PROJECT ID 1440-13/15-00 **FHWA-WI-EIS-04-03-LS SF**
WISCONSIN STATE HIGHWAY 23
FOND DU LAC to PLYMOUTH
FOND DU LAC AND SHEBOYGAN COUNTIES, WISCONSIN

LIMITED SCOPE SUPPLEMENTAL FINAL ENVIRONMENTAL IMPACT STATEMENT,
RECORD OF DECISION
And Section 4(f) Evaluation Combined
Submitted Pursuant to 42 U.S.C. 4332(2)(c), 49 U.S.C. 303, and
Public Law 112-141, 126 Stat. 405, Section 1319(b)
By the
U.S. Department of Transportation
Federal Highway Administration
and
Wisconsin Department of Transportation

COOPERATING AGENCY
U.S. Army Corps of Engineers (pursuant to 33 CFR 230)

[redacted]

3/17/14
Date — For Federal Highway Administration

[redacted]

3/17/14
Date — For Wisconsin Department of Transportation

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ABSTRACT

Wisconsin Highway 23 is part of the National Highway System (NHS) and is a rural principal arterial that connects Fond du Lac and Sheboygan in east central Wisconsin. Both west and east ends of the project are located in the growing urban areas of Fond du Lac and Plymouth. Nearly 20 miles in length, this highway corridor serves high traffic volumes near the urban areas and lower traffic volumes in rural areas. This combined Limited Scope Final Environmental Impact Statement and Record of Decision (LS SFEIS/ROD) evaluates the No- Build Alternative, several Build Alternatives, and a series of corridor preservation alternatives for future transportation improvements, and selects an alternative. The Preferred Build Alternative is the Selected Alternative and reconstructs WIS 23 to a 4-lane divided highway on the existing alignment and creates interchanges, connector roads, and a trail. Corridor preservation alternatives evaluate areas needed for future interchanges, overpasses, and connector roads as well as the US 151/WIS 23 interchange.

FHWA and WisDOT have prepared this Limited Scope Supplemental Final Environmental Impact Statement (LS SFEIS) in accordance with Title 23, Part 771.130 (f) of the Code of Federal Regulations (23 CFR 771.130). This LS SFEIS is used to address issues of limited scope associated with the overall project.

This Record Of Decision has been prepared in accordance with 23 CFR 771.127, 40 CFR 1505.2 and Public Law 112-141, 126 Stat. 405, Section 1319(b)

NATIONAL ENVIRONMENTAL POLICY ACT STATEMENT

The National Environmental Policy Act (NEPA), 42 USC 4321-4347, became effective January 1, 1970. This law requires that all federal agencies have prepared for every recommendation or report on proposals for legislation and other major federal actions significantly affecting the quality of the human environment a detailed Environmental Impact Statement (EIS). The Federal Highway Administration (FHWA) is therefore required to have prepared an EIS on proposals that are funded under its authority if the proposal is determined to be a major action significantly affecting the quality of the human environment.

EISs are required for many transportation projects as outlined in NEPA. This Limited Scope Supplemental Environmental Impact Statement (LS SEIS) follows the same procedure as an original EIS, except that scoping is not required [40 CFR 1502.9(c), 23 CFR 771.130]. The processing of the LS SEIS is carried out in two stages. Limited Scope Supplement Draft EISs (LS SDEIS) are first written and forwarded for review and comment to federal, state, and local agencies with jurisdiction by law or special expertise and it is made available to the public. The LS SDEIS must be made available to the public at least 15 days before the public hearing and no later than the first public hearing notice or notice of opportunity for a hearing. A minimum 45-day comment period is provided from the date the LS SDEIS notice of availability is published in the Federal Register. WisDOT must receive agency and public comments on or before the date listed on the front cover of the LS SDEIS unless a time extension is granted by the FHWA and the Wisconsin Department of Transportation (WisDOT). After the comment period for the LS SDEIS has elapsed, preparation of the Limited Scope Supplemental Final EIS (LS SFEIS) can begin. It includes:

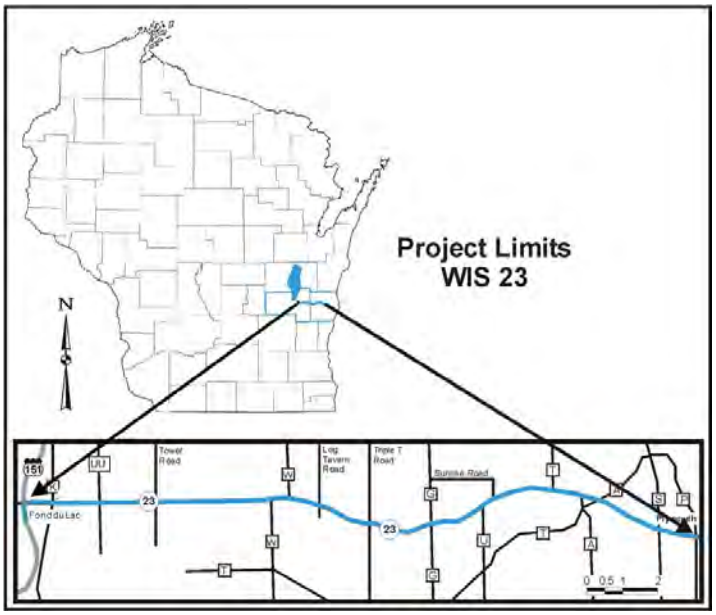
1. Basic content of the Draft Statement (or Supplemental Draft Statement), as amended, due to internal agency comments, editing, additional alternatives being considered, and changes due to the time lag between the Draft, Supplemental Draft, and Final EIS.
2. Summary of public hearing comments.
3. Summary of written comments received on the Draft Statement or Supplemental Draft Statement.
4. Evaluation and response to substantive comments.

A Record of Decision (ROD) is the administrative action that approves the selected alternative. Public Law 112-141, 126 Stat. 405, Section 1319(b) states that to the maximum extent practicable, the lead agency shall expeditiously develop a single document that consists of a FEIS and a ROD. This environmental document is a combined LS SFEIS/ROD.

The name, address, and telephone number of the individual from whom additional information can be obtained is listed on the cover of this document.

GENERAL REVIEWER INFORMATION

This combined LS SFEIS and ROD has been combined with the original 2010 FEIS for ease of review. Original 2010 FEIS text is shown in black. Items that are considered revisions that target specifically identified issues in the January 19, 2012 Notice of Intent to prepare an LS EIS are shown in blue text. This document has also been updated to reflect changes to data, policies, or conditions since the 2010 FEIS was published. These updates are shown in maroon text. Text that has changed between the LS SDEIS and this LS SFEIS/ROD is highlighted in yellow or is designated by lines in the margin. In addition, for ease of review, a summary of changes is provided at the beginning of each section.



Project Location
Project 1440-13/15-00
WIS 23
Fond du Lac and Sheboygan Counties

9.0 APPENDICES

(NOTE: 2010 FEIS APPENDICES PROVIDED IN CD ON COVER OF THIS LS SFEIS)

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The Appendices only contain information that is new since the release of the 2010 FEIS. This includes updated traffic (Appendix LS-A), Purpose and Need Screening (Appendix LS-B), Indirect and Cumulative Effects (Appendix LS-C), Current Correspondence (Appendix LS-D), and an updated list of preparers (Appendix LS-E), the 2010 ROD (Appendix LS-F), and a distribution list (Appendix LS-G). The appendices from the 2010 FEIS are provided in a CD on the back cover of this LS SDEIS.

9.0
APPENDICES

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APPENDIX LS-A
TRAFFIC TECHNICAL MEMOS

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CORRESPONDENCE/MEMORANDUM **State of Wisconsin**

Date: 4-25-2012

To: Tracey Blankenship
Bethaney Bacher-Gresock
Andrew Brinkerhoff
Jay Waldschmidt

From: Jill Michaelson

Subject: Project 1440-13-00
WIS 23 (Fond du Lac - Plymouth)
Fond du Lac and Sheboygan Counties

Re: Forecasting

Traffic Counts

Forecasts for the WIS 23 major project have been projected using 2001, 2005, 2008, 2011, and 2012 traffic counts. The 2011 and 2012 traffic counts are lower than previous count years. In general, statewide counts seemed to peak in about 2005. The decline in traffic counts may be linked to the down turn in the economy, unemployment rates and other factors.

WIS 23 is not the only corridor which has experienced a decrease in traffic counts. WIS 15 (New London – Greenville) traffic counts have also decreased. WIS 15 is being recounted to rule out the potential for equipment malfunctions. WIS 23 was counted with the same equipment. WIS 23 will be recounted again in June.

Traffic counts are checked when they are received by the WisDOT forecast unit with the forecast request. If they change more than 20% in either direction, a re-count or an explanation may be requested of the regional office to try to understand possible causes.

Forecasting Methodology

Traffic forecasts report travel behavior that will occur in a roadway design year (20 years after anticipated construction) or in a long-range plan projection year. As per WisDOT Facilities Development Manual (FDM) Section 3-10-10, federal- and state-funded projects require traffic forecasts (projections) performed and/or approved by the forecasting unit in Central Office. Forecasts are prepared and approved centrally to

assure that a consistent methodology is utilized for all forecasts in the state. The following types of forecasts exist; facility, corridor, traffic impact analysis, turning movement, expansion (new roadway) and alternatives analysis.

FDM Section 3-10-10 requires forecasts for the following project types:
1. Resurfacing
2. Pavement Replacement
3. Reconditioning
4. Reconstruction
5. Capacity Expansion
6. Bridge Replacement
7. Access Control
8. Corridor Studies

The forecasting unit transforms a wide array of traffic and socio-economic data into forecasts and related traffic information.

Forecasts requested for projects that fall within an MPO jurisdiction or regional travel demand model area are required to utilize the model as a tool to complete the forecast. Local Road Forecasts and/or the Traffic Analysis Forecast Information System (TAFIS) are compared to the model output when applicable.

For the 2012 forecasts, the NE Region Travel Demand Model (TDM), latest version fall 2011, was used. Models incorporate road networks, land use, demographic, and economic data to replicate existing and future traffic conditions. Models provide the basis to generate traffic projection forecasts and are used for statewide, regional and project-specific traffic forecasting purposes. Models use socioeconomic and land use data to help determine origins and destinations throughout the region. Traffic counts are used in post-processing when the growth rate from the model is applied and to validate the model after it is updated.

Models are a very useful tool in traffic forecasting, particularly in alternatives analysis forecasting and in forecasting growth based on specific socioeconomic factors. However, because of the difficulty in calibrating and validating the models, the raw assigned traffic can misrepresent the actual traffic volumes. This will show up in the model's base year data and can be tested by comparing the raw base year traffic assignment to the counts on corresponding road segments or "links." Usually, if a factor in the model causes the raw base year assignment to be higher than the corresponding count, it will also cause the future assignment to be high (over-assignment). The same is true for assignments that are lower than the corresponding counts (under-assignment).

To account for the differences between base year assignments and counts, a set of methodologies was produced by the Transportation Research Board and published in the National Cooperative Highway Research Program (NCHRP) Report #255 Highway Traffic Data for Urbanized Area Project Planning and Design (1982). The methods

include: Difference Adjustment, Ratio Adjustment, and an Average of Difference and Ratio Adjustment. Standard WisDOT policy is to use the best methodology for each individual situation based on recommendations from the NCHRP report. The most important aspect in using a methodology is that it, and its output, makes sense. These methodologies also set a standard for adjusting the raw future year assignment based on the base year assignment and count values.

Further adjustments to the forecast value are required when the base year count is not the most recent count on a segment for which a forecast is requested. The most recent count is the most valuable piece of traffic forecasting information. As is the policy for forecasts completed outside of model areas using Local Road Forecasts and TAFIS, the most recent count is the starting point from which the line that represents the future year forecasts begins. A new count that is higher than previous counts will shift this forecast line up, and a new count that is lower will shift the forecast line down. In model areas, the growth rate, which is represented by the slope of the future year forecast line, is based on the model average annual growth rate. The growth rate is then applied to the most recent count to create the future year forecast values. The growth rate may not be less than 0.5% or greater than 5% unless there is significant change in model inputs such as socioeconomic data or the road network. As always, judgment should be used to determine if the applied growth rate makes sense intuitively and compared to TAFIS.

The Traffic Analysis Forecast Information System (TAFIS) tool was also used for the 2012 projections. TAFIS contains tabular and spatial traffic count data in an ArcGIS system. WisDOT collects traffic count data from almost 7,000 sites in the State. Data is collected in every Wisconsin county on a 3-year cycle. The traffic count relational database is the source of TAFIS data. The forecasting unit views and downloads count data.

Cyclical data from previous traffic counts has ongoing forecasting and statistical value. Data in this series is used to generate statewide, regional and project-specific traffic forecast projections and maps. The forecasting unit compares current and older data for regression analysis purposes (use Box-Cox method), to determine future traffic forecast projections based on past growth. TAFIS is updated regularly.

When no travel demand models are available, the forecasting unit can only use the TAFIS output with manual adjustments to the output. This was the situation prior to the development and adoption of the NE Region TDM. This was the basis of the 2005 forecasts. Those forecasts are based on “unconstrained” output, based on past counts projected forward without any regard to facility type.

The 2012 forecasts are considered “constrained” forecasts. In other words, the traffic output to the system is influenced by the amount of traffic the system can handle. Change in the number of lanes does not add trips. The model simply redistributes the trips that are already generated by the future socioeconomic data to address the network changes. The forecasting unit compares the results to the TAFIS output.

The slopes or growth rates generated by the model are checked against the TAFIS system and traditional regression methods, and future forecast values should be within 10% of those produced by TAFIS for that corresponding future year. If the forecast values created by a travel demand model are greater than 10% different than TAFIS, a compromise number should be reached. This [compromise] number should generally be the edge of the accepted 10% range in TAFIS, as long as it is also within 10% of the model forecast value. The travel demand model growth rate is preferred to a regression-based growth rate because it can account for anticipated changes in population and employment in specific locations, while the regression-based growth rates are simply formulas applied to the past and current counts on that site, with no intelligence on why those changes occurred.

If poor calibration in the travel demand model is suspected (only a problem on very low-volume local roads), a Local Roads Forecast or TAFIS forecast may produce a better forecast value. If an adjustment is necessary, a note should be made explaining the reason for the difference between TAFIS and the Travel Demand Model. The basis for this policy is present in a document entitled "Criteria for Accepting or Overriding a STH System Traffic Forecast with an Urban Travel Demand Model" which can be found in the Miscellaneous Section of the 1991 Travel Demand Forecasting and Analysis Handbook produced by the Traffic Forecasting Section.

WIS 23 Forecasts

Forecasts can vary annually based on the information available. Below are the count, forecast and growth rate data for 2005, the basis for the original preferred alternate selection:

Table 1: Central Office No Build Forecast (2005 Counts)

Location	Count	Forecast	Growth
Year	2005	2036	Rate
US 151 – CTH K	11425	18600	2.0
CTH K – CTH UU	8600	13025	1.7
CTH UU – Hinn Rd	8200	12525	1.7
Hinn Rd – CTH W	8600	16050	2.8
CTH W – CTH G	7625	12400	2.0
CTH G – CTH A	9150	14900	2.0
CTH A - CTH P	9525	17375	2.7

Central Office forecast used Box-Cox method and some manual adjustments.

The WIS 23 major project is considered a committed project because it has been enumerated for construction. It is appropriate from the sense of applying a forecast to this project to use "no build" and "build" forecasts that coincide with the respective alternative types that are considered in the supplemental EIS.

DTSD and DTIM met on March 12, 2012 to discuss the updated forecast and travel trends in the area. There was consensus to move forward with the latest forecasts based on 2012 counts below.

Table 2: Central Office Forecasts (2012 Counts)

Site ID	2012 Counts	2035 No Build[1]	2035 Passing Lane Without Left Turns[1]	2035 Passing Lane with Left Turn Lanes and Median Refuge [1]	2035 Hybrid 4-Lane to CTH G Passing Lane CTH G to CTH P[1]	2035 4-Lane Build On Alignment [1]
US 151 – CTH K	10484	15,700	14,600	14,600	14,900	17,600
CTH K – CTH UU	9455	11,000	11,800	11,800	12,300	13,400
CTH UU – Hinn Rd	7452	9,100	9,600	9,600	10,200	11,200
Hinn Rd – CTH W	7650	8,900	9,900	9,900	10,500	10,800
CTH W – CTH G	7084	7,900	8,700	8,700	9,400	9,500
CTH G – CTH A	6434	7,200	7,500	7,500	8,300	8,800
CTH A - CTH P	7439	8,200	8,400	8,400	9,100	9,600

[1] **Constrained Forecast Produced with Travel Demand Model and TAFIS** - As a result of the statistical analysis conducted, any official forecast produced will not necessarily match outputs of either TAFIS or the travel demand model directly. The Northeast Travel Demand Model was completed for forecasting purposes in this area of the state, in Fall 2010. Forecasts completed 2/9/2012. Note: Whether or not left turn lanes are built does not affect the passing lane forecast results as long as it is not divided and the posted speed remains the same.

Traffic increases for the "build" alternatives over the "no build" alternative, as shown in Table 2 above, are due not to added area trips but to the redistribution of area trips by the travel demand model. The number of trips already generated by future growth will travel on highways based on the amount of traffic the system can handle. When passing lanes are added and/or capacity is expanded to four lanes, WIS 23 will experience better traffic operations and/or be able to handle more traffic.

Environmental Document

The original projected design year traffic volumes were a key justification for the selection of the preferred Four-Lane, On-Alignment Build Alternative and the dismissal of the Passing Lane Alternative.

The 2012 forecasts for the “No Build”, “Passing Lane without Left Turns”, “Passing Lane with Left Turn Lanes and Median Refuge”, “Hybrid 4-Lane to County G, Passing Lane County G to County P” and “4-Lane Build On Alignment” conditions will be discussed in the environmental document as one of several criteria to determine if an alternative meets the project purpose and need.

WIS 23 Traffic Count and Forecast History Memo

September 27, 2012

Purpose of Memo

In response to litigation filed against FHWA and WisDOT, it was determined appropriate to update portions of the Environmental Impact Study and publish a Supplemental Environmental Impact Study (SEIS). Existing traffic analysis had used traffic information from 2005. Being nearly 7 years old, it was decided it would be prudent to update the SEIS using the most recent traffic data. An updated forecast was created in January 2012. However, the results of the forecast were questioned by project staff and triggered much discussion. Subsequently, additional traffic counts were requested and associated forecasts were completed. FHWA had questions about these processes and reasons for performing the additional work. This memo is a detailed explanation by the NE Region and DTIM to provide a background and history for the reasons additional information was requested and will explain the process followed for taking counts and creating forecasts.

This memo outlines standard practice for data requests, data collection and data quality checks for this project which generally describes Department procedures.

Memo Outline

I. Traffic Counting

- A. Standard Practices
- B. Raw Counts (See attached map with Raw Data (Unfactored) locations)
  WIS 23 Count Data – Tables 1, 1A, 1B
- C. Factors and Factored Counts (See attached map with Factored Data locations)
  WIS 23 Factored Counts - Table 2, 3

II. Traffic Forecasting

- A. Standard Practices
- B. Methodology
  WIS 23 Corridor Traffic Forecasts and Forecasting Tools – Table 4
- C. Forecasts Using WIS 23 AADT's – Tables 5, 6, 7, 8

III. Evaluation and Validation

IV. Conclusion

I. TRAFFIC COUNTING

A. Standard Practices

Annual average daily traffic counts (AADT) are reported as the number of vehicles expected to pass a given location, or count site, on an average day of the year. The region sets out counters and collects the raw count data. The Central Office Data Management Section (DMS) processes the raw counts to develop AADTs. The AADT at a coverage count site is based on a short-term traffic count, usually 48 hour intervals, taken at the location. This count is then adjusted for the variation in traffic volume throughout the year and the average number of axles per vehicle. When the raw count is first processed, a *preliminary* AADT is generated using factors based on continuous data from the previous year. Part of the annual processing of all traffic count data is the generation of new factors based on current year continuous data. These current year factors are then applied to all of the short-term counts taken during the year to compute a *final* AADT for each site.

Short-term traffic counts (coverage counts) are collected over a three-year cycle at over 26,700 rural and urban locations throughout the state. Counties were assigned to the three-year cycle in a way that attempted to minimize the difference in the number of counts needed to be taken each year. DMS assigned individual count sites to the three, six or "ten" year cycle based on their functional classification and traffic volume.

- Subcycle 3 is comprised of principal arterials, minor arterials with an AADT of 5,000 or more, HPMS and NHS segments, ramps needed for mainline count balancing and ramps in an interchange where at least one leg has an AADT of 2,000 or more. These sites are counted every three years.
- Subcycle 6 is comprised of minor arterials with AADT less than 5,000, collectors with an AADT of 2,000 or more, and ramps in interchanges where all legs have AADTs of less than 2,000. Half of these sites are counted in even numbered years (6E) and the other half are counted in odd numbered years (6O).
- Subcycle 10 is comprised of collectors with an AADT of less than 5,000. These sites are counted only in years ending in 9, 0 or 1.

In years ending in 9, 0 or 1, all short term sites in the appropriate cycle are counted regardless of subcycle. This is done to match up counts on all roads with the decennial census data collection. It was also intended to match the timing of functional classification changes, but that is no longer the case.

Scheduled coverage counts should not be taken if they would be influenced by highway construction, detours, holidays or other special events. The goal is to collect data when traffic is as close to "normal" as possible. If necessary, these sites could be collected in an off-cycle year as a special count.

Most coverage counts are taken with TimeMark Delta NT traffic data recorders using one or more road tubes. A small number of coverage counts are taken with Wavetronix SmartSensor 105 or SmartSensor 125HD digital radar sensor/recorders.

The Wisconsin Department of Transportation uses TRADAS©, a proprietary traffic data management, validation, summarization and archive software system developed by Chaparral System's Corporation, as the data management portion of the Wisconsin Traffic Monitoring System for Highways(WTMSH). This system is designed to process, validate and perform quality checks on traffic data, summarize the data to average daily, monthly, and annual statistics, store the data, generate reports, and prepare data for submission to federal agencies.

TRADAS© was designed to meet and exceed state and federal data processing requirements documented in the American Association of State Highway Transportation Officials' (AASHTO's) 2009 Guidelines for Traffic Data

Programs, Federal Highway Administration's (FHWA's) 2001 Traffic Monitoring Guide (TMG) and 2010 Highway Performance Monitoring System (HPMS) Manual.

The data in TRADAS© has multiple transportation uses for planning, project development, highway operations, maintenance, access, and more. Data collected also provides the source of information for traffic forecasting studies and projections.

In addition to the validation and quality checks in TRADAS©, additional short -duration count quality control processes are performed at, DMS Traffic Data Program. Two techniques used are:

1. Compare *preliminary* short-term AADT traffic count against historical AADTs to assess the historical pattern at that location. Counts +/- 20% of the previous AADT taken at the location are checked for accuracy. A preliminary traffic count +/- 20% of its historic AADT count does not mean the count is unreliable. The +/- 20% is a threshold used to indicate counts may need additional review.

2. Compare *preliminary* short-term AADT traffic counts along a roadway to see if possible problems with one or more traffic counts become visible.

DMS may request the Region re-count if:

- There are missing data or data gaps - data is required for each hour of a day
- Traffic volume equals 0 for all lanes for a specified number of consecutive hours
- Total volume in any lane for entire day equals 0
- Short duration counts with < 24 hours'of data
- Preliminary AADT traffic volume > +/- 20% of previous AADT

Recounts are considered special counts. Special counts aren't unusual. They are simply counts that fall outside of the regular count cycle. For example, the Traffic Forecasting Section may request a special count if a spot location is needed. Other units of WisDOT may also request special counts for specific purposes.

Regions typically request special counts for:

- Design projects
- Corridor studies
- Special event traffic
- Changes in traffic patterns
- Intersection analysis
- Origin-Destination studies
- Railroad Crossing studies
- Supplemental information

Traffic counts (coverage and special) are taken by region personnel. Collection of the annual field traffic data for the Region coverage count program includes:

- Scheduling coverage counts to meet program guidelines and avoid construction detours and road closures
- Installing portable automated traffic recording equipment at the locations depicted on the traffic count location maps to record traffic data

- Retrieving the traffic recording equipment after scheduled count duration and downloading data to PC disk to forward to Region/Central Office for processing and incorporation into statewide coverage count files.
- Re-taking incorrect or questionable counts to facilitate efficient operation and collection of representative traffic data.

B. Raw Counts

A "raw" count is the total number of vehicles recorded during whatever period of time the traffic data recorder was set to record data. Short duration counts (24 hours minimum, 48 hours recommended) require adjustments in order to convert the 'raw' count to an estimate of Annual Average Daily Traffic (AADT). Adjustments are applied to reduce the effects of temporal bias if the short duration count is to be used to estimate AADT.

Traffic counts were taken on WIS 23, from Fond du Lac to Plymouth, in 2005, 2008, and 2011 as part of the scheduled three-year count cycle. Additional mainline counts were requested by the Traffic Forecasting Section and taken in February of 2012. Based on Region perceived season/February count and equipment concerns, the Region Office conducted recounts in June of 2012.

TABLE 1 shows the raw mainline counts in the appropriate years, noting that some locations were not taken every year. See attached project location map showing raw data.

Count Site **Fond du Lac County**	Count Date June 2005**	Count Date August 2008	Count Date August 2011	Count Date Feb 2012	Count Date June 2012
201185		29492(May)	28989	25954	28837
200219	28048	27687	25933		26314
206104*	19930 (June) 16800(Aug)	20370	16361	16987	19712
200222	20277	20725	18849	17439	10437
200224	18011	18017	17797	16150	17559
Sheboygan County	April 2005**	July 2008	May 2011	Feb 2012	June 2012
590118	15114	9236	14723	14746	17142
591421	16292	11512	15658	15347	17909
590195	18573	12279	18411	17039	12557

TABLE 1 – Raw Count Numbers

* Two counts were taken at the same site because of the first count's variance from the previous (2003) count. The second count, once factored, was closer to the previous AADT and used in the forecast.

** Coverage counts scheduled by county, not corridor, so the Sheboygan and Fond du Lac site counts were taken in different months.

The "**raw**" counts for Site 200222 and 590195 in June 2012 show an 'atypical' decrease in traffic volume counts. The lower traffic volumes reflected in July 2008 and June 2012 are a result of < 48 hours traffic data collected. The duration variability is addressed by the factoring process.

TABLES 1A and 1B illustrate the variation in raw counts when a count of less than 48 hours occurs.

Raw Counts	***200222***	***%Change***	***Duration***
6/2005	20,277		48 hr
8/2008	20,725	+2.21%	48 hr
8/2011	18,849	-9.05%	47 hr
2/2012	17,439	-7.48%	48 hr
6/2012	*10,437*	*-40.15%*	*26 hr*

TABLE 1A

Raw Counts	***590195***	***% Change***	***Duration***
4/2005	18,573		48 hr
7/2008	*12,279*	*-33.89%*	*28 hr*
5/2011	18,411	+49.94	48 hr
2/2012	17,039	-7.45%	48 hr
6/2012	*12,557*	*-26.30%*	*28 hr*

TABLE 1B Note: Short-term traffic data require a minimum of 24 hours.

Variables

Traffic counts fluctuate due to many variables. Some variables are unpredictable and hard to account for in raw data, such as equipment set-up variations, equipment failure, inclement weather conditions, and traffic incidents/crashes. Region personnel will often make note of any extenuating circumstances during the counts in their field notes. Re-counts or special counts may be taken if equipment failure or other such variables are suspected.

More predictable variables include the following:

- Counts are taken by county in different months of the year, usually April to September to optimize seasonal weather conditions.
- Counts are taken on different days, usually weekdays between Monday noon and Friday noon
- In addition, while typical counts are 48 hours long, counts may be taken for varying lengths of time.

To account for these variables, raw counts are factored using the system described below.

C. Factors and Factored Counts

Annual average daily traffic (AADT) is an estimate of traffic volume passing a specific location on an "average" day. Raw counts are factored in order to generate an AADT estimate.

The formula used to convert 'raw' counts to a 'factored' count, or annual average daily traffic (AADT), for short-duration traffic volume counts is:

AADT = VOL * M * D * P * A *(if needed)*

AADT = the annual average daily travel at location
VOL = the 24-hour or 48-hour volume at location
M = the applicable seasonal (monthly) factor for factor group
D = the applicable day-of-week factor for factor group
P = the applicable pulse factor to convert vehicle to axle counts
A = the applicable axle-correction factor for location (if needed)

This formula is modified as necessary to account for the traffic count's specific characteristics. For example, if the short duration count is taken with two pneumatic axle tubes to capture classification, the axle correction factor (A) is removed from the formula.

Seasonal (Monthly) Factors
Monthly factors are used to correct for seasonal bias in short duration counts.

Day-of-Week Factors
Day-of- week factors are needed to estimate AADT if the period of monitoring for a short duration count does not account for the differences in travel by day of week.

Pulse Factors
Represents a device's relatively crude estimate of how many axles belong to a single vehicle.

Axle Correction Factors
The application of axle correction factors is dependent on the type of equipment in use. Equipment that detects vehicles directly (such as inductance loops or vehicle classification counters), do not require axle adjustment.

Seasonal and day-of-week factors based on continuous volume data collected in the same year as the short-term counts is used to compute the *final* AADT. Seasonal and day-of-week factors based on the previous year's continuous volume data are used to compute the *preliminary* AADT. Axle correction factors based on current year continuous and short-term classification data are used in computing the *final* AADT if needed. Axle correction factors based on the previous year's continuous and short-term classification data are used to compute the *preliminary* AADT.

TABLE 2 below shows the results of Table 1 with the factors applied to the raw count date by site. See attached project location map showing factored data.

Count Site **Fond du Lac County**	Factored Count Date June 2005	Count Date August 2008	Count Date August 2011	Count Date Feb 2012	Count Date June 2012
201185		12505	12544	10848	12181
200219	11431	11731	11219		11115
206104	8365 7806	9507	7870	7452	8802
200222	8596	8838	8525	7650	8784
200224	7634	7684	7791	7084	8081
Sheboygan County	April	July	May		
590118	6992	7043	6674	6434	7643
591421	7353	7404	7347	6695	7984
590195	8582	8380	8118	7439	9516

TABLE 2 – Factored Count Numbers

Historical Pattern Comparison
Comparing site specific traffic count locations against historical counts, counts fall within an acceptable +/- 20% threshold with the exception of 206104 August 2008 and 591421 June 2012 counts.

Roadway Pattern Comparison
Comparing traffic count locations along WIS 23 between Sheboygan and Fond Du Lac, counts fall within an acceptable +/- 20% threshold with the exception of 591421 June 2012 count.

DMS reviews the factored counts for consistency, using a plus or minus variance of 20 percent as a guideline. If a single location is out of normal range, that location may be checked to determine if there was an equipment failure, construction nearby, a poor location or other issues. As an example, the Table 3 illustrates changes in the AADT counts. It can be seen that site 206104 is above the 20% threshold for the 2008 count. This site was counted twice in 2005 and it appears the second count was chosen because it was closer to the previous (2003) AADT of 7500 vehicles (4.1% increase). The first count taken in 2005 was an increase of 11.5% over the 2003 AADT. Likewise, the change for the June 2012 count at site 591421 is above the 20% threshold, but since the adjacent sites are within the threshold, and show similar changes, the count is acceptable. The AADT counts for June 2012 were considered reliable and forwarded to TFS for forecast development. (Note: Even if DMS considers the AADT counts reliable, TFS or Region could still question the count fluctuation and request a recount.)

TABLE 3 below shows the percent change in factored counts.

	AADT 2005	AADT 2008	% Change 2008 - 2005	AADT 2011	% Change 2011 - 2008	AADT 2012-Feb	% Change 2012(Feb) - 2011	AADT 2012-June	% Change 2012(June) - 2011
201185		12,505		12,544	0.31%	10,848	-13.52%	12,181	-2.89%
200219	11,431	11,731	2.62%	11,219	-4.36%			11,115	-0.93%
206104	8,365 7,806	9,507	***21.79%***	7,870	-17.22%	7,452	-5.31%	8,802	11.84%
200222	8,596	8,838	2.82%	8,525	-3.54%	7,650	-10.26%	8,784	3.04%
200224	7,634	7,684	0.65%	7,791	1.39%	7,084	-9.07%	8,081	3.72%
590118	6,992	7,043	0.73%	6,674	-5.24%	6,434	-3.60%	7,643	14.52%
591421	7,353	7,404	0.69%	6,383	-13.79%	6,695	4.89%	7,984	***25.08%***
590195	8,582	8,380	-2.35%	8,118	-3.13%	7,439	-8.36%	9,516	17.22%

TABLE 3

-It is standard procedure to apply factors to compute preliminary AADT based on prior year data. Final AADTs are not available until Annual Processing has been completed, typically by April or May.
-2010 factors were applied to the February 2012 counts (2011 *factors were not available since Annual Processing was not complete*)
-2011 factors were applied to June 2012 counts

II. Traffic Forecasting

A. Standard Practice

Highway traffic forecasting is the process of estimating the number of vehicles that will use a specific roadway in the future. Traffic forecasts report conditions predicted in a roadway design year (usually 20 years after anticipated construction) or in a long-range plan projection year. As per WisDOT Facilities Development Manual (FDM) Section 3-10-10, federal and state-funded projects require traffic forecasts (projections) performed and/or approved by TFS. Forecasts are prepared and approved centrally to assure that a consistent methodology is utilized for all forecasts in Wisconsin.

The TFS is the overall WisDOT business area lead in forecasting travel and conducting future travel analysis. TFS uses a standard, multi-step traffic forecasting process and procedure to develop roadway traffic forecasts. Usually, WisDOT conducts forecasts at least twice during the life cycle of a project; once during planning and then during data gathering stage of final design.

B. Methodology

WisDOT uses the best forecasting tools and data available at a particular time to conduct traffic forecasts. It is WisDOT policy to use the Traffic Analysis Forecasting Information System (TAFIS) alone to conduct roadway traffic forecasts in all areas of Wisconsin where no travel demand model exists, and to use a combination of the

TAFIS outputs and travel demand model outputs together to conduct the traffic forecasts where travel demand models do exist.

Developed in 2001, the TAFIS computer program compiles historic traffic volume information and other data at a specific state trunk highway traffic count site and then performs a Box-Cox regression in order to predict future traffic at that site. WisDOT has programmed TAFIS as a series of prediction techniques that produce results based on data conditions at or surrounding each traffic site. TFS periodically runs a set of business rules to update the TAFIS to gather traffic counts from the relational database and from TRADAS. TAFIS does not take into account classification data, roadway number of lanes or land use development patterns to predict traffic volumes.

The Northeast Travel Demand Model is another forecast tool. Like all travel demand models and unlike TAFIS, this tool uses current socio-economic data, roadway networks, trip rates and other factors to calculate current and future travel patterns. Travel demand models analyze future land use development scenarios to predict how and where future roadway traffic will go. The Northeast Travel Demand Model is based on a classic four-step process that consists of trip generation, trip distribution, mode choice and traffic assignment.

TABLE 4 below shows all the area forecasts since 2001 and the tools used to produce them.

Forecast Date	WIS 23 Location (From – To)	Used NE Travel Demand Model?	Used TAFIS?
7/28/2005	County K – East of WIS 67	No	Yes
2/16/2006	US 151 – County UU	No	Yes
9/20/2007	West of Branch Rd – Chicago/NW Railroad (1 site only)	No	Yes
5/25/2010	US 151 – WIS 67	No	Yes
11/4/2010	WIS 23 at County G (Turning Movement Forecast)*	No	Yes
1/10/2012	US 151 – WIS 67	Yes	Yes
2/9/2012 and 3/5/2012	US 151 – WIS 67	Yes	Yes
7/8/2012	US 151 – WIS 67	Yes	Yes

TABLE 4 – WIS 23 Corridor Traffic Forecasts and Forecasting Tools

* Note: For the 11/4/2010 forecast, traffic counts were derived from turning movement data (not TRADAS). See attached forecasts for count dates.

Table 4 outlines all of the WIS 23 Traffic Forecasts since 2001 and the forecasting tools that were used to produce results. Before 2011, a travel demand model did not exist on this corridor for the Northeast Region, so forecasts (including the 7/28/2005 Forecast) did not consider travel demand model results. These forecasts and others using only TAFIS can also be referred to as an “unconstrained” output of one of the prediction techniques. After 11/2011, traffic forecasts were produced using the NE Travel Demand Model. The 2012 forecasts can also be referred to as “constrained” forecasts, because the travel demand model reports the amount of future traffic the roadway system can handle.

Therefore, TAFIS and the Northeast Travel Demand Model are generated with different information at their core. WisDOT policy is to compare travel demand model growth rates with the TAFIS growth rates using several techniques. The travel demand model growth rate accounts for anticipated changes in population and employment in specific locations. Regression-based TAFIS growth rates are based on formulas that are applied to the past and current traffic counts on each count site, with little to no intelligence behind the assumption as to why changes into the future will occur. Because of this, TFS documents differences in growth rates before choosing them in traffic forecasts. Also, sound and logical judgment are used to determine if the applied growth rate makes sense intuitively.

When the travel demand model forecast produces a future forecast year volume greater than 10% over the TAFIS future forecast year volume, a compromise number is reached. The compromise number should generally be the edge of the accepted 10% range in TAFIS, as long as it is also within 10% of the travel demand model forecast volume. This is because travel demand models, like the Northeast Travel Demand Model, generally have better information regarding future growth patterns than TAFIS. If poor calibration in the model is suspected, the TAFIS growth rates would hold as likely producing a better forecast value. Therefore, the decision was made to insure that forecasted volumes in the Northeast Travel Demand Model and TAFIS were to be within 10% of each other.

If an adjustment in growth rates is necessary, a note is made explaining the reason for the difference between TAFIS and the Travel Demand Model. The basis for this policy is present in a document entitled “Criteria for Accepting or Overriding a WIS System Traffic Forecast with an Urban Travel Demand Model” which can be found in the Miscellaneous Section of the 1991 Travel Demand Forecasting and Analysis Handbook produced by the WisDOT’s Traffic Forecasting Section (TFS).

In the spring of 2012, a post-processing script was added to the Northeast Travel Demand Model forecasting procedure that made it easier to gather up the most recent traffic volumes out of the TAFIS system link them to traffic segments in the travel demand model. Thus, automating a process that at one time was conducted by the traffic forecaster verifying each data point. This slight change to the ‘read of data’ improves model comparisons to TAFIS overall and should have had no change to the model outputs or to the forecasting methodologies used. It just made things easier for the traffic forecaster.

C. Forecasts Using WIS 23 AADT’s

As Table 4 indicated earlier, several forecasts have been conducted on WIS 23. The Draft Environmental Impact Statement for WIS 23 was completed in 2004. As the study moved into the FEIS stage, an updated forecast was requested by the NE Region using the short-term tri-annual 2005 AADT counts. TFS used TAFIS to conduct the traffic forecast using historic counts and a standard Box-Cox regression analysis. Manual adjustments to the TAFIS outputs were made, and the 7/28/2005 forecast was produced.

TABLE 5 shows the results of the 7/28/2005 No Build Forecast using 2005 AADT Counts.

Location Year	Count 2005	Forecast 2036
201185	11425	18600
200219	8600	13025
206104	8200	12525
200222	8600	16050
200224	7625	12400
590118	9150	14900
590195	9525	17375

TABLE 5 – 2005 AADT Count, 7/28/2005 No Build Forecast

In January 2012, an updated forecast was requested for the WIS 23 Supplemental Environmental Impact Statement. The forecast was completed using the short-term tri-annual 2011 factored counts. The Northeast Region Travel Demand Model (latest version fall 2011), and TAFIS were used to develop the forecast on January 10, 2012. Normal procedure was followed to update traffic forecast information. As mentioned before, forecasting tools had evolved since 2005. The 2005 forecast did not utilize a travel demand model output, but the 2012 traffic forecasts used both the model and TAFIS. Another issue that can affect forecast results and affected them here involves traffic counts. Traffic counts had not grown significantly since 2005, but had gone down or remained steady. Count information changes the results of the Box-Cox regression analysis inside TAFIS. Rather than increasing, growth rates leveled off. Steady traffic counts also meant that the most recent count that the travel demand model would start from before it is run, would be from a lower starting point when it uses the most up-to-date traffic counts in its analysis.

TABLE 6 shows the results of the 1/10/2012 No Build Forecast using 2011 AADT Counts.

Location Year	Count 2011	Forecast 2035
201185	11100	16300
200219	10000	11700
206104	7600	9300
200222	7300	8500
200224	6700	7500
590118	5800	6600
590195	7100	7800

TABLE 6 – 2011 AADT Count, 1/10/2012 No Build Forecast

III. Evaluation and Validation

The 2011 AADT count, 1/10/2012 No Build forecasts were much lower than the 2005 AADT count, 7/28/2005 No Build forecasts. A meeting was conducted in late January 2012 between the WisDOT Region project team, the TFS and the East Central Regional Planning Commission to discuss concerns and exchange information. As a result of this meeting, and at the request to verify the data was correct, the TFS requested that new traffic counts be taken and another forecast prepared. Special counts (not part of the three year cycle) were taken in early February 2012, due to good winter weather conditions.

Special counts are not unheard of. WisDOT requires the use of the most recent factored average annual daily traffic count to develop traffic forecasts and will collect new traffic counts when the most recent count is older than 3-years old. If no traffic counts exist, the Region is advised to collect new traffic counts before sending in a traffic forecast request to the TFS. As the forecast begins to be developed, the TFS uses the same 20% guideline that DMS uses to verify traffic counts. If a traffic count seems to be out of the range of the 20% guideline, TFS will verify with DMS, who will then, usually, verify with the WisDOT Region if the traffic count seems reasonable.

As a result of the February 2012 traffic counts, TFS developed a new set of forecasts dated 2/9/2012 and 3/5/2012 using the NE Region Travel Demand Model and TAFIS. These forecasts took the forecasting process a step further, by changing the geometry within the travel demand model to show the respective alternatives for the proposed WIS 23 project. The forecasts clearly indicated the "no build" and "build" alternatives and other alternative types that are considered in the supplemental EIS.

TABLE 7 shows the result of the Central Office 2/9/2012 and 3/5/2012 No Build and Build Forecasts using February 2012 AADT Counts .

Site ID	February 2012 Counts	2035 No Build	2035 Passing Lane w/o Left Turn Lanes	2035 Passing Lane w/Left Turn Lanes and Median Refuges	2035 Hybrid 4-lane to CTH G Passing Lane CTH G to CTH P	2035 4-Lane Build on Alignment
201185	10484	15700	14600	14600	14900	17600
200219	9455	11000	11800	11800	12300	13400
206104	7452	9100	9600	9600	10200	11200
200222	7650	8900	9900	9900	10500	10800
200224	7084	7900	8700	8700	9400	9500
590118	6434	7200	7500	7500	8300	8800
590195	7439	8200	8400	8400	9100	9600

TABLE 7 – 2012 AADT Count, 2/9/2012 and 3/5/2012 No Build and Build Forecasts

Constrained Forecast Produced with Travel Demand Model and TAFIS - As a result of the statistical analysis conducted, any official forecast produced will not necessarily match outputs of either TAFIS or the travel demand model directly. The Northeast Travel Demand Model was completed for forecasting purposes in this area of the state, in Fall 2011. Forecasts completed 2/9/2012 and 3/5/2012. Note: Whether or not left turn lanes are built does not affect the passing lane forecast results as long as it is not divided and the posted speed remains the same.

The February forecasts were higher than the January forecasts. The Region had concerns about the traffic counts used to develop the forecast. One concern was that counts are not normally taken during winter months to avoid snow and other inclement Wisconsin weather. The Region staff wondered if, even with seasonal factors applied, we were comparing like counts to the coverage counts used in the January forecasts.

A second concern was regarding the hose counts. New equipment was purchased between the 2005 forecasts and the 2012 forecasts. The Timemark Delta NT counters/hoses recorded only time tagged axle counts and were considered easy to set up in the field. Typically hose counters are laid across the entire roadway and are activated when a vehicle crosses them. On a similar project, counts were taken in 2010 and again in 2012 with a different hose configuration and different results. The new configuration included a "knot" in the hose that enabled the traffic crossing the hose simultaneously in opposite directions to be counted as two vehicles, not just one as previously done. It was believed that the new configuration would correct what was thought to be an "error" in the earlier WIS 23 traffic counts.

Special counts were taken in June 2012 with the new hose configuration. TFS developed a 7/8/2012 forecast using the NE Region Travel Demand Model and TAFIS. Forecasts showed reasonable results.

Table 8 shows the result of the TFS 7/8/2012 No Build and Build Forecasts (June 2012 AADT Counts).

Site ID	June 2012 Counts	2035 No Build	2035 Passing Lane w/o Left Turn Lanes	2035 Passing Lane w/Left Turn Lanes and Median Refuges	2035 Hybrid 4-lane to CTH G Passing Lane CTH G to CTH P	2035 4-Lane Build on Alignment
201185	12181	17400	16000	16000	16300	17000
200219	11115	12300	13100	13100	13600	14200
206104	8802	10800	11000	11000	11500	11900
200222	8784	9500	11000	11000	11500	11900
200224	8081	9100	9700	9700	10400	11000
590118	7643	8500	9100	9100	9400	10200
590195	9516	10400	10700	10700	11200	12000

TABLE 8 – June 2012 Count, 7/8/2012 No Build and Build Forecasts

As the Region continued to investigate the traffic count fluctuations and forecast variations, concerns about the February counts were addressed. First, with seasonal factor applications, DMS found the February and June counts to be reasonable and within normal traffic fluctuations (within the plus or minus 20% range). Second, there are several plausible reasons for count variations, including different hose configurations. Because WIS 23 within the project limits was nearly all rural roadway with no stop conditions, there was little likelihood that enough traffic crossed the hose simultaneously in opposite directions to noticeably affect the traffic counts. Based on further information and discussion with DMS, the count differences were likely due to normal variations and not a specific error.

IV. Conclusion

Standard practices in data requests, data collection and data quality were performed during the entire Wis23 evaluation.

The 2005 and 2012 traffic forecast variances were due to the difference in forecasting tools available at the time the forecasts were completed. The differences are also due to traffic counts holding steady and not growing at a large rate over the course of the past several years. The 7/8/2012 No Build and Build Forecasts are what TFS would consider reasonable based on the data available, standard practice and forecasting technique.

The July 8, 2012 No Build and Build Forecasts from the June AADT counts are the most current data available for the project. WisDOT uses the most current data available in our projects. This information will be incorporated into the supplemental EIS and be considered, along with the other purpose and need criteria, when evaluating alternatives.