TRAFFIC ANALYSIS REPORT

CITY OF SARTELL
SARTELL-ST. STEPHEN SCHOOL DISTRICT

Collector and Minor Arterial Road and Street Traffic Study

WSB Project 1623-00

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Table of Contents

Figures

Tables

Traffic Analysis Report

Background
The purpose of the traffic study covered in this report was to address the traffic-related aspects of a proposed future collector street and minor arterial system in the City of Sartell, Minnesota. In particular, the study was carried out to determine the future peak period traffic loads that the individual roads and streets in the proposed system would carry and to identify measures necessary to accommodate those loads.

The traffic study is part of a cooperative project undertaken by the City of Sartell and the Sartell-St. Stephen Independent School District 748 to identify optimal corridors for both east-west and north-south roads to address future access needs in a growing part of the city. The study area is bounded by 12th and 40th Streets North on the south and north, respectively, and 75th Avenue and Stearns County State Aid Highway (CSAH) 1 on the west and east as shown in Figures 1 and 2 on the following pages.

To carry out the study, the city contracted with WSB and Associates, Inc., an engineering and planning consulting firm based in Minneapolis and St. Cloud. The Sartell City Council appointed a technical advisory committee (TAC) representing the City Council, City Planning, the City Engineer, and the school district to assist in the selection of street and road corridors, and to help assure that local issues and concerns regarding the project and its outcomes were identified and appropriately dealt with. (The TAC members are identified in the appendix to this report.) The St. Cloud Area Planning Organization (APO) was also a party to the study in providing pertinent planning and background data regarding the study area.

Study Year
As the outcome of this project is intended to be a long-range plan, a study year well into the future was selected. Since the St. Cloud APO has designated 2030 as the year for its land use forecast, that year was deemed to be appropriate for traffic forecasts and the analyses carried out for this report. Twenty-five years is also considered to be an outside limit on such forecasting as assumptions on future development in a wide geographic area can become increasingly speculative and unreliable.

The Site
The project area has a relatively flat topography with a number of wetlands and some wooded areas that are not environmentally conducive to road building. Much of the area has served as farmland; however, several large residential subdivisions have been developed in the southeast corner of the study area (between Pine Cone Road and CSAH 1 from 12th to 22nd Streets) in recent years. More recently, major subdivisions have been platted as far north as 35th Street.

The largest single site in the project area is nearly three-quarters of a section between 13th Avenue and Pine Cone Road, and 27th and 32nd Streets on which the Sartell-St. Stephen Independent School District 748 is tentatively planning to build a new high school some time after 2015. An elementary school was completed on the southwestern portion of the property in 2004.

The proposed use of this land as a high school site was one of the reasons cited for the need to identify the future collector roads and streets in the area. In the city's currently adopted transportation plan, the extension of 30th Street had been identified as a future east-west collector street location crossing the study area and bisecting the site. The school district has indicated that the property would not or could not be considered as a feasible site for the proposed high school if it were to be divided by a public road.

The aerial photograph in Figure 3 on the next page provides an excellent picture of the land use in the study area as of 2004.

Road and Street Corridor Selection Process

Several logical east-west and north-south locations, shown superimposed on the aerial photo in Figure 4 on Page 6, were identified early in the study as possible corridors for the street and road grid. The TAC was then asked to review the corridors for their ability to serve mobility needs along with the potential impacts in their immediate vicinity as well as on the study area as a whole. A rational means to identify the scale of these impacts to assist in the selection of the most promising corridors was devised by the consultants. The TAC reviewed the procedure for its applicability, suggested modifications, and then used it to evaluate the corridors. The procedure, format, applicable impacts, rating system, and results are covered in the chart in Figure 5 on Page 7.

Based on their review of the impacts and knowledge of the area, the TAC recommended the following corridors. These corridors are assumed to provide for a 45 mph design speed outside of the concentrated residential areas. Figure 6 on Page 8 is a map of the selected corridors superimposed on an aerial photo.

SELECTED CORRIDORS

East-West	**North-South**
15th/12th Streets**	75th Avenue*
24th/27th Streets**	19th Avenue
35th/32nd Streets**	13th Avenue
40th Street*	Pine Cone Road*
	CSAH 1*

*Existing road in place
**Partially in place

It should be understood that the selected corridors represent a basic system that would provide acceptable service to the study area. However, it may be necessary to consider designation of additional collector roads as development occurs and specific land uses are established. Such land use could include neighborhood access, retail, and other uses not identified in the current St. Cloud APO land use forecast.

Key Intersections

With the corridors designated, the key intersections in the study area were then identified. Key intersections are those that have the potential to cause significant delays for road users based on the anticipated traffic volumes and turning movements. Therefore, these intersections are subject to analyses as described later in this report. The key intersections identified in this study are listed below. They are also shown on the aerial photo in Figure 6.

KEY INTERSECTIONS
<u>On Pine Cone Rd. and on CSAH 1</u>

12th Street
15th Street
27th Street
32nd Street
40th Street

None of the intersections on 13th, 19th, and 75th Avenues were identified as key intersections as the traffic volumes at those locations will be significantly lower than at the above listed intersections. Any traffic operational difficulties that may arise at the study area's western intersections are not likely to occur until long after the forecast year – assuming that development of the surrounding areas does not greatly exceed the St. Cloud APO's land use forecasts.

Trip Generation Rates

One of the principal factors in determining the traffic volumes that a road can be expected to carry is the number of trips generated within the area served by a road network. The number of trips generated is directly related to the number and type of traffic generating units (such as homes, offices, stores, schools, community centers, etc.) and, in turn, those numbers are influenced by time of day.

Because traffic generation is such an important factor in transportation engineering and planning, a great number of studies have been and continue to be carried out to determine trip-generating rates for every significant form of traffic generator. As a service to the transportation industry, the Institute of Transportation Engineers updates and publishes a compilation of the results of these studies known as the *Trip Generation Manual.*[1] Information in the manual generally available for each type of generator includes trip rate per weekday and weekend days, trip rate per peak hour (AM and PM), and trip distribution (entering and exit-

[1] *Trip Generation,* Seventh Edition, Institute of Transportation Engineers, Washington, D. C., 2003.

ing). The manual was used to determine trip rates for the traffic generators in the study area.

In general, the PM period generates the heaviest traffic volumes. Therefore, most traffic analysis studies usually concentrate on that time of day and the focus of this report is on the PM peak hour.

By far the greatest number of trips in the study area, now and in the study year, is generated by single-family homes. The forecasted land use indicates a relatively small number of multifamily units will have been built by the study year and a single, small commercial development will have been established. The most concentrated generator in the study area is the proposed high school. The recently completed elementary school is already generating a significant amount of traffic.

The trip generation rates used in the Sartell study are as shown in Table 1, below. Note that both the elementary school and the high school have two trip rates shown in the table. One is for the peak hour trip generation of the school; the other is for the peak hour that coincides with the peak hour of the adjacent street as indicated in the notes below the table. As might be expected, the earlier rates for the schools are much higher as they represent the period when students are dismissed. The later rates occur when other traffic on the adjacent street is at its peak. (The later rate for the elementary school is an estimated rate as explained in the table notes.) Both rates were employed in the intersection analyses for the 27th and 32nd Street intersections with Pine Cone Road to assure that the worst-case turning movements were accounted for in the study.

Table 1. PM Peak Hour Trip Generation Rates

Code*	Title	Trip Rate	Entering	Exiting
210	Single Family Detached Housing	1.01/DU**	63%	37%
230	Residential Condominium/Townhouse	0.52/DU**	67%	3%
520	Elementary School	0.28/Stu.†	45%†	55%†
		0.12/Stu.‡	25%‡	75%‡
530	High School	0.28/Stu.†	32%†	68%†
		0.14/Stu.‡	47%‡	53%‡
814	Specialty Retail Center	5.02/M-ft^2	56%	44%

*From ITE *Trip Generation Manual.*

**Dwelling Unit

†Peak hour of generator – between 2:00-4:00 PM

‡Peak hour of adjacent street – between 4:00-6:00 PM. (Note that the data for the elementary school was estimated as the *Trip Generation Manual* doe not provide data for the peak hour of the street. It was assumed that most of the later elementary school trips are employee related.)

The procedure for employing the trip generation rate component in determining the traffic load on the streets in the collector system and at its key intersections is described below.

Traffic Volumes and Turning Movements

The anticipated PM peak hour traffic volumes and turning movements for the key intersections were determined by a procedure covered in the following sequence.

- *Residential Plat Counts*
  Each lot in the existing and platted residential areas in the study area was counted and assigned to an intersection on the designated collector and minor arterial grid system based primarily on each lot's proximity or most convenient access to those roads. For the most part, the plats are concentrated near Pine Cone Road and CSAH 1. (Note that this step required assignments at intersections not identified as key intersections above in order to account for all of the housing units.)

- *Anticipated Residential Development Counts*
  The St. Cloud APO land use forecast identifies several sections (and partial sections) of land that are anticipated to be platted as single family and multi-family residential developments in the study area. The density of the lots in these future plats was assumed to be an average of the existing residential lot density in the vicinity. As there is no significant amount of existing multi-family residential development in the study vicinity, a density was selected that is within the general range of suburban multi-family developments. As in the bullet above, each potential lot was assigned to what appears to be the most convenient intersection on the designated collector system.

- *Residential Trip Distribution*
  It is clear that a vast majority of the trips generated in the study area are oriented to the south and the City of St. Cloud. Given the relatively sparse development to the north and west and the constraint of the Mississippi River on the east, it was determined that an appropriate trip distribution would be 10% to the north and 90% to the south. (Trips to the west were designating by adding a typical rural road traffic volume with some increases as those roads approached the developed areas.)

  It was also determined that drivers on most north/south trips from the residential developments in the vicinity of Pine Cone Road and CSAH 1 will most likely choose to take one or the other of those two roads based on the convenience (i.e., generally whichever is closest to their homes) and follow it to the south beyond the limits of the study area. Any east-west travel, aside from that necessary to get to one or the other route, would occur south of the study area. The rationale for this determination is that the heavier traffic volume on CSAH 1 will discourage drivers who are more conveniently located near Pine Cone Road, while drivers nearer to CSAH 1 will still take CSAH 1 as their trip length will be significantly increased by driving west and then east at some point south of the study area to reach their destinations. Of course, there will be some drivers who will be making the choice to drive across to one or the other route even though it may appear to be less convenient for them; however, it is reasonable to assume that these trips will be relatively few in number and they will tend to "cancel out" their effects on the total Pine Cone Road and CSAH 1 traffic volumes.

- *Residential Turning Movement Calculation*
  With the intersections assigned a total of traffic generating units as described in the above bullets, the following calculations were made to forecast turning movements at each intersection:
  - The number of units was multiplied by the number of trips per PM peak hour as indicated in the *Trip Generation Manual* for each type of unit.
  - The numbers obtained in the above bullet were multiplied by 10% and 90% (0.10 and 0.90) to identify the number of trips that would turn to the north and south, respectively.
  - Each of the numbers obtained in the above bullet were multiplied by respective entering and exiting percentages obtained from the manual to identify the turning movements.

  The following is an example of the above calculations taken from the trip contribution from single-family housing oriented to the "T" intersection at 18th Street and Pine Cone Road:

Sample Residential Traffic Assignment to Intersection

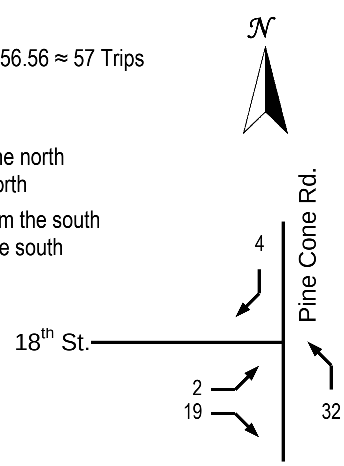
56 Single-family housing units approaching Pine Cone Road via 18th St.

56 Units X 1.01 PM peak hour trips/unit = 56.56 ≈ 57 Trips

57 x 0.10 = 5.7 trips to the north
57 x 0.90 = 51.3 trips to the south

5.7 x 0.63 = 3.59 ≈ 4 trips entering from the north
5.7 x 0.37 = 2.11 ≈ 2 trips exiting to the north

51.3 x 0.63 = 32.32 ≈ 32 trips entering from the south
51.3 x 0.37 = 18.98 ≈ 19 trips exiting to the south



- *School Campus Turning Movements*
  Turning movements for the school campus could not be developed in the same way as they were for the housing traffic as covered in the above descriptions. Traffic distribution to and from the schools is generally governed by the location and concentration of residential units – thus generating a traffic pattern quite different from the north-south orientation assumed for the residential traffic.

The traffic generation from the schools was computed on a per student basis as indicated in Table 1. Assuming that both schools would be expanded to their anticipated ultimate capacity by 2025, the elementary school would be able to serve 750 students and the high school would have room for 2,200 students. The number of trips generated would then be as shown in Table 2, below.

Table 2. PM Peak Hour School Trips

School	Trip Rate	Students	No. of Trips	Entering*	Exiting*
Elementary	0.28/Stu.†	750	210	95	115
	0.12/Stu.††		90	22	68
High	0.28/Stu.†	2,200	616	197	419
	0.14/Stu.††		308	145	163

*See Table 1 for entering and exiting percentage splits.
†Building peak hour rate – between 2:00-4:00 PM
††Adjacent street peak hour rate – between 4:00-6:00 PM. (Elementary rate is estimated.)

The elementary school PM trips were distributed directionally on 27th Street: 25% to and from the west and 75% to and from the east. From this entry point, the distribution was fanned out (as was the initial split) according to the density of the existing residential areas observed in aerial photos, the proposed residential areas that have been platted, and the areas designated as residential in the St. Cloud APO 2030 Land Use map. Similarly, the high school trips were directed east on 32nd Street to Pine Cone Road with 25% headed to and arriving from the north and 75% headed to and from the south. All of these trips were routed through the most likely key intersections and the turning movements associated with the number of trips were noted at each. These distributions were made for both the early (building) and late (adjacent street) peak hours.

- *Commercial Center Traffic Generation*
  The St. Cloud APO land use forecast map indicates a very small commercial development in the southeast corner of the Pine Cone Road/27th Street intersection. Based on the amount of land set aside for the commercial center on the St. Cloud APO 2030 forecast, it was determined that a building of 20,000 square feet could be supported. At 5.02 trips per 1,000 square feet, the center would generate 100 trips in the PM peak hour. With the observed in-place and forecasted residential density it was estimated that the trips to the commercial center would be 40% to the east, 20% to the west, 20% to the north, and 20% to the south. These trips were distributed to the surrounding intersections, accordingly. However, given the size of the center, it was assumed that the center would have a rather limited draw beyond one or two intersections in each direction.

- *Background Traffic*
  It should be understood that much of the traffic on the streets in the collector system does not now nor will it in the future originate or terminate within the study area boundaries. This pass-through traffic is defined as "background traffic." This traffic was developed for the study by factoring the existing traffic volumes from the traffic flow maps published by the Minnesota Department of Transportation (Mn/DOT) for trunk highways, county state-aid highways, county roads, and municipal state-aid streets. 2003 average annual daily traffic (AADT) volumes are identified on the maps for Pine Cone Road, CSAH 1, and 12th Street. The AADT volumes at that time were as follows:

Mn/DOT TRAFFIC VOLUMES

Location	**2003 AADT**
CSAH 1 at 7th St.	9,600
CSAH 1 at 18th St.	6,400
Pine Cone Rd. at 7th St.	5,200
12th St. at 5th Ave.	880

This data was reduced to PM peak hour traffic by assuming that it is 10% of the AADT, a commonly accepted value in the absence of more specific data. The PM peak hour volumes for the north-south streets were then factored in a 1/3-2/3 ratio to represent the directional distribution of the peak traffic with the higher volume flowing in the northbound direction. The east-west traffic on 12th Street is assumed to have an approximately even distribution for both directions.

It should be noted that there is no traffic volume data for existing north-south roads on the western side of the study area, and, of course, there is no data for any of the proposed new roads in the collector system. The background traffic for these roads was determined by noting that the forecasted land use in much of the western and northern parts of the study area will in 2030 remain essentially as it is today. Therefore, background traffic volumes can expected to be typical of low volumes found on roads providing access to generally rural areas today.

Finally, the above peak hour volumes were converted to 2030 levels. This was done by using the Stearns County 20-year "growth factor," currently at 1.4% according to the Mn/DOT *State Aid Manual,*[2] and expanding it to a 27-year factor with the assumption that there will be a constant, compounded annul growth rate. The growth rate for 27 years is then 1.57%.

[2] *State Aid Manual,* Chapter 5-892.810, "Projection Factor," and Figure A(2) 5-892.810, Minnesota Department of Transportation, Division of State Aid for Local Transportation, St. Paul, Minnesota, October 12, 2003.

- *Total Turning Movements*
  The last step in assigning the traffic and turning movements to the collector system was to add and subtract the computed turning movements to and from the 2030 adjusted background traffic on each successive intersection on the roadway network in the study area. The resulting 2030 forecasted turning movements at the key intersections are shown in Figure 7 on the following page.

Overall, a worst-case scenario has probably been defined by the PM peak hour traffic volumes forecasted for the study area, i.e., the volumes are quite likely to be on the high side. One of the reasons for this assumption is that no allowance was made for the duplicate counting of trips that occurred by making separate computations for the traffic generated by the schools and the residential areas. This duplication occurs for any trips taken between the schools and any residential units within the study area. It was also noted that the summing of the trips along the Pine Cone Road and CSAH 1 corridors created a traffic volume significantly greater than that obtained by merely applying the 27-year growth factor to the background traffic. Furthermore, the trips generated by the schools during their peak hour (mid afternoon) were added to the general peak hour (late afternoon) traffic volumes rather than to what would be lower general traffic volumes at the mid afternoon time of day. (These are the turning movements shown in parentheses in Figure 7.)

Intersection Traffic Analysis Method
The traffic operation analyses followed procedures outlined in the Transportation Research Board's *Highway Capacity Manual* (HCM)[3] for signalized and un-signalized intersections. "Synchro 6," an analysis software package based on HCM methodologies, was used to build the roadway network and as a database for the traffic lane geometrics, turning movement volumes, and intersection traffic control. This information was then used with "SimTraffic 6," a companion to the Synchro 6 software, to simulate traffic operations and to estimate delay times and traffic queue lengths.

Intersection Traffic Control
Intersection traffic controls must be identified for the Synchro analysis. To identify the control at each intersection, a determination was made as to which roads and streets in the collector system would be "through" (or major) roads. Other (minor) roads intersecting the major roads were assumed to be controlled by STOP signs. At those intersections where relatively equal traffic volumes could be expected on each entering leg, an all-way stop was assumed. 75th Street, Pine Cone Road, and CSAH 1 were assumed to be the major north-south through roads. By their nature of being continuous across the collector system, 15th, 24th-27th, 35th-32nd, and 40th Streets were assumed to be major roads; however, in most cases, these east-west roads were stopped for the three major north-south roads.

[3] *Highway Capacity Manual 2000,* Transportation Research Board, National Academy of Sciences, Washington, D.C., 2000.

A tabulation of the traffic controls at each intersection is included in the appendix to this report.

Level of Service

The measure used to describe the traffic operations at an intersection is called "Level of Service" (LOS). An intersection is given an LOS grade from "A" to "F" to describe the average amount of delay per vehicle at the intersection over a one-hour period as defined in the HCM. LOS A is the best traffic operating condition, and drivers experience minimal delay at an intersection operating at that level. LOS E represents the condition where the intersection is at capacity and some drivers may have to wait through more than one green phase to make it through the intersection if it is controlled by traffic signals. LOS F represents a condition where there is more traffic than can be handled by the intersection, and many vehicle operators may have to wait through more than one green phase to make it through the intersection. At a STOP sign-controlled intersection, LOS F would be characterized by exceptionally long vehicle queues on each approach at an all-way STOP; or long queues and/or great difficulty in finding an acceptable gap for drivers on the minor leg at a through-street intersection.

A given LOS can be altered by adding to (or subtracting from) the number of lanes, adjusting the signal timing, or other lesser geometric improvements. LOS would also change if traffic volumes increase or decrease.

Typically, LOS D is considered the minimum acceptable LOS in an urban area. A graphical representation of LOS for both signalized and unsignalized intersections is shown in Figure 8 on the following Page.

LOS, as described above, can also be determined for the individual legs or lanes (turn lanes in particular) of an intersection. It should be noted that a LOS E or F might be acceptable or justified in those cases where a leg(s) or lane(s) has a very low traffic volume as compared to the volume on the other legs. For example, improving LOS on such low-volume legs by adjusting signal timing could result in a significant penalty for the many drivers on the major road while benefiting the few on the minor road. Also, geometric improvements on minor legs, such as additional lanes or longer turn lanes, could have limited positive effects and might be prohibitive in terms of benefit to cost.

2030 Forecasted Levels of Service

Table 3, on Page 19, summarizes the 2030 forecasted PM LOS at the key intersections based on the assumption that all of the intersections would have one lane in each direction (except as noted), all intersections would be controlled by STOP signs, and the turning movements would be as shown in Figure 7. (A full summary of the delay, queue lengths, and other results pertinent to the LOS analyses are tabulated in the appendix to this report.)

As can be seen from the table, all of the key intersections are forecasted to have excellent LOS. The table indicates that some intersections were assumed to have turn lanes. However, without the turn lanes, the only

Table 3. 2030 PM Forecasted Level of Service at Key Intersections

Intersection	LOS	Delay (Sec/Veh)
Pine Cone Rd./12th Street	A	1.7
Pine Cone Rd./15th Street	A	5.6
Pine Cone Rd./27th Street	A	6.8
	A†	8.9†
Pine Cone Rd./32nd Street*	A	5.7
	A†	8.4†
Pine Cone Rd./40th Street	A	1.7
CSAH 1/12th Street**	A	2.5
CSAH 1/15th Street**	A	2.9
CSAH 1/27th Street**	B	12.2
CSAH 1/32nd Street	A	5.9
CSAH 1/40th Street	A	4.2

*Assumed that intersection would include an eastbound right-turn lane and a northbound left turn lane.

**Assumed that intersection would include a northbound left turn lane.

†School peak hour (Between 2:00-4:00 PM)

additional intersection that would have an LOS as low as B (very satisfactory), according to the SimTraffic analysis, was the one at 12th Street on CSAH 1.

The turn lanes are recommended to address the potential for delays (though relatively minor), to reduce traffic queue lengths at CSAH 1 intersections, and to mitigate whatever congestion may occur during the short periods when school busses would be concentrated at the 27th and 32nd Street intersections on Pine Cone Road. With the turn lanes that have been added for this analysis, the maximum 95th percentile queue length at any of the intersections in the study area is 79 feet (at 12th Street/Pine Cone Road), a length equivalent to approximately three passenger vehicles. (As noted above, queue lengths and other data pertinent to the intersection analysis results are tabulated in the appendix to this report.)

School Access

Figure 9 on the following page is an architect's site plan concept for the school campus showing the proposed location of the future high school, the completed elementary school, and related elements including parking lots, athletic fields, a bus garage, and internal roadways. The layout indicates that access to the high school would be via 32nd Street rather than directly to and from Pine Cone Road – a very desirable choice with respect to traffic engineering considerations.

The desirability of a direct access to 13th Avenue for both the high and elementary schools should be addressed. (The 13th Avenue access shown on Figure 9 does not appear on earlier versions of the site plan.) An entry and exit at this location would reduce conflicts with traffic on 27th Street for trips to and from the northwest. A similar reduction could occur on 32nd Street as well. To preserve the possibility of access to 13th Avenue, the school district should reserve a corridor close to the property line north of the athletic fields as shown in Figure 9. This corridor is roughly equivalent to 30th Street.

LOS analyses with the 13th Avenue access in place were not carried out. As the availability of a third school access would reduce turning movements at the 27th and 32nd Street intersections with Pine Cone Road, it is clear that the already excellent LOS would be even better (although only marginally so). While turning movements would increase somewhat at the 27th and 35th Street intersections with 13th Avenue, the traffic levels are anticipated to be quite low at these locations; thus, there would be little potential for operational problems.

The school district should take care to assure that appropriate consideration is given to internal traffic circulation within the school campus. Such circulation would be of particular concern if access is provided to and from 13th Avenue in addition to the 27th and 32nd Street accesses. It is clearly desirable to construct a road between the two schools to accommodate vendors, to expedite the possibility of some shared administrative and janitorial services, and to provide access to the bus garage; however, such a road could be attractive to some drivers who want to get from a location near one of the access points to one of the other two accesses. That such drivers would even consider passing through is also an indication that they are probably "in a hurry," and it is not unlikely that they would drive accordingly through the school grounds. There are potential conflicts between students using the athletic fields, school busses, and drivers who are high school students. Aside from the busses, much of the conflict could be eliminated by making it clear to students and employees that the connecting roadway is "off limits," posting NO THROUGH TRAFFIC signs, installing speed limit signs (not with unrealistically low limits, however), providing marked crosswalks at safe locations with adequate sight distance, installing fencing to encourage crossing only at crosswalks, and speed humps. Other innovative measures might become evident during the detail design stage for the high school and its surroundings. A traffic engineering review at that time could be quite helpful as well as shortly after the high school opens for its first students.

It would be desirable to require that all high school bus operations be limited to the 32nd Street entrances and all elementary school bus operations be limited to 27th Street (and the 13th Avenue entrance – if it is constructed). All drivers returning busses to the garage should be directed to use the 27th Street entrance. Busses going to the garage from or too the high school might be allowed to use the internal connecting road; however, if such operations prove to be hazardous, such trips could be routed via Pine cone Road and 27th Street.

It appears that the roadway system design around the elementary school was intended to permit one-way operation. If one-way operation is under consideration, it should be noted that some drivers using the parking area will be likely to violate the one-way postings while circulating to find parking and/or when leaving as they will be apprehensive about driving to an exit they cannot see and their orientation will be to the entrance through which they arrived.

A one-way operation at the high school might be desirable for the high school in that it would tend to reduce some conflicts in the parking area as well as on 32nd Street when large numbers of students all arrive or depart within a very narrow time period. A one-way operation would tend to provide for a more orderly and efficient exodus. The concept layout for the parking area does not seem to favor either a one- or two-way operation. However, signing and markings, as well as directives to students and occasional surveillance would probably lead to a high level of compliance.

The schools will generate most of the traffic using the Pine Cone Road intersections with 27th and 32nd Streets. In spite of the excellent operation (LOS A) forecasted for both of them, the school district might want to consider staggering the starting and dismissal times for the elementary and the high schools when the high school is completed. Although the LOS for each of the two intersections was determined assuming a simultaneous dismissal time, some conflicts could be avoided, and an even smoother operation – both on the roads and at the bus garage – is rather likely if the busses, parents bringing or picking up children, and students driving to and from the high school, are not trying to arrive or depart all at the same time.

If and when the school district becomes more certain about the construction of a high school on the school site, it is encouraged to develop a transportation plan for vehicular and pedestrian traffic that addresses movements to and from the site as well as movements within it. The plan should consider many – if not all – of the issues relating to the schools noted in the several above paragraphs.

Access Management

A major concern in the establishment of a collector road system is the management of access to adjacent property. Even at the local level, a collector road must be expected to provide a safe and viable mobility function while concurrently providing reasonable access to each adjacent parcel. However, studies have shown that there are direct negative correlations between the number of access points on a road, and its traffic carrying capacity and traffic crash rates. Therefore, one of the keys to developing an optimal system of collector roads that will retain its effectiveness as the city develops in the future is to assure that a standard process is adopted to deal with access concerns.

To achieve effective access management, the city should apply the St. Cloud APO access guidelines it has adopted to *all* roads that have the potential to serve a local collector or higher-level classification function while addressing the following needs:

- Adequate sight distance and spacing requirements
- Shared and consolidated access
- Reduction of multiple access points
- Restricted turning movements (e.g., right-in/right-out only; left-in only)
- Setbacks for future frontage roads
- Orientation of access to local streets
- Platting review
- Connectivity between adjacent plats
- Official mapping to preserve corridors
- Purchase of access control where necessary

A reproduction of the St. Cloud APO guidelines, in a tabular format, is included in the appendix to this report.

Conclusions

Based on the analysis documented in this report, WSB has concluded that it is unlikely that there would be any significant traffic operational problems associated with the collector system corridors proposed to address the local access and commuting demands in the next 25 years within the study area. An excellent level of service can be expected at all of the key intersections on the proposed system of two-lane roads and streets. Even the turn lanes suggested in this report are not critical to maintaining the excellent LOS. It should be understood, of course, that these conclusions assume that future land use in and around the study area will be essentially in keeping with the St. Cloud APO 2030 forecast. In the event that development occurs earlier than, or differs significantly from, the APO forecast, the city should take appropriate measures to assure that the collector system and its schedule for implementation are modified accordingly so as to maintain the system's integrity and its intended function.

Recommendations

Although traffic analyses based on future roadway networks can provide reliable indications of system adequacy (or the lack thereof), it must be understood that a forecast 25 or more years into the future is based on a rather high level of speculation. Therefore, as development occurs in and near the study area, the proposed collector network should be reviewed periodically to determine the need for modifications and, in particular, to determine when individual portions of the system should be designed and constructed so as to allow adequate time to address funding requirements and the project development sequence. Ideally, new roadway infrastructure should be in place by the time it is needed. A more refined traffic analysis for the individual segments should be carried out at the outset of project development to assist in the determination of design parameters.

Based on the data available at this time, it appears that a collector system of two-lane roads as covered in this report should adequately serve the study area through 2030. Including the turn lanes recommended in Table 3 will provide for smoother and safer traffic operations. Turn lanes at some of the other intersections might be beneficial in the near- and long-term future as development occurs. Ongoing traffic analysis of the system should be carried out to determine where such spot improvements might be called for.

As access management will be a key factor in the long-range successful operation of the collector road system, it is imperative that the St. Cloud APO Recommended Access Management Guidelines adopted by the City be applied to the system's development. The City should also consider the application of these or similar access guidelines to *all roads that have the potential to serve an arterial and/or collector function* in the city in order to protect its investment, retain optimal levels of service, and to enhance road user safety.

APPENDIX

Technical Advisory Committee (TAC) Members

Assumed Intersection Traffic Controls

SimTraffic Data Sheets
PM Peak Hour
PM Peak Hour Corresponding to School Dismissal

St. Cloud APO Recommended Access Management Guidelines

Technical Advisory Committee (TAC) Members

The Sartell City Council appointed the following to serve on the Technical Advisory Committee for the collector road system study on October 25, 2004:

Mike Nelson – City Engineer/BWK
Anita Rasmussen – City Planning Director
Robin Froelich – City Planning Commission member
Michelle Meyer – Sartell School Board & City/School District Collaborative Plg Member
Steve Wruck – School District Business Manager
Paul Orndorff – City Council & Public Works Commission Member
Bill Hansen or Scott Mareck – St. Could Area Planning Organization

Assumed Intersection Traffic Controls

The intersections in the collector system study area were assigned traffic controls (STOP signs) as follows so as to provide information necessary for the analyses performed with the "Synchro" and "SymTraffic" software. The STOP signs were located so as to favor "through" movements and driver expectation as to what the favored movements ought to be, e.g., a "T" intersection generally favors the movements along the top of the T rather then the stem where all approaching traffic must turn. An all-way stop was indicated at some intersections where relatively equal traffic volumes were anticipated on each leg.

It is understood, of course, that actual placement of traffic controls will be subject to traffic engineering investigations and will depend on the actual conditions observed as well as the construction plans for the new intersections. All controls will conform to warrants and standards set forth in the *Minnesota Manual on Uniform Traffic Control Devices* and other applicable traffic engineering guidelines.

Intersection	Traffic Control	Remarks
40th Street/75th Avenue	Westbound STOP	"T" Intersection
40th Street/Pinecone Road	East- and Westbound STOP	
40th Street/CSAH 1	East- and Westbound STOP	
35th Street/75th Avenue	Westbound STOP	"T" Intersection
35th Street/13th Avenue	Northbound STOP	"T" Intersection
32nd Street/ Pinecone Road	East- and Westbound STOP	Intersection serves proposed high school
32nd Street/CSAH 1	Eastbound STOP	"T" Intersection
24th Street/75th Avenue	Westbound STOP	"T" Intersection
27th Street/19th Avenue	Three-way STOP	"T" Intersection
27th Street/13th Avenue	All-Way STOP	
27th Street/Pinecone Road	East- and Westbound STOP	
27th Street/ CSAH 1	East- and Westbound STOP	
15th Street/75th Avenue	Westbound STOP	"T" Intersection
15th Street/19th Avenue	All-Way STOP	
15th Street/13th Avenue	Southbound STOP	"T" Intersection
15th Street/Pinecone Road	East- and Westbound STOP	
15th Street/CSAH 1	Eastbound STOP	"T" Intersection
12th Street/Pinecone Road	Westbound STOP	"T" Intersection
12th Street/CSAH 1	Eastbound STOP	"T" Intersection

SimTraffic Data Sheets

PM Peak Hour

For the data sheets contained herein, contact:

WSB& Associates, Inc.,
701 Xenia Avenue South
Suite 300
Minneapolis, MN 55416
763-541-4800,

SimTraffic Data Sheets

PM Peak Hour Corresponding to School Dismissal

For the data sheets contained herein, contact:

WSB& Associates, Inc.,
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Suite 300
Minneapolis, MN 55416
763-541-4800,

St. Cloud APO

Recommended Access Management Guidelines

St. Cloud APO
Recommended Access Management Guidelines

ATTACHMENT A

	PRINCIPAL ARTERIAL**	MINOR ARTERIAL	COLLECTOR	LOCAL STREET	TOWNSHIP ROAD
Access	Lowest	Low	Moderate	Highest	Moderate
Mobility	Highest	High	Moderate	Low	Moderate
Roadway ADT	15,000 (+)	5,000-20,000	1,000-5,000	< 1,000	1,000-2,000
Trip Lengths	> 8 Miles	2-6 Miles	1-4 Miles	< 2 Miles	1-4 Miles
Posted Speed Limit	30-55 mph	35-45 mph	30-35 mph	30 mph	Varies
Right-of-Way (widths)	200-300 Feet	100-150 Feet	80-100 Feet	66 Feet	66 Feet
Parking	Not Allowed	Highly Restricted	Restricted	Limited Restrictions	Unrestricted
Large Trucks	Unrestricted	Unrestricted	Unrestricted	Highly Restricted	Unrestricted

Full Movement Intersection Spacing* *(Measured from centerline to centerline) Partial intersections should be reviewed individually.*

Urban Core	300 Feet (30-40 mph)	330-660 Feet (30 mph)	330-660 Feet (30 mph)	330 Feet Minimum	N/A
Urbanizing	2,640 Feet (40-45 mph)	1,980-2,640 Feet (30-40 mph)	660 Feet Minimum (30 mph)	330 Feet Minimum	330 Feet Minimum
Rural	5,280 Feet (45-55 mph)	2,970 Feet (45 mph)	1,320-2,310 Feet (30-35 mph)	N/A	600 Feet
Traffic Control Devices	Interchange, Traffic Signals	Traffic Signals	Traffic Signals or All-Way Stops	Stops as Needed	Cross-Street Stops
Signal Spacing	2,640-3,630 Feet (40-55 mph)	1,980-2,970 Feet (30-40 mph)	1,320-2,310 Feet (30-35 mph)	N/A	N/A

Driveways

Accesses	No Direct Access	Highly Restricted	Restricted	Permitted	1/40 Acres
Driveway Spacing from the Outside Edge of the Intersection	N/A	100-160 Feet	50-100 Feet	30-50 Feet	50-100 Feet
Distance between Drive-ways (edge to edge)	N/A	≥ 100 Feet	≥ 50 Feet	≥25 Feet	≥ 50 Feet
Driveways per Parcel	N/A	1	1	1	1
Shared Driveways	N/A	Wherever Possible	Wherever Feasible	Acceptable	Wherever Feasible

System Mileage (%) Ideal percentage of miles (w/in a system) based on the roadway classification

Urban Roadways	5-10	15-25	5-10	65-80	N/A
Rural Roadways	2-4	6-12	20-25	65-75	20-25
System Traffic (VMT %)	40-65	15-40	5-10	10-30	5-10

Average Daily Traffic (ADT)
Vehicle Miles Traveled (VMT)
**Intersection and signal spacing is predicated on the range of speeds, per function and an average cycle length of 90 seconds.*
**Numbers are reflective of State principal and minor arterials access management guidelines.

October 2002 – November 2004