Iowa City Gateway
Supplemental Traffic Operations Analysis
March 25, 2014

This supplemental traffic analysis memorandum has been prepared at the request of the City of Iowa City and the Metropolitan Planning Organization of Johnson County (MPOJC) staff. It is in response to various questions regarding existing and future traffic operations within the Iowa City Gateway project area. Specifically, Council has posed questions regarding operations at the intersection of Dubuque Street and Park Road, including:

- Is it necessary to add a right turn lane to southbound Dubuque Street at the Park Road intersection?
- How many dedicated left turns are needed for eastbound Park Road at the Dubuque Street intersection?
- Would a dedicated left turn lane and a shared left/right turn lane suffice for eastbound Park Road?
- How many westbound lanes should there be on the Park Road Bridge?

Analysis conducted previously during the NEPA study and a recent reexamination of existing conditions indicates that a dedicated southbound right turn is necessary for Dubuque Street at Park Road. Furthermore, analysis concludes that two dedicated left turns and one dedicated right turn on eastbound Park Road at Dubuque Street is warranted today and in the future. Lastly, maintaining the two westbound lanes to better accommodate vehicular traffic and the existing Cambus service on the Park Road Bridge is recommended.

Please note that HNTB staff only analyzed intersection operations at Dubuque and Park Road as part of this work. The current four-lane configuration on Dubuque Street is sufficient for existing and projected future traffic volumes and added capacity was not an element of the project's purpose and need.

Methodology

This memorandum summarizes detailed Synchro analysis results of various traffic operations modeling scenarios. Existing (year 2010) and future (year 2040) traffic operations were reevaluated using Synchro 8 software. Synchro models vehicle movements with existing and future year 2040 traffic volumes. Staff analysis involved scenarios utilizing existing and future traffic volumes including:

- Operations on the existing Dubuque Street and Park Road lane configurations (No Build)
- Operations with a dedicated right turn lane on southbound Dubuque Street at Park Road
- Operations with a dedicated left turn and one shared left/right turn on eastbound Park Road at Dubuque
- Operations with two dedicated left turn lanes and one right turn lane on eastbound Park Road at Dubuque
- Operations with one westbound lane on Park Road and a scenario with two westbound lanes.

The analysis utilizing Synchro provides an average delay per vehicle for each intersection movement. A level of service (LOS) rating is assigned to the resulting average delay per vehicle that is measured in seconds of delay. The criteria for level of service ratings is provided in Chapters 18 and 19 of the Highway Capacity Manual, 2010. Levels of service range from A

(free flowing traffic), to F (delays exceeding 80 seconds). The level of service criteria are as follows:

Level of Service	Control Delay (seconds/vehicle) Signalized	Unsignalized
A (best)	Less than or equal to 10	Less than or equal to 10
B	10-20	10-15
C	20-35	15-25
D	35-55	25-35
E	55-80	35-50
F (worst)	Greater than 80	Greater than 50

Ideally, a level of service of C is provided, but in an urban area, a level of service of D is considered acceptable during peak traffic conditions.

Existing Operations (No Build)

As a basis of comparison to answer Council questions, staff reexamined traffic operations at Dubuque Street and Park Road using the current lane configurations at the intersection. Existing and future year operations were analyzed to determine if conditions warranted modifications to the intersection. The analysis indicates that in both the existing and future years, poor operations on southbound Dubuque Street in the morning and on eastbound Park Road in the afternoon peak warrant examining modifications to the intersection.

Tables 1 through 4 show the existing and future no-build operations. Each table displays the following for each movement in the intersection: volume of vehicles; delay in seconds, and; level of service. At the bottom of each table, the overall intersection level of service and the average intersection delay in seconds is provided.

Table 1: Existing AM Peak Hour Volumes, Delay and LOS

Existing AM 2010						
	Park		Dubuque			
	EBL	EBR	NBL	NBT	SBT	SBR
Traffic Volume	154	71	175	447	971	742
Movement Delay (Sec)	28.5	7.1	13.5	7.0	216.5	-
Movement LOS	C	A	B	A	F	-
Approach Delay (Sec)	21.7		8.8		216.5	
Approach LOS	C		A		F	
Overall Intersection LOS:	**F**		**Average Intersection Delay:**			**148.9**

Table 2: Existing PM Peak Hour Volumes, Delay and LOS

Existing PM 2010						
	Park		Dubuque			
	EBL	EBR	NBL	NBT	SBT	SBR
Traffic Volume	563	240	239	1088	653	177
Movement Delay (Sec)	241.2	6.1	16.7	10.2	23.9	-
Movement LOS	F	A	B	B	C	-
Approach Delay (Sec)	170.9		11.3		23.9	
Approach LOS	F		B		C	
Overall Intersection LOS:	E		Average Intersection Delay:		58.2	

Table 3: 2040 No-Build AM Peak Hour Volumes, Delay and LOS

No Build AM 2040						
	Park		Dubuque			
	EBL	EBR	NBL	NBT	SBT	SBR
Traffic Volume	211	97	171	437	995	760
Movement Delay (Sec)	31.9	6.5	12.4	6.9	231.9	-
Movement LOS	C	A	B	A	F	-
Approach Delay (Sec)	23.9		8.5		231.9	
Approach LOS	C		A		F	
Overall Intersection LOS:	F		Average Intersection Delay:		157.1	

Table 4: 2040 No-Build PM Peak Hour Volumes, Delay and LOS

No Build PM 2040						
	Park		Dubuque			
	EBL	EBR	NBL	NBT	SBT	SBR
Traffic Volume	743	317	239	1089	765	207
Movement Delay (Sec)	440.8	11.1	18.7	9.9	29.0	-
Movement LOS	F	B	B	A	C	-
Approach Delay (Sec)	312.4		11.5		29.0	
Approach LOS	F		B		C	
Overall Intersection LOS:	F		Average Intersection Delay:		111.5	

As displayed in the above tables, there are two key observations regarding existing and future traffic operations are as follows:

- In the morning peak hour, the southbound Dubuque Street approach operates at a LOS F. This is the case today with existing operations (216.5 seconds/vehicle) and in the future no-build (231.9 seconds/vehicle) conditions.
- In the afternoon peak hour, the Park Road eastbound left turn movement operates at a LOS F in existing (241.2 seconds/vehicle) and future no-build (440.8 seconds/vehicle) conditions.

During the morning peak hour, in both existing and future conditions, the entire intersection has an LOS F because of how poorly the southbound approach performs. This makes the average delay for the intersection a LOS F – with delays of 148.9 seconds/vehicle in the existing scenario and 157.1 seconds/vehicle in 2040. For the afternoon peak hour period, delays on eastbound Park Road cause the eastbound movement to fail today (LOS E, 58.2 second/vehicle delay), and the entire intersection to fail in year 2040 (LOS F, 111.5 seconds/vehicle delay). It should also be noted that the two westbound lanes on Park Road experience no operational issues receiving existing or future year traffic.

Question 1: is the Southbound Dedicated Right Turn Lane Necessary?

As indicated previously, southbound Dubuque Street operates poorly during the morning peak period in existing and future year conditions due to delays created by vehicles turning onto westbound Park Road. To examine the issue, the intersection was examined first with the existing configuration – one southbound through lane and a shared through/right turn lane – then with two through lanes and a dedicated right turn lane added.

Scenario 1A: Dubuque Street Southbound Without Dedicated Right Turn

Scenario 1A examined operations without a southbound right turn lane for existing and future traffic. **Tables 5 and 6** display operations in existing and future conditions. The analysis confirms that in the morning peak hour, delays are caused by vehicles traveling southbound seeking to turn right onto Park Road. Without a dedicated right turn lane, right turning vehicles must stop behind through traffic during a red signal. This prevents the right turn on red movement by the southbound right turning vehicles. In both the existing and future year, the delays on southbound Dubuque cause the intersection to fail (LOS F).

Table 5: Dubuque Street with no Southbound Right Turn
2010 AM Peak Hour Volumes, Delay and LOS

Scenario 1A* AM 2010						
	Park		Dubuque			
	EBL	EBR	NBL	NBT	SBT	SBR
Traffic Volume	154	71	175	447	971	742
Total Delay (Sec)	17.4	-	13.5	7.0	216.5	-
LOS	B	-	B	A	F	-
Approach Delay (Sec)	17.4		8.8		216.5	
Approach LOS	B		A		F	
Overall Intersection LOS: F			Average Intersection Delay: 148.5			

* Scenario 1A includes one LT and one shared LT/RT on EB Park and one lane on WB Park

Table 6: Dubuque Street with no Southbound Right Turn
2040 AM Peak Hour Volumes, Delay and LOS

Scenario 1A* AM 2040						
	Park		Dubuque			
	EBL	EBR	NBL	NBT	SBT	SBR
Traffic Volume	211	97	171	437	995	760
Total Delay (Sec)	19.7	-	12.4	6.9	231.9	-
LOS	B	-	B	A	F	-
Approach Delay (Sec)	19.7		8.5		231.9	
Approach LOS	B		A		F	
Overall Intersection LOS: F			Average Intersection Delay: 156.6			

* Scenario 1A includes one LT and one shared LT/RT on EB Park and one lane on WB Park

Scenario 1B: Dubuque Street Southbound With A Dedicated Right Turn

Because of the poor operations without a southbound right turn, Scenario 1B was developed to provide a dedicated southbound right turn lane and intersection operations were again evaluated. It should be noted that in each case, the existing Park Road lane configurations were utilized. A 275-foot right turn lane was added, as determined by the 95th percentile queue length (in this case a 273-foot queue).

When a dedicated, southbound right turn lane is added, operational performance of the intersection in both the existing and year 2040 improves. As displayed in **Tables 7 and 8**, when a dedicated right turn lane is added to southbound Dubuque Street, the delay for the southbound approach decreases from 216.5 seconds/vehicle to 22.1 seconds/vehicle in existing conditions. With the turn lane addition in future conditions, the southbound approach decreases from 231.9 seconds/vehicle to 23.4 seconds/vehicle in delay. In each instance, overall intersection performance improves from a level of service F to an expected level of service B.

Table 7: Dubuque Street with a Dedicated Southbound Right Turn Lane
2010 AM Peak Hour Volumes, Delay and LOS

Scenario 1B* AM 2010						
	Park		Dubuque			
	EBL	EBR	NBL	NBT	SBT	SBR
Traffic Volume	154	71	175	447	971	742
Movement Delay (Sec)	17.4	-	13.5	7.0	31.3	9.9
Movement LOS	B	-	B	A	C	A
Approach Delay (Sec)	17.4		8.8		22.1	
Approach LOS	B		A		C	
Overall Intersection LOS: B			Average Intersection Delay: 18.4			

* Scenario 1B includes Dubuque SB RT and one LT and one shared LT/RT on EB Park and one lane on WB Park

Table 8: Dubuque Street with a Southbound Dedicated Right Turn Lane
2040 AM Peak Hour Volumes, Delay and LOS

Scenario 1B* AM 2040						
	Park		Dubuque			
	EBL	EBR	NBL	NBT	SBT	SBR
Traffic Volume	211	97	171	437	995	760
Movement Delay (Sec)	19.7	-	12.4	6.9	32.9	11.0
Movement LOS	B	-	B	A	C	B
Approach Delay (Sec)	19.7		8.5		23.4	
Approach LOS	B		A		C	
Overall Intersection LOS: B			**Average Intersection Delay: 19.6**			

* Scenario 1B includes Dubuque SB RT and one LT and one shared LT/RT on EB Park and one lane WB Park

Question 2: How Many Dedicated Left Turn Lanes Does Eastbound Park Road Need?

With the identification of the need for an added right turn lane on southbound Dubuque Street, attention turned to operations on the Park Road movements. As discussed previously, eastbound Park Road performs poorly during the PM peak period for both the existing and future year conditions. The large volume of vehicles trying to utilize one left turn lane on the bridge causes delay. Typically, two left turn lanes are warranted at approximately 300 vehicles in the peak hour. This movement currently has approximately 560 vehicles turning during the peak hour and is forecasted to see 743 vehicles doing the same in 2040.

To examine how best to facilitate eastbound left turns and minimize delays, Staff requested the examination of two scenarios. The scenarios include examining 1) a two-lane solution with dedicated eastbound left turn lane and a shared left/right turn lane, and 2) a three-lane solution with two dedicated left turn lanes and a dedicated right turn lane.

Scenario 2A: Two lanes eastbound – Dedicated left turn and shared left/right turn

Scenario 2A utilizes two lanes for eastbound Park Road – one dedicated left turn and one shared left/right turn. Analysis indicates that in this scenario, the eastbound movement would operate slightly better today, but would fail in year 2040. With the shared left/right turn configuration, the eastbound left turn movement operates at a LOS E in existing conditions (64.2 seconds/vehicle) and a LOS F in year 2040 (188.7 seconds/vehicle).The results for this analysis are displayed in **Tables 9 and 10** below. The net effect of the slightly improved eastbound operations in the existing year condition improves the overall intersection operations to LOS C. In the future year, the eastbound left turn movement fails, but not to the magnitude previously, hence the overall intersection operations improve slightly to LOS E.

Table 9: Park Road with Dedicated Left Turn and Shared Left/Right Turn
2010 PM Peak Hour Volumes, Delay and LOS

Scenario 2A* PM 2010						
	Park		Dubuque			
	EBL	EBR	NBL	NBT	SBT	SBR
Traffic Volume	563	240	239	1088	653	177
Movement Delay (Sec)	64.2	-	10.1	10.2	21.8	3.9
Movement LOS	E	-	B	B	C	A
Approach Delay (Sec)	64.2		10.2		18.0	
Approach LOS	E		B		B	
Overall Intersection LOS: C			Average Intersection Delay: 27.0			

* Scenario 2A includes Dubuque SB RT and one LT and one shared LT/RT on EB Park and one lane WB Park

Table 10: Park Road with Dedicated Left Turn and Shared Left/Right Turn
2040 PM Peak Hour Volumes, Delay and LOS

Scenario 2A* PM 2040						
	Park		Dubuque			
	EBL	EBR	NBL	NBT	SBT	SBR
Traffic Volume	743	317	239	1088	765	207
Movement Delay (Sec)	188.7	-	12.6	9.9	23.6	3.8
Movement LOS	F	-	B	A	C	A
Approach Delay (Sec)	188.7		10.4		19.4	
Approach LOS	F		B		B	
Overall Intersection LOS: E			Average Intersection Delay: 69.2			

* Scenario 2A includes Dubuque SB RT and one LT and one shared LT/RT on EB Park and one lane WB Park

Scenario 2B: Three lanes eastbound Park – Two dedicated left turn lanes and dedicated right turn

Scenario 2A improved operations on the Park Road movement compared to the No Build, but not to the extent desired. Therefore, Staff also examined a three-lane solution. This scenario includes two eastbound dedicated left turns and one eastbound dedicated right turn. The results of in this scenario indicate greatly improved operations for both the eastbound movement and for the intersection as a whole.

These results of Scenario 2B are displayed in **Tables 11 and 12**. If the eastbound approach has three lanes then the eastbound left turn movement operates at LOS C in the existing condition (33.9 seconds/vehicle) and LOS E in year 2040 (58.6 seconds/vehicle). The overall performance of the intersection improves to LOS B and LOS C in the existing and future year conditions, respectively.

Table 11: Park Road with Two Dedicated Left Turn Lanes and Dedicated Right Turn Lane 2010 PM Peak Hour Volumes, Delay and LOS

Scenario 2B* PM 2010						
	Park		Dubuque			
	EBL	EBR	NBL	NBT	SBT	SBR
Traffic Volume	563	240	239	1088	653	177
Total Delay (Sec)	33.9	6.1	9.7	9.9	21.8	3.9
LOS	C	A	A	A	C	A
Approach Delay (Sec)	25.6		9.8		18.0	
Approach LOS	C		A		B	
Overall Intersection LOS: B			Average Intersection Delay: 16.4			

* Scenario 2B includes Dubuque SB RT lane and two dedicated LT lanes and one RT lane on EB Park and one lane on WB Park

Table 12: Park Road with Two Dedicated Left Turn Lanes and Dedicated Right Turn Lane 2040 PM Peak Hour Volumes, Delay and LOS

Scenario 2B* PM 2040						
	Park		Dubuque			
	EBL	EBR	NBL	NBT	SBT	SBR
Traffic Volume	743	317	239	1088	765	207
Movement Delay (Sec)	58.6	6.4	12.6	9.9	23.6	3.8
Movement LOS	E	A	B	A	C	A
Approach Delay (Sec)	43.0		10.4		19.4	
Approach LOS	D		B		B	
Overall Intersection LOS: C			Average Intersection Delay: 23.3			

* Scenario 2B includes Dubuque SB RT lane and two dedicated LT lanes and one RT lane on EB Park and one lane on WB Park

Question 3: How Many Westbound Lanes Should There be on the Park Road Bridge?

Analysis of the existing lane configuration indicates that the westbound lanes on the Park Road Bridge operate well under capacity, both today and in the future. Although the lanes are under capacity, there is an increased discomfort level for drivers traveling from northbound Dubuque to westbound Park. Drivers turning left from northbound Dubuque into the westbound receiving lanes are generally not comfortable making the turn at the same time as an opposing vehicle traveling southbound making a right turn onto westbound Park Road.

Two scenarios were tested for westbound Park Road – Scenario 3A utilized one westbound lane on Park Road and Scenario 3B utilized two westbound lanes. In both scenarios, eastbound Park Road was configured with three lanes (2 left turns/1 right) and southbound Dubuque Street was configured with two through lanes and a right turn lane.

Scenario 3A: One lane on westbound, three lanes eastbound Park Road

Scenario 3A has the same lane configuration as Scenario 2B. Scenario 2B tested and demonstrated the need for two dedicated left turn lanes and a dedicated right turn lane on eastbound Park and one westbound lane on Park Road. Both Scenario 2B and 3A include a southbound right turn lane for Dubuque Street. As mentioned previously and displayed in **Tables 9, 10, 11 and 12**, Scenario 3A operates well in the morning and afternoon peak hours

for both existing and future year traffic turning westbound onto Park Road. If this four-lane Park Road Bridge scenario is considered further, moving the existing westbound Cambus stop to a location between the west abutment of the Park Road Bridge and the entrance to Lower City Park is recommended to prevent intermittent lane blockages during bus loading and unloading operations. Additionally, an increased shy area on the bridge would be recommended to provide greater driver comfort westbound on the bridge.

Scenario 3B: Two lanes on westbound Park Road

Scenario 3B includes two lanes on westbound Park, three lanes on eastbound and a right turn lane on southbound Dubuque Street. This configuration would allow the westbound lane Cambus stop to operate as it does today on the bridge. It also provides a greater comfort level for northbound Dubuque Street drivers turning left and southbound drivers turning right. However, as displayed in **Tables 13 and 14** the operations of the individual movements and for the overall intersection do not change from Scenario 3A, which utilized one westbound lane.

Table 13: Two Lanes Westbound and Three Lanes Eastbound on Park Road
2010 PM Peak Hour Volumes, Delay and LOS

Scenario 3B* PM 2010						
	Park		Dubuque			
	EBL	EBR	NBL	NBT	SBT	SBR
Traffic Volume	563	240	239	1088	653	177
Movement Delay (Sec)	33.9	6.1	9.7	9.9	21.8	3.9
Movement LOS	C	A	A	A	C	A
Approach Delay (Sec)	25.6		9.8		18.0	
Approach LOS	C		A		B	
Overall Intersection LOS: B			Average Intersection Delay: 16.4			

* Scenario 3B includes Dubuque SB RT lane and two dedicated LT lanes and one RT lane on EB Park

Table 14: Two Lanes Westbound and Three Lanes Eastbound on Park Road
2040 PM Peak Hour Volumes, Delay and LOS

Scenario 5* PM 2040						
	Park		Dubuque			
	EBL	EBR	NBL	NBT	SBT	SBR
Traffic Volume	743	317	239	1088	765	207
Movement Delay (Sec)	58.6	6.4	12.6	9.9	23.6	3.8
Movement LOS	E	A	B	A	C	A
Approach Delay (Sec)	43.0		10.4		19.4	
Approach LOS	D		B		B	
Overall Intersection LOS: C			Average Intersection Delay: 23.3			

* Scenario 3B includes Dubuque SB RT lane and two dedicated LT lanes and one RT lane on EB Park

Conclusions

In response to questions raised in recent City Council work sessions, staff reexamined the previous traffic operations analysis conducted for the Iowa City Gateway project. This analysis focused on operations at the intersection of Dubuque Street and Park Road at the Park Road

Bridge. This work included developing scenarios designed to test the need of a southbound right turn lane for Dubuque Street and various lane configurations for Park Road. The analysis results lead to the following recommendations to Council questions as follows:

- *Is it necessary to add a right turn lane to southbound Dubuque Street at the Park Road intersection?* Yes, analysis indicates a dedicated, 275-foot long right turn lane is needed now and in the future to address existing issues with morning peak hour operations.
- *How many dedicated left turns are needed for eastbound Park Road at the Dubuque Street intersection?* Three eastbound lanes on Park Road – two left turn lanes and one right turn lane – are needed to improve PM peak hour operations today and to maintain acceptable intersection operations in the future.
- *Would a dedicated left turn lane and a shared left/right turn lane suffice for eastbound Park Road?* No, while overall intersection operations would improve slightly, this configuration would cause the eastbound movement to continue to fail now and in the future.
- *How many westbound lanes should there be on the Park Road Bridge?* While one westbound lane could receive existing and future year westbound volumes without issues, staff recommends keeping two westbound lanes. Two westbound lanes maintains current capacity, provides more room for turning onto Park Road westbound and will allow the Cambus to maintain its current stop location on the Park Road Bridge which is closer to Mayflower.

If Council prefers a four-lane bridge, the lanes can be configured with three eastbound lanes and one westbound lane. With this configuration, the Cambus stop would need to be moved to the west, either at the west end of the bridge or at a location between the bridge and Lower City Park entrance. Additionally, a three-lane bridge was examined and it degrades operations now and in the future. It would cause the intersection to operate at an unacceptable level of service today and would degrade further in future years and is not recommended.