TECHNICAL MEMORANDUM

TO: Earl Haugen, GF-EGF MPO
FROM: Kshitij Sharma, ATAC
Subject: **New Elementary School Study Phase I**
Date: May 31, 2013

This memorandum documents the Travel Demand Analysis and Intersection Capacity Utilization/Level of Service Analysis performed for the new elementary school planned at the intersection of 40th Ave S and S 34th St in Grand Forks.

BACKGROUND

A new elementary school is proposed in the south-east quadrant of the intersection of 40th Ave S and S 34th St (Refer to Appendix 2) as shown in Figure 1 below. The Grand Forks-East Grand Forks MPO (MPO) intends to address potential traffic operations and traffic safety issues around the proposed site before the school is expected to be open (Fall 2015). This elementary school is located within a new 288 acre development. The development includes approximately 1300 residential units. The school is ultimately expected to have approximately 600 students. The scope of Phase I of this project is to determine how much of the proposed street network is required to provide adequate mobility when the school opens for its first session.

Figure 1 Proposed Elementary School Site

METHODOLOGY

The 2010 Regional Travel Demand Model (Base Model) was compared to the 2015 Regional Travel Demand Models (Hybrid Models). The 2010 model was used as base since it is the most up-to-date Travel Demand Model for the Grand Forks East Grand Forks MPO. Figure 2 below shows a snapshot of the base network with respective ADTs.

Figure 2 2010 Base Network with ADTs

The Hybrid Models were created by making changes to the Base Model. The changes included:

- ✓ Traffic Growth
  - o From 2010 to 2015
- ✓ Geometric Improvements
  - o Existing + Committed
- ✓ Expected Socioeconomic Changes between 2010 and 2015
  - o As reported by MPO
- ✓ Local Developments
  - o School Site
  - o Park
  - o Residential
  - o Commercial
  - o Street Network

In addition to the Base Model, the Hybrid Models are specifically based on the following assumptions:

- **Concept 19O**
  The MPO provided ATAC with a proposed concept referred to as Concept 19O. The concept showed various proposed (land use) zones and a street network. It also included an interchange at 47th Ave S. However, the interchange was not modeled in the Hybrid Models.

- **2015 TAZ**
  A subarea was strategically selected around the Transportation Analysis Zone (TAZ) with proposed school and development (TAZ 227). The zones selected are shown in figure below:

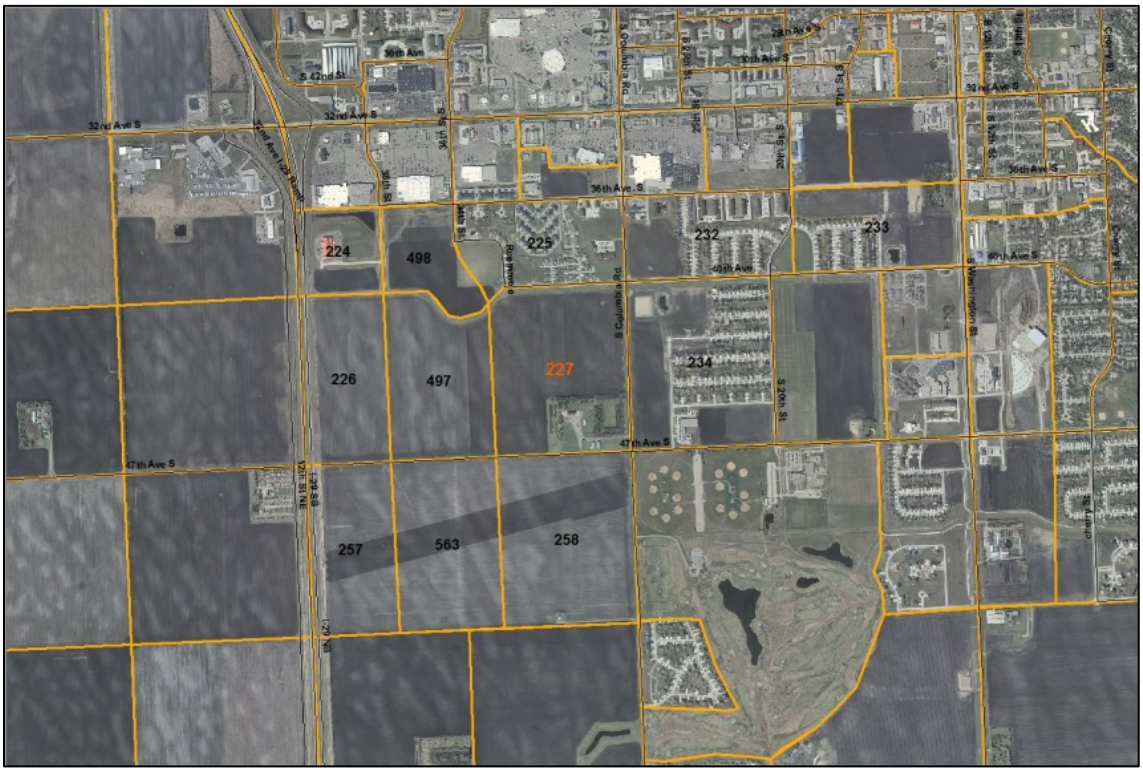

Figure 3 Selected TAZs

The 2015 TIP provided by the MPO, with respect to the selected zones, was then used to create the hybrid models. No major changes affecting the selected subarea were committed to be completed by 2015. Also, the TIP did not include an interchange at 47th Ave S, which is why it was not included in the Hybrid Models despite being shown in Concept 19O.

- **2015 TAZ Socioeconomic Data**
  The MPO provided ATAC with the 2015 socioeconomic data* for the transportation analysis zones (TAZs) around the school. Part of the data, pertaining to 2015 projections, included the following:

Table 1 Socioeconomic data per Transportation Analysis Zone

TAZ	HOUSING15	1pHH15	2pHH15	3pHH15	4pHH15	5pHH15	6pHH15	7pHH15	TotalEmp15	Service15	Retail15	Other15
224	0	0	0	0	0	0	0	0	40	19	21	0
225	210	44	90	46	13	4	4	1	61	58	0	3
232	407	109	143	76	38	9	0	2	20	18	0	2
233	451	30	80	60	80	50	10	0	0	0	0	0
234	209	22	60	30	67	17	3	3	263	219	42	2
227	51	14	21	6	5	2	0	0	48	40	8	0
226	0	0	0	0	0	0	0	0	0	0	0	0
258	0	0	0	0	0	0	0	0	0	0	0	0
563	0	0	0	0	0	0	0	0	0	0	0	0
498	150	71	48	16	6	0	0	0	0	0	0	0
497	0	0	0	0	0	0	0	0	0	0	0	0
257	0	0	0	0	0	0	0	0	0	0	0	0

Where;
npPHH15 = n person(s) per household (1-7 person households) for year 2015
TotalEmp15 = total employment for each TAZ for year 2015
Service15 = number of service jobs per TAZ for year 2015
Retail15 = number of retail jobs per TAZ for year 2015, and
Other15 = number of other jobs per TAZ for year 2015.

Critical intersections within the subarea were then selected for further analysis. Note that the selected intersections are along S Columbia Rd (Principal Arterial). Also, 47th Ave S is a Minor Arterial and 40th Ave S is classified as a Collector.

Peak period intersection turning movement counts were obtained from respective Travel Demand Models including Base Model and Hybrid Models (Base AM, Hybrid 1 PM etc.). Both AM & PM peak periods consisted of two (2) hours each. The duration of AM peak period is 7 – 9 am and that of PM peak period is 4 – 6 pm. The peak period traffic volumes

* Refer Appendix 3

were reduced to peak hour traffic volumes by using national average Peak Hour Factors. The Peak Hour Factors used were:

- AM Peak Hour Factor: 0.566
  A Peak Hour Factor of 0.566 means that 56.6% of the peak period traffic travelled during the peak hour.

- PM Peak Hour Factor: 0.51
  A Peak Hour Factor of 0.51 translates to 51% of the peak period traffic travelled during the peak hour.

The output obtained from the Regional Travel Demand Model did not account for truck traffic. Therefore, using engineering judgment, 4% of truck traffic was assumed for every movement within the subarea intersection analysis. Note that the data obtained from the City of Grand Forks shows less than 2% truck traffic at a major intersection in the vicinity of the subarea.

The selected intersections were then analyzed using Intersection Capacity Utilization (ICU) and corresponding Level of Service (LOS) evaluation procedures. For details on individual intersection evaluations refer to Appendix 1.

MODELED ALTERNATIVES

Potential alternatives were based on the Concept 19O. Figures 4 and 5 show the basic network setup used for the alternatives. Four (4) alternatives were modeled:

Hybrid 1:

- In addition to the Base Model's network, Hybrid 1 includes:
  - S 34th St from Ruemmele Rd to 45th Ave S
  - 43rd Ave S from S 34th St to S Columbia Rd*
  - S 32nd St from 40th Ave S to 43rd Ave S

Hybrid 1a:

- In addition to the Hybrid 1 network, Hybrid 1a is based on assumption that the north- and south-bound approaches on the following intersections will have exclusive left-turn lanes:
  - S Columbia Rd and 40th Ave S
  - S Columbia Rd and 43rd Ave S*
  - S Columbia Rd and 47th Ave S

Figure 4 Hybrid 1 GIS Network

*Note: The intersection of S Columbia Rd and 43rd Ave S is setup as a T-intersection. There is no WB movement.

Hybrid 2:

- In addition to the Base Model's network, Hybrid 2, in accordance with concept 19O, includes:
    - All of Hybrid 1
        - S 34th St from Ruemmele Rd to 45th Ave S
        - 43rd Ave S from S 34th St to S Columbia Rd*
        - S 32nd St from 40th Ave S to 43rd Ave S
    - 45th Ave S from S 34th St to S Columbia Rd*
    - S 34th St from 45th Ave S to 47th Ave S

Hybrid 2a:

- In addition to the Hybrid 2 network, Hybrid 2a is based on assumption that the north- and south-bound approaches on the following intersections will have exclusive left-turn lanes:
    - S Columbia Rd and 40th Ave S
    - S Columbia Rd and 43rd Ave S*
    - S Columbia Rd and 45th Ave S*
    - S Columbia Rd and 47th Ave S

Figure 5 Hybrid 2 GIS Network

*Note: The intersections of S Columbia Rd and 43rd Ave S and S Columbia Rd and 45th Ave S are setup as T-intersections. There is no WB movement at both of the intersections.

RESULTS

As mentioned earlier, critical intersections within the subarea were analyzed beyond Travel Demand Modeling using Intersection Capacity Utilization and corresponding Level of Service evaluation procedures. The base conditions (Base Model) analysis included the following intersections:

- 36th Ave S and S Columbia Rd
- 40th Ave S and S Columbia Rd
- 47th Ave S and S Columbia Rd

Additional intersections, in line with those proposed in Concept 19O, were included for analysis in the hybrid alternatives (Hybrid Models). These included:

- 43rd Ave S and S Columbia Rd*
- 45th Ave S and S Columbia Rd

*Hybrids 1 and 1a only

The summary of ICU & LOS results of respective intersections is presented in the tables below:

Table 2 Intersection Capacity Utilization and Level of Service Results (AM Peak Hour)*

Intersection	AM									
	Base		Hybrid 1		Hybrid 1a		Hybrid 2		Hybrid 2a	
	ICU	LOS	ICU	LOS	ICU	LOS	ICU	LOS	ICU	LOS
S Columbia Rd & 47th Ave S	43%	A	61%	B	56%	B	67%	C	32%	A
S Columbia Rd & 45th Ave S	n/a	n/a	n/a	n/a	n/a	n/a	57%	B	43%	A
S Columbia Rd & 43rd Ave S	n/a	n/a	75%	D	51%	A	57%	B	50%	A
S Columbia Rd & 40th Ave S	54%	A	65%	C	58%	B	62%	B	57%	B
S Columbia Rd & 36th Ave S	75%	D	72%	C	72%	C	72%	C	72%	C

Table 3 Intersection Capacity Utilization and Level of Service Results (PM Peak Hour)*

Intersection	PM									
	Base		Hybrid 1		Hybrid 1a		Hybrid 2		Hybrid 2a	
	ICU	LOS	ICU	LOS	ICU	LOS	ICU	LOS	ICU	LOS
S Columbia Rd & 47th Ave S	35%	A	46%	A	43%	A	65%	C	41%	A
S Columbia Rd & 45th Ave S	n/a	n/a	n/a	n/a	n/a	n/a	36%	A	30%	A
S Columbia Rd & 43rd Ave S	n/a	n/a	48%	A	41%	A	45%	A	38%	A
S Columbia Rd & 40th Ave S	48%	A	101%	G	79%	D	91%	F	60%	B
S Columbia Rd & 36th Ave S	83%	E	82%	E	82%	E	59%	B	59%	B

*Note: LOS based on intersection capacity utilization and not control delay. Refer to Appendix 4.

DISCUSSION & CONCLUSIONS

AM Peak Period

As can be seen in the table above, all the hybrid alternatives, considered for AM Peak Hour analysis, are feasible. Thus, when the new school opens its doors in 2015, the following stretches of roadways are not necessary to attain acceptable levels of operations in and around the new school site:

- 45th Ave S between S 34th St and S Columbia Rd
- S 34th St between 45th Ave S and 47th Ave S

PM Peak Period

As is evident from the table above, Hybrids 1 and 2 show congested conditions during the PM Peak Hour. The LOS F indicates that the intersection may require a cycle length of over 120s to meet the demand at all the approaches. It also indicates that the intersection would likely experience congestion (during the PM Peak Hour). LOS G indicates even worse conditions where road users may begin to seek alternative routes due to the congestion experienced during the respective peak hour. Also, an unconventionally long cycle length of over 120s may be necessary to be able to serve the demand existing at the intersection.

Hybrids 1a and 2a, on the other hand, are feasible as they represent acceptable operational conditions. Similar to the AM analysis, it can be seen that the construction of the abovementioned stretches of roadways is not necessitated by the school site alone. This is assuming that the base condition of hybrids 1a & 2a is met (exclusive n/s left turn lanes at intersections along S Columbia Rd). However, it is understood that the construction may be necessary to provide access to other developments in the area such as housing, commercial, etc.

APPENDICES

Appendix 1: ICU Analysis Spreadsheets
Appendix 2: Concept 19O
Appendix 3: 2015 TAZ Socioeconomic Data
Appendix 4: ICU & LOS Descriptions