TO:	Bob Walton, NDDOT Fargo District, District Engineer
FROM:	Shawn Birst
SUBJECT:	Hotel Traffic Impact Study
DATE:	September 24, 2004

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Per the NDDOT's request, some minor changes and clarification were made to the Hotel Traffic Impact Study dated September 1, 2004. However, the modifications had no bearing on the study's results.

The Advanced Traffic Analysis Center (ATAC) evaluated the potential traffic impacts of the proposed hotel to 19th Ave. N. Our analysis is based on information made available to us about the hotel, including the location, size, proposed features, and intended usage. We used the F-M Metro COG's latest available traffic volume data for assessing possible traffic impacts in the surrounding area of the hotel, especially 19th Avenue North. In addition, the peak traffic flow was gathered at the proposed access point along 19th Ave. N.

The proposed extended stay hotel is expected to generate between 460 and 920 vehicle-trips per day. This estimate was calculated using full occupancy of the expected 92 rooms plus additional service and delivery trips. To determine the potential impact to 19th Ave. N., the worst case scenario was analyzed using the Highway Capacity Manual 2000 methodology. According to the HCM 2000 analysis, the additional traffic to 19th Ave. N. would not adversely affect the operations of the roadway. However, the final design of the access should consider the safety impacts due to traffic entering/exiting the hotel, especially making a northbound left-turn movement.

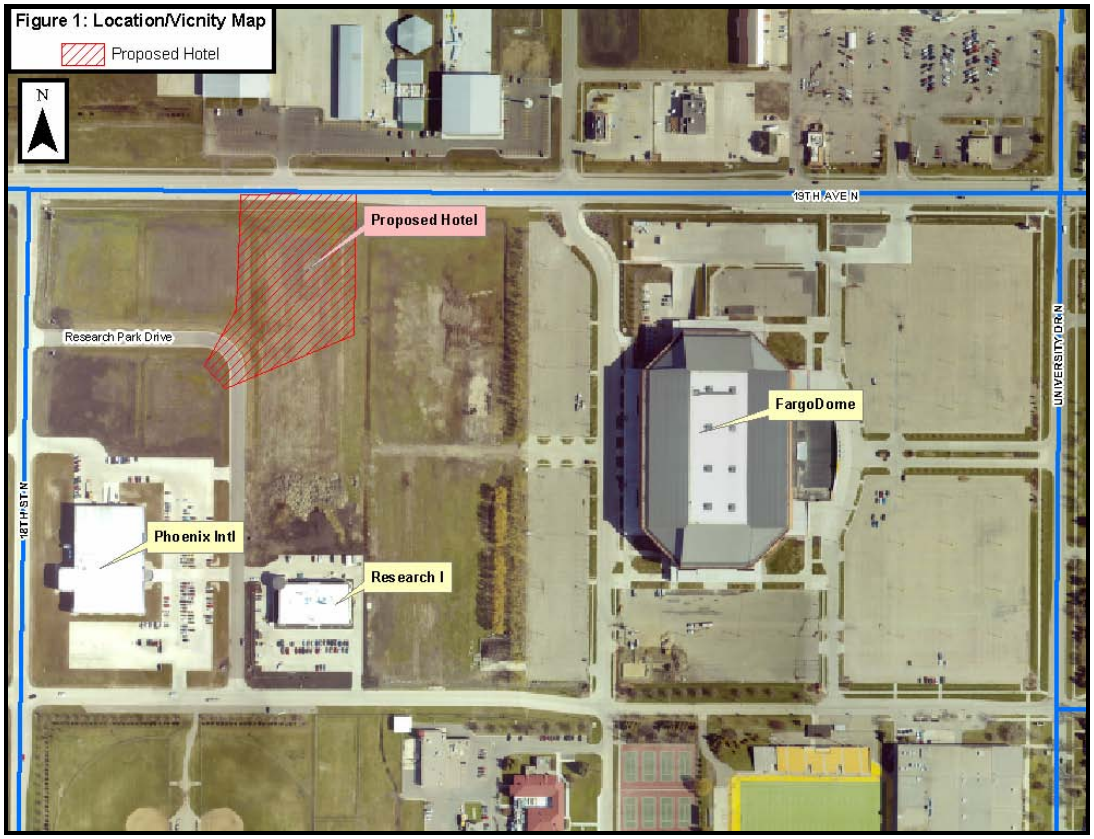
LOCATION AND SCOPE

The proposed hotel will be located on the north end of the NDSU campus along Research Park Drive (Figure 1). The hotel is expected to target business travelers with ties to NDSU's Research and Technology Park, as well as other campus units. Therefore, the hotel is expected to offer extended stay accommodations, with a total capacity of 92 rooms. It is also anticipated that several classrooms will be developed in the lower level of the hotel to serve students from NDSU's Hospitality and Tourism Management major. The hotel is not expected to house a restaurant that would attract non-guests to the premises. Therefore, the majority of trips attracted to the hotel will be made up of hotel guests, in addition to employees and delivery trips.

The hotel is expected to have a parking lot consisting of approximately 119 parking stalls, including 5 handicapped accessible stalls. Initial plans show that the main access for the hotel will be from Research Park Drive. A second access connecting to 19th Ave. N. is being considered since it provides an easier access for visitors not familiar with the location.

Since the hotel targets individuals with business ties to NDSU, it is expected most of the outbound trips will be south to campus. The hotel will be in close proximity to NDSU's Research and Technology Park that visitors would have several transportation alternatives, including walking, shuttle bus, and driving. NDSU students will predominantly ride the Metro Area Transit's (MAT) campus circulator to access the classrooms at the hotel. Therefore, no additional vehicular trips are expected from the students.

The main focus of this analysis is to estimate the hotel's impact to 19th Ave. N. Nineteenth Ave. N. is a major arterial north of campus, which also provides access to the airport and the Fargo Dome. The analysis will examine the current level of use on 19th Ave. N. and determine if the additional access would negatively affect the roadway.



ANALYSIS

The following section will describe the current traffic conditions surrounding the study area, possible hotel traffic generation, and the affects it may have on the existing transportation system. It should be noted that the results are based on the initial plans for the hotel and they do not take into consideration impacts resulting from the final design of access points.

Current Conditions

The proposed hotel is bordered to the north by 19th Ave. N. and 18th St. to the west. Currently, 19th Ave. N. carries about 16,000 vehicles per day (vpd) whereas 18th St. carries 2,800 vpd. Since the level of service of a road is generally measured by its level of use (traffic levels) relative to its capacity, it is important to estimate the capacity on these two roads. The access accommodating Vics Aviation is approximately half way between 18th St. and Albrecht Blvd., which are 1,320 ft apart. The current access for Vics Aviation is unrestricted and incorporates a left-turn lane from 19th Ave. N. (note Figure 2).

Future Conditions

Figure 2 also illustrates the proposed modifications to 19th Ave. N. due to hotel construction. The hotel access would create a 4-leg intersection and a left-turn lane would be incorporated along 19th Ave. N. The new left-turn lane would not adversely affect existing storage areas along 19th Ave. N. The initial storage length of 250 ft was

incorporated and a queue length estimation will be performed to determine if the length is adequate.

Figure 2. Existing conditions and future (blue hatching) modifications of 19th Ave. N.

Estimating Hotel Traffic

To examine the impact of the proposed hotel on the area's transportation system, it is necessary to estimate the amount of new traffic generated by the hotel. For that purpose, we used the Institute of Transportation Engineers (ITS) Trip Generation Manual (*1*). This manual provides average trip generation rates for various land use sites (i.e., by facility type and attributes). For the proposed extended stay hotel, the closest corresponding ITE land use type was related to "all suites hotel." Depending on the facility and area characteristics, the average trips per day per room is 6.24 and may range from 5 to 10 trips.

The average of 6.24 vehicle-trips per occupied guest room includes guest arrivals, delivery trucks, and employee trips. This rate also assumes that 50% of the trips are exiting and 50% of the trips are entering the facility. Table 1 shows the expected number of vehicle trips generated per day based on occupancy percentage and a range of trip generation rates. With 100% of the rooms occupied, the expected trips for the extended stay hotel will be approximately 574 trips.

Table 1. Daily hotel vehicle trips

Hotel Occupancy		Daily Vehicle Trips
% Occupied	**Number of Units**	**6.24 (Trip Rate)**
100	92	**574**
75	69	431
50	46	287

Note: The trip rate value was obtained from the ITE Trip Generation Manual.

Typically, the peak-hour conditions are of most interests for designers and traffic operations personnel. Table 2 illustrates potential peak-hour vehicular traffic arriving and leaving the hotel. The values were calculated using the peak-hour vehicle-trip rate of 0.55. With 100% occupancy, the PM peak-hour traffic entering and exiting the facility was calculated to be 21 and 30 vehicle trips, respectively.

Table 2. PM peak-hour vehicle trips entering and existing the facility

PM Peak Hour of Adjacent Street	
Trip Rate (per occupied room)	0.55
Entering	Exiting
42%	58%
21	**30**

Note: Based on 92 units, the peak hour trip rate, and movement percentage (ITE Trip Generation Manual).

Future Traffic Levels

The Fargo/Moorhead Council of Governments (FM-COG) long-term transportation plan predicts for the model year 2030 that 19th Ave. N. and 18th St. will carry about 20,000 and 4,000 vehicles per day, respectively. These projections predict 19th Ave. N. to grow about 1% per year and 18th St. will grow about 1.4% per year for the next 25 years.

As previously mentioned, the proposed hotel will have an access with Research Park Dr., which will primarily serve guests and students dealing with NDSU. The 19th Ave. N. access would primarily serve non-NDSU clients and those people arriving/departing from the north. Since an existing access is located directly north of the proposed hotel, it would seem appropriate to grant an access to the hotel if it wouldn't adversely affect traffic flow along 19th Ave. N. Based on the current and projected traffic levels along 18th St., the additional hotel traffic could be accommodated. However, the motorist would incur more travel time (delay time) since they would experience a longer route and have to contend with more intersection traffic control.

Expected Hotel Impacts to 19th Ave. N.

An HCM 2000 analysis was performed for the proposed hotel access using the Highway Capacity Software (HCS) 2000 (*2*). The hotel access would create a four-leg intersection operating under two-way stop control (TWSC). The analysis determined the impact to 19th Ave. N. with the current traffic volumes and the 2030 projected traffic (Table 3). The current PM peak-hour traffic was obtained August 26, 2004. For the 2030 traffic, 10% of the ADT was used for 19th Ave. N. and applied the same directional distribution as the 2004 traffic.

Table 3. Existing and projected peak traffic volumes for the proposed access.

Traffic Scenario	EB Approach			WB Approach			NB Approach			SB Approach		
	L[1]	T	R	L[2]	T	R[1]	L	T	R[2]	L[1]	T	R[1]
2004 Hourly Flow Rate	10	1,178	-	21	769	3	-	-	30	4	-	20
2030 Hourly Flow Rate	10	1,337	-	21	1,109	3	-	-	30	4	-	20

[1] Vics Aviation arriving and departing traffic.
[2] Projected hotel arriving and departing traffic.

To determine the worst case scenario for 19th Ave. N., all of the vehicle trips (21) were treated as westbound left turns entering the hotel. Based on the initial HCM results, traffic exiting the hotel using the 19th Ave. N. access experienced high delay time. The northbound left-turn movement could be easily made during off-peak times; however, motorists would be deterred from using it during peak periods, especially the PM peak, due to the high delay. Therefore, most of the departing traffic traveling west would use the south access. Due to this occurrence, the HCM output considers all of the exiting traffic making a northbound right-turn onto 19th Ave. N.

The intersection geometry modeled in HCS 2000 consisted of two through lanes and a left-turn lane for both the east and west approaches. The north and south approaches incorporated a single-lane approach. The critical movement along 19th Ave. N. is the westbound left-turn movement since it opposes the higher eastbound traffic. Initial concerns were related to having adequate storage space for the westbound left-turning traffic. Based on the current pavement markings along 19th Ave. N., approximately 350 ft of storage, which can store approximately 14 vehicles, is available for the westbound left-turn lane.

Based on the HCS 2000 results, the estimated traffic impacts to 19th Ave. N. for both the 2004 and 2030 scenarios are minimal (Table 4). The delay time ranges for the 2004 and 2030 scenarios ranged from (9.4 – 11.1 s/veh) and (10.9 – 12.1 s/veh), respectively. The westbound left-turn's 95% queue length for the 2004 and 2030 scenarios were 0.11 and 0.12 vehicles, respectively.

Table 4. Potential hotel impacts for 2004 and 2030 traffic conditions.

Traffic Scenario	EB Approach	WB Approach	NB Approach	SB Approach
	L	L	R	LR
2004 Control Delay (s/veh)	9.4	11.1	11.7	16.5
2004 LOS	A	B	B	C
2004 95% Queue (veh)	0.04	0.11	0.17	0.23
2030 Control Delay (s/veh)	10.9	12.1	12.7	26.8
2030 LOS	B	B	B	D
2030 95% Queue (veh)	0.05	0.12	0.19	0.43

CONCLUSION

Based on the current capacity of 19th Ave. N., a substantial traffic increase is needed before drivers experience any significant delay along the roadway. Using ITE's average trip generation rate, the extended stay hotel is not expected to produce a large volume of traffic. Pavement markings would be used to establish the westbound left-turn lane entering the hotel. Initially, a right-turn lane for the eastbound traffic is not necessary; however, it may be incorporated in the future due to safety concerns regarding speed differentials.

The main objective of this study was to evaluate the traffic impact to 19th Ave. N. However, significant vehicle delay making a left-turn onto 19th Ave. N. may occur during the peak periods, the hotel's developer must analyze alternatives to reduce the delay impacts. Left-turn restrictions through regulation or channelization may have to be implemented based on left-turn delay time, crash history, and additional travel time for alternative routes.

RESOURCES

1. Institute of Transportation Engineers, Trip Generation 7th Edition, Washington, D.C., 2003.

2. Highway Capacity Software 2000, HSC2000 Unsignalized Intersections, Version 4.1d, McTrans Center, University of Florida, Gainesville, FL.