

TRAFFIC AND PAVEMENT ANALYSIS

CTH K BUFFALO COUNTY

PREPARED FOR BUFFALO COUNTY HIGHWAY DEPARTMENT

Prepared by:

Fleming, Andre & Associates, Inc.
3615 N. Hastings Way Suite 100
Eau Claire, WI 54703

Introduction

Fleming, Andre & Associates was retained to evaluate traffic and roadway impacts originating from a sand mining development on County Trunk Highway (CTH) K, Buffalo County Wisconsin.

The proposed sand mine access will be located on the north side of CTH K at the Breezy Point Farm, approximately 2 miles east of the STH 25/CTH K intersection. See Attachment A for location map.

The proposed sand mine will haul 13,200 to 22,000 truckloads totaling between 330,000 and 550,000 tons annually. This report was conducted to determine traffic impacts from the additional trucks generated, safety issues from existing geometrics, and evaluate the existing pavement structure with increased truck loading.

Existing Conditions

The proposed sand mine access will be located on the north side of CTH K at the Breezy Point Farm, approximately 2 miles east of the STH 25/CTH K intersection. See Attachment A.

County Trunk Highway K is classified as a major collector and is a two-lane rural roadway with two 11-foot asphaltic pavement driving lanes and 2-foot aggregate/turf shoulders. The statutory speed limit is 55 mph. The existing land use adjacent to the site is primarily agricultural. CTH K has a rolling terrain with several residential driveways and two local road intersections along this portion of CTH K.

Signing and Marking

There are numerous signs along CTH K including several curve advisory signs. Pavement chip sealing was recently performed on CTH K and there are no centerline or edge line pavement markings. See Attachment B for existing sign survey.

Accidents

Crash data provided from WIS TOPS LAB, shows that over the past three years there have been no reportable accidents within this segment of CTH K.

Traffic Counts

On Tuesday March 24, 2015, manual traffic counts were performed by Fleming, Andre, & Associates. Counts were taken from 3:00 PM to 6:00 PM for a total of three hours. See Attachment C.

Trip Generation / Trip Distribution

Trips generated from the proposed sand mine will be predominately trucks. From the information provided by Buffalo County Highway Department, the maximum daily trip generations will be 200 truckloads (100in/100out).

Peak hour traffic volume was determined by combining the field gathered traffic counts with the hourly truck volume, which is estimated to be ten percent of total volume or 20 truckloads (10 in/10 out). A seasonal adjustment factor of 18% was used to increase the ADT. Traffic generated from the sand mine personnel is assumed to be negligible and was not added to the roadway total. See Attachment D for trip generations.

Buffalo County Highway has indicated that the primary hauling route will be from the Breezy Point Farms on CTH K to south on STH 25. The secondary hauling route will be north on STH 25 from CTH K. Truck traffic was distributed to/from the west of the sand mine development on CTH K exclusively.

Capacity Analysis

A capacity analysis was performed using Highway Capacity Software (HCS) for peak hour traffic on CTH K at the proposed sand mine intersection. Traffic used in the analysis was tabulated using the manual counts combined with the projected truck traffic. Traffic added to CTH K for peak hour analysis on CTH K is 20 Peak Hour Vehicles (10 in/10 out). Total traffic on CTH K at the proposed intersection is estimated to be 44 Peak Hour Vehicles. See Attachment D for peak hour traffic breakdowns.

Level of service and delay are criteria used in the determination of operating conditions. Table 1 below shows the level of service with respective delay ranges and descriptions. The Wisconsin Department of Transportation (WisDOT) uses this method to describe operating conditions of all highways and intersections. WisDOT requires that highways and intersections operate at a minimum Level of Service "C" or "D".

Table 1 Level of Service Descriptions

LOS		
ALPHA LOS	UNSIGNALIZED DELAY SECONDS/VEH	DESCRIPTIONS
A	<10	No Congestion, Minimal Delay
B	10 to 20	No Congestion
C	20 to 35	Minimal Congestion
D	35 to 55	Moderate Congestion
E	55 to 80	Severe Congestion
F	>80	Extreme Congestion

The analysis reveals that all movements will operate at Level of Service A with minimal delays. See Attachment E for HCS inputs and results.

Intersection Sight Distance/Vision Triangle

The speed limit on CTH K is a statutory 55 MPH. Sight distances for both left turn and right turn movements were evaluated as required by Wisconsin Department of Transportation (FDM 11-10, Table 5-2). Intersection sight distance was checked at the proposed intersection location for 55 mph design criteria. Sight distance for both passenger cars and combination trucks were evaluated. Desirable sight distance out of the intersection for combination trucks were met for both left (1055 ft) and right turns (975 ft). Desirable sight distance for passenger cars was met for right turns out (650 ft) and minimum sight distance was met for left turns out (610 ft).

Vision triangles at the proposed intersection were also evaluated and found to be acceptable. See Attachment F for sight distance and vision triangle plan sheet.

Horizontal/Vertical Geometrics

Horizontal and vertical geometrics were evaluated on CTH K from STH 25 to the proposed intersection. The horizontal curves along this segment are all rated for speeds of 50 mph and greater.

The vertical alignment along this segment consists of 10 crest and 11 sag vertical curves. The majority of the vertical curves are rated for 40 mph and higher. The sag curve located at station 51+02 is rated for design speed between 30 and 35 mph. See Attachment G for CTH K plan sheets.

Culverts

On April 2, 2015, culvert cross drains on CTH K were inspected. From STH 25 to the proposed sand mine intersection on CTH K there are 9 culvert pipes. See Attachment H for the culvert inspection reports.

Pavement Structure

The proposed sand mine is expected to operate for a maximum of six years and with the increased truck traffic may impact the roadway structure. A pavement design was performed to determine an adequate pavement structure required to accommodate the increased pavement loading. The pavement design was completed using Wisconsin Department of Transportation pavement software WISPAVE 4. Traffic counts and area soil properties are needed to complete the pavement design.

On March 11, 2015 a geotechnical analysis on CTH K was performed. Five soil borings were taken at random along the roadway to a depth of 6.5 feet. From the borings, the existing pavement structure consists of 3 to 3.5 inches of asphaltic pavement over 5.5 to 8 inches of base course. The subgrade soils were generally sand, silt and gravel materials. It was noted in the report that groundwater was visible in the boreholes at completion. It was also noted that the soils in this area are generally poor for subgrade with high frost susceptibility. See Attachment I for the complete geotechnical report.

From the manual traffic counts performed, peak hour traffic (PHV) counted was 20 vehicles. Using the assumption that Peak Hour Traffic (PHV) is ten percent of the Average Daily Traffic (ADT) and using an 18% seasonal (March) adjustment factor, the ADT on CTH K is 236. With the added trucks from the sand mine expected to be a maximum of 200 trips (100 in/100 out), the total ADT used in the pavement design was 436. The truck percentage on CTH K during the duration of the sand mine is determined to be 46% of the total ADT. Traffic other than from the sand mine is not expected to increase along CTH K during this time and is not accounted for in the pavement design.

From the pavement design software it was determined that a pavement structural number (SN) of 3.16 is needed. Two alternatives were designed and satisfy this number. The first design consists of 4.5-inches HMA pavement over 12 inches of base aggregate. The second design consists of 5.0-inches HMA pavement over 10 inches of base aggregate. See Attachment J for WISPAVE pavement design results.

Summary

This report analyzed several potential impacts from the sand mine operation proposed to be located on CTH K. This report examined intersection operational capacity, existing roadway geometrics, recent accident history, pavement structure, sight distances and signing and marking.

Traffic added to CTH K from the sand mine will have minimal operational impacts on CTH K and the proposed intersection. The proposed intersection on CTH K will operate at a high level (LOS A) of service over the life of the sand mine.

There are no reported accidents on the segment of CTH K. The horizontal and vertical alignments have curves that are rated less than 55 mph, but with no accident history and minor increases in traffic, the segment of CTH K should continue to operate safely and efficiently.

The existing roadway consists of 11-foot travel lanes with 2-foot shoulders and meets current Wisconsin Department of Transportation standards for major collector classification.

From the geotechnical report and the estimated traffic increase, a pavement structure was designed for the increased loading. Using the WISPAVE software from the Wisconsin Department of Transportation, two HMA pavement possibilities were

found to be acceptable. The first pavement structure option consists of 4.5 inches HMA pavement over 12 inches of base aggregate, the second consists of 5 inches of HMA pavement over 10 inches of base aggregate.

Sight distances for semi-trucks at the proposed intersection on CTH K meet desirable Wisconsin Department of Transportation standards. Sight distances for passenger cars meet the minimum standards.

Recommendations

The HCS analysis performed indicates that the proposed sand mine intersection on CTH K will operate at a Level of Service A, which is no congestion and minimal delays. Sight distances at the proposed intersection are at desirable standards. The existing geometrics have some deficiencies, but with little added traffic to the roadway the overall safety to the highway should not be compromised. It is recommended that the intersection be constructed with the following conditions:

- Construct perpendicular to CTH K.
- Install stop sign.
- Install culvert pipe if necessary.
- Construct intersection to Wisconsin Department of Transportation Type C standards.
- Pave HMA pavement beyond right-of-way to reduce gravel on CTH K.

Although sight distances meet desirable standards, advanced intersection warning signs for trucks entering/exiting should be considered.

From the pavement design performed, the existing pavement structure does not meet the needed structural number for the increased truck traffic. Premature failures with increased maintenance to the roadway may occur as a result of the increase in truck traffic, particularly if trucks are allowed to operate during the spring thaw period. Pavement usage, maintenance, upgrades or replacement areas should be negotiated with Buffalo County Highway prior to trucks hauling on CTH K.