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Verify Certain ITE Trip Generation Rate Applications in South Dakota Study SD2005-02 Final Report

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<p>16. Abstract This report presents the findings and recommendations on the Verification of Certain ITE Trip Generation Rate Applications in South Dakota. The project reviewed six Discount Superstores, two Home Improvement Stores, and one Grocery Store, to determine if the trip generation rates and projected traffic met or exceeded the traffic projections documented in Traffic Impact Studies.</p> <p>Prior to the completion of this study, South Dakota Department of Transportation (SDDOT) Traffic Engineers often relied upon the Institute of Transportation (ITE) Trip Generation Manual to determine projected traffic impacts for development of new businesses in South Dakota. The SDDOT needed to verify if the ITE Trip Generation rates for major traffic generating businesses accurately reflected the rates found in rural areas such as South Dakota.</p> <p>Traffic count information and trip generation rates were calculated for each site and compared to the traffic impact studies and the ITE Trip Generation Manual. The signalized intersections reviewed in the various communities as a part of this research project all met at least one MUTCD traffic signal warrant and provided increased safety and convenience for the traveling public. These studies verified that the traffic signal recommendations were all based on sound traffic engineering judgment.</p> <p>The trip generation rates for all land uses identified in the traffic impact studies and ITE manual were consistently low for all but two locations. Four Discount Superstores and both Home Improvement Stores had trip generation rates that exceeded the recommended rates found in the ITE manual. The Pierre, South Dakota Super Wal-Mart exhibited the highest trip generation rate which was 59.7% higher than the ITE rate during the average weekday AM peak hour, and 57.5% higher during the PM peak hour. The average weekday 24 hour rate was 54% higher than the ITE rate. The city of Pierre is located in a relatively rural part of the state but serves a large economic trade area with limited discount shopping opportunities.</p>			
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Chapter 1

Executive Summary

This report presents the findings and recommendations for the research that will “Verify Certain ITE Trip Generation Rate Applications in South Dakota”. The South Dakota Department of Transportation (SDDOT) often relies on the Institute of Transportation Engineers (ITE) Trip Generation Manual to provide guidance in determining the impacts of new development adjacent to our highways. Many of the ITE trip generation rates were developed for large urban areas and may over estimate the amount of traffic being generated in rural areas such as South Dakota. The SDDOT needed to verify if the ITE Trip Generation rates for major traffic generating businesses such as Super Wal-Mart, Menards, Hy-Vee Food Stores, and other large businesses overestimate the amount of traffic that can be expected to be generated for these types of businesses. The SDDOT Office of Road Design did not have sufficient information available to determine if the projected traffic for these businesses was accurately documented in the traffic analyses that were required as a part of the site development plan. Since traffic signals, turning lanes, and other improvements are designed and installed in response to the projected traffic volumes, we have to be certain that the Manual of Uniform Traffic Control Devices (MUTCD) Traffic Signal Warrants are met before traffic signals or other highway improvements are completed. We also needed to contact other rural states in the mid-west who use the ITE trip generation rates, to find out if their rates have been modified to more accurately reflect their rural nature.

Objectives

- 1) Verify if the ITE Trip Generation Rates and the NCHRP 365 Trip Generation Rates recommended for large businesses such as Wal-Mart, Home Depot, Menards and HY-Vee Food Store’s accurately reflect the rates found in South Dakota.
- 2) Determine if existing traffic conditions found at large businesses accurately reflect the traffic impact studies projected traffic used to meet traffic signal warrants in South Dakota cities above and below 50,000 population.

Research

Literature dealing with traffic forecasting, trip generation, and trip distribution is found in the ITE Trip Generation Manual and the National Cooperative Highway Research Program (NCHRP) Report 365 “Travel Estimation Techniques for Urban Planning”. While transferable parameters have been developed for various traffic generators identified in the NCHRP Report 365, they are often based on studies completed on the east coast and in other heavily populated areas. The literature revealed that the NCHRP Report 365 trip generation tables utilized many of the same land uses and trip generation numbers as found in the 6th edition of the ITE Trip Generation Manual.

SDDOT Traffic Engineers and the Sioux Falls and Rapid City Engineering Departments were contacted to obtain copies of traffic impact studies that were completed for the businesses selected by the technical panel. Traffic impact studies completed by HDR Engineering, Inc. were obtained for the Sioux Falls Hy-Vee Store, Super Wal-Mart and Menards in Sioux Falls, and the Super Wal-Mart Store in Pierre. A traffic impact study completed by Interstate Engineering Inc. was obtained for Lowe's Home Improvement Store in Rapid City.

Working with staff from the SDDOT Office of Traffic Inventory Management, and the Office of Road Design, a traffic count plan was developed for each of the selected business sites. The plan included the use of traffic counting tubes at each of the entrances and exits of the businesses to allow us to get traffic counts in fifteen minute increments by direction. Several SDDOT interns used traffic count boards to determine peak hour traffic movements at key signalized intersections adjacent to the selected businesses. The counting period included an entire week when resources permitted. In all cases, several weekdays and the entire weekend needed to be counted for each business.

Traffic count information and trip generation rates were calculated for each site and compared with the HDR Engineering, Inc. Traffic Impact Studies and the ITE Trip Generation Manual. For all Super Wal-Mart's, except the Rapid City Super Wal-Mart, the traffic impact studies used the ITE trip generation rates for a Free-Standing Discount Superstore Land Use #813. The Sioux Falls Hy-Vee grocery store study completed by HDR Engineering, Inc. used the ITE Supermarket Land Use # 850. The Sioux Falls Menards study and the Rapid City Lowe's Home Improvement Store study both used the ITE Home Improvement Superstore Land Use #862. South Dakota trip generation rates were calculated for each site and are shown in tables along with the ITE trip rates.

In order to be consistent with the ITE Manual, two different rates were noted for both the AM and PM peak hours. The typical AM peak hour rate in the HDR studies utilized the ITE trip rate for the "peak hour of adjacent street traffic" for a one hour period between 7:00 AM and 9:00 AM. The "adjacent street traffic" rate for the Free Standing Discount Superstore (ITE#813) was 1.84. Similarly, the "adjacent street traffic" rate for the one hour period between 4:00 and 6:00 PM was 3.82.

The second set of peak hour rates were those developed for the average weekday AM and PM "peak hour of the generator". These rates were somewhat higher and reflect the average weekday peak hour rates as determined from the traffic counts. The ITE "peak hour of the generator" rates for the Free Standing Discount Superstore (ITE#813) were 3.17 in the AM and 4.03 in the PM. South Dakota rates based on traffic tube counts were developed for both the "adjacent street traffic" and the "peak hour of the generator".

Findings and Conclusions

The signalized intersections reviewed in the various communities as a part of this research project all met at least one MUTCD traffic signal warrant and provided increased safety and convenience for the traveling public. These studies verified that the trip generation rates and corresponding traffic signal recommendations were all based on sound traffic engineering judgment. Additional intersections in Pierre and Spearfish may warrant the installation of traffic signals at the discretion of the SDDOT Region Traffic Engineers and local government officials.

The Institute of Transportation Engineers 7th Edition Trip Generation Manual and the National Cooperative Highway Research Program (NCHRP) Report 365 “Travel Estimation Techniques for Urban Planning” were used to determine the amount of trips that could be expected for each of the land use types studied in this research project. A review of both documents revealed that the NCHRP Report 365 trip generation tables utilized many of the same land use types and trip generation numbers as found in the 6th edition of the ITE Trip Generation Manual.

A review of the trip generation rates for the Sioux Falls Hy-Vee Grocery Store and the Supermarket ITE #850 land use shows the Sioux Falls store generated a lower number of trips than was estimated by the ITE during the average weekday AM peak hour by 46.42 %, and the PM peak hour by 18.94%. However, the 24 hour average weekday trip rate was 9.68% higher than the ITE rate. In addition, the Saturday and Sunday Sioux Falls 24 hour trip rates were 60.56% and 53.66% less than what would have been expected by the ITE trip rate for a supermarket.

The Sioux Falls East Menards Home Improvement Store and the Rapid City Lowe’s Home Improvement Store were very comparable to each other, but produced significantly higher trip rates than could be found in the ITE Home Improvement Superstore land use #862. The Sioux Falls Menards Store trip generation rate was 51% higher than the ITE rate during the average weekday AM peak hour, and 45.7% higher during the average weekday PM peak hour. The 24 hour trip rate was 60% higher than the ITE rate for a Home Improvement Superstore. Similarly, the Rapid City Lowe’s Home Improvement Store trip generation rate was 53.46% higher than the ITE rate during the average weekday AM peak hour, and 55.86% higher during the PM peak hour. The average weekday 24 hour rate was 59.8% higher than the ITE 24 hour rate, and 48.12% higher for the Saturday trip rates.

This research study looked at the trip generation rates for six Super Wal-Marts constructed in South Dakota during the last four years. The Pierre Super Wal-Mart opened in April of 2005. Traffic counts were taken in June 2005 and trip generation rates were calculated and compared to the HDR Engineering, Inc. Traffic Impact Study that was completed during the summer of 2003. The Pierre trip generation rate was 59.72% higher than the ITE rate during the average weekday AM peak hour, and 57.51% higher during the PM peak hour. The average weekday 24 hour rate was 54.11% higher than the ITE 24 hour rate and 49.97% higher for the Saturday trip rates. The Pierre Super Wal-

Mart had the highest trip generation rate of any of the other Super Wal-Marts' studied in South Dakota.

Yankton, South Dakota had a much lower trip generation rate at its Super Wal-Mart compared with Pierre, even though its population of 13,528 is very similar to Pierre. The Yankton trip generation rate was 9.17% higher than the ITE rate during the average weekday AM peak hour, and 17.46% higher during the PM peak hour. The average weekday 24 hour rate was 10.78% higher than the ITE rate, and 18.88% higher for the Saturday trip rates.

Spearfish, South Dakota with a population of only 8,606 had the lowest trip generation rates for any of the Super Wal-Marts we looked at. Spearfish is a college town and school was not in session when we took the traffic counts. However, Spearfish is a major tourist destination and the counts were taken during the summer tourist season. The Spearfish trip generation rate was 12.11% lower than the ITE rate during the average weekday AM peak hour, and 8.36% lower during the PM peak hour. The average weekday 24 hour rate was 15.69% lower than the ITE rate, and 22.69% lower for the Saturday trip rates.

Watertown, South Dakota with a population of 20,237 also had low trip rates when compared to the other Super Wal-Marts. The Watertown trip generation rate was 8.32% lower than the ITE rate during the average weekday AM peak hour, and 10.5% lower for the PM peak hour. The average weekday 24 hour rate was 9.28% lower than the ITE rate, and 15.27% lower for the Saturday trip rates. It should be noted that the traffic counts were taken during the time that road construction activities were occurring on some of the neighboring streets.

Sioux Falls, South Dakota with a population of 123,975 had higher trip generation rates than were noted in the ITE Manual for a Free Standing Discount Superstore. The Sioux Falls trip generation rate was 17.41% higher than the ITE rate during the average weekday AM peak hour, and 30.62% higher during the PM peak hour. The average weekday 24 hour rate was 25.6% higher than the ITE rate, and 19.9% higher for the Saturday trip rates.

Rapid City, with a population of 59,607 also had higher trip generation rates than the ITE. The Rapid City Super Wal-Mart shares the same parking lot with the Golden Corral Steak House Restaurant. We were not able to separate the trips between the two businesses, so the South Dakota trip generation rate includes both businesses and is only compared to the trip rates projected in the HDR Engineering, Inc., Traffic Impact Study. To help with the analysis of the area, we did include the number of meals served by the Golden Corral, as well as the times of day it is busiest. Both the AM and the PM peak hours for the complex occurred during the busiest hours for the restaurant. It should also be noted that the Rapid City traffic impact study was completed in 2000, and traffic in the area of the Super Wal-Mart complex has increased due to additional businesses developed in that area since the original study was completed.

The Rapid City trip generation rate for the Super Wal-Mart complex was 7.52 per 1,000 sq. ft. during the average weekday AM peak hour and 9.59 per 1,000 sq. ft. during the PM peak hour. The average weekday trip generation rate for the complex was 64.49% higher than the HDR projected rate for the AM peak hour and 13% higher during the PM peak hour. The Saturday 24 hour trip rate was 10.45 compared to the HDR projected rate of 9.61% for a difference of 8.04%.

In summary, the traffic conditions found at all of the signalized intersections studied either met or exceeded the traffic projections obtained from each of the site impact studies. The signalized intersections reviewed in the communities with populations above and below 50,000 met at least one MUTCD traffic signal warrant and provided increased safety and convenience for the traveling public.

The trip generation rates for all land uses identified in the traffic impact studies were consistently low for all locations except the Spearfish and Watertown Super Wal-Marts. These locations generated average weekday 24 hour trip generation rates that were 15% and 9% lower than what was found in the ITE Trip Generation Manual. Both Yankton and Pierre Super Wal-Marts exceeded the average weekday 24 hour ITE trip generation rates by 10% and by 54% respectively. Therefore, with the exception of the Pierre Super Wal-Mart, the trip generation rates identified in the ITE manual provide a reasonable ballpark estimate of trips for cities with populations less than 50,000 without any needed adjustments.

Recommendations

- 1. It is recommended that the ITE trip generation rates for Free Standing Discount Superstores in cities with populations less than 50,000 be used as provided in the ITE Trip Generation Manual unless the city is located in an isolated area with a large economic trade area with limited discount shopping opportunities.**
- 2. It is recommended that the ITE trip generation rates for Free Standing Discount Superstores in rural geographic areas with limited discount shopping opportunities and a geographically large economic trading area be increased.** Possibly due to the large trade area surrounding the city of Pierre, and the lack of other discount shopping opportunities in this area, the trip generation rates for the Free Standing Discount Superstore were very high.
- 3. It is recommended that the ITE Trip Generation rates for Supermarkets (ITE #850) in cities over 50,000 be used with caution especially when projecting average weekday AM peak hour and weekend traffic.** The Sioux Falls Hy-Vee Grocery Store generated significantly less trips during the peak hours and weekends, but had a 9.68% higher 24 hour average weekday trip rate than what was found in the ITE Trip Generation Manual. Due to the limited number of ITE studies and the variability in the supermarket peak hour traffic, it is difficult to determine if the rates should be higher or lower.

- 4. It is recommended that when traffic engineers conduct traffic impact studies in cities over 50,000 population in rural areas similar to South Dakota, they should consider increasing the ITE trip generation rates for the Free Standing Discount Superstores and the Home Improvement Super Stores.**
The Home Improvement Stores located in Sioux Falls and Rapid City had significantly higher trip generation rates than what was projected in the site impact studies. In addition, the Super Wal-Marts in both Sioux Falls and Rapid City had significantly higher 24 hour average weekday trip rates than what had been projected in the site impact studies.
- 5. It is recommended that the Office of Research send the SD2005-02 Final Report to all South Dakota Department of Transportation Traffic Engineers as well as the Traffic Engineers in Sioux Falls and Rapid City.**
- 6. It is recommended that the Office of Research send an electronic copy of the SD2005-02 Final Report and Appendix to the Institute of Transportation Engineers for use in updating the ITE Trip Generation Manual.**
- 7. It is recommended that the Office of Research send an electronic copy of the SD2005-02 Final Report to the Transportation Research Board Subcommittee on Statewide Travel Forecasting for distribution and use by its members.**

Chapter 2

Problem Description

The South Dakota Department of Transportation (SDDOT) often relies on the Institute of Transportation Engineers (ITE) Trip Generation Manual to provide guidance in determining the impacts of new development adjacent to our highways.(1) Many of the ITE trip generation rates were developed for large urban areas and therefore may over estimate the amount of traffic being generated in rural areas such as South Dakota. The SDDOT needed to verify if the ITE Trip Generation rates for major traffic generating businesses (such as Super Wal-Mart, Menards, Hy-Vee Food Stores, and other business office buildings) overestimate the amount of traffic that can be expected to be generated for these types of businesses. The SDDOT Office of Road Design did not have sufficient information available to determine if the projected traffic for these businesses was accurately documented in the traffic analyses that were required as a part of the site development plan. Since traffic signals, turning lanes, and other improvements are designed and installed in response to the projected traffic volumes, we have to be certain that the Manual of Uniform Traffic Control Devices (MUTCD) Traffic Signal Warrants are met before traffic signals or other highway improvements are completed. We also needed to contact other rural states in the mid-west who use the ITE trip generation rates, to find out if their rates have been modified to more accurately reflect their rural nature.

Chapter 3

Objectives

- 1) Verify if the ITE Trip Generation Rates and the NCHRP 365 Trip Generation Rates recommended for large businesses such as Wal-Mart, Home Depot, Menards and HY-Vee Food Store's accurately reflect the rates found in South Dakota.
- 2) Determine if existing traffic conditions found at large businesses accurately reflect the traffic impact studies projected traffic used to meet traffic signal warrants in South Dakota cities above and below 50,000 population.

The research study looked at six Super Wal-Marts in South Dakota as well as two Home Improvement Stores and one Grocery Store. Traffic counters were used to determine AM and PM peak hour trip generation rates as well as 24 hour trip generation rates for each of the businesses. The results of the trip generation analyses for each of the businesses were compared with the trip generation rates identified in the ITE Trip Generation Manual and the Traffic Impact Studies that had previously been completed for each business studied.

Summer Research Interns conducted turning movement counts at each of the signalized intersections surrounding the businesses. In addition, traffic counting tubes were placed at each entrance and exit in such a manner that we were able to collect directional traffic counts. All of the traffic count information was analyzed by the SDDOT Office of Road Design to determine if the signalized intersections met the MUTCD traffic signal warrants.

Chapter 4

Task Description

1) Meet with the projects technical panel to review the project's scope and work plan.

The project's researchers met several times with a subgroup of the technical panel to review the work plan and determine the location and numbers of businesses that would be studied.

2) Through review of current literature, and through contact with other states that are geographically and demographically similar, identify trip generation rates used for large businesses such as Wal-Mart, Home Depot, Menards, Cabelas, Hy-Vee Food Stores, and Best Buy.

Literature dealing with traffic forecasting, trip generation, and trip distribution is found in the ITE Trip Generation Manual and the National Cooperative Highway Research Program (NCHRP) Report 365 "Travel Estimation Techniques for Urban Planning".(2) While transferable parameters have been developed for various traffic generators identified in the NCHRP Report 365, they are often based on studies completed on the east coast and in other heavily populated areas. The literature revealed that the NCHRP Report 365 trip generation tables utilized many of the same land uses and trip generation numbers as found in the 6th edition of the ITE Trip Generation Manual.

Much of the background information for this project was derived from traffic impact studies completed for new developments in South Dakota. HDR Engineering, Inc. provided Traffic Impact Studies for all of the Super Wal-Marts that were studied as well as for the Sioux Falls Hy-Vee Grocery Store and Menards. Interstate Engineering, Inc provided the Traffic Impact Study for the Lowe's Subdivision in Rapid City, South Dakota.

In an effort to determine if our neighboring states used trip generation rates from sources other than the ITE Trip Generation Manual, our research intern contacted the traffic engineering departments in each of the surrounding states. Responses were documented from Minnesota, Iowa, and Montana.(3,4,5) All three of these states utilize the ITE Trip Generation Manual for determining trip rates for new developments. The responders indicated that they have not done any local trip generation studies to supplement the ITE Manual. Due to time constraints, no follow-up phone calls were made to North Dakota, Wyoming, or Nebraska.

3) Acquire and review the site traffic impact studies for the following businesses in South Dakota:

- **Hy-Vee Food Store on East 10th Street in Sioux Falls**
- **Super Wal-Mart and Menards in Sioux Falls**
- **Cabelas, Menards, and Super Wal-Mart in Mitchell**
- **Super Wal-Mart in Pierre**

- **Lowe's Home Improvement Store on North Haines Avenue in Rapid City**

SDDOT Traffic Engineers and the Sioux Falls and Rapid City Engineering Departments were contacted to obtain copies of traffic impact studies that were completed for the businesses selected by the technical panel. Traffic impact studies completed by HDR Engineering, Inc. were obtained for the Sioux Falls Hy-Vee Store, Super Wal-Mart and Menards in Sioux Falls, and the Super Wal-Mart Store in Pierre. A traffic impact study completed by Interstate Engineering Inc. was obtained for Lowe's Home Improvement Store in Rapid City. We were not able to secure site impact studies for Cabelas, Menards, and the Super Wal-Mart store in Mitchell.

Following discussions with SDDOT Traffic Engineers, additional traffic impact studies were secured for the Rapid City Super Wal-Mart, Yankton Super Wal-Mart, Spearfish Super-Wal-Mart and the Watertown Super Wal-Mart. These site impact studies were also completed by HDR Engineering, Inc.

4) Develop a traffic count plan that replicates the types of forecasted traffic and vehicle movements identified in the traffic impact studies.

Working with staff from the SDDOT Office of Traffic Inventory Management, and the Office of Road Design, a traffic count plan was developed for each of the selected business sites. The plan included the use of traffic counting tubes at each of the entrances and exits of the businesses to allow us to get traffic counts in fifteen minute increments by direction. Several SDDOT interns would use traffic count boards to determine peak hour traffic movements at key signalized intersections adjacent to the selected businesses. The counting period would include an entire week when resources permitted. In all cases, several weekdays and the entire weekend needed to be counted for each business.

5) Complete the required traffic and turning movement counts according to the plan.

During the months of June and July 2005, the traffic and turning movement counts were completed according to the approved plan.

6) Compare the traffic count information generated at each site with the traffic forecasts in the respective traffic impact studies.

The results of the directional traffic counts were compared with the previously completed site impact studies. Both AM and PM peak hour counts were calculated from the tube counts located at each of the businesses entrances and exits. Twenty-four hour counts were also provided for weekdays and the weekends. The traffic count information for all entrances and exits at each site were reviewed to make sure there were no discrepancies or irregular counts. The traffic counts were redone for the Lowe's Home Improvement site in Rapid City due to equipment failure. The Yankton Super Wal-Mart required an

adjustment to the Friday PM counts at one of the entrances due to an abnormal amount of extra hits on the traffic count tubes. This adjustment is reflected in the following tables.

7) Compare the traffic count information with estimated trip generation rates found in both the ITE Trip Generation Manual and the NCHRP Report 365.

Traffic count information and trip generation rates were calculated for each site and compared with the HDR Engineering, Inc. Traffic Impact Studies and the ITE Trip Generation Manual. For all Super Wal-Mart's, except the Rapid City Super Wal-Mart, the HDR studies used the ITE trip generation rates for a Free-Standing Discount Superstore Land Use #813. The Sioux Falls Hy-Vee grocery store study completed by HDR Engineering, Inc. used the ITE Supermarket Land Use # 850. The Sioux Falls Menards study and the Rapid City Lowe's Home Improvement Store study both used the ITE Home Improvement Superstore Land Use #862. South Dakota trip generation rates were calculated for each site and are shown in the following tables along with the ITE trip rates.

In order to be consistent with the ITE Manual, two different rates were noted for both the AM and PM peak hours. The typical AM peak hour rate in the HDR studies utilized the ITE trip rate for the "peak hour of adjacent street traffic" for a one hour period between 7:00 AM and 9:00 AM. The "adjacent street traffic" rate for the Free Standing Discount Superstore (ITE#813) was 1.84. Similarly, the "adjacent street traffic" rate for the one hour period between 4:00 and 6:00 PM was 3.82.

The second set of peak hour rates were those developed for the average weekday AM and PM "peak hour of the generator". These rates were somewhat higher and reflect the average weekday peak hour rates as determined from the traffic counts. The ITE "peak hour of the generator" rates for the Free Standing Discount Superstore (ITE#813) were 3.17 in the AM and 4.03 in the PM. South Dakota rates based on traffic tube counts were developed for both the "adjacent street traffic" and the "peak hour of the generator". Task 9 of this report compares the "peak hour of the generator" rates as identified in the ITE Manual and as calculated from the actual peak hour of trips in the AM and PM for each of the facilities studied.

Super Wal-Mart in Pierre, South Dakota

The Pierre Super Wal-Mart opened in the spring of 2005, has 155,078 sq. ft. of GFA, and is located south of Airport Road and east of U.S. Highway 14B. A Wal-Mart that was operating before the new Super Wal-Mart was built was located .25 miles southwest of the new location and had an estimated 84,000 sq. ft. GFA.(6)

Traffic Volumes

Prior to constructing the new Super Wal-Mart, traffic volumes including PM peak hour turning movements were collected at the intersection of US-14B/Airport Road, US -14B/ Harrison Ave., and US- 14B/Pierre Mall Driveway on Wednesday, May 14, 2003. The AM peak hour turning movement counts were collected on Thursday May 15, 2003. Entering and exiting vehicle data was collected at each access driveway to the site and is shown in Table 1.

Table 1. Wal-Mart trips prior to the construction of the new Super Wal-Mart in Pierre, S.D.

Driveway	Am Peak Hour		PM Peak Hour	
	In	Out	In	Out
West(Harrison)	37	31	114	108
North Harrison	10	6	37	33
South (US-14B)	28	23	100	95
Total	75	60	251	236

Table 2. Proposed Trip Generation for the new Super Wal-Mart store as shown in the HDR Engineering, Inc. Site Impact Study for Pierre, S.D. Population 13, 876

Proposed Land Use- Free Standing Discount Superstore	Units	Number of Units	ITE Land Use Code	ITE Trip Rate	Trip Generation			
					Total	% Enter	Enter	Exit
AM Peak Hour	1,000	155	813	1.84	285	51%	145	140
PM Peak Hour	1,000	155	813	3.82	592	49%	290	302

HDR recommended that a traffic signal be installed at each intersection because of the peak hour Traffic Signal Warrant. Tables 3 and 4 provide the 2005 average weekday and the weekend AM and PM peak hour traffic as well as the calculated South Dakota trip generation rates for this location. A comparison is made with the ITE trip generation rates as identified in the HDR Engineering, Inc. study.

Table 3. Super Wal-Mart in Pierre, S.D. Peak Hour Traffic
 Super Wal-Mart In Pierre, S.D., 155,000 sq. ft., Population 13,876
 Free-Standing Discount Superstore (ITE #813)

Date	Units/1000 sq. ft.	Peak Hour Time	In/Out	Traffic	Total Traffic	SD Trip Rate	ITE Trip Rate Peak Hour	Percent Difference ((SD-ITE)/SD)*100
Average Weekday		Wednesday-Friday and Monday						
6/15/05-6/17/05	155	7:00 -8:00 AM	In	158	297	1.92	1.84	3.97
	155	7:00 -8:00 AM	Out	139				
6/20/2005	155	5:00-6:00 PM	In	682	1470	9.48	3.82 (HDR)	59.72
	155	5:00-6:00 PM	Out	788				
AM Peak Hour	155	11:00-12:00 AM	In	454	914	5.90	3.17	46.24
	155	11:00-12:00 AM	Out	460				
PM Peak Hour	155	5:00-6:00 PM	In	682	1470	9.48	4.03	57.51
	155	5:00-6:00 PM	Out	788				
Saturday 6/18/2005	155	7:00 -8:00 AM	In	190	335	2.16	N/A	
	155	7:00 -8:00 AM	Out	145				
	155	5:00-6:00 PM	In	535	1276	8.23		
		155	5:00-6:00 PM	Out				
AM Peak Hour	155	11:00-12:00 AM	In	660	1297	8.37		
	155	11:00-12:00 AM	Out	637				
PM Peak Hour	155	3:30-4:30 PM	In	710	1427	9.21	5.01	45.58
	155	3:30-4:30 PM	Out	717				
Sunday 6/19/2005	155	7:00 -8:00 AM	In	151	270	1.74	N/A	
	155	7:00 -8:00 AM	Out	119				
	155	5:00-6:00 PM	In	493	1131	7.30		
		155	5:00-6:00 PM	Out				
AM Peak Hour	155	11:00-12:00 AM	In	484	1197	7.72		
	155	11:00-12:00 AM	Out	711				
PM Peak Hour	155	4:30-5:30 PM	In	640	1290	8.32	4.27	48.69
	155	4:30-5:30 PM	Out	722				

Table 4. Super Wal-Mart in Pierre, S.D. 24 Hour Traffic

Super Wal-Mart in Pierre, S.D., 155,000 sq. ft. Population 13, 876

Free Standing Discount Superstore (ITE #813)

Date	Units/1000 sq. ft.	24 Hour Traffic	24 Hour Trip Rate	ITE Trip Rate 24 Hour Period	Percent Difference ((SD- ITE)/SD)*100
Average Weekday		Wednesday-Friday and Monday			
6/15/05-6/17/05	155	16621	107.23	49.21	54.11
6/20/2005					
Saturday	155	17815	114.94	57.50	49.97
6/18/2005					
Sunday	155	16212	104.59	46.98	55.08
6/19/2005					
Thursday	155	17333	111.83	N/A	
6/16/2005					
Friday	155	17863	115.25	N/A	
6/17/2005					
Monday	155	15107	97.46	N/A	
6/20/2005					

Super Wal-Mart in Sioux Falls, South Dakota

The Sioux Falls Super Wal-Mart is a 204,000 sq. ft. GFA store located near the Intersection of SD 42 and SD11. The street network in the study area consists primarily of 12th Street, Sycamore Avenue and SD Highway 11. East 12th Street is an east-west arterial consisting of two through lanes in each direction and a center two-way left- turn lane (TWLTL) from Sycamore Avenue to approximately Gordon Drive. Sycamore Avenue is a north-south arterial with a three-lane cross-section widened to five lanes at the 12th Street intersection. SD 11 is a rural two-lane highway with a widened intersection at SD 42.(7)

The intersection of 12th street and Sycamore Avenue is signalized. All other intersections in the study area are currently unsignalized. The intersection of 12th/ Marquette, 12th Foss and SD 42/ SD 11 were stop sign controlled prior to the construction of the new Super Wal-Mart. Following the construction, traffic signals were installed at Foss Ave/

SD42, and at the Intersection of Highline Ave/SD 42 the entrance of Menards and Wal-Mart Supercenter.

**Table 5. Proposed Trip Generation for Super Wal-Mart in Sioux Falls, S.D.
Population 123,975 as shown in the HDR Site Impact Study**

Proposed Land Use- Free Standing Discount Superstore	Units	Number of Units	ITE Land Use Code	ITE Trip Rate	Trip Generation			
					Total	% Enter	Enter	Exit
AM Peak Hour	1,000	204	813	1.84	375	51%	191	184
PM Peak Hour	1,000	204	813	3.82	779	49%	382	397

Tables 6 and 7 provide the 2005 average weekday and the weekend AM and PM peak hour traffic as well as the calculated South Dakota trip generation rates for this location. A comparison is made with the ITE trip generation rates as identified in the HDR Engineering, Inc. study.

Table 6. East Super Wal-Mart in Sioux Falls, S.D. Peak Hour Traffic

East Super Wal-Mart in Sioux Falls, S.D. 204,000 sq. ft.

Population 123,975

Free-Standing Discount Superstore (ITE #813)

Date	Units/1000 sq. ft.	Peak Hour Time	In/Out	Traffic	Total Traffic	SD Trip Rate	ITE Trip Rate Peak Hour		Percent Difference ((SD-ITE)/SD)*100
Wednesday-Friday									
Average Weekday 6/22/05-6/24/05	204	7:00-8:00 AM	In	114	265	1.30	1.84		-41.53
	204	7:00-8:00 AM	Out	151					
	204	5:00-6:00 PM	In	638	1185	5.81	3.82 (HDR)		34.24
	204	5:00-6:00 PM	Out	547					
AM Peak Hour	204	11:00-12:00 AM	In	406	783	3.84	3.17		17.41
	204	11:00-12:00 AM	Out	377					
PM Peak Hour	204	5:00-6:00 PM	In	638	1185	5.81	4.03		30.62
	204	5:00-6:00 PM	Out	547					
Saturday 6/25/2005	204	7:00-8:00 AM	In	141	246	1.21	N/A		
	204	7:00-8:00 AM	Out	105					
	204	5:00-6:00 PM	In	559	1112	5.45			
	204	5:00-6:00 PM	Out	553					
AM Peak Hour	204	11:00-12:00 AM	In	540	1056	5.18			
	204	11:00-12:00 AM	Out	516					
PM Peak Hour	204	5:15-6:15 PM	In	559	1121	5.50	5.01	8.83	
	204	5:15-6:15 PM	Out	562					
Sunday 6/26/2005	204	7:00-8:00 AM	In	110	185	0.91	N/A		
	204	7:00-8:00 AM	Out	75					
	204	5:00-6:00 PM	In	542	1108	5.43			
	204	5:00-6:00 PM	Out	566					
AM Peak Hour	204	11:00-12:00 AM	In	518	988	4.84			
	204	11:00-12:00 AM	Out	470					
PM Peak Hour	204	3:15-4:15 PM	In	599	1241	6.08	4.27	29.81	
	204	3:15-4:15 PM	Out	642					

Table 7. East Super Wal-Mart in Sioux Falls, S.D. 24 Hour Traffic
 Super Wal-Mart in Sioux Falls, S.D. 204,000 sq. ft., Population 123,975
 Free-Standing Discount Superstore (ITE #813)

Date	Units/1000 sq. ft.	SD 24 Hour Traffic	SD 24 Hour Trip Rate	ITE Trip Rate 24 Hour Period	Percent Difference ((SD-ITE)/SD)*100
Average		Wednesday-Friday			
6/22/05- 6/24/05	204	13493	66.14	49.21	25.60
Saturday 6/25/2005	204	14645	71.79	57.5	19.90
Sunday 6/26/2005	204	13738	67.34	46.98	30.24

Super Wal-Mart in Spearfish, South Dakota

The Spearfish Super Wal-Mart is a 203,000 sq. ft. store located south of 1st Ave. and east of 27th Street. The primary access driveways are located on 1st Ave.(8)

Table 8. Proposed Trip Generation for Super Wal-Mart in Spearfish, S.D.
 Population 8,606 as shown in the HDR Site Impact Study

Proposed Land Use- Free Standing Discount Superstore	Units	Number of Units	ITE Land Use Code	ITE Trip Rate	Trip Generation			
					Total	% Enter	Enter	Exit
AM Peak Hour	1,000	203	813	1.84	374	51%	191	183
PM Peak Hour	1,000	203	813	3.82	775	49%	380	395

Tables 8 and 9 provide the 2005 average weekday and weekend AM and PM peak hour traffic as well as the calculated South Dakota trip generation rates for this location. A comparison is made with the ITE trip generation rates as identified in the HDR Engineering, Inc. study.

Table 9. Super Wal-Mart in Spearfish, S.D. Peak Hour Traffic

Super Wal-Mart In Spearfish, S.D. 203,000 sq. ft.,
Free-Standing Discount Superstore (ITE #813)

Date	Units/1000 sq. ft.	Peak Hour Time	In/Out	Traffic	Total Traffic	SD Trip Rate	ITE Trip Rate Peak Hour	Percent Difference ((SD-ITE)/SD)*100
Average Weekday		Tuesday-Friday and Monday						
6/7/05- 6/10/05 6/13/2005	203	7:00-8:00 AM	In	56	161	0.79	1.84	-132.00
	203	7:00-8:00 AM	Out	105				
	203	5:00-6:00 PM	In	336	692	3.41	3.82	-12.02
		203	5:00-6:00 PM	Out				
AM Peak Hour	203	11:00-12:00 AM	In	283	574	2.83	3.17	-12.11
	203	11:00-12:00 AM	Out	291				
PM Peak Hour	203	3:00-4:00 PM	In	360	755	3.72	4.03	-8.36
	203	3:00-4:00 PM	Out	395				
Saturday 6/11/2005	203	7:00-8:00 AM	In	105	190	0.94	N/A	
	203	7:00-8:00 AM	Out	85				
	203	5:00-6:00 PM	In	290	616	3.03		
		203	5:00-6:00 PM	Out				
AM Peak Hour	203	11:00-12:00 AM	In	444	787	3.88		
	203	11:00-12:00 AM	Out	343				
PM Peak Hour	203	3:30-4:30 PM	In	421	839	4.13	5.01	-21.22
	203	3:30-4:30 PM	Out	418				
Sunday 6/12/2005	203	7:00-8:00 AM	In	79	147	0.72	N/A	
	203	7:00-8:00 AM	Out	68				
	203	5:00-6:00 PM	In	318	646	3.18		
		203	5:00-6:00 PM	Out				
AM Peak Hour	203	11:00-12:00 AM	In	389	695	3.42		
	203	11:00-12:00 AM	Out	306				
PM Peak Hour	203	2:30-3:30 PM	In	370	872	4.30	4.27	0.60
	203	2:30-3:30 PM	Out	502				

Table 10. Super Wal-Mart in Spearfish, S.D. 24 Hour Traffic

Super Wal-Mart In Spearfish, S.D. 203,000 sq. ft., Population 8,606
Free-Standing Discount Superstore (ITE #813)

Date	Units/1000 sq. ft.	SD 24 Hour Traffic	24 Hour Trip Rate	ITE Trip Rate 24 Hour Period	Percent Difference ((SD-ITE)/SD)*100
Average Weekday		Tuesday-Friday and Monday			
6/7/05-6/10/05 6/13/2005	203	8635	42.54	49.21	-15.69
Saturday 6/11/2005	203	9514	46.87	57.5	-22.69
Sunday 6/12/2005	203	8985	44.26	46.98	-6.14

Super Wal-Mart in Yankton, South Dakota

The Yankton Super Wal-Mart is a 203,007 sq. ft. store located south of Highway 50 and west of Highway 81. The primary access driveway from Highway 81 is located at an existing median break. There are two-access driveway's north to Highway 50 and south of Fox Run Parkway.

The intersection of Highway 50 and Highway 81 is the only signalized intersection in the study area. The Highway 50 approaches consist of a shared left-turn/through lane and an exclusive right-turn lane. The Highway 81 approaches consist of a left-turn lane, a through lane and a shared through/right turn lane.(9)

**Table 11. Proposed Trip Generation for Super Wal-Mart in Yankton, S.D.
Population 13,528 as shown in the HDR Site Impact Study**

Proposed Land Use- Free Standing Discount Superstore	Units	Number of Units	ITE Land Use Code	ITE Trip Rate	Trip Generation			
					Total	% Enter	Enter	Exit
AM Peak Hour	1,000	203	813	1.84	374	51%	191	183
PM Peak Hour	1,000	203	813	3.82	775	49%	380	395

Tables 12 and 13 provide the 2005 average weekday and the weekend AM and PM peak hour traffic as well as the calculated South Dakota trip generation rates for this location. A comparison is made with the ITE trip generation rates as identified in the HDR Engineering, Inc. study. Please note the adjusted numbers for the Friday PM traffic due to a road tube that had an abnormal amount of extra hits. The counts were adjusted based on historic traffic at that location.

Table 12. Super Wal-Mart in Yankton, S.D. Peak Hour Traffic

Super Wal-Mart in Yankton, S.D. 204,000 sq. ft., Population 13,528
Free-Standing Discount Superstore (ITE #813)

Date	Units/1000 sq. ft.	Peak Hour Time	In/Out	Traffic	Total Traffic	SD Trip Rate	ITE Trip Rate Peak Hour	Percent Difference ((SD- ITE)/SD)*100
Average Weekday								
Wednesday- Friday 6/15/05- 6/17/05	204	7:00-8:00 AM	In	126	235	1.15	1.84	-59.73
	204	7:00-8:00 AM	Out	109				
	204	5:00-6:00 PM	In	417	930*	4.56*	3.82	16.21*
		204	5:00-6:00 PM	Out				
AM Peak Hour	204	11:00-12:00 AM	In	355	712	3.49	3.17	9.17
	204	11:00-12:00 AM	Out	357				
PM Peak Hour	204	4:15-5:15 PM	In	514	996*	4.88*	4.03	17.46*
	204	4:15-5:15 PM	Out	482*				
*Adjusted Numbers								
Saturday 6/18/2005	204	7:00-8:00 AM	In	114	213	1.04	N/A	
	204	7:00-8:00 AM	Out	99				
	204	5:00-6:00 PM	In	433	1022	5.01		
		204	5:00-6:00 PM	Out				
AM Peak Hour	204	11:00-12:00 AM	In	620	1164	5.71		
	204	11:00-12:00 AM	Out	544				
PM Peak Hour	204	2:00-3:00 PM	In	579	1414	6.93	5.01	27.72
	204	2:00-3:00 PM	Out	835				
Sunday 6/19/2005	204	7:00-8:00 AM	In	93	191	0.94	N/A	
	204	7:00-8:00 AM	Out	98				
	204	5:00-6:00 PM	In	366	761	3.73		
		204	5:00-6:00 PM	Out				
AM Peak Hour	204	11:00-12:00 AM	In	535	991	4.86		
	204	11:00-12:00 AM	Out	456				
PM Peak Hour	204	12:30-1:30 PM	In	511	1126	5.52	4.27	22.64
	204	12:30-1:30 PM	Out	615				

Table 13. Yankton, S.D. 24 Hour Traffic

Super Wal-Mart in Yankton, S.D. 204,000 sq. ft., Population 13,528
Free-Standing Discount Superstore (ITE #813)

Date	Units/1000 sq. ft.	24 Hour Traffic	SD 24 Hour Trip Rate	ITE Trip Rate 24 Hour Period	Percent Difference ((SD-ITE)/SD)*100
Average Weekday					
Wednesday- Friday 6/15/05-6/17/05	204	11252*	55.16*	49.21	10.78*
*Adjusted Numbers					
Saturday 6/18/2005	204	14460	70.88	57.5	18.88
Sunday 6/19/2005	204	11592	56.82	46.98	17.32

Hy-Vee Grocery Store on East 10th Street in Sioux Falls, South Dakota

The Sioux Falls Hy-Vee grocery store is a 66,000 sq. ft. facility located on the north side of 10th Street. The street network serving the study area consists of 10th Street and cross streets at Cleveland Avenue, Chapel Hill Road, and Thompson Avenue. Tenth Street is the major east-west arterial through the center of Sioux Falls, providing two through lanes in each direction, a semi-continuous two-way center turn lane and intersection turn lanes. Cleveland Avenue is a collector street varying from two to three lanes, with additional turn lanes at the major intersections. Chapel Hill Road and Thompson Avenue are local streets which both form T-intersections with 10th Street. (HDR page 4)(10)

Trip Generation

HDR Engineering, Inc. provided the following discussion concerning trip generation for the proposed grocery store. “ITE trip generation rates for grocery stores, as a function of the square footage of the store, show that during a typical weekday the proposed store can be expected to generate about 7,000 vehicle trips, equally split between entering and exiting trips.”

“The PM peak hour, however, is the period of most concern to local officials. Existing traffic counts show that the evening rush hour is the most congested time of the day. ITE rate calculations show that approximately 351 trips are expected to enter the site during the PM peak, while approximately 337 exit the site.”

Unfortunately, the HDR study did not identify which ITE Land Use was used to determine the trip generation numbers. After reviewing the ITE Trip Generation Manual for suitable land uses, we decided to use Land Use: 850 Supermarket. However, there was only one study referenced in the ITE Manual, so care must be taken when comparing the results with the South Dakota rates documented at this site.

Table 14. Sioux Falls, S.D. Hy-Vee Grocery Store Peak Hour Traffic
Hy-Vee In Sioux Falls, S.D. 66,000 sq. ft., Population 123,975 Supermarket ITE #850

Date	Units / 1000 sq. ft.	Peak Hour Time	In/Out	Traffic	Total Traffic	SD Trip Rate	ITE Trip Rate Peak Hour	Percent Difference ((SD-ITE)/SD)*100
Average Weekday		Wednesday-Friday						
6/22/05- 6/24/05	66	7:00-8:00 AM	In	115	225	3.41	3.25	4.67
	66	7:00-8:00 AM	Out	110				
	66	5:00-6:00 PM	In	324	667	10.11	10.45	-3.40
	66	5:00-6:00 PM	Out	343				
Peak AM Hour	66	11:00-12:00 AM	In	237	453	6.86	10.05	-46.42
	66	11:00-12:00 AM	Out	216				
Peak PM Hour	66	5:00-6:00 PM	In	324	667	10.11	12.02	-18.94
	66	5:00-6:00 PM	Out	343				
Saturday 6/25/2005	66	7:00-8:00 AM	In	106	194	2.94	N/A	
	66	7:00-8:00 AM	Out	88				
	66	5:00-6:00 PM	In	239	514	7.79		
	66	5:00-6:00 PM	Out	275				
Peak AM Hour	66	11:00-12:00 AM	In	287	559	8.47		
	66	11:00-12:00 AM	Out	272				
Peak PM Hour	66	4:15-5:15 PM	In	279	585	8.86	10.76	-21.44
	66	4:15-5:15 PM	Out	306				
Sunday 6/26/2005	66	7:00-8:00 AM	In	88	141	2.14	N/A	
	66	7:00-8:00 AM	Out	53				
	66	5:00-6:00 PM	In	236	500	7.58		
	66	5:00-6:00 PM	Out	264				
Peak AM Hour	66	11:00-12:00 AM	In	276	568	8.61		
	66	11:00-12:00 AM	Out	292				
Peak Hour	66	11:15 AM-12:15 PM	In	276	599	9.08	18.93	-108.48
	66	11:15 AM -12:15 PM	Out	323				

Table 15. Sioux Falls, S.D. Hy-Vee Grocery Store 24 Hour Traffic
Hy-Vee In Sioux Falls, S.D. 66,000 sq. ft., Population 123, 975 Supermarket ITE #850

Date	Units/1000 sq. ft.	24 Hour Traffic	SD 24 Hour Trip Rate	ITE Trip Rate 24 Hour Period	Percent Difference ((SD- ITE)/SD)*100
Average Weekday		Wednesday-Friday			
6/22/05-6/24/05	66	7471	113.20	102.24	9.68
Saturday 6/25/2005	66	7300	110.61	177.59	-60.56
Sunday 6/26/2005	66	7149	108.32	166.44	-53.66

East Menards in Sioux Falls, South Dakota

The Sioux Falls, S.D. Menards Home Improvement Store is a 60,000 sq. ft. business located in the same vicinity as the Super-Walmart store on SD Highway 42 and Highline

Avenue. There was a traffic signal installed at this intersection for the East Super Wal-Mart and the Menards Store.(9)

Table 16. Proposed Trip Generation for East Menards in Sioux Falls, South Dakota as shown in the HDR SD 42/SD11 Traffic Impact Study

Proposed Land Use- Home Improvement Superstore	Units	Number of Units	ITE Land Use Code	ITE Trip Rate	Trip Generation			
					Total	% Enter	Enter	Exit
AM Peak Hour	1,000	60	862	1.48	88	54%	48	40
PM Peak Hour	1,000	60	862	2.87	172	47%	81	91

Tables 17 and 18 provide the 2005 average weekday and the weekend AM and PM peak hour traffic as well as the calculated South Dakota trip generation rates for this location. A comparison is made with the ITE trip generation rates as identified in the HDR Engineering, Inc. study.

Table 17. Sioux Falls, South Dakota, East Menards Peak Hour Traffic
East Menards in Sioux Falls, S.D., Population 123,975
Home Improvement Superstore (ITE#862)

Date	Units/1000 sq. ft.	Peak Hour Time	In/Out	Traffic	Total Traffic	SD Trip Rate	ITE Trip Rate Peak Hour	Percent Difference ((SD-ITE)/SD)*100	
Average Weekday									
Wed-Fri 6/22/2005	60	7:00-8:00 AM	In	54	87	1.45	1.2	17.24	
	60	7:00-8:00 AM	Out	33					
	60	5:00-6:00 PM	In	163	317	5.28	2.45	53.63	
		60	5:00-6:00 PM	Out					154
Peak AM Hour	60	11:00-12:00 AM	In	187	349	5.82	2.85	51.00	
	60	11:00-12:00 AM	Out	162					
Peak PM Hour	60	2:15-3:15 PM	In	156	337	5.62	3.05	45.70	
	60	2:15-3:15 PM	Out	181					
Saturday 6/25/2005	60	7:00-8:00 AM	In	51	74	1.23	N/A		
	60	7:00-8:00 AM	Out	23					
	60	5:00-6:00 PM	In	155	366	6.10			
		60	5:00-6:00 PM	Out					211
Peak AM Hour	60	10:45-11:45 AM	In	239	470	7.83			
	60	10:45-11:45 AM	Out	231					
Peak PM Hour	60	2:30-3:30 PM	In	230	510	8.50	5.4	36.47	
	60	2:30-3:30 PM	Out	280					

Table 18. Sioux Falls, S.D. East Menards 24 Hour Traffic

East Menards in Sioux Falls, S.D. Population 123,975

Home Improvement Superstore (ITE#862)

Date	Units/1000 sq. ft.	SD 24 Hour Traffic	SD 24 Hour Trip Rate	ITE Trip Rate 24 Hour Period	Percent Difference ((SD-ITE)/SD)*100
Average Weekday					
Wednesday-Friday 6/22/05-6/24/05	60	4470	74.50	29.8	60.00
Saturday 6/25/2005	60	5545	92.42	45.67	50.58

Rapid City, South Dakota Super Wal-Mart

The Rapid City Wal-Mart store in the northeast quadrant of LaCrosse Street/Anamosa was recently expanded from a 151,000 sq. ft. business to a 222,000 sq. ft. Super Wal-Mart. The street network in the vicinity of the Super Wal-Mart property consists of LaCrosse Street, Anamosa Street and a number of short service streets, including Meridian Lane and Farnwood Street. LaCrosse Street is a main north-south arterial street with a five-lane cross-section. Anamosa Street will be expanded to a major east-west arterial in the future.(11)

The Super Wal-Mart store shares the same parking lot and entrances with the Golden Corral Steakhouse Restaurant. The restaurant is not open for business until 11:00 in the morning on weekdays, so therefore would not have much of an impact on the AM trip generation rates for the area. At capacity, the 9,000 sq. ft. restaurant seats 325 customers. The trip generation rates for the newly constructed Super Wal-Mart were developed by HDR Engineering, Inc. based on twenty-four hour traffic counts that were taken at each of the four driveways that served the previous Wal-Mart store at that location. Trip generation rates relating driveway traffic volumes to the square footage of the 151,000 sq. ft. building were developed. These rates are not the same as those found in the ITE Trip Generation Manual.

As described in the HDR Traffic Impact Study, “The trip generation rates calculated for the Rapid City Wal-Mart store appear to be somewhat higher than average trip generation rates found through studies in other parts of the country. This higher level of trip generation is attributed to several characteristics of this site:

- the store serves a large geographic area
- the demographics of the store service area somewhat favor discount shopping
- the high incidence of tourist traffic favors a higher trip generation, and
- between 15 and 30 recreational vehicles were parked on the Wal-Mart lot at any time, using the site as a temporary “home” and generating auxiliary trips.”

Table 19. HDR Trip Generation for each entrance for Wal-Mart in Rapid City, South Dakota based on the 151,000 sq. ft. building prior to expanding into a Super Wal-Mart

Anamosa St.	VEH/1000 S.F. (IN)	VEH/1000 S.F. (OUT)
Weekday AM	0.44	0.43
Weekday PM	0.78	1.45
Weekend	1.08	1.32

Meridian St.	VEH/1000 S.F. (IN)	VEH/1000 S.F. (OUT)
Weekday AM	0.58	0.39
Weekday PM	2.69	1.80
Weekend	3.10	2.65

Farnwood St.	VEH/1000 S.F. (IN)	VEH/1000 S.F. (OUT)
Weekday AM	0.08	0.13
Weekday PM	0.22	0.34
Weekend	0.08	0.19

Wal-Mart Driveway	VEH/1000 S.F. (IN)	VEH/1000 S.F. (OUT)
Weekday AM	0.34	0.28
Weekday PM	0.58	0.47
Weekend	0.67	0.52

Tables 20 and 21 provide the 2005 average weekday and weekend AM and PM peak hour traffic as well as the South Dakota trip generation rates for the Rapid City Super Wal-Mart complex that includes the Golden Corral Steakhouse Restaurant. A comparison is made with the HDR trip generation rates as identified in the HDR Engineering, Inc. Traffic Impact Study.

Table 20. Super Wal-Mart and Golden Corral Restaurant Rapid City, South Dakota Peak Hour Traffic

Super Wal-Mart Rapid City 222,000 sq. ft., Population 59,607
 This Data Includes Golden Corral, a 9,000 sq. ft. High-Turnover (Sit-Down) Restaurant (ITE #932) that seats 325 & Free Standing Discount Superstore (ITE #813)

Date	Units/1000 sq. ft.	Peak Hour Time	In/Out	Traffic	Total Traffic	SD Trip Rate	HDR Trip Rate	HDR Rate Percent Difference ((SD- HDR)/SD)*100
Average Weekday		6/21/05-6/24/05		Tuesday-Friday				
AM Peak Hour	222	11:00-12:00 AM	In	849	1670	7.52	2.67	64.49
	222	11:00-12:00 AM	Out	821				
PM Peak Hour	222	5:00-6:00 PM	In	1070	2130	9.59	8.33	13.14
	222	5:00-6:00 PM	Out	1060				
Saturday 6/25/05								
PM Peak Hour	222	1:00-2:00 PM	In	1142	2320	10.45	9.61	8.04
	222	1:00-2:00 PM	Out	1178				
Sunday 6/24/05								
PM Peak Hour	222	1:45-2:45 PM	In	1003	2061	9.28		N/A
	222	1:45-2:45 PM	Out	1058				

Table 21. Rapid City, S.D. Super Wal-Mart and Golden Corral 24 Hour Traffic

Rapid City Super Wal-Mart 222,000 sq. ft., Population 59,607
 This Data Includes Golden Corral, a 9,000 sq. ft. High-Turnover (Sit-Down) Restaurant (ITE #932) that seats 325 & Free Standing Discount Superstore (ITE#813)

Date	24 Hour Traffic	SD 24 Hour Trip Rate*	ITE Trip Rate #813 - 24 Hour Period X 222 units	ITE Trip Rate #932 - 24 Hour Period X 9 units
Tuesday-Friday				
Average Weekday 6/21/05-6/24/05	25375	114.30	49.21	127.15
Saturday 6/25/2005	27519	123.96	57.5	158.37
Sunday 6/26/2005	24652	111.05	46.98	131.84

* The South Dakota Trip Rate includes both the Super Wal-Mart traffic and the Golden Corral Steakhouse Restaurant traffic. The rate is calculated by taking the total 24 hour traffic divided by 222 units for the Super Wal-Mart only.

To help determine the impact of the Golden Corral Steakhouse Restaurant on the total number of trips generated at the Super Wal-Mart complex, we contacted the restaurant manager who provided the total number of meals served during the five days the traffic counters were operational. He also indicated that the restaurant is busiest from 12:30 – 1:30 PM, and from 5:30 – 7:30 PM.(12)

Table 22. Golden Corral Steakhouse Restaurant 9,000 sq. ft. seating capacity 325 Number of meals served

Wednesday 6/22/2005	Thursday 6/23/2005	Friday 6/24/2005	Saturday 6/25/2005	Sunday 6/26/2005
489 Lunches	469 Lunches	677 Lunches	219 Breakfasts	336 Breakfasts
815 Dinners	745 Dinners	918 Dinners	599 Lunches	667 Lunches
1304 Total Meals	1214 Total Meals	1595 Total Meals	954 Dinners	693 Dinners
			1772 Total Meals	1696 Total Meals

Lowe's Home Improvement Center in Rapid City, South Dakota

The following discussion is taken from the Draft Traffic Impact Study for Lowe's Subdivision prepared by Interstate Engineering, Inc. Billings, Montana.

The Lowe's Home Improvement Warehouse is a 121,000 sq. ft. store with an associated garden center on the southeast corner of Haines Avenue and Mall Drive in Northeast Rapid City. Haines Avenue is a Principal Arterial that exists as a five-lane section adjacent to the warehouse. Posted with a 35mph speed limit, this facility provides interchange access to Interstate 90 and serves as a primary north-south city traffic corridor within the study area. Haines Avenue has continuity from far north of the city, to the downtown area and beyond to southerly areas of the city. Haines Avenue carries the heaviest traffic of all the study area streets (Lowe's Traffic Impact Study Page 3).(13)

In 2001, Haines Avenue carried variable volumes of traffic with as much as 24,000 vehicles per day (vpd) near its interchange with I-90, to 7,500 vpd north of Mall Drive. Peak periods on Haines Avenue occur during the evening period and bring volumes of nearly 1,600 vph in the segments near I-90. The peak hour volume north of Mall Drive drops to 700 vph. Along the project frontage, Haines Avenue carries about 9,800 vpd with peak hour volumes of about 800 vph. Peak period traffic is directional with one direction heavier than the opposite. In the case of Haines Avenue, about 57% of traffic is northbound during the PM peak hour (Lowe's Traffic Impact Study Page 5).

Mall Drive is a primary traffic corridor serving the Northeast Area of Rapid City. Currently classified as a Major Arterial, the Northeast Area Transportation study recommended re-classification to Principal Arterial status in light of traffic projections further east of the subject development. Mall Drive currently exists as a two-lane paved arterial street carrying light traffic in the vicinity of the project. Posted with a 45 mph speed limit, this roadway provides good east-west access within the study area. Mall

Drive provides access to the Black Hills Mall's north side between Haines Avenue and LaCrosse Street. (Lowe's Traffic Impact Study Page 3).

In 2001, Mall Drive carried traffic volumes of about 1,600 vpd west of Haines Avenue. Mall Drive east of Haines Avenue saw about 2,700 vpd. Peak hour traffic on this segment also occurs during the evening period. During peak hour traffic, Mall Drive east of Haines Avenue will experience about 250 vph while the segment west of Haines Avenue will see only about 100 vph. East of Haines Avenue, PM peak hour traffic on Mall Drive is about 65% westbound, with only 35% of peak period traffic oriented in the eastbound direction. West of Haines Avenue westbound traffic also predominates, constituting 53% of the PM peak hour volume (Lowe's Traffic Impact Study Page 6).

Disk Drive is located at the southern boundary of the site as an arterial street serving as the primary access to the Black Hills Mall. With continuity between Haines Avenue and LaCrosse Avenue, and with significant bordering commercial/retail development, Disk Drive carries a significant volume of traffic. Disk Drive is currently constructed as a 4-lane arterial throughout its run from Haines Avenue to LaCrosse Avenue.

Disk Drive at its intersection with Haines Avenue carries about 10,000 vpd. Peak period traffic on this section of roadway is about 900 vpd, with the PM peak being highly directional in a westbound direction (58% westbound, 42 eastbound)(Lowe's Traffic Impact Study Page 6).

Table 23. Recommended Trip Generation for Lowe's Home Improvement Center (ITE#832) in Rapid City, S.D. Population 59,607 as identified in the Lowe's Traffic Impact Study

Period	Total Trip Ends	Pass-by Trip Ends	New Entering Trips (%)	New Exiting Trip (%)
24-hr. Daily-Weekday	4,814	2,310	2,407	2,407
AM Peak Hour	200	96	100	100
PM Peak Hour	388	186	194	194

Tables 24 and 25 provide the 2005 average weekday and the weekend AM and PM peak hour traffic as well as the calculated South Dakota trip generation rates for the Lowe's Home Improvement Center in Rapid City, South Dakota. A comparison is made with the ITE trip generation rates as identified in the Interstate Engineering, Inc. study.

Table 24. Lowe's Home Improvement Center in Rapid City, S.D. Peak Hour Traffic

Lowe's Home Improvement Center in Rapid City, S.D. 121,000 sq. ft.

Population 59,607 Home Improvement Superstore (ITE# 862)

Date	Units/1000 sq. ft.	Peak Hour Time	In/Out	Traffic	Total Traffic	SD Trip Rate	ITE Trip Rate Peak Hour	Percent Difference ((SD-ITE)/SD)*100
Average Peak Hour Weekday								
7/7/05- 7/8/05	121	7:00-8:00 AM	In	95	192	1.59	1.2	24.38
	121	7:00-8:00 AM	Out	97				
7/11/05- 7/12/05	121	5:00-6:00 PM	In	349	661	5.46	2.45	55.15
	121	5:00-6:00 PM	Out	312				
AM Peak Hour	121	11:00-12:00 AM	In	378	741	6.12	2.85	53.46
	121	11:00-12:00 AM	Out	363				
PM Peak Hour	121	12:30-1:30 PM	In	441	836	6.91	3.05	55.86
	121	12:30-1:30 PM	Out	395				
Saturday 6/9/2005	121	7:00-8:00 AM	In	118	236	1.95	N/A	
	121	7:00-8:00 AM	Out	118				
	121	5:00-6:00 PM	In	336	669	5.53		
	121	5:00-6:00 PM	Out	333				
AM Peak Hour	121	11:00-12:00 AM	In	524	1049	8.67		
	121	11:00-12:00 AM	Out	525				
PM Peak Hour	121	1:30-2:30 PM	In	599	1194	9.87	5.4	45.28
	121	1:30-2:30 PM	Out	595				
Sunday 6/10/2005	121	7:00-8:00 AM	In	42	84	0.69	N/A	
	121	7:00-8:00 AM	Out	42				
	121	5:00-6:00 PM	In	280	567	4.69		
	121	5:00-6:00 PM	Out	287				
AM Peak Hour	121	11:00-12:00 AM	In	467	936	7.74		
	121	11:00-12:00 AM	Out	469				
PM Peak Hour	121	1:45-2:45 PM	In	555	1102	9.11		
	121	1:45-2:45 PM	Out	547				

Table 25. Lowe's Home Improvement Center in Rapid City, S.D. 24 Hour Traffic

Lowe's Home Improvement Center in Rapid City SD, 121,000 sq. ft.,
Population 59,607 Home Improvement Superstore (ITE#862)

Date	Units/1000 sq. ft.	SD 24 Hour Traffic	SD 24 Hour Trip Rate	ITE Trip Rate 24 Hour Period	Percent Difference ((SD- ITE)/SD)*100
7/7/05-7/8/05:7/11/05-7/12/05					
Average Weekday	121	8969	74.12	29.8	59.80
Saturday 6/9/2005	121	10651	88.02	45.67	48.12

Super Wal-Mart in Watertown, South Dakota

As described in the 2003 HDR Traffic Impact Study, the Watertown Super Wal-Mart is a 204,000 sq. ft. store located south of Highway 212 and west of 29th Street. The primary access driveway from Highway 212 is located at 29th Street. There are two additional access drives onto 29th Street and one proposed access drive onto Highway 212 approximately 900' west of 29th Street (page 7 Watertown HDR Traffic Impact Study).(14)

The study area is located in eastern Watertown, South Dakota. The primary roadway facility in the study area is Highway 212, an east-west route. The Super Wal-Mart is located within the Mallard Pointe Business Park. The Mallard Pointe Business Park is located south of Highway 212 between 23rd Street and Interstate 29. Highway 212 is a four-lane divided major arterial with two lanes in each direction with a depressed grass median and left and right-turn lanes at all intersections along the highway within the study area. The speed limit along Highway 212 is 45 miles per hour. Median breaks currently exist along Highway 212 at 23rd Street, 29th Street, 31st Street, 33rd Street, and the West Driveway to the proposed Wal-Mart Super center.

Highway 212/ 23rd Street

The intersection of Highway 212/ 23rd Street is a one-way stop controlled "T" intersection. 23rd Street functions as a commercial collector roadway. The eastbound approach of this intersection consists of two through lanes and a right-turn lane. The westbound approach consists of two through lanes and a right turn lane. The westbound approach consists of two through lanes and an exclusive left-turn lane. The northbound approach could accommodate an exclusive left and right-turn lane. Analysis on the intersection was performed with two lanes on the northbound approach.

Highway 212/West Driveway

The stop controlled west driveway of Wal-Mart creates a “T” intersection with Highway 212. It is approximately 900’ west of 29th Street. The eastbound approach consists of a through lane and a shared through/right-turn lane. The westbound approach consists of two through lanes and a left-turn lane. The west driveway consists of one exiting lane for all movements.

Highway 212/29th Street

At the intersection of Highway 212/29th Street, 29th Street is stop-controlled and creates a “T” intersection with Highway 212. The 29th Street approach could accommodate an exclusive left and right-turn lane. Analysis was performed with two lanes on this approach. The eastbound approach consists of two through lanes and a right-turn lane. The westbound approach consists of two through lanes and a left-turn lane.

Highway 212/31st Street

The Highway 212/31st Street intersection is a one-way stop controlled “T” intersection. The southbound approach can accommodate two lanes, thus analysis was performed with a left and right-turn lane on this approach. The eastbound approach consists of two through lanes and a left-turn lane. The westbound approach consists of two through lanes and right-turn lane.

Highway 212/33rd Street

33rd Street is stop controlled at Highway 212 and creates a “T” intersection with Highway 212. The northbound approach of this intersection can accommodate two exiting lanes, thus analysis was completed with a left and right-turn lane on this approach. The eastbound Highway 212 approach consists of two through lanes and a right-turn lane. The westbound approach consists of two through lanes and a left-turn lane.

**Table 26. Recommended Trip Generation for Super Wal-Mart in Watertown, S.D.
Population 20,237 as identified in the HDR Traffic Impact Study**

Proposed Land Use- Free Standing Discount Superstore	Units	Number of Units	ITE Land Use Code	ITE Trip Rate	Trip Generation			
					Total	% Enter	Enter	Exit
AM Peak Hour	1,000	204	813	1.84	375	51%	191	184
PM Peak Hour	1,000	204	813	3.82	779	49%	382	397

Tables 27 and 28 provide the 2005 average weekday and weekend AM and PM peak hour traffic as well as the calculated South Dakota trip generation rates for this location. A comparison is made with the ITE trip generation rates as identified in the HDR Engineering, Inc. study.

Table 27. Super Wal-Mart in Watertown, S.D. Peak Hour Traffic

Super Wal-Mart in Watertown, S.D. 204,000 sq. ft., Population 20,237
Free-Standing Discount Superstore (ITE #813)

Date	Units/1000 sq. ft.	Peak Hour Time	In/Out	Traffic	Total Traffic	SD Trip Rate	ITE Trip Rate Peak Hour	Percent Difference ((SD-ITE)/SD)*100	
Average Weekday				Wednesday-Friday					
7/13/05-7/15/05	204	7:00-8:00 AM	In	74	153	0.75	1.84	-145.33	
	204	7:00-8:00 AM	Out	79					
	204	5:00-6:00 PM	In	315	696	3.41	3.82	-12.02	
		204	5:00-6:00 PM	Out					381
AM Peak Hour	204	11:00-12:00 AM	In	264	597	2.93	3.17	-8.19	
	204	11:00-12:00 AM	Out	333					
PM Peak Hour	204	12:30-1:30 PM	In	361	744	3.65	4.03	-10.41	
	204	12:30-1:30 PM	Out	383					
Saturday 7/16/2005	204	7:00-8:00 AM	In	93	204	1.00	N/A		
	204	7:00-8:00 AM	Out	111					
	204	5:00-6:00 PM	In	233	627	3.07			
		204	5:00-6:00 PM	Out					394
	AM Peak Hour	204	11:00-12:00 AM	In	421	819			4.01
		204	11:00-12:00 AM	Out	398				
PM Peak Hour	204	1:45-2:45 PM	In	442	927	4.54	5.01	-10.25	
	204	1:45-2:45 PM	Out	485					
Sunday 7/17/2005	204	7:00-8:00 AM	In	61	132	0.65	N/A		
	204	7:00-8:00 AM	Out	71					
	204	5:00-6:00 PM	In	325	698	3.42			
		204	5:00-6:00 PM	Out					373
	AM Peak Hour	204	11:00-12:00 AM	In	310	640			3.14
		204	11:00-12:00 AM	Out	330				
PM Peak Hour	204	1:30-2:30 PM	In	402	830	4.07	4.27	-4.95	
	204	1:30-2:30 PM	Out	428					

Table 28. Super Wal-Mart in Watertown, S.D. 24 Hour Traffic

Super Wal-Mart in Watertown, S.D. 204,000 sq. ft., Population 20,237
Free-Standing Discount Superstore (ITE #813)

Date	Units/1000 sq. ft.	SD 24 Hour Traffic	SD 24 Hour Trip Rate	ITE Trip Rate 24 Hour Period	Percent Difference ((SD- ITE)/SD)*100
Average Weekday					
Wednesday- Friday 7/13/05-7/15/05	204	9186	45.03	49.21	-9.28
Saturday 7/16/2005	204	10176	49.88	57.5	-15.27
Sunday 7/17/2005	204	8763	42.96	46.98	-9.37

8) Compare the information generated in tasks six and seven and determine if the existing traffic movements meet the MUTCD Traffic Signal Warrants at each of these locations.

The SDDOT Office of Road Design reviewed all of the traffic counts and turning movements and used PC Warrants Software to determine if the studied locations met the MUTCD Traffic Signal Warrants.

Excerpts from the MUTCD concerning traffic signal warrants: (15)

- The satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal.
- A traffic control signal should not be installed unless an engineering study indicates that installing a traffic control signal will improve the overall safety and/or operation of the intersection.
- A traffic control signal should not be installed if it will seriously disrupt progressive traffic flow.

Table 29. Intersections that met at least one traffic volume warrant:

Pierre - US14B/Airport Rd (Wal-Mart) (from a count board)
Pierre - US14B/Wal-Mart Entrance (Wal-Mart) (from minor road tube counts and major road north and south intersections count board data)
Pierre - US14B/Harrison Ave (Wal-Mart) (from a count board)

Spearfish - 27th St/1st Ave (Wal-Mart) (from a count board)
Spearfish - 27th St/Exit 14 WB Ramps (Wal-Mart) (from a count board)
Spearfish - 27th St/Exit 14 EB Ramps (Wal-Mart) (from a count board)
Spearfish - 27th St/Colorado Blvd (Wal-Mart) (from a count board)

Sioux Falls - SD42/HyVee Entrance (Hy-Vee) (from minor road tube counts and major road ADT)
Sioux Falls - SD42/Highline Drive (Menards and Wal-Mart) (from minor road tube counts and major road ADT)

Rapid City – LaCrosse/Wal-Mart Entrance (Wal-Mart) (from minor road tube counts and major road ADT)

Table 30. Intersections that did not meet any traffic volume warrants:

Rapid City - Haines/Paha Sapa (Lowe's) (from a count board)

The Haines Avenue / Paha Sapa intersection near the Lowe's Home Improvement store is a three – leg intersection that operates with a stop sign for the east bound Paha Sapa Road. Adequate left-turn deceleration / storage bay space exists for the northbound left turn movements, while two lanes carry northbound through and southbound through and right-turn traffic. This intersection provides one of three access points to a residential subdivision of approximately 200 dwelling units located on the west side of Haines Avenue. Traffic studies conducted during the summer of 2005 confirmed that this intersection operates at an acceptable level of service without a traffic signal.

The signalized intersections reviewed in the various communities as a part of this research project all met at least one MUTCD traffic signal warrant and provided increased safety and convenience for the traveling public. These studies verified that the trip generation rates and corresponding traffic signal recommendations were all based on sound traffic engineering judgment. Additional intersections in Pierre and Spearfish may warrant the installation of traffic signals at the discretion of the SDDOT Region Traffic Engineers and local government officials.

9) Identify any trip generation rate differences found in tasks 2, 6, and 7, and recommend how the trip generation rates used for traffic impact studies should be adjusted for South Dakota cites above and below the 50,000 population threshold.

The Institute of Transportation Engineers 7th Edition Trip Generation Manual and the National Cooperative Highway Research Program (NCHRP) Report 365 “Travel Estimation Techniques for Urban Planning” were used to determine the amount of trips that could be expected for each of the land use types studied in this research project. A review of both documents revealed that the NCHRP Report 365 trip generation tables utilized many of the same land use types and trip generation numbers as found in the 6th edition of the ITE Trip Generation Manual.

HDR Engineering, Inc was the primary engineering company relied upon by the SDDOT to conduct the Traffic Impact Studies in each community. All of the Super Wal-Mart studies as well as the Menards study and the Hy-Vee Grocery Store study were completed by HDR. It appeared that the 6th edition of the ITE Trip Generation Manual was used in each of these studies with the exception of the Rapid City Super Wal-Mart. In that case, HDR used traffic counts from a pre-existing Walmart store in Rapid City to determine what trip generation rates could be expected when the store was expanded into a Super Wal-Mart. The rates that were used were higher than the rates established for the ITE Free Standing Discount Superstore (#813) but still underestimated the number of trips that were generated by the new store.

The only Traffic Impact Study reviewed as a part of this research that did not utilize HDR Engineering, Inc., was the Lowe’s Subdivision Home Improvement Store in Rapid City, South Dakota. This study was completed by Interstate Engineering, Inc. from Billings Montana. The study used the ITE Trip Generation Manual Land Use # 862 Home Improvement Superstore to determine the trip generation rates for the facility. These rates were vastly exceeded when the Home Improvement Store was opened for business.

In addition to the review of the ITE and NCHRP trip generation rates, our Research Intern contacted the states of Minnesota, Iowa, and Montana to determine if these states had developed their own trip generation rates for various businesses based on local conditions. All three states indicated that they used the ITE or NCHRP trip generation rates without any modifications when conducting traffic impact studies.

10) Prepare a final report summarizing the research methodology, findings, conclusions, and recommendations.

This report summarizes the research methodology, findings, conclusions, and recommendations pertaining to the research to “Verify Certain ITE Trip Generation Rate Applications in South Dakota”.

11) Make an executive presentation to the Research Review Board.

Dan Clay provided an executive presentation to the Research Review Board during their July 21, 2005 meeting.

Chapter 5

Findings and Conclusions

A review of the trip generation rates for the Sioux Falls Hy-Vee Grocery Store and the Supermarket ITE #850 land use shows the Sioux Falls store generated a lower number of trips than was estimated by the ITE during the average weekday AM peak hour by 46.42 %, and the PM peak hour by 18.94%. However, the 24 hour average weekday trip rate was 9.68% higher than the ITE rate. In addition, the Saturday and Sunday Sioux Falls 24 hour trip rates were 60.56% and 53.66% less than what would have been expected by the ITE trip rate for a supermarket. (Tables 14 and 15)

The Sioux Falls East Menards Home Improvement Store and the Rapid City Lowe's Home Improvement Store were very comparable to each other, but produced significantly higher trip rates than could be found in the ITE Home Improvement Superstore land use #862. (Tables 17, 18, 24, and 25) The Sioux Falls Menards store trip generation rate was 51% higher than the ITE rate during the average weekday AM peak hour, and 45.7% higher during the average weekday PM peak hour. The 24 hour trip rate was 60% higher than the ITE rate for a Home Improvement Superstore. Similarly, the Rapid City Lowe's Home Improvement Store trip generation rate was 53.46% higher than the ITE rate during the average weekday AM peak hour, and 55.86% higher during the PM peak hour. The average weekday 24 hour rate was 59.8% higher than the ITE 24 hour rate, and 48.12% higher for the Saturday trip rates.

This research study looked at the trip generation rates for six Super Wal-Marts constructed in South Dakota during the last four years. The Pierre Super Wal-Mart opened in April of 2005. Traffic counts were taken in June 2005 and trip generation rates were calculated and compared to the HDR Engineering, Inc. Traffic Impact Study that was completed during the summer of 2003. The Pierre trip generation rate was 59.72% higher than the ITE rate during the average weekday AM peak hour, and 57.51% higher during the PM peak hour. The average weekday 24 hour rate was 54.11% higher than the ITE 24 hour rate and 49.97% higher for the Saturday trip rates. The Pierre Super Wal-Mart had the highest trip generation rate of any of the other Super Wal-Marts' studied in South Dakota.

Yankton, South Dakota had a much lower trip generation rate at its Super Wal-Mart compared with Pierre, even though its population of 13,528 is very similar to Pierre. The Yankton trip generation rate was 9.17% higher than the ITE rate during the average weekday AM peak hour, and 17.46% higher during the PM peak hour. The average weekday 24 hour rate was 10.78% higher than the ITE rate, and 18.88% higher for the Saturday trip rates.

Spearfish, South Dakota with a population of only 8,606 had the lowest trip generation rates for any of the Super Wal-Marts we looked at. Spearfish is a college town and school was not in session when we took the traffic counts. However, Spearfish is a major tourist destination and the counts were taken during the summer tourist season. The

Spearfish trip generation rate was 12.11% lower than the ITE rate during the average weekday AM peak hour, and 8.36% lower during the PM peak hour. The average weekday 24 hour rate was 15.69% lower than the ITE rate, and 22.69% lower for the Saturday trip rates.

Watertown, South Dakota with a population of 20,237 also had low trip rates when compared to the other Super Wal-Marts. The Watertown trip generation rate was 8.32% lower than the ITE rate during the average weekday AM peak hour, and 10.5% lower for the PM peak hour. The average weekday 24 hour rate was 9.28% lower than the ITE rate, and 15.27% lower for the Saturday trip rates. It should be noted that the traffic counts were taken during the time that road construction activities were occurring on some of the neighboring streets.

Sioux Falls, South Dakota with a population of 123,975 had higher trip generation rates than were noted in the ITE Manual for a Free Standing Discount Superstore. The Sioux Falls trip generation rate was 17.41% higher than the ITE rate during the average weekday AM peak hour, and 30.62% higher during the PM peak hour. The average weekday 24 hour rate was 25.6% higher than the ITE rate, and 19.9% higher for the Saturday trip rates.

Rapid City, with a population of 59,607 also had higher trip generation rates than the ITE. The Rapid City Super Wal-Mart shares the same parking lot with the Golden Corral Steak House Restaurant. We were not able to separate the trips between the two businesses, so the South Dakota trip generation rate includes both businesses and is only compared to the trip rates projected in the HDR Engineering, Inc., Traffic Impact Study. To help with the analysis of the area, we did include the number of meals served by the Golden Corral, as well as the times of day it is busiest. Both the AM and the PM peak hours for the complex occurred during the busiest hours for the restaurant. It should also be noted that the Rapid City traffic impact study was completed in 2000, and traffic in the area of the Super Wal-Mart complex has increased due to additional businesses developed in that area since the original study was completed.

The Rapid City trip generation rate for the Super Wal-Mart complex was 7.52 per 1,000 sq. ft. during the average weekday AM peak hour and 9.59 per 1,000 sq. ft. during the PM peak hour. The average weekday trip generation rate for the complex was 64.49% higher than the HDR projected rate for the AM peak hour and 13% higher during the PM peak hour. The Saturday 24 hour trip rate was 10.45 compared to the HDR projected rate of 9.61% for a difference of 8.04%.

In summary, the traffic conditions found at all of the signalized intersections studied either met or exceeded the traffic projections obtained from each of the site impact studies. The signalized intersections reviewed in the communities with populations above and below 50,000 met at least one MUTCD traffic signal warrant and provided increased safety and convenience for the traveling public.

The trip generation rates for all land uses identified in the traffic impact studies were consistently low for all locations except the Spearfish and Watertown Super Wal-Marts. These locations generated average weekday 24 hour trip generation rates that were 15% and 9% lower than what was found in the ITE Trip Generation Manual. Both Yankton and Pierre Super Wal-Marts exceeded the average weekday 24 hour ITE trip generation rates by 10% and by 54% respectively. Therefore, with the exception of the Pierre Super Wal-Mart, the trip generation rates identified in the ITE manual provide a reasonable ballpark estimate of trips for cities with populations less than 50,000 without any needed adjustments.

Chapter 6

Recommendations

- 1. It is recommended that the ITE trip generation rates for Free Standing Discount Superstores in cities with populations less than 50,000 be used as provided in the ITE Trip Generation Manual unless the city is located in an isolated area with a large economic trade area with limited discount shopping opportunities.**
- 2. It is recommended that the ITE trip generation rates for Free Standing Discount Superstores in rural geographic areas with limited discount shopping opportunities and a geographically large economic trading area be increased.**
Possibly due to the large trade area surrounding the city of Pierre, and the lack of other discount shopping opportunities in this area, the trip generation rates for the Free Standing Discount Superstore were very high.
- 3. It is recommended that the ITE Trip Generation rates for Supermarkets (ITE #850) in cities over 50,000 be used with caution especially when projecting average weekday AM peak hour and weekend traffic.** The Sioux Falls Hy-Vee Grocery Store generated significantly less trips during the peak hours and weekends, but had a 9.68% higher 24 hour average weekday trip rate than what was found in the ITE Trip Generation Manual. Due to the limited number of ITE studies and the variability in the supermarket peak hour traffic, it is difficult to determine if the rates should be higher or lower.
- 4. It is recommended that when traffic engineers conduct traffic impact studies in cities over 50,000 population in rural areas similar to South Dakota, they should consider increasing the ITE trip generation rates for the Free Standing Discount Superstores and the Home Improvement Super Stores.** The Home Improvement Stores located in Sioux Falls and Rapid City had significantly higher trip generation rates than what was projected in the site impact studies. In addition, the Super Wal-Marts in both Sioux Falls and Rapid City had significantly higher 24 hour average weekday trip rates than what had been projected in the site impact studies.
- 5. It is recommended that the Office of Research send the SD2005-02 Final Report to all South Dakota Department of Transportation Traffic Engineers as well as the Traffic Engineers in Sioux Falls and Rapid City.**
- 6. It is recommended that the Office of Research send an electronic copy of the SD2005-02 Final Report and Appendix to the Institute of Transportation Engineers for use in updating the ITE Trip Generation Manual.**
- 7. It is recommended that the Office of Research send an electronic copy of the SD2005-02 Final Report to the Transportation Research Board Subcommittee on Statewide Travel Forecasting for distribution and use by its members.**

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