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DESIGN MEMORANDUM

To: Bill Stogsdill, CPM, PWM, PWLF
Public Works Director – City of Fairway

From: David J. Mennenga, P.E., PTOE

Date: December 14, 2017

Subject: Belinder Avenue Traffic Calming Study

As you requested, George Butler Associates, Inc. (GBA) has prepared this design memorandum to summarize the traffic engineering evaluations that we have completed in association with the study of potential traffic calming improvement needs along the Belinder Avenue corridor. The study corridor extends between the intersections with Shawnee Mission Parkway on the north end and State Park Road on the south end.

Existing Conditions: The study segment of Belinder Avenue is generally a two-lane residential collector roadway. The roadway is lined with single-family residential lots along its western side, with the Mission Hills Country Club property located along the east side. The roadway has an approximate width of 26 feet, measured back of curb to back of curb.

On-street parking is allowed in front of the adjacent residences, but is prohibited along the eastern side of the road. The posted speed limit along the study segment of Belinder Avenue is currently 25 miles per hour (mph). At this time, there are no sidewalks or other bicycle / pedestrian accommodations provided along the corridor. The existing conditions along the corridor are generally depicted on the photos provided as ***Exhibits A through D***.

Data Collection: To complete the required traffic calming evaluations along the Belinder Avenue corridor, GBA first obtained bi-directional 24-hour traffic volumes, vehicle travel speeds, and vehicle classification counts, utilizing on-road machine tube counters. These daily traffic counts were obtained at the following five (5) locations:

- On Belinder Avenue, south of Shawnee Mission Parkway (SMP);
- On Belinder Avenue, just south of the mid-block hill crest;
- On Belinder Avenue, north of State Park Road;
- On the State Park Road to Belinder Avenue connection;
- On Norwood Road, between SMP and State Park Road.

Most of these traffic counters were installed on Wednesday November 1, 2017 and maintained in place for seven consecutive days, so that data was obtained for four "typical" weekdays as well as for one weekend period. It should be noted

that the southernmost traffic counter on Belinder Avenue, located just to the north of the State Park Road intersection, was installed one day later on the morning of Thursday, November 2, 2017.

Data Analysis: The attached ***Tables 1 and 2*** depict the results of the traffic data collection process. As shown on ***Table 1***, daily traffic volumes along the Belinder Avenue study corridor generally range from a low of about 1,350 vehicles per day (vpd) up to approximately 1,750 vpd on any "typical" weekday. During the weekend, the traffic volumes on Belinder Avenue are generally between 800 – 900 vpd on a Saturday and between 700 – 800 vpd on a Sunday. Heavy vehicle experience along the study corridor was determined to be very low, with less than one percent truck traffic indicated at any of the count stations.

The current 85th-percentile vehicle speeds on Belinder Avenue range between 29 mph and 43 mph, as shown on ***Table 1***. The extremes at each end of this corridor speed spectrum were both found to occur just north of the State Park Road intersection. Although the southbound vehicles are on a significant downgrade toward this intersection, it appears that they are also somewhat slowing down as they approach the intersection, where drivers are required to stop at one of the two existing stop signs before making their desired turning maneuvers. Still, about 62 percent of these southbound vehicles were found to be traveling in excess of the posted 25 mph speed limit.

Based upon the traffic counter placed across the State Park Road to Belinder Avenue connector roadway, most of the northbound traffic was found to originate from the south across the low-water crossing from adjoining Mission Hills. With no traffic control or other influences at the State Park Road intersection for these northbound vehicles, they were found to be traveling the fastest of any vehicles along the study corridor. Despite traveling uphill on that particular section of Belinder Avenue, about 94 percent of the northbound vehicles were found to be traveling in excess of the posted 25 mph speed limit.

At the remaining count stations along Belinder Road, the 85th-percentile speeds were found to be between 32 and 34 mph. At the northernmost count station, approximately 80 percent of the northbound vehicles and about 69 percent of the southbound vehicles were found to be traveling in excess of the posted 25 mph speed limit. Likewise, at the count station located near the hill crest in the middle of the study segment, about 73 percent of the northbound vehicles and 78 percent of the southbound vehicles were found to be traveling in excess of the posted speed limit.

Table 2 depicts the collected traffic data from the remaining count stations on both Norwood Road and the State Park Road connector to Belinder Avenue. As shown on this table, Norwood Road currently carries around 400 vpd on a typical weekday and about 250 vpd during the weekend. The 85th-percentile speeds on Norwood Road are about 28 mph in each direction of travel, not significantly higher than the posted 25 mph speed limit. Between 35 and 40 percent of the vehicles on this street were found to be traveling in excess of the posted speed limit. There is almost no truck traffic currently utilizing this street, as shown in the table.

Finally, the connector roadway between State Park Road and Belinder Avenue was found to carry between 250 and 400 vpd during a typical weekday. Less than 150 vpd utilize this roadway connection during the weekend days. Due to the short segment length on this roadway connector, vehicle speeds are very low (i.e., 10-15 mph) and vehicle classification results with the on-road counter were not accurate.

Traffic Calming Evaluations: Based upon our review of the collected traffic data and comparisons versus the City's established vehicle speed and traffic volume criteria, we would recommend that the installation of traffic calming measures on Belinder Avenue should be considered. We understand that the City's established process requires that several surveys should first be performed within the affected neighborhood to obtain a 60 percent consensus of the residents regarding both the presence of a speeding issue along the Belinder Avenue corridor and to also approve the installation of temporary traffic control devices as part of the Phase I mitigation plan.

GBA would recommend that the City staff consider several of the parallel streets within the adjoining neighborhood for inclusion into the defined "affected area" for this traffic calming project on Belinder Avenue, based on our review of the surrounding neighborhood and the observed / expected travel patterns. It is likely that some drivers from these nearby residential streets would also be impacted by the implementation of any traffic calming devices on Belinder Avenue. So that a list of affected property owners can be assembled for the required survey purposes, as defined in the City's traffic calming policy, we would recommend that the residents along Norwood Road, Fairway Road, and Aberdeen Road also be included within the "affected area" for this project.

Traffic Calming Recommendations: To facilitate the temporary implementation of any Phase I traffic control devices, if appropriate direction is received following the required survey and approval processes, GBA's traffic engineers also evaluated the existing Belinder Avenue corridor to determine the optimal opportunities for placement of a variety of potential traffic calming devices. As shown on the attached ***Exhibit 1***, many of these potential locations are in close proximity to existing fire hydrants located along the western side of the roadway, where residential parking would already be restricted. Based upon our field investigations, there are several locations along the study corridor with increased spacing between the adjacent driveways that may best accommodate traffic calming devices (i.e., with more than 100 feet of uninterrupted curb line available).

GBA's traffic engineers would make the following recommendations to the City staff, based upon our completed engineering evaluations, regarding the potential traffic calming solutions that should be considered for the Belinder Avenue corridor:

- Based on the severity of the vehicle speeding conditions that have been found, it is very unlikely that acceptable speed reductions can be obtained simply through the placement of additional traffic control signage or even increased police enforcement.

- Therefore, various types of more significant traffic calming devices should be considered further by the City and the project advisory committee (i.e., vertical deflection devices, horizontal deflection devices, or a combination thereof):

    - To achieve acceptable speed reduction with vertical deflection devices, it is likely that a series of devices would be necessary. We believe the most appropriate vertical traffic calming device for this project would be speed tables with a typical configuration recommended by the Institute of Transportation Engineers (ITE). These speed tables provide an approximate 3-1/2 inch vertical deflection, and have 6-foot ramps on either end up to a 10-foot plateau (i.e., a 22-foot total profile length). Based on the overall length of the Belinder Avenue study corridor, a series of at least three speed tables would be recommended to segment the corridor

approximately into quarters. To achieve this configuration, speed tables could be provided near the following residence locations: 5346-5406 Belinder, 5510-5514 Belinder, and 5606-5012 Belinder.

- There are several different options for horizontal deflection devices that could be used to calm the traffic along the Belinder Avenue study corridor, as shown on the attached ***Exhibit 2***. We would recommend that at least two of these more significant horizontal traffic calming devices be considered, generally located closer to the ends of the project corridor. As shown on the exhibit, these devices could best be accommodated near the following residence locations: 5400-5406 Belinder and 5606-5612 Belinder.

    - A chicane option could be considered to require vehicles to slow down and maneuver side-to-side in order to navigate the roadway. These mitigation measures would be centered generally near the existing hydrant locations to minimize the impacts to any existing on-street parking. The chicane islands have been shown on the exhibit projecting about six feet into the roadway, about the same depth as any parked vehicles. This configuration would leave approximately 16 feet of roadway surface (edge-to-edge) or about 19 feet (face-to-face) between curbs. These narrowed lane widths should still be traversable by emergency response vehicles and other garbage, mail, and delivery trucks that utilize the roadway. As shown, it would be necessary to provide a line of tubular markers or similar devices through the chicane to require vehicles to stay in their travel lanes.

    - If on-street parking can be restricted within the recommended 100-foot device length and for a short distance both upstream and downstream of the device, another horizontal traffic calming option would be to provide a 4-foot wide raised median island in the center of the roadway to narrow each travel lane to approximately 9 feet in width.

    - A third horizontal option would be to provide some narrowing on both sides of the roadway. Again, it would be necessary to provide a line of tubular markers or similar devices through this narrowing to require vehicles to stay in their respective travel lanes. Like the chicane option, this configuration would leave approximately 16 feet of roadway surface (edge-to-edge) or about 19 feet (face-to-face) between curbs.

- In conjunction with any of these three horizontal traffic calming options, it would still be possible to place a vertical deflection speed table in the space between the recommended locations. If a speed table was included at the mid-block location, it may help to prevent vehicles from over-speeding between the horizontal traffic calming devices. If located near 5510 Belinder, it could also serve as an appropriate connection to the Mission Hills Country Club and clubhouse, if pedestrian accommodations were ever added along the east side of the Belinder Avenue study corridor in the future.

We appreciate the opportunity to be of service to you and the City of Fairway on this very important project. At your convenience, we look forward to continuing these discussions of the vehicle speed concerns along the Belinder Avenue study corridor and the potential traffic calming mitigations to address these current issues. Please let us know if you should have any questions or need additional information.

Table 1
Belinder Avenue Volume, Speed & Classification Traffic Counts

Belinder Avenue (North)

	Northbound (vpd)	Southbound (vpd)	2-Way Total (vpd)
THU 11/2/17 Volumes	944	808	1,752
FRI 11/3/17 Volumes	945	684	1,629
SAT 11/4/17 Volumes	502	413	915
SUN 11/5/17 Volumes	445	344	789
MON 11/6/17 Volumes	786	644	1,430
TUE 11/7/17 Volumes	882	736	1,618
85th Percentile Speed	33 MPH	32 MPH	
Average Speed	29 MPH	27 MPH	
10 MPH Pace	26-35 MPH	26-35 MPH	
Percent > 25 MPH	80.4%	68.5%	
Heavy Vehicles (>3 axles)	0.7%	0.6%	

Belinder Avenue (Middle)

	Northbound (vpd)	Southbound (vpd)	2-Way Total (vpd)
THU 11/2/17 Volumes	905	767	1,672
FRI 11/3/17 Volumes	932	658	1,590
SAT 11/4/17 Volumes	475	372	847
SUN 11/5/17 Volumes	417	329	746
MON 11/6/17 Volumes	760	631	1,391
TUE 11/7/17 Volumes	938	732	1,670
85th Percentile Speed	32 MPH	34 MPH	
Average Speed	27 MPH	29 MPH	
10 MPH Pace	26-35 MPH	26-35 MPH	
Percent > 25 MPH	73.3%	78.3%	
Heavy Vehicles (>3 axles)	0.4%	0.4%	

Belinder Avenue (South)

	Northbound (vpd)	Southbound (vpd)	2-Way Total (vpd)
THU 11/2/17 Volumes	n/a	n/a	n/a
FRI 11/3/17 Volumes	919	661	1,580
SAT 11/4/17 Volumes	459	348	807
SUN 11/5/17 Volumes	407	308	715
MON 11/6/17 Volumes	748	609	1,357
TUE 11/7/17 Volumes	935	702	1,637
85th Percentile Speed	43 MPH	29 MPH	
Average Speed	36 MPH	26 MPH	
10 MPH Pace	31-40 MPH	21-30 MPH	
Percent > 25 MPH	94.1%	62.0%	
Heavy Vehicles (>3 axles)	0.2%	0.2%	

Table 2
Adjacent Street Volume, Speed & Classification Traffic Counts

Norwood Road

	Northbound (vpd)	Southbound (vpd)	2-Way Total (vpd)
THU 11/2/17 Volumes	157	217	374
FRI 11/3/17 Volumes	159	233	392
SAT 11/4/17 Volumes	110	151	261
SUN 11/5/17 Volumes	107	148	255
MON 11/6/17 Volumes	150	199	349
TUE 11/7/17 Volumes	174	238	412
85th Percentile Speed	28 MPH	28 MPH	
Average Speed	22 MPH	23 MPH	
10 MPH Pace	21-30 MPH	21-30 MPH	
Percent > 25 MPH	35.4%	38.1%	
Heavy Vehicles (>3 axles)	0.1%	0.1%	

State Park Rd. Connector

	Westbound (vpd)	Eastbound (vpd)	2-Way Total (vpd)
THU 11/2/17 Volumes	137	159	296
FRI 11/3/17 Volumes	119	174	293
SAT 11/4/17 Volumes	55	85	140
SUN 11/5/17 Volumes	40	83	123
MON 11/6/17 Volumes	110	144	254
TUE 11/7/17 Volumes	181	199	380
85th Percentile Speed	13 MPH	12 MPH	
Average Speed	9 MPH	8 MPH	
10 MPH Pace	1-10 MPH	1-10 MPH	
Percent > 25 MPH	1.6%	0.7%	
Heavy Vehicles (>3 axles)	n/a	n/a	

EXHIBIT A

Belinder Avenue – South End Looking North

Belinder Avenue – Middle Looking North

EXHIBIT B

Belinder Avenue – North End Looking North

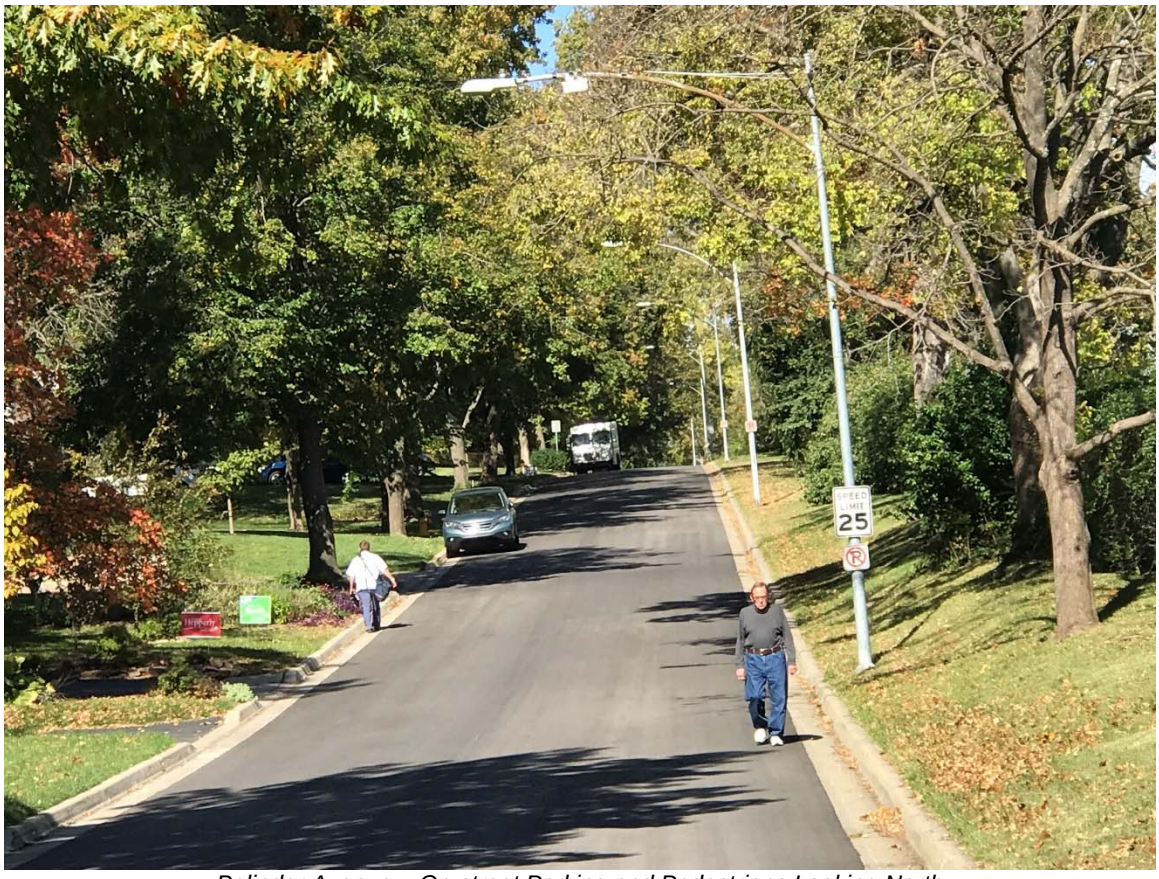
Belinder Avenue – North End Looking South

EXHIBIT C

Belinder Avenue – Middle Looking South

Belinder Avenue – South End Looking South

EXHIBIT D



Belinder Avenue – On-street Parking and Pedestrians Looking North

Belinder Avenue – On-Street Parking and Pedestrians Looking South

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DATE:	11/16/2017
DESIGN BY:	DJM
DRAWN BY:	RLC
PROJECT NO.:	13860
SHEET NO.	1
TOTAL SHEETS	2

David J Mennenga
Professional Engineer
License No. 16041

Traffic Calming Measures
Belinder Ave
Fairway, KS

NO.	DATE	REVISIONS	BY	APPROVED

100' 0' 100' 200'
SCALE : 1 INCH = 100 FEET

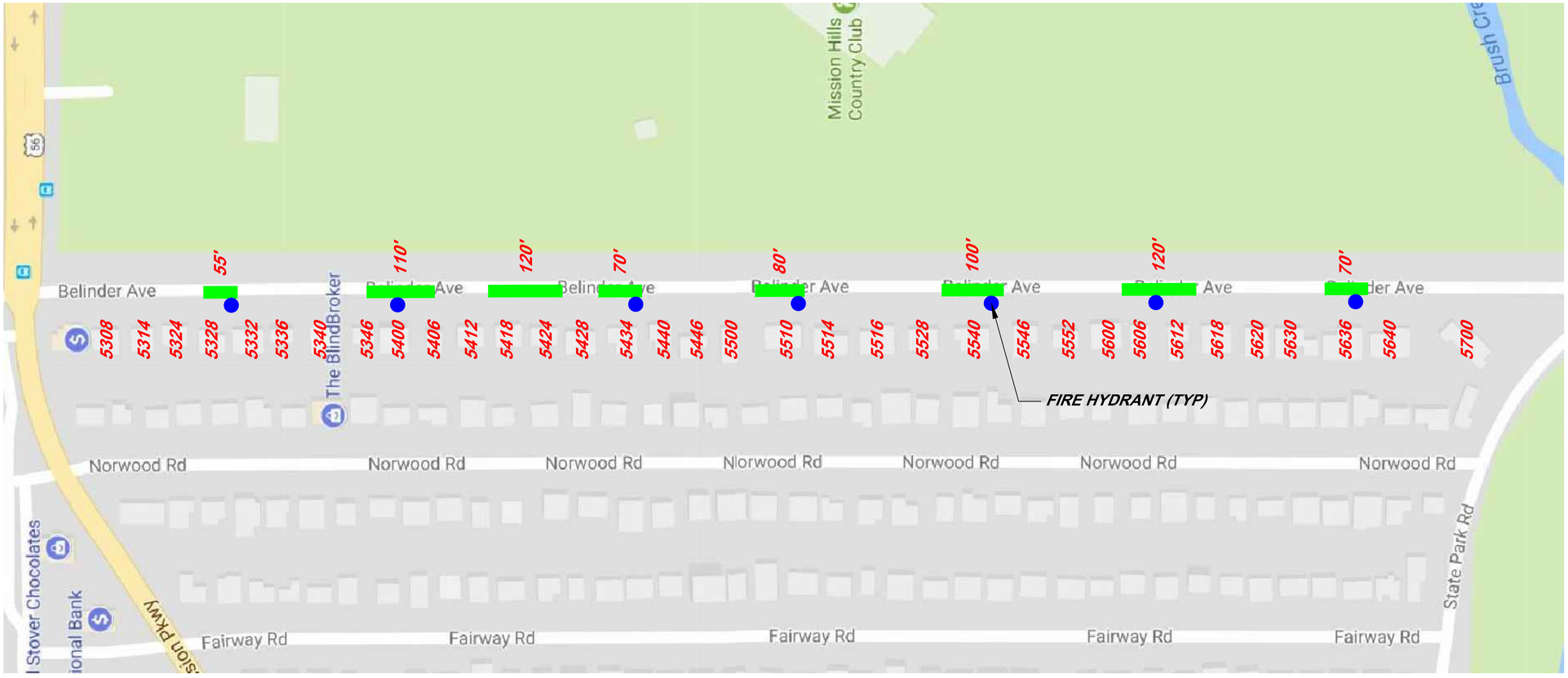
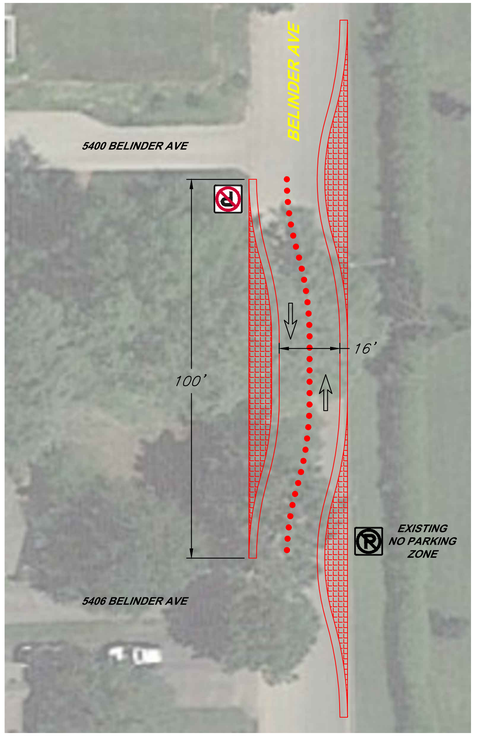
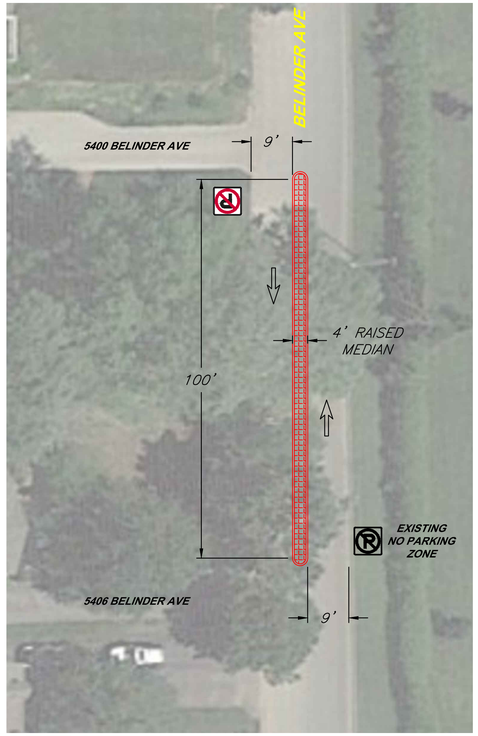


EXHIBIT 1
TRAFFIC CALMING DEVICES
POTENTIAL BELINDER AVE LOCATIONS

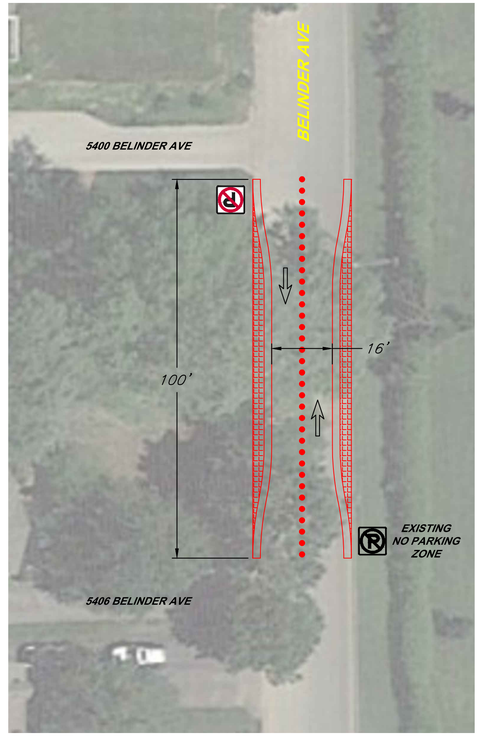
CHICANE OPTION

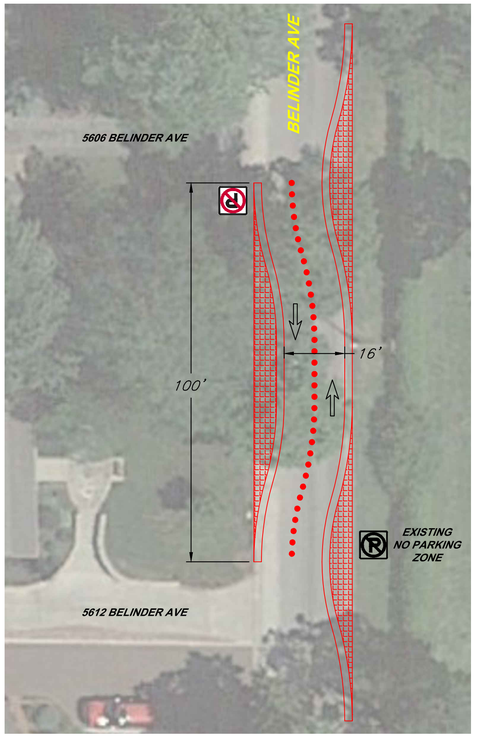


MEDIAN OPTION

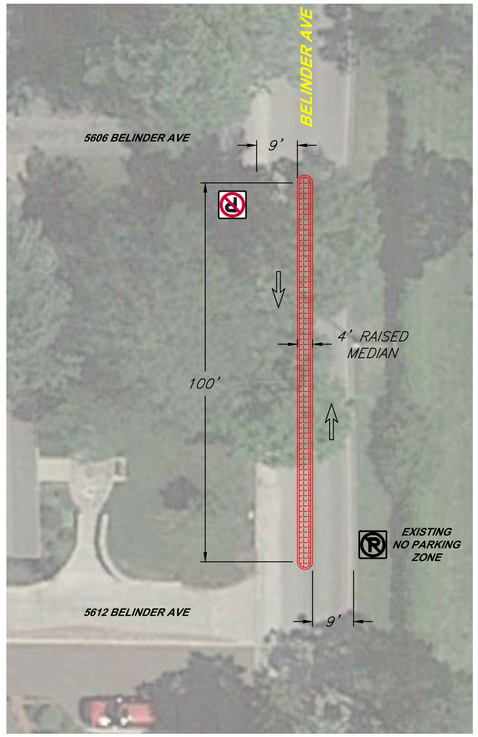


NARROWING OPTION





CHICANE OPTION



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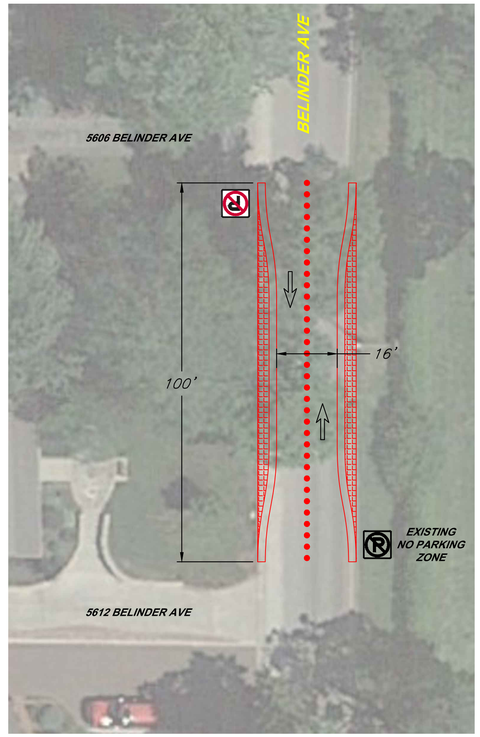

NARROWING OPTION

20' 0' 20' 40'

SCALE : 1 INCH = 20 FEET

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DATE:	11/16/2017
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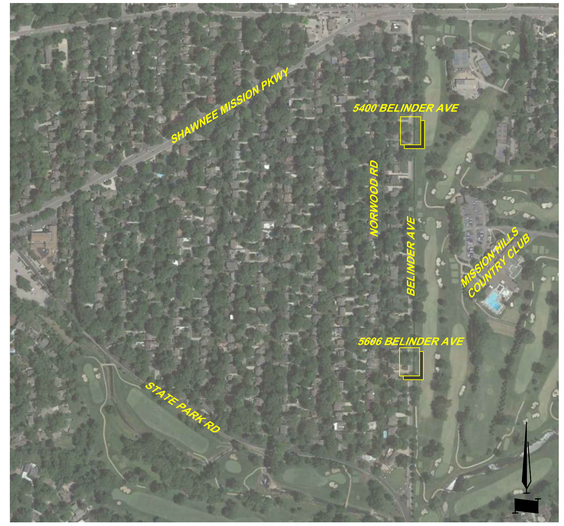
Traffic Calming Measures
Belinder Ave
Fairway, KS

NO.	DATE	REVISIONS	BY	APPROVED



KEY MAP
SCALE: 1:400

EXHIBIT 2
TRAFFIC CALMING DEVICES
HORIZONTAL ALTERNATIVES