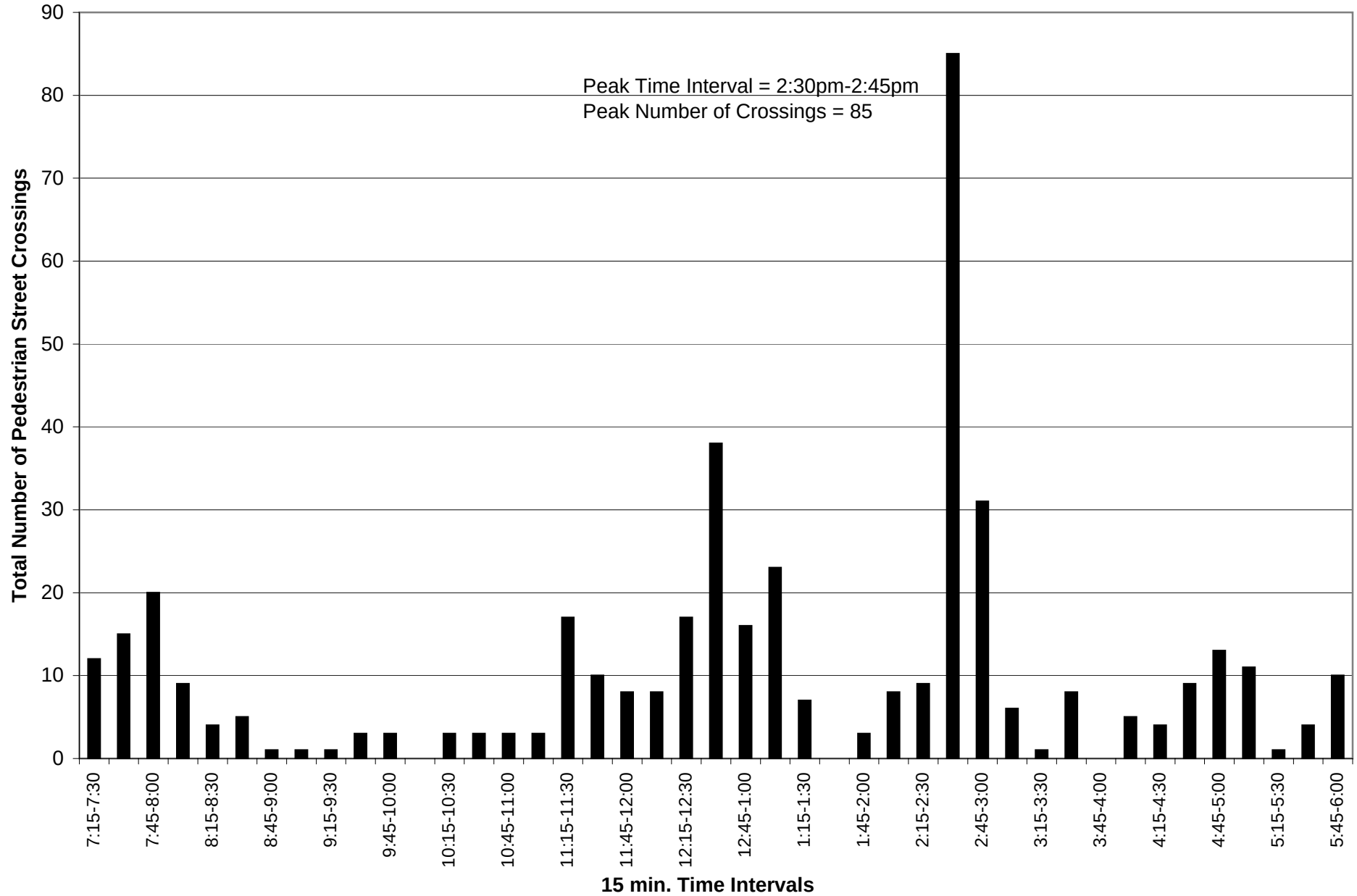
Notes: Red indicates INJURY crash

2004 cost of crashes based on national averages adjusted for Kansas = \$211,200

Pedestrian Counts **19th and Louisiana**

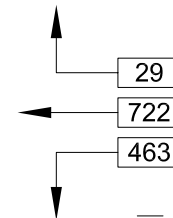
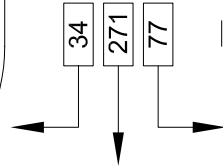
	NE to S	NE to W	NW to S	NW to E	SE to N	SE to W	SW to N	SW to E	
7:15-7:30	1	5	5	0	0	1	0	0	
7:30-7:45	0	5	5	1	0	3	1	0	
7:45-8:00	1	8	8	0	0	3	0	0	
	2	18	18	1	0	7	1	0	47
8:00-8:15	2	0	3	0	0	3	0	1	
8:15-8:30	0	2	2	0	0	0	0	0	
8:30-8:45	2	1	2	0	0	0	0	0	
8:45-9:00	0	0	0	0	0	0	0	1	
	4	3	7	0	0	3	0	2	19
9:00-9:15	0	0	0	0	1	0	0	0	
9:15-9:30	0	0	0	0	0	0	1	0	
9:30-9:45	0	0	0	1	1	0	1	0	
9:45-10:00	0	1	1	0	0	0	0	1	
	0	1	1	1	2	0	2	1	8
10:00-10:15	0	0	0	0	0	0	0	0	
10:15-10:30	0	0	1	0	1	0	0	1	
10:30-10:45	1	0	0	0	1	1	0	0	
10:45-11:00	0	2	1	0	0	0	0	0	
	1	2	2	0	2	1	0	1	9
11:00-11:15	0	0	0	2	0	0	1	0	
11:15-11:30	0	3	3	3	3	1	1	3	
11:30-11:45	0	3	4	1	0	0	1	1	
11:45-12:00	0	0	1	2	2	0	2	1	
	0	6	8	8	5	1	5	5	38
12:00-12:15	1	1	1	2	0	1	2	0	
12:15-12:30	0	3	3	7	0	0	4	0	
12:30-12:45	0	9	9	11	3	0	4	2	
12:45-1:00	0	9	7	0	0	0	0	0	
	1	22	20	20	3	1	10	2	79
1:00-1:15	0	11	8	2	0	0	2	0	
1:15-1:30	0	0	0	2	0	0	2	3	
1:30-1:45	0	0	0	0	0	0	0	0	
1:45-2:00	2	0	0	0	1	0	0	0	
	2	11	8	4	1	0	4	3	33
2:00-2:15	1	0	1	1	2	1	1	1	
2:15-2:30	0	0	0	4	1	0	4	0	
2:30-2:45	0	0	0	35	0	1	38	11	
2:45-3:00	0	0	1	4	9	1	6	10	
	1	0	2	44	12	3	49	22	133
3:00-3:15	3	1	1	1	0	0	0	0	
3:15-3:30	0	0	1	0	0	0	0	0	
3:30-3:45	0	0	0	2	0	1	2	3	
3:45-4:00	0	0	0	0	0	0	0	0	
	3	1	2	3	0	1	2	3	15
4:00-4:15	2	1	1	0	1	0	0	0	
4:15-4:30	2	1	1	0	0	0	0	0	
4:30-4:45	1	2	4	0	0	0	2	0	
4:45-5:00	0	2	7	1	1	1	1	0	
	5	6	13	1	2	1	3	0	31
5:00-5:15	0	2	1	1	2	1	2	2	
5:15-5:30	0	0	1	0	0	0	0	0	
5:30-5:45	0	1	2	0	0	0	0	1	
5:45-6:00	0	0	3	2	0	2	1	2	
	0	3	7	3	2	3	3	5	26
	19	73	88	85	29	21	79	44	438

19th and Louisiana Total Pedestrian Street Crossings

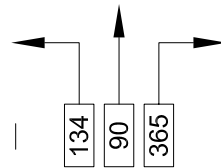
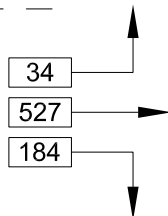


Note: 7:15 to 4:00 data recorded on April 7, 2005 -- 4:00 to 6:00 data recorded on April 21, 2005

Louisiana Street



19th Street



Note: Turning movement data shown on this sheet accounts for 2% truck traffic and has been adjusted for the peak 15 minutes of the peak hour.



Multi-Lane Roundabout Operations Worksheet - 2005

Multi-Lane Operations (AM Peak Hour - 2005)

	NB	SB	EB	WB (thru/rt)	EB (right bypass)	WB (left)
Entering Flow (vph)	508	109	376	746	126	269
Circulating Flow (vph)	393	1152	332	286	315	286
Approach Capacity (vph)	998	800	1031	1056	1040	1056
V/C Ratio	0.51	0.14	0.36	0.71	0.12	0.25
95th Percentile Queue (veh)	3	1	2	7	1	2
Average Delay (sec)	7.3	5.2	5.5	11.2	3.9	4.6
Intersection Delay (sec)	8.4					

Multi-Lane Operations (3:00 PM Hour (End of School) - 2005)

	NB	SB	EB	WB (thru/rt)	EB (right bypass)	WB (left)
Entering Flow (vph)	495	199	483	605	211	381
Circulating Flow (vph)	540	1091	535	200	478	200
Approach Capacity (vph)	918	821	921	1103	952	1103
V/C Ratio	0.54	0.24	0.52	0.55	0.22	0.35
95th Percentile Queue (veh)	4	1	4	4	1	2
Average Delay (sec)	8.4	5.8	8.1	7.2	4.9	5.0
Intersection Delay (sec)	7.6					

Multi-Lane Operations (PM Peak Hour - 2005)

	NB	SB	EB	WB (thru/rt)	EB (right bypass)	WB (left)
Entering Flow (vph)	589	382	561	751	184	463
Circulating Flow (vph)	638	1319	811	258	734	258
Approach Capacity (vph)	864	740	770	1071	812	1071
V/C Ratio	0.68	0.52	0.73	0.70	0.23	0.43
95th Percentile Queue (veh)	6	4	7	7	1	3
Average Delay (sec)	12.6	9.9	16.1	10.8	5.7	5.9
Intersection Delay (sec)	12.4				Approx. ADT = 26,636	

Note 1. Right-turns removed from EB entering flow

Note 2. WB entering approaches modeled separately as single lane approach

Note 3. SB is modeled as double-lane roundabout with a factor of 0.5 to Approach Cap.

Note 4. Estimated ADT is 10 times the total entering flow divided by 1.10 to remove ±10% PHF.

Multi-Lane Roundabout Operations Worksheet - 2010

Note: Projected traffic growth rate = 2% per year

Multi-Lane Operations (AM Peak Hour - 2010)

	NB	SB	EB	WB (thru/rt)	EB (right bypass)	WB (left)
Entering Flow (vph)	561	121	416	824	140	297
Circulating Flow (vph)	434	1272	367	316	348	316
Approach Capacity (vph)	976	757	1012	1040	1022	1040
V/C Ratio	0.58	0.16	0.41	0.79	0.14	0.29
95th Percentile Queue (veh)	4	1	3	9	1	2
Average Delay (sec)	8.6	5.7	6.0	15.2	4.1	4.8
Intersection Delay (sec)	10.7					

Multi-Lane Operations (3:00 PM Hour (End of School) - 2010)

	NB	SB	EB	WB (thru/rt)	EB (right bypass)	WB (left)
Entering Flow (vph)	547	220	534	668	233	421
Circulating Flow (vph)	597	1205	591	221	528	221
Approach Capacity (vph)	887	781	890	1092	924	1092
V/C Ratio	0.62	0.28	0.60	0.61	0.25	0.39
95th Percentile Queue (veh)	5	2	5	5	1	2
Average Delay (sec)	10.4	6.4	9.9	8.4	5.2	5.4
Intersection Delay (sec)	9.1					

Multi-Lane Operations (PM Peak Hour - 2010)

	NB	SB	EB	WB (thru/rt)	EB (right bypass)	WB (left)
Entering Flow (vph)	651	422	620	830	204	512
Circulating Flow (vph)	705	1457	896	285	811	285
Approach Capacity (vph)	828	690	724	1057	770	1057
V/C Ratio	0.79	0.61	0.86	0.79	0.26	0.48
95th Percentile Queue (veh)	9	5	11	9	2	3
Average Delay (sec)	18.3	13.1	27.1	14.6	6.3	6.6
Intersection Delay (sec)	18.4				Approx. ADT = 29,445	

Note 1. Right-turns removed from EB entering flow

Note 2. WB entering approaches modeled separately as single lane approach

Note 3. SB is modeled as double-lane roundabout with a factor of 0.5 to Approach Cap.

Note 4. Estimated ADT is 10 times the total entering flow divided by 1.10 to remove ±10% PHF.

Multi-Lane Roundabout Operations Worksheet - 2015

Note: Projected traffic growth rate = 2% per year

Multi-Lane Operations (AM Peak Hour - 2015)

	NB	SB	EB	WB (thru/rt)	EB (right bypass)	WB (left)
Entering Flow (vph)	620	133	459	910	154	328
Circulating Flow (vph)	480	1405	405	349	384	349
Approach Capacity (vph)	951	709	991	1022	1003	1022
V/C Ratio	0.65	0.19	0.46	0.89	0.15	0.32
95th Percentile Queue (veh)	6	1	3	13	1	2
Average Delay (sec)	10.6	6.2	6.7	23.8	4.2	5.2
Intersection Delay (sec)	15.2					

Multi-Lane Operations (3:00 PM Hour (End of School) - 2015)

	NB	SB	EB	WB (thru/rt)	EB (right bypass)	WB (left)
Entering Flow (vph)	604	243	589	738	258	465
Circulating Flow (vph)	659	1330	653	244	583	244
Approach Capacity (vph)	853	736	856	1079	894	1079
V/C Ratio	0.71	0.33	0.69	0.68	0.29	0.43
95th Percentile Queue (veh)	7	2	6	6	2	3
Average Delay (sec)	13.8	7.3	12.9	10.2	5.6	5.8
Intersection Delay (sec)	11.6					

Multi-Lane Operations (PM Peak Hour - 2015)

	NB	SB	EB	WB (thru/rt)	EB (right bypass)	WB (left)
Entering Flow (vph)	718	466	684	916	225	565
Circulating Flow (vph)	778	1608	989	315	895	315
Approach Capacity (vph)	788	636	673	1040	724	1040
V/C Ratio	0.91	0.73	1.02	0.88	0.31	0.54
95th Percentile Queue (veh)	13	7	17	13	2	4
Average Delay (sec)	32.2	19.5	58.5	22.3	7.2	7.5
Intersection Delay (sec)	33.3				Approx. ADT =	32,491

Note 1. Right-turns removed from EB entering flow

Note 2. WB entering approaches modeled separately as single lane approach

Note 3. SB is modeled as double-lane roundabout with a factor of 0.5 to Approach Cap.

Note 4. Estimated ADT is 10 times the total entering flow divided by 1.10 to remove ±10% PHF.