Minnesota Safety Rest Area Programs

NIGHTTIME COMMERCIAL VEHICLE PARKING DEMAND AT 15 HIGH-USE MINNESOTA REST AREAS

Minnesota Department of Transportation

Office of Technical Support

Site Development Unit

December 2001

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Prepared for:

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Prepared by:

SRF
Consulting Group, Inc.

December 2001

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1.0 STUDY PURPOSE AND ORGANIZATION

The purpose of this study was to refine and focus the recommendations of a previous study initiated by the Minnesota Department of Transportation (Mn/DOT) published December 1998, *Commercial Truck Usage – Nighttime Parking Demand Analysis.* This original study analyzed over two years of data on nighttime parking conditions for oversized vehicles at 50 full-service rest areas around the state of Minnesota. An important study finding was that 15 of the 50 rest areas had occasional to frequent nighttime parking capacity shortfalls for oversized vehicles. Since the conclusion of this original (1998) study, data collection has continued at these 15 rest areas. This present study was initiated to define the extent and frequency of existing parking shortfalls within this set of 15, and to identify which rest areas suffered greater capacity shortfalls than the others.

This report is organized in two sections. The first section summarizes various national and statewide initiatives attempting to quantify the extent of truck parking shortfall problems and to suggest possible solutions. The second section focuses on parking shortfalls within Minnesota, presenting results of recent data analysis from Minnesota's 15 nighttime highest-use rest areas and identifying where critical nighttime capacity deficiencies exist. The report concludes with considerations for further study, enhanced data collection methods, and a methodology for design considerations at high-use rest areas.

2.0 NATIONAL AND STATE RESEARCH FINDINGS

Ensuring an adequate system of safety rest areas on interstate highways is an issue directly related to highway safety. Tired drivers are dangerous drivers and the size of most commercial trucks in relation to automobiles increases the severity of any crashes that may result. A 1998 U.S. Department of Transportation (DOT) report (*Trends in Large Truck Crashes)* stated that "large trucks account for about 3.5 percent of all vehicles and for approximately 7 percent of all vehicle travel, while accounting for at least 12 percent of all traffic fatalities." Further research by the National Highway Traffic Safety Administration suggests that truck driver fatigue may be a contributing factor in as many as 30 to 40 percent of all heavy truck accidents and that 31 percent of accidents fatal to truck drivers are fatigue related.

2.1 NATIONAL RESEARCH FINDINGS

Various national studies have been conducted to address the issue of commercial driver rest facility requirements. Two of the more important studies were conducted by the Federal Highway Administration (FHWA).

2.1.1 COMMERCIAL DRIVER REST & PARKING REQUIREMENTS: MAKING SPACE FOR SAFETY (May 1996)

In 1992, the United States Senate, recommending further research on the causes of truck driver loss of alertness at the wheel, directed the FHWA's Office of Motor Carriers to undertake a nationwide study of public and private rest areas. One of the concerns that guided this study was the growth in truck traffic and the increased parking demand at rest areas. These trends, coupled with evidence that truck drivers were parking illegally along highway shoulders, entrance and exit ramps due to a shortage of adequate rest facilities, led to identification of this issue as a highway safety problem.

The research documented important distinctions between public rest areas and private rest stops. Public rest areas analyzed were located on Interstate highway rights-of-way, while private stops were located off the Interstate right-of-way. Public rest areas provide a variety of non-commercial facilities including parking for cars and trucks as well as rest rooms. Truck stops provide additional commercial services such as fuel, showers, sleeping quarters, stores and restaurants.

A truck parking demand model was developed for this study, based on a Truck Parking Estimation Model developed by Mn/DOT in 1979 and modified for the study to calculate increases (current and future) in commercial truck parking demand at rest areas. Results of applying the study's model (Apogee Demand Model) indicated a current total nationwide shortfall of 28,400 parking spaces at public rest areas. The shortfall in Minnesota for the Interstate system was estimated at 813 spaces. The study authors estimated the costs of meeting the identified nationwide shortfall of 28,400 truck parking spaces at between $489 to $629 million. Costs in Minnesota of supplying the needed number of truck parking spaces was estimated at $14.5 to $18.4 million.

After analyzing public rest areas nationwide, a second phase of the study was conducted to assess supply and demand for parking at privately-owned truck stops. Surveys were mailed to members of the National Association of Truck Stop Operators (NATSO). Statistical weighting was used to adjust deviations resulting from a small sample size disproportionately weighted to large truck stop operators clustered in certain areas of the nation.

Findings of this study included the following:

- Private truck stops and public rest areas are not direct substitutes for each other, but rather complementary. The shortfall of truck parking spaces nationwide is a problem to be addressed by both public and private sectors.

- Public rest area policies were grouped into four categories:

    1) Enforcement: increase enforcement of time limits or reduce time limits to encourage greater turnover of spaces

2) Modification: modify existing facilities by turning car parking areas into nighttime truck parking, or use park-and-ride facilities, or modify existing ramps at rest areas

3) Renovation: redesign parking area of existing facilities to allow for additional truck parking spaces and better parking lot use (e.g., designing diagonal pull-through spaces instead of parallel spaces).

4) New Construction: Build new rest areas.

- Recommendations on the most cost-effective way to increase the number of parking spaces were to renovate and expand existing facilities and, where necessary, to build new facilities.

- State and local officials must analyze current spending practices and integrate truck parking requirements into their programs to meet identified truck parking shortages thereby improving highway safety.

2.1.2 TEA-21 SECTION 4027 COMMERCIAL MOTOR VEHICLE PARKING STUDY

The FHWA is conducting a follow-up commercial motor vehicle parking study to the one discussed above, as mandated by Congress in TEA-21, Section 4027 on June 9 1998. The purpose of the study is "to determine the location and quantity of public parking facilities at commercial truck stops and travel plazas and public rest areas that could be used by motor carriers to comply with Federal hours-of-service rules." This study differs from the 1996 study in that it covers the entire National Highway System (NHS) and all facilities, both public and private.

The results of this study are not yet available for public review; however, a report titled "Technical Guidance – TEA-21 Section 4027 Study of the Adequacy of Commercial Truck Parking Facilities Serving the National Highway System" was published in July 2000. This report documents technical guidance for determining commercial driver rest area adequacy on the NHS. It summarizes factors affecting commercial driver parking needs, and the planning process that could be undertaken to determine adequacy.

Factors affecting parking needs of commercial drivers include: truck volume, trip length, hours-of-service (HOS) regulations, on-board rest provisions, truck and payload characteristics, purpose for stopping, site amenities, and parking area characteristics. The planning process to determine parking adequacy consisted of four steps: 1) identifying major trucking corridors and select analysis segments; 2) inventorying public and private parking space supply for each segment; 3) applying the truck parking demand model for each segment; and, 4) analyzing the results.

A new corridor-based parking-demand model was developed for the Section 4027 study predicting truck parking demand within an analysis segment based on total vehicle hours of truck

travel and the time and duration of stops. The model considers HOS restrictions, the ratio of short- to long-haul trucks, and the propensity to use public or private parking spaces for different parking purposes. Factors influencing demand at commercial truck parking areas are:

1. Truck Volume
2. Trip Length (i.e., short-haul trips are more likely to generate short-duration, daytime parking demand, while long-haul trips generate longer-duration, nighttime demand).
3. Hours-of-Service Regulations (current regulations require 8-hour rest for every 10-hours of driving but these have been in place for decades and propositions have been made to change them).
4. On-Board Rest Provisions
5. Truck and Payload Characteristics
6. Purpose for Stopping
7. Site Amenities
8. Parking Area Characteristics

The impacts of applying this new commercial vehicle parking demand model in Minnesota, along with any other study findings and conclusions, should be reviewed as soon as possible after national study publication to determine an appropriate Mn/DOT response.

2.2 STATE ACTIVITIES

Recent state activities to address commercial vehicle parking shortfalls range from initiating studies and task forces to ambitious new construction programs. Some of these activities are highlighted as follows:

2.2.1 COMPREHENSIVE STUDIES

In 1999, California's Transportation Department – Caltrans – convened a safety rest area task force of internal and external stakeholders from the transportation, tourism and motor carriers industries that developed eight recommendations for addressing rest area parking shortfalls: raise the priority of rest areas as integral to highway safety, develop an updated rest area master plan, expand and formalize public and private partnerships, conduct ongoing rest area evaluation, investigate truck parking capacity issues, maintain stakeholder involvement, and update rest area design standards.

Tennessee published a study titled *Truck Parking Along Tennessee's Highways and Rest Areas* in 1999. This study recommended the construction of more commercial vehicle parking spaces and also recommended strategies increasing the use of private truck stops by adopting better signage, design, lighting and security. The study also highlighted the need to explore opportunities for public/private partnerships to reduce parking problems.

2.2.2 PUBLIC/PRIVATE PARTNERSHIPS

Federal law prohibits states from allowing private entities to sell goods for profit at interstate public rest areas (under 23 *United States Code* 111). Some exceptions exist on toll roads such as the New York State Thruway and the Pennsylvania Turnpike because these roads were built before being designated as interstates. This law limits the extent to which states can partner with private entities to fund rest area rehabilitation and construction along Interstate highways. Although a January 1998 research study, sponsored by the Arkansas State Highway and Transportation Department and the FHWA (*Rural Rest Area Privatization Conditions)* found that advantages of commercialized rest areas are reduced costs and increased services and safety, and that, furthermore, commercialized rest areas on toll roads have been successful, federal and some state laws would have to be modified in order to allow for these partnerships. This may be quite difficult to accomplish given the resistance of various trade groups to relaxing existing laws limiting interstate rest area privatization.

Iowa did experiment with public/private partnerships on a non-toll road, interstate facility, entering into a public/private partnership in 1994 to develop and maintain a welcome center serving I-35 in which the developer is responsible for operating and maintaining the center and the Iowa DOT shares in the cost. However, controversy surrounding this partnership resulted in the passage of legislation preventing future public/private partnering because of perceptions of the unfair advantage conferred by the state on one commercial entity.

2.2.3 NEW CONSTRUCTION

New York State has entered on an ambitious public rest area construction program. On highways other than toll roads, eleven public rest areas have been constructed or are in the design phase adding a total of 200 to 300 commercial vehicle parking spaces. By 2011, 23 public rest areas will be reconstructed and 11 new facilities built; the cost will be over $320 million. Lessons learned have been that public rest areas serve a critical public safety need and that inadequate attention has been paid to parking and rest area needs of commercial drivers. Recommendations included calling for increased Federal flexibility for appropriate commercialization of public rest areas and Federal encouragement to help the development of additional private truck stops.

Virginia has constructed one large Truck Only rest area along I-81 near the Tennessee border accommodating nearly 110 trucks. Highway patrol officers provide security by passing through frequently. The cost of this facility was nearly $5.7 million. The State also plans to construct another Truck Only facility in a northern location.

In Texas, an ambitious program of rest area construction using TEA-21 enhancement funds has been initiated. Approximately 25 percent of Texas' TEA-21 ($47 million) enhancement funds are being spent on new public rest area construction. The goal of the program is to have a complete system of rest areas spaced no more than 60 to 100 miles apart on their state's NHS system.

2.2.4 REST AREA MODIFICATION

Several states have modified existing rest area design to add more parking spaces and to modify parallel parking sites by designing pull-through parking stalls, which are generally preferred by truck drivers. Kentucky has enlarged the area for truck parking in a few existing rest areas.

2.2.5 ALTERNATIVE REST AREA SITES

Some studies have focused on using existing parking sites or other highway infrastructure for rest area parking. Potential sites include metropolitan-area park-and-ride lots, truck weigh stations, and state welcome centers. Georgia has used state welcome centers as parking rest areas for trucks, buses or recreational vehicles. Florida has one weigh station at which overnight commercial-vehicle parking is permitted and plans to develop parking at nine more stations. Kentucky has provided truck parking at five weigh stations. A promotional effort also took place in Kentucky to inform truckers of these facilities and to assure them about a "no interruption" policy that had been agreed to with motor vehicle enforcement officers. These facilities are called "Truck Rest Havens" and are open 24-hours-a-day with no time limits for use. Maryland has opened up park-and-ride commuter lots at night to provide additional truck parking when needed.

2.2.6 IMPROVING DRIVER INFORMATION

At times, commercial vehicle parking shortfalls may be attributed to a lack of adequate information regarding nearby facilities that may have parking availability. Several states, including Michigan and Maryland, have increased signage on interstates informing drivers of private parking facilities and updated driver maps informing them of both public rest area and private truck stop locations. In cooperation with truck stop operators, Michigan is making their driver guide to public and private parking areas available at truck stops listed in the guide.

Some states are also investigating advanced technologies providing parking availability information to drivers. Both Maryland and Ohio are considering installing signs providing real-time knowledge of parking availability at public rest areas.

2.2.7 IMPROVING PARKING SECURITY

Security at rest areas has been cited as a driver concern in various studies, particularly in a summary of issues identified by stakeholders in an I-35 corridor study, as well as in the FHWA's National Rest Area Forum held in June, 1999. North Carolina has attempted to address this issue in a program called "Operation Rest Assured", involving State and local officers patrolling public rest areas 24-hours-a-day to eliminate crime.

3.0 MINNESOTA FINDINGS

The Minnesota Department of Transportation operates a network of 55 full-service safety rest areas along Interstates and high-volume, non-interstate highways. Prior to 1995, Mn/DOT did not measure nighttime commercial vehicle parking use in rest areas. In response to the 1996 FHWA study, summarized in Section 2 above, Mn/DOT began collecting nighttime parking data for oversized vehicles at 50 full-service rest areas around the state. Based on the findings of an analysis of this parking data, collected between 1995 and 1998 (*Commercial Truck Usage – Nighttime Parking Demand Analysis)*, Mn/DOT identified 15 full service rest areas as currently having occasional to high-level nighttime parking capacity problems for oversized vehicles. Since this time, nighttime parking data has continued to be collected at these 15 rest areas.

3.1 STUDY METHODOLOGY

The 15 high-use rest areas are primarily concentrated on three interstate highways, I-35 south of the Twin Cities, I-90 and I-94. Although scattered throughout the state, the greatest concentration of high-use rest areas is found in southeastern Minnesota and the Twin Cities Metropolitan area (see Figure 1 on the following page). On-site custodial staff recorded nightly vehicle counts for oversized vehicles parked in each rest area. Data was collected each night at 10:00 p.m.; midnight; 1:00, 2:00 or 3:00 a.m. depending on the end of shift for custodians; and 6:00, 7:00, or 8:00 a.m. depending on the new start of the new shift for the custodians. The data, which is summarized below, was collected over a period of approximately two and a half years, from July 1998 to December 2000.

3.2 EXISTING USAGE

3.2.1 PARKING BY TIME OF DAY

In keeping with findings made in the 1998 study, the peak time period recorded for nighttime truck parking demand remained the 1:00 a.m. to 3:00 a.m. observation period (see Figure 2). Therefore, the tables and figures that follow, summarizing the extent and frequency of parking shortfalls, represent parking observations made during this peak time period.

Figure 2 - Average Number of Trucks by Time of Day (All days)

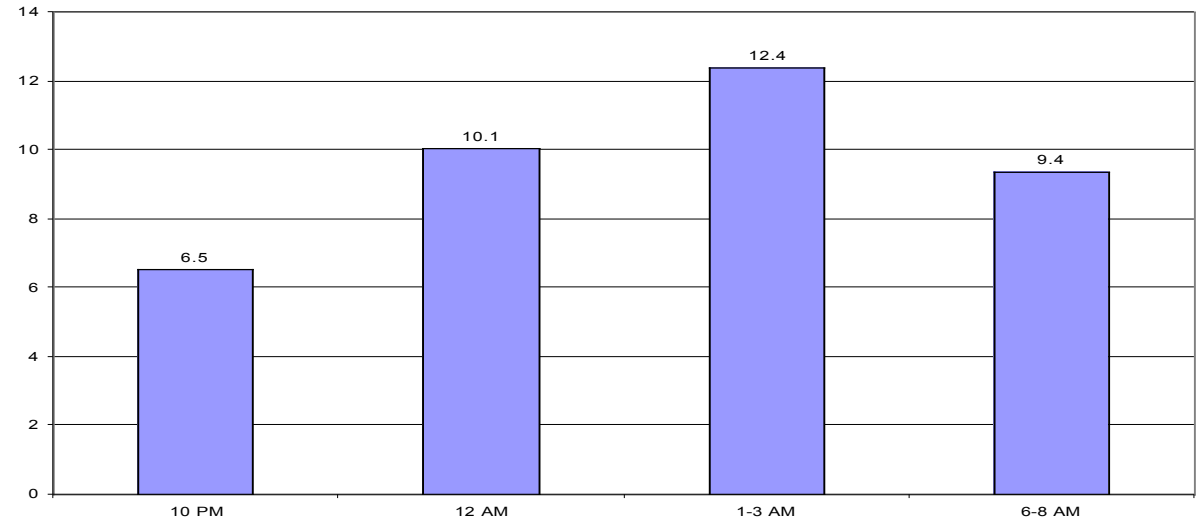
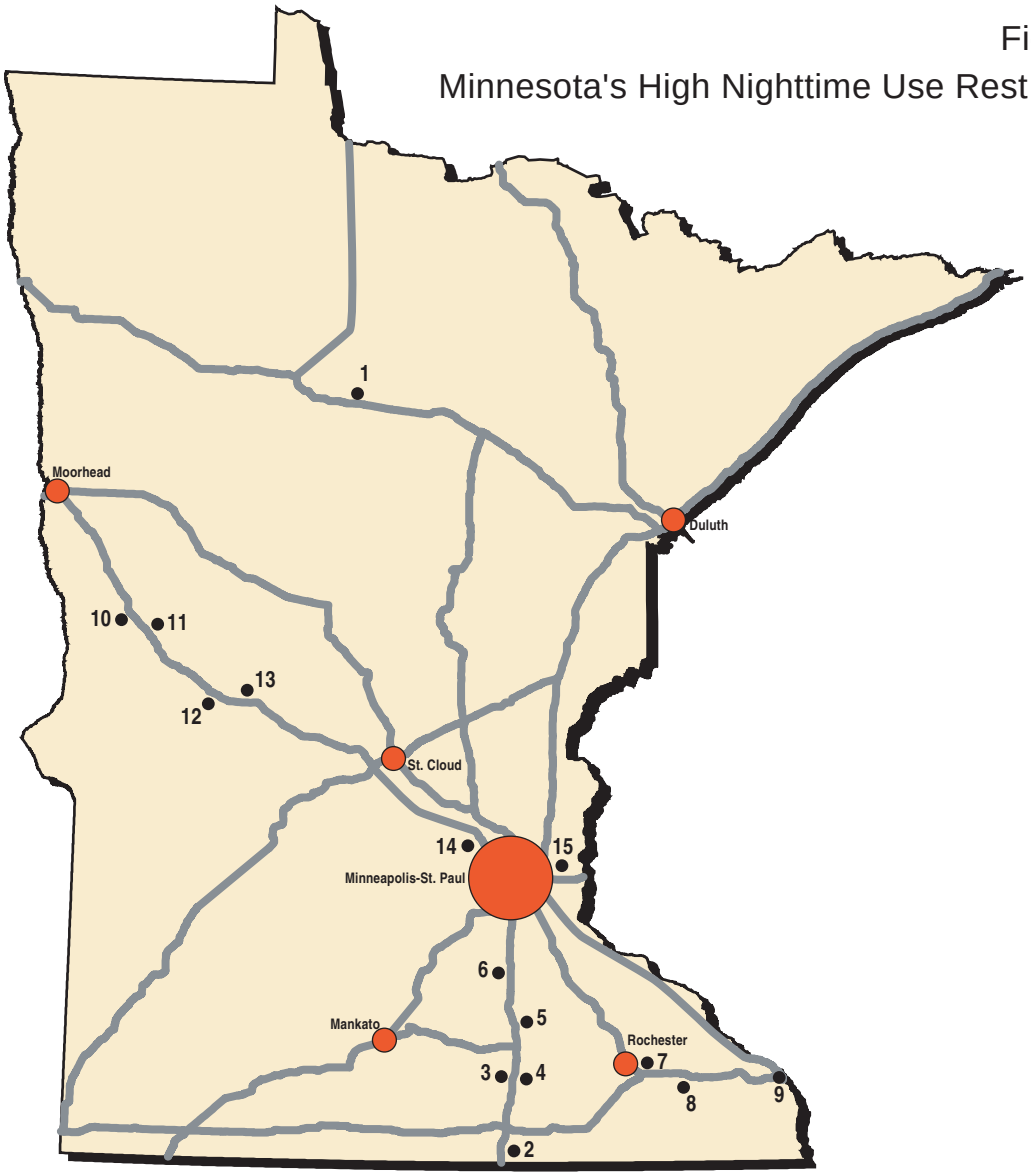


Figure 1
Minnesota's High Nighttime Use Rest Areas



15 Minnesota Safety Rest Area study site locations where commercial truck parking data was collected.

MAP KEY NUMBER	ROUTE	MILE POST	SAFETY REST AREA NAME
1	T.H. 2	131	Cass Lake
2	I-35	1	Albert Lea TIC (NB)
3	I-35	35	Straight River (SB)
4	I-35	35	Straight River (NB)
5	I-35	68	Heath Creek (NB)
6	I-35	75	New Market (SB)
7	I-90	221	Marion (WB)
8	I-90	243	Enterprise (EB)
9	I-90/US 61	275	Dresbach TIC (WB)
10	I-94	60	Lake Iverson (EB)
11	I-94	69	Hansel Lake (WB)
12	I-94	100	Lake Latoka (EB)
13	I-94	105	Burgen Lake (WB)
14	I-94	216	Elm Creek RA (EB)
15	I-94	256	St. Croix TIC (WB)

3.2.2 PARKING BY DAY OF WEEK

Figure 3 shows the daily distribution of parking demand at the 15 high-use rest areas. The highest demand occurred on Tuesdays, closely followed by Mondays, Wednesdays, and Thursdays. Demand on Fridays, Saturdays and Sundays is significantly below this level.

Figure 3 - Average Number of Trucks by Day of Week (All days)

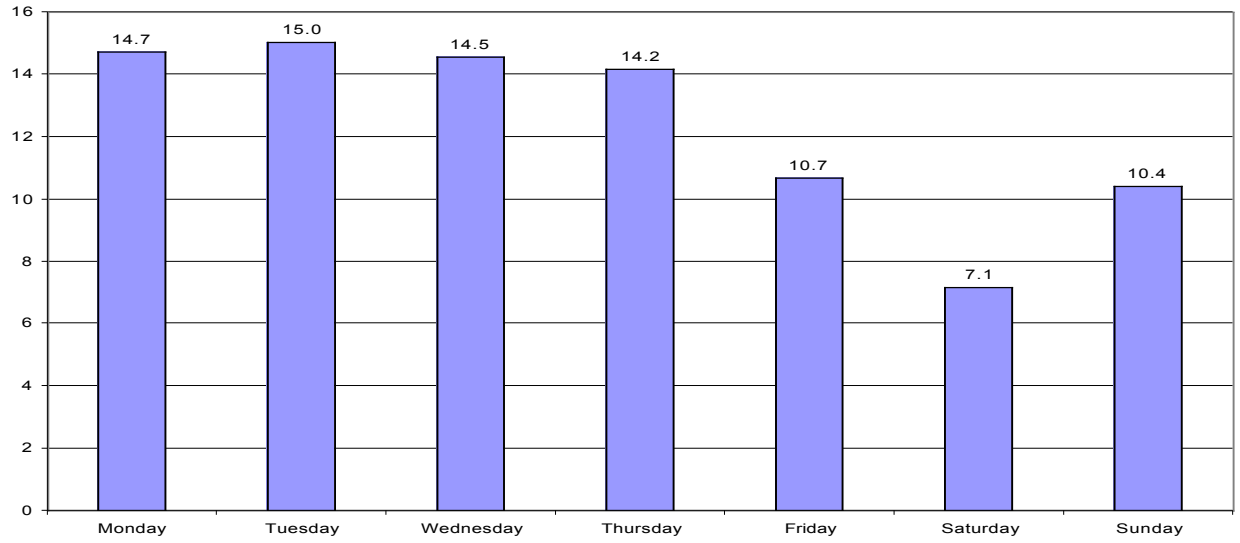


Table 1 summarizes truck observations, by rest area, by day of week, for all 15 rest areas. The highest-use sites are Marion (westbound on I-90) and St. Croix T.I.C. (westbound on I-94).

TABLE 1
TRUCK PARKING SPACE UTILIZATION BY DAY OF WEEK (JULY 1998 - DECEMBER 2000)

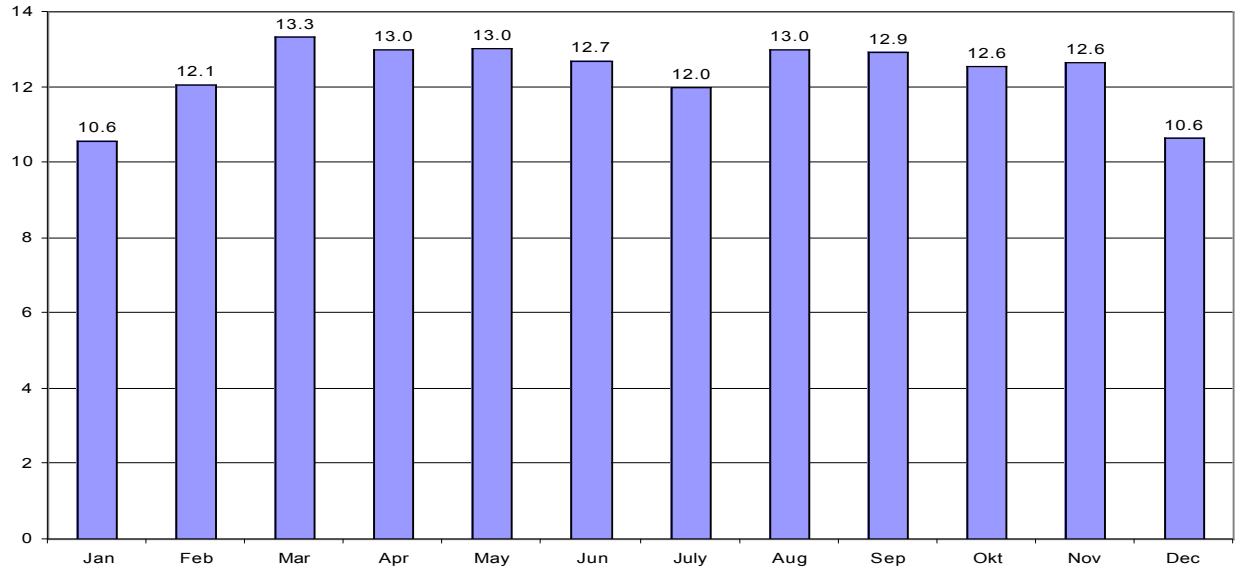
Map Key Number	Safety Rest Area Name	Roadway	Existing Truck Parking Stalls	Average Number of Trucks Observed at 1-3 AM					Max. Number of Trucks at 1-3 AM
				Mon-Thu	Friday	Saturday	Sunday	All Days	
1	Cass Lake	US 2	9	3.3	3.0	2.3	2.5	3.0	10
2	Albert Lea TIC (N.B.)	I-35	12[(1)]	15.1	8.1	4.8	15.1	12.6	29
3	Straight River (S.B.)	I-35	12	9.8	9.3	4.6	5.3	8.4	20
4	Straight River (N.B.)	I-35	14	12.3	5.9	2.8	11.7	10.0	27
5	Heath Creek (N.B.)	I-35	20	15.1	5.5	2.9	16.2	12.1	29
6	New Market (S.B.)	I-35	16	12.7	10.9	4.2	7.0	10.4	23
7	Marion (W.B.)	I-90	27	30.9	19.9	12.7	22.9	25.5	57
8	Enterprise (E.B.)	I-90	14	12.9	8.7	5.7	8.6	10.7	36
9	Dresbach TIC (W.B.)	I-90/US 61	7	3.3	2.4	1.4	2.4	2.8	11
10	Lake Iverson (E.B.)	I-94	11	11.7	9.7	8.9	10.0	10.8	20
11	Hansel Lake (W.B.)	I-94	10	9.1	9.8	8.9	6.7	8.8	22
12	Lake Latoka (E.B.)	I-94	19	19.7	10.3	12.0	16.4	16.8	47
13	Burgen Lake (W.B.)	I-94	10	12.6	11.0	7.3	9.2	11.1	30
14	Elm Creek (E.B.)	I-94	15	16.1	11.5	9.1	12.0	13.8	31
15	St. Croix T.I.C. (W.B.)	I-94	35	34.5	34.2	19.5	10.3	28.9	66

(1) Rest area was reconstructed and reopened Spring 2001 with 29 commercial vehicle parking stalls

3.2.3 PARKING BY TIME OF YEAR

As seen in Figure 4, demand by time of year is relatively steady, with little fluctuation from February to November with December and January having somewhat less demand.

Figure 4 - Average Number of Trucks by Month of Year (All days)



3.3 EXISTING PARKING SHORTFALLS

After looking at the data in aggregate to discern parking trends (as discussed above), data were disaggregated to discern trends at individual rest areas. This was done to determine the extent and frequency of potential capacity deficiencies at these sites. Differing means by which to define and to determine rest area capacity are discussed below.

3.3.1 EXISTING PARKING UTILIZATION

Table 2 summarizes the average number of trucks observed at each rest area using varying methods of observation. In one instance, a four-day time period is used, concentrating on the highest-use days of Monday through Thursday. Other time periods studied were a five-day time period (Monday through Friday), a six-day time period (Sunday through Friday) and a seven-day time period (Saturday through Sunday). Again, the Marion rest area (westbound on I-90) and the St. Croix T.I.C. rest area (westbound on I-94) are the highest-use sites of all 15 analyzed.

TABLE 2
TRUCK PARKING SPACE UTILIZATION BY NUMBER OF DAYS (JULY 1998 - DECEMBER 2000)

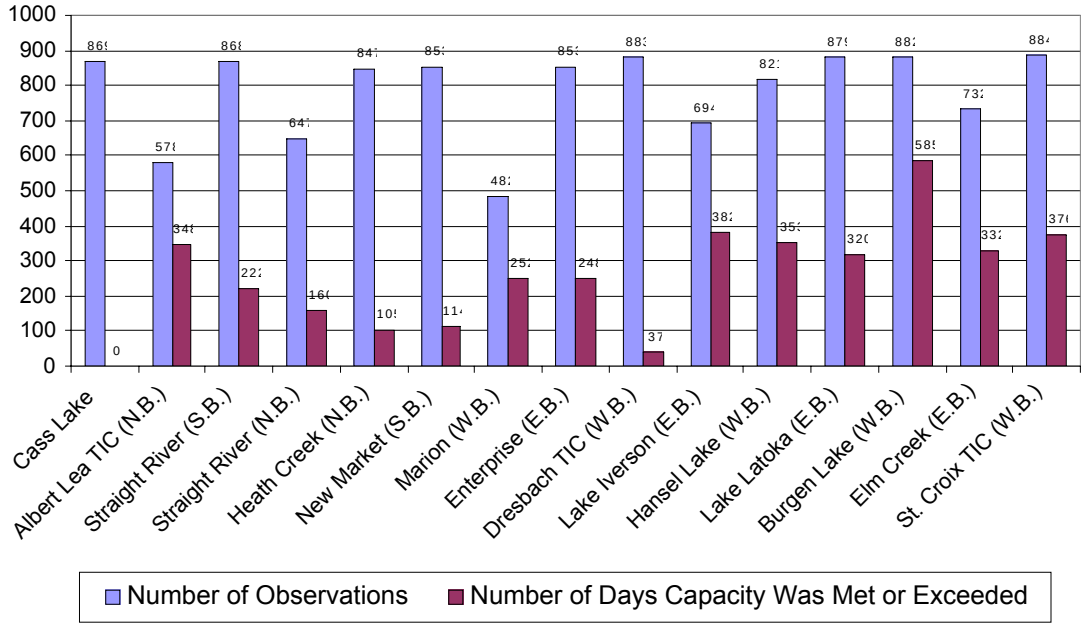
Map Key Number	Safety Rest Area Name	Roadway	Existing Truck Parking Stalls	Average Number of Trucks Observed at 1-3 AM Mon-Thu 4 days	Mon-Fri 5 days	Sun-Fri 6 days	Sun-Sat 7 days
1	Cass Lake	US 2	9	3.3	3.3	3.1	3.0
2	Albert Lea TIC (N.B.)	I-35	12(1)	15.1	13.7	13.9	12.6
3	Straight River (S.B.)	I-35	12	12.3	11.0	11.1	10.0
4	Straight River (N.B.)	I-35	14	10.0	9.8	9.1	8.5
5	Heath Creek (N.B.)	I-35	20	15.1	13.2	13.7	12.1
6	New Market (S.B.)	I-35	16	12.7	12.3	11.4	10.4
7	Marion (W.B.)	I-90	27	30.9	28.7	27.7	25.5
8	Enterprise (E.B.)	I-90	14	12.9	12.1	11.5	10.7
9	Dresbach TIC (W.B.)	I-90/US 61	7	3.3	3.1	3.0	2.8
10	Lake Iverson (E.B.)	I-94	11	11.7	11.3	11.1	10.8
11	Hansel Lake (W.B.)	I-94	10	9.1	9.2	8.8	8.8
12	Lake Latoka (E.B.)	I-94	19	19.7	17.8	17.6	16.8
13	Burgen Lake (W.B.)	I-94	10	12.6	12.3	11.8	11.1
14	Elm Creek (E.B.)	I-94	15	16.1	15.2	14.6	13.8
15	St. Croix T.I.C. (W.B.)	I-94	35	34.5	34.4	30.4	28.9

(1) Rest area was reconstructed and reopened Spring 2001 with 29 commercial vehicle parking stalls

3.3.2 CAPACITY UTILIZATION

Figure 5 graphically depicts the number of observations made at each rest area contrasted with the number of days capacity was met or exceeded at each rest area. As can be seen, Burgen Lake (westbound on I-94) experienced the greatest number of capacity exceedances (585) followed by Lake Iverson (eastbound on I-94) with 382 exceedances of capacity and St. Croix TIC (westbound on I-94) with 376 exceedances of capacity.

Figure 5 - Number of Observations and Capacity Problems (7 day time period)



The following two figures depict the impact of choosing differing periods of observation (four-day to seven-day) on two different criteria for measuring current parking demand at rest areas. Figure 6 depicts, by rest area, the average percent of capacity used at each rest area during the analysis period. The four-day analysis period shows the highest average usage. Figure 7 depicts, by rest area, the percent of days capacity was met or exceeded. The highest-use days, Monday – Thursday, demonstrate greater capacity problems than would be observed if a larger subset of days is included. Using either measure (average capacity of use [Figure 6] or percent of days capacity is met or exceeded [Figure 7]) Albert Lea TIC (northbound on I-35) and Burgen Lake (westbound on I-94) are the sites with the greatest number of capacity exceedances.

Figure 6 - Average Percent of Capacity Used

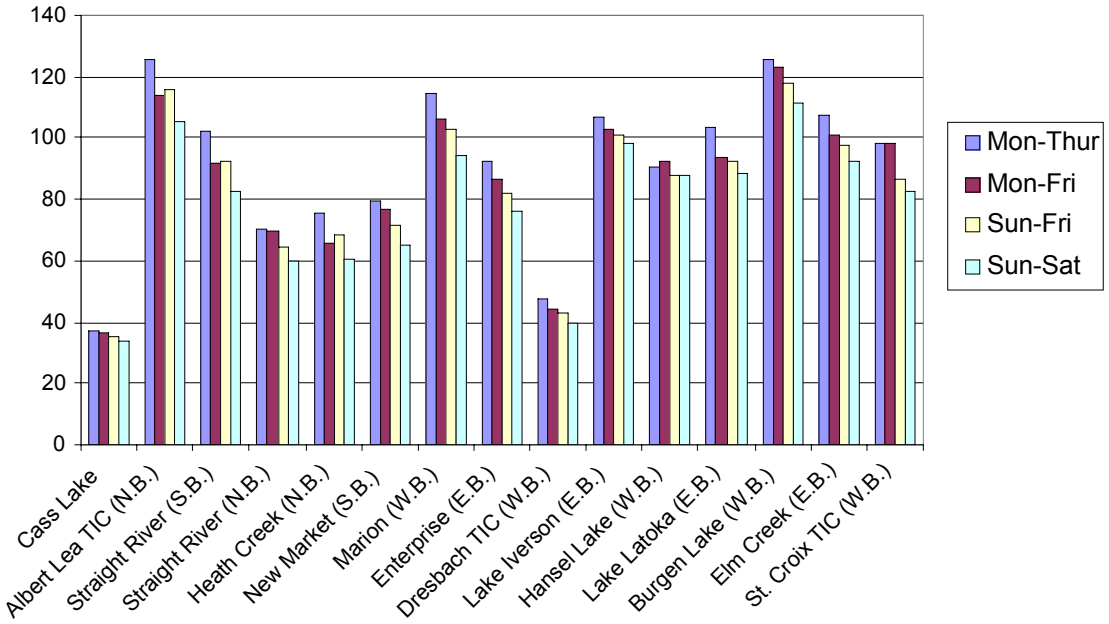
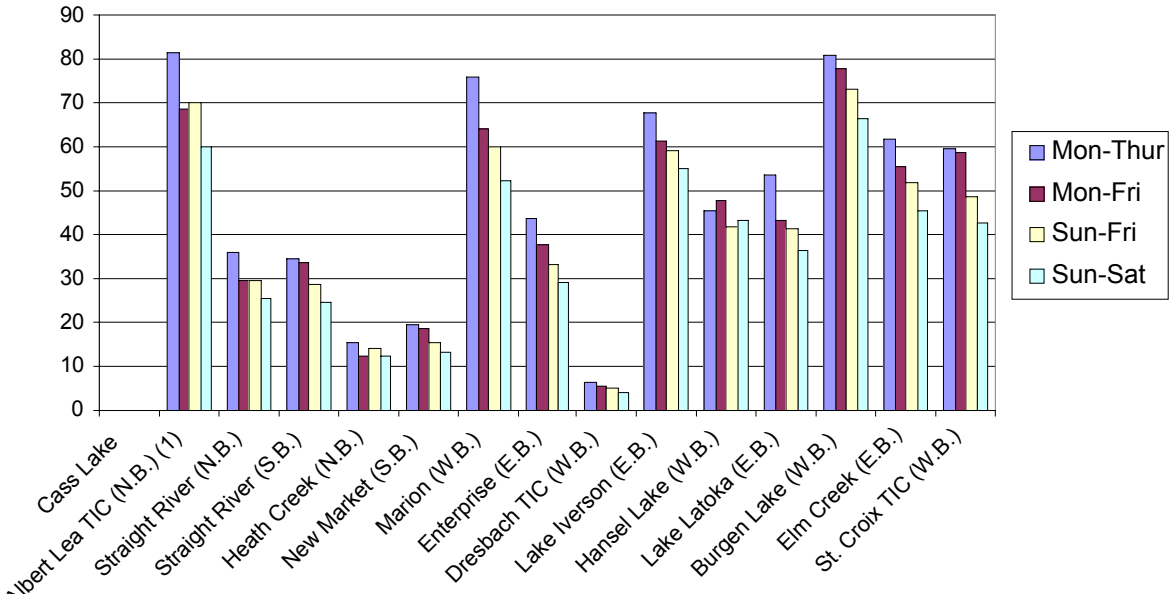


Figure 7 - Percent of Days Capacity Was Met or Exceeded



It was determined that a conservative-use scenario should be used in choosing a time period on which to base all the subsequent data analysis determining the extent of rest area capacity problems. This meant focusing only on the highest-use days for evaluation was not desirable as it may overstate the case for capacity deficiencies. However, it was felt that using the seven-day time period, which included Saturday, would skew the data as Saturday usage was significantly lower (nearly 50 percent) than the average for all days. Therefore, it was determined to use the six-day time period for subsequent evaluation to conservatively state the extent of existing, commercial vehicle parking deficiencies. All of the tables and figures that follow are based on this six-day data sample.

3.3.3 CAPACITY THRESHOLDS

Table 3 summarizes two measures for establishing capacity thresholds. The last two columns measure the average percent of capacity used by site, and the percent of days capacity was met or exceeded by site. As found previously, Burgen Lake (westbound on I-94) has the highest average percent of capacity used, in addition to the highest percent of days that capacity is met or exceeded.

TABLE 3
TRUCK PARKING SPACE UTILIZATION SUNDAY TO FRIDAY (JULY 1998 - DECEMBER 2000)

(Six Day Time Period, Sun. – Fri.)

Map Key Number	Safety Rest Area Name	Roadway	Existing Truck Parking Stalls	Ave. Number of Trucks Observed at 1-3 AM	Average Percent of Capacity Used (%)	Percent of Days Capacity Met or Exceeded (%)
1	Cass Lake	US 2	9	3	35	0
2	Albert Lea TIC (N.B.)	I-35	12(1)	13	116	70
3	Straight River (S.B.)	I-35	12	10	93	30
4	Straight River (N.B.)	I-35	14	8	64	29
5	Heath Creek (N.B.)	I-35	20	12	68	14
6	New Market (S.B.)	I-35	16	10	71	16
7	Marion (W.B.)	I-90	27	26	103	60
8	Enterprise (E.B.)	I-90	14	11	82	33
9	Dresbach TIC (W.B.)	I-90/US 61	7	3	43	5
10	Lake Iverson (E.B.)	I-94	11	11	101	59
11	Hansel Lake (W.B.)	I-94	10	9	88	42
12	Lake Latoka (E.B.)	I-94	19	17	93	41
13	Burgen Lake (W.B.)	I-94	10	11	118	73
14	Elm Creek (E.B.)	I-94	15	14	98	52
15	St. Croix T.I.C. (W.B.)	I-94	35	29	87	49

(1) Rest area was reconstructed and reopened Spring 2001 with 29 commercial vehicle parking stalls

These two measures summarized in Table 3 were combined to establish capacity thresholds, defined in Table 4 as High, Medium or Low problem areas. A rest area with a high-level of capacity problem was defined as one at which the Sunday to Friday average site capacity in use exceeded 90 percent or at which the percent of days capacity was exceeded was greater than 50 percent. In practical terms, this means that a rest area with a high-level capacity problem would have less than 10 percent of its parking spaces available during the six days, and that for three of those days, it would be operating over capacity. Commercial vehicle drivers would be forced to make one of two choices; to park their truck at the over-capacity rest area illegally on ramps or at parking spaces not marked for commercial vehicle parking, or to continue their journey at risk of becoming a fatigued driver.

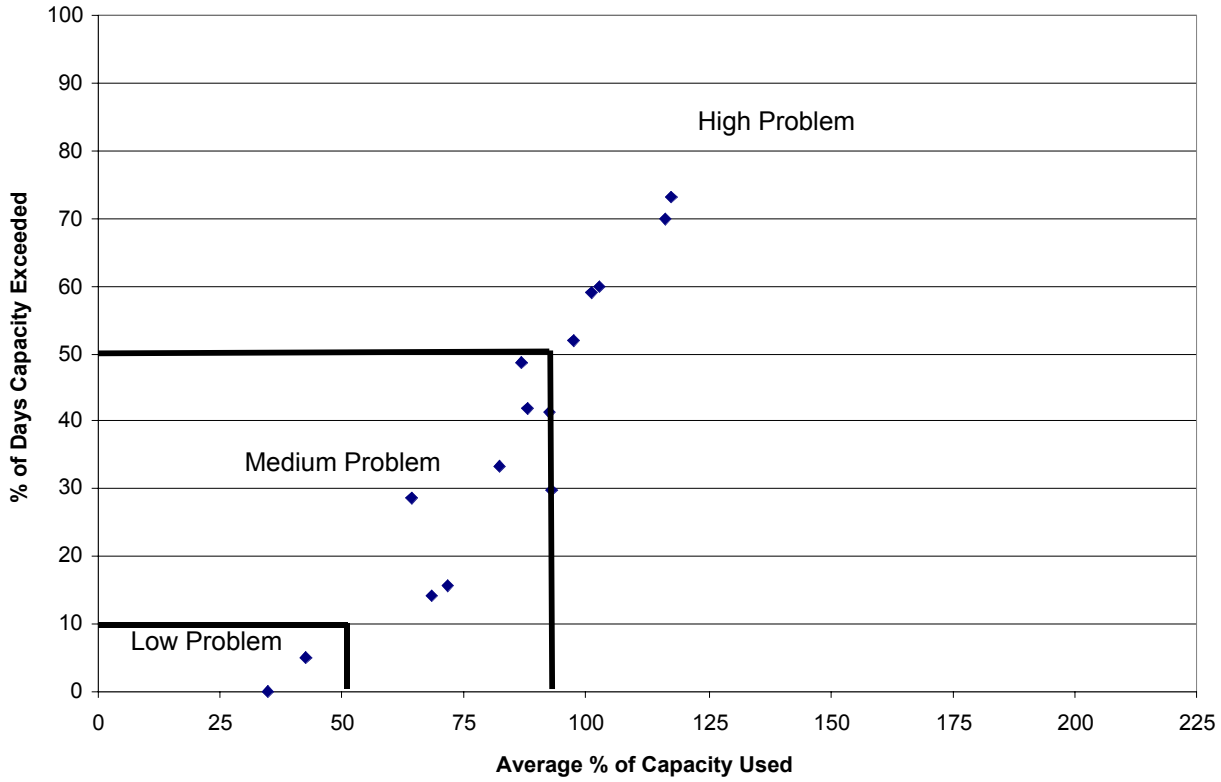
Rest areas identified as having a high-level capacity problem included Burgen Lake and Lake Iverson (eastbound on I-94) in addition to Albert Lea (northbound on I-35), Straight River (southbound on I-35), Marion (westbound on I-90), Lake Latoka (eastbound on I-94), and Elm Creek (eastbound on I-94).

TABLE 4
LEVEL OF CAPACITY PROBLEM SUNDAY TO FRIDAY (JULY 1998 - DECEMBER 2000)
(Six Day Time Period, Sun. – Fri.)

Map Key Number	Safety Rest Area Name	Roadway	Level of Capacity Problem (1)
1	Cass Lake	US 2	Low
2	Albert Lea TIC (N.B.)	I-35	High
3	Straight River (S.B.)	I-35	High
4	Straight River (N.B.)	I-35	Medium
5	Heath Creek (N.B.)	I-35	Medium
6	New Market (S.B.)	I-35	Medium
7	Marion (W.B.)	I-90	High
8	Enterprise (E.B.)	I-90	Medium
9	Dresbach TIC (W.B.)	I-90/US 61	Low
10	Lake Iverson (E.B.)	I-94	High
11	Hansel Lake (W.B.)	I-94	Medium
12	Lake Latoka (E.B.)	I-94	High
13	Burgen Lake (W.B.)	I-94	High
14	Elm Creek (E.B.)	I-94	High
15	St. Croix T.I.C. (W.B.)	I-94	Medium

Figure 8 graphically depicts the 15 rest areas by classification. As can be seen, two rest areas do not currently exhibit any capacity problems. These two low-level capacity problem areas are Cass Lake and Dresbach TIC. Six rest areas rank as having a medium-level capacity problem (Straight River [northbound], Heath Creek, New Market, Enterprise, Hansel Lake and St. Croix T.I.C.), with the remaining six rest areas identified as having a high-level capacity problem. The most significant problems are occurring at the Burgen Lake and Albert Lea sites.

Figure 8 - Truck Parking Capacity Problem Classification (Year 2000)



3.4 FUTURE PARKING SHORTFALLS

As existing parking shortfalls were defined, the next step in the study process was to define future parking shortfalls. This was done by estimating future year heavy commercial average daily traffic (HCADT), and forecasting future nighttime commercial vehicle parking demand based on an extrapolation of existing parking demand relative to existing HCADT and carrying that factor forward to future year HCADT.

3.4.1 FUTURE HCADT

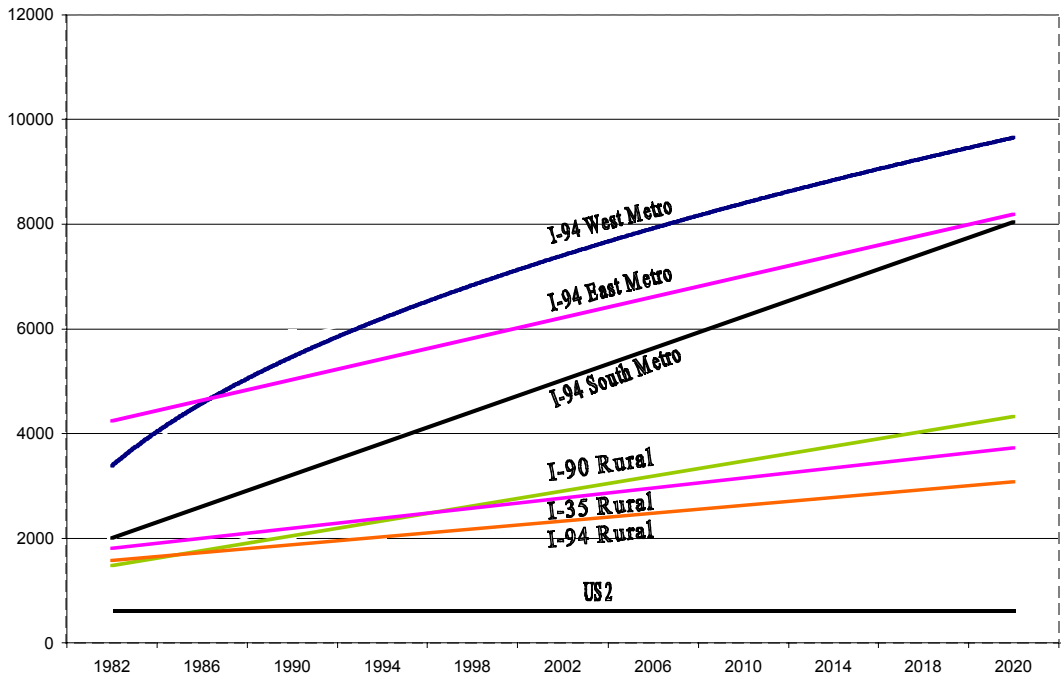
Future HCADT on highway segments adjoining the 15 high-use rest areas is summarized in Table 5. Future HCADT was based on existing HCADT (as depicted in Table 5) and calculated by applying traffic growth factors established as part of Mn/DOT's 2000 *Interregional Corridor Study*. Future HCADT was calculated at five-year increments from 2000 to 2020.

TABLE 5
EXISTING AND ESTIMATED FUTURE DAILY HEAVY COMMERCIAL VEHICLE TRAFFIC NEAR SELECTED REST AREAS
(Six Day Time Period, Sun. – Fri.)

Map Key Number	Rest Area Name	Route	Mile Post	HCADT 1998	Estimated daily heavy commercial vehicle volumes 2000	2005	2010	2015	2020
1	Cass Lake	US 2	131	580	600	600	600	600	600
2	Albert Lea TIC (N.B.)	I-35	1	2,550	2,600	2,900	3,100	3,400	3,600
3	Straight River (S.B.)	I-35	35	2,700	2,800	3,000	3,300	3,500	3,800
4	Straight River (N.B.)	I-35	35	2,700	2,800	3,000	3,300	3,500	3,800
5	Heath Creek (N.B.)	I-35	68	4,500	4,800	5,600	6,300	7,100	7,800
6	New Market (S.B.)	I-35	75	4,600	4,900	5,700	6,400	7,200	7,900
7	Marion (W.B.)	I-90	221	2,800	2,900	3,300	3,700	4,000	4,400
8	Enterprise (E.B.)	I-90	243	2,750	2,900	3,200	3,600	4,000	4,300
9	Dresbach TIC (W.B.)	I-90/US 61	275	2,900	3,000	3,400	3,800	4,100	4,500
10	Lake Iverson (E.B.)	I-94	60	2,150	2,200	2,400	2,600	2,800	3,000
11	Hansel Lake (W.B.)	I-94	69	2,250	2,300	2,500	2,700	2,900	3,100
12	Lake Latoka (E.B.)	I-94	100	2,400	2,500	2,700	2,900	3,000	3,200
13	Burgen Lake (W.B.)	I-94	105	2,600	2,700	2,900	3,100	3,200	3,400
14	Elm Creek (E.B.)	I-94	216	6,550	7,100	7,800	8,400	8,900	9,500
15	St. Croix T.I.C. (W.B.)	I-94	256	5,500	5,700	6,200	6,700	7,200	7,700

Figure 9 graphically depicts the trendlines for traffic growth assumed as part of the forecasting of HCADT by corridor.

Figure 9 - Truck Traffic Forecast Trend Lines



3.4.2 FUTURE PARKING DEMAND

Future parking demand by site was estimated by establishing the factor of existing demand relative to existing HCADT and applying that factor to future year HCADT. The results are displayed in Table 6.

TABLE 6
ESTIMATED FUTURE PARKING DEMAND SUNDAY TO FRIDAY

Map Key Number	Safety Rest Area Name	Roadway	Existing Truck Parking Stalls	Average Number of Truck Observed 1998-2000 (1)	Estimated Average Number of Trucks at 1-3 AM 2005	2010	2015	2020
1	Cass Lake	US 2	9	3	3	3	3	3
2	Albert Lea TIC (N.B.)	I-35	12(1)	14	16	17	19	20
3	Straight River (S.B.)	I-35	12	11	12	14	14	16
4	Straight River (N.B.)	I-35	14	9	10	11	12	13
5	Heath Creek (N.B.)	I-35	20	14	17	19	22	24
6	New Market (S.B.)	I-35	16	11	14	16	18	20
7	Marion (W.B.)	I-90	27	28	33	37	40	44
8	Enterprise (E.B.)	I-90	14	12	13	15	17	18
9	Dresbach TIC (W.B.)	I-90/US 61	7	3	4	4	4	5
10	Lake Iverson (E.B.)	I-94	11	11	12	13	14	16
11	Hansel Lake (W.B.)	I-94	10	9	10	11	11	12
12	Lake Latoka (E.B.)	I-94	19	18	20	21	22	23
13	Burgen Lake (W.B.)	I-94	10	12	13	14	14	15
14	Elm Creek (E.B.)	I-94	15	15	17	19	20	21
15	St. Croix T.I.C. (W.B.)	I-94	35	30	34	37	40	43

(1) Rest area was reconstructed and reopened Spring 2001 with 29 commercial vehicle parking stalls

3.4.3 FUTURE CAPACITY PROBLEMS

Future capacity problems by site are summarized for future years 2005, 2010, 2015 and 2020 (see Table 7). The final column in the table gives an estimated year at which capacity problems at the rest area would be anticipated to occur, based on the criterion of capacity being exceeded 50 percent of the time (i.e., three days out of six, demand would exceed capacity). Based on the application of this criterion to future year parking demand, three rest areas are not anticipated to experience any capacity problems in the next 20 years; Cass Lake, Dresbach TIC, and Albert Lea TIC (rest area was reconstructed in Spring 2001 with 29 commercial parking stalls to address overnight parking shortfalls experienced previously, as documented in Section 2 of this report). What is remarkable amongst the remaining rest areas is that four of the subset of twelve (Marion, Lake Iverson, Burgen Lake and Elm Creek) are already at capacity, with four of the remaining (Enterprise, Hansel Lake, Lake Latoka, and St. Croix T.I.C.) expected to exceed capacity in the next five years.

TABLE 7
ESTIMATED FUTURE CAPACITY PROBLEMS SUNDAY TO FRIDAY

Map Key Number	Safety Rest Area Name	Roadway	Existing Truck Parking Stalls	Percent of Days Capacity Met or Exceeded (1998-2000)	Estimated Percent of Days Capacity Met or Exceeded[1] 2005	2010	2015	2020	Estimated Time of Capacity Problem [2]
1	Cass Lake	US 2	9	0	0	0	0	0	-
2	Albert Lea TIC (N.B.)	I-35	12[3]	70	1	2	7	11	-
3	Straight River (S.B.)	I-35	12	30	39	52	60	68	2009
4	Straight River (N.B.)	I-35	14	29	39	45	52	59	2016
5	Heath Creek (N.B.)	I-35	20	14	33	53	66	71	2009
6	New Market (S.B.)	I-35	16	16	44	55	62	69	2007
7	Marion (W.B.)	I-90	27	60	77	80	83	85	Current
8	Enterprise (E.B.)	I-90	14	33	50	57	65	74	2005
9	Dresbach TIC (W.B.)	I-90/US 61	7	5	11	15	19	22	-
10	Lake Iverson (E.B.)	I-94	11	59	72	76	81	88	Current
11	Hansel Lake (W.B.)	I-94	10	42	55	61	66	71	2003
12	Lake Latoka (E.B.)	I-94	19	41	53	56	60	65	2004
13	Burgen Lake (W.B.)	I-94	10	73	79	81	83	85	Current
14	Elm Creek (E.B.)	I-94	15	52	65	73	76	78	Current
15	St. Croix T.I.C. (W.B.)	I-94	35	49	67	72	75	77	2001

(1) Number of trucks estimated at 1-3 AM
(2) Capacity problem exists if the % of days capacity is exceeded is greater than 50% (3 days out of 6)
(3) Rest area was reconstructed and reopened Spring 2001 with 29 commercial vehicle parking stalls

Figures 10 and 11 graphically depict the level of capacity problems at the 15 high-use sites for 2010 and 2020 respectively.

Figure 10 - Truck Parking Capacity Problem Classification (Year 2010)

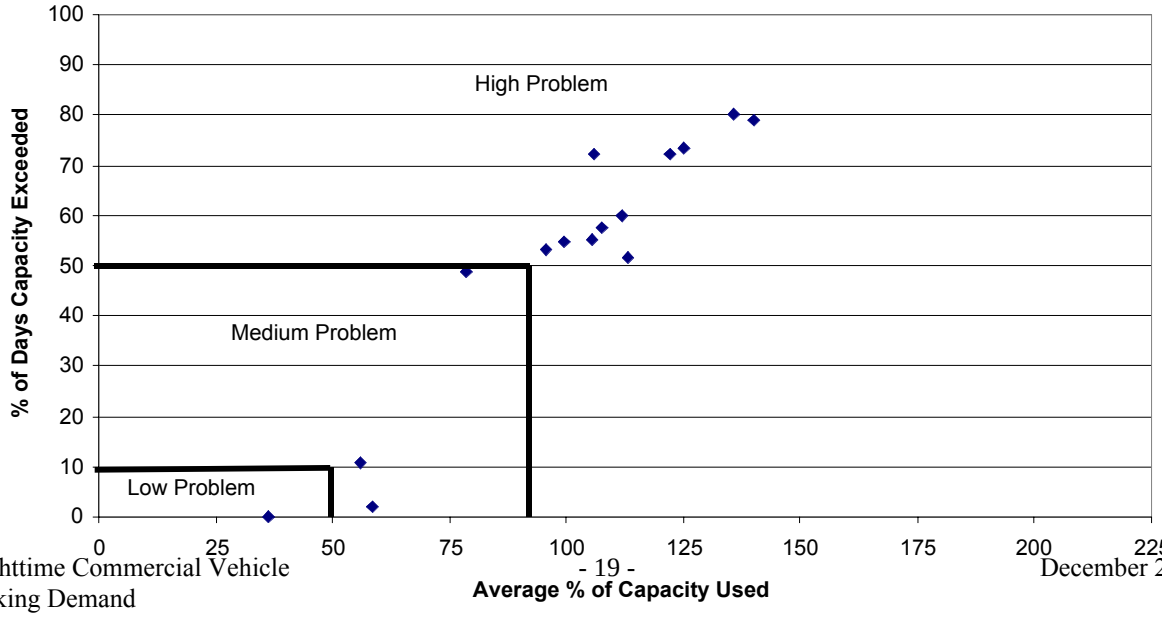
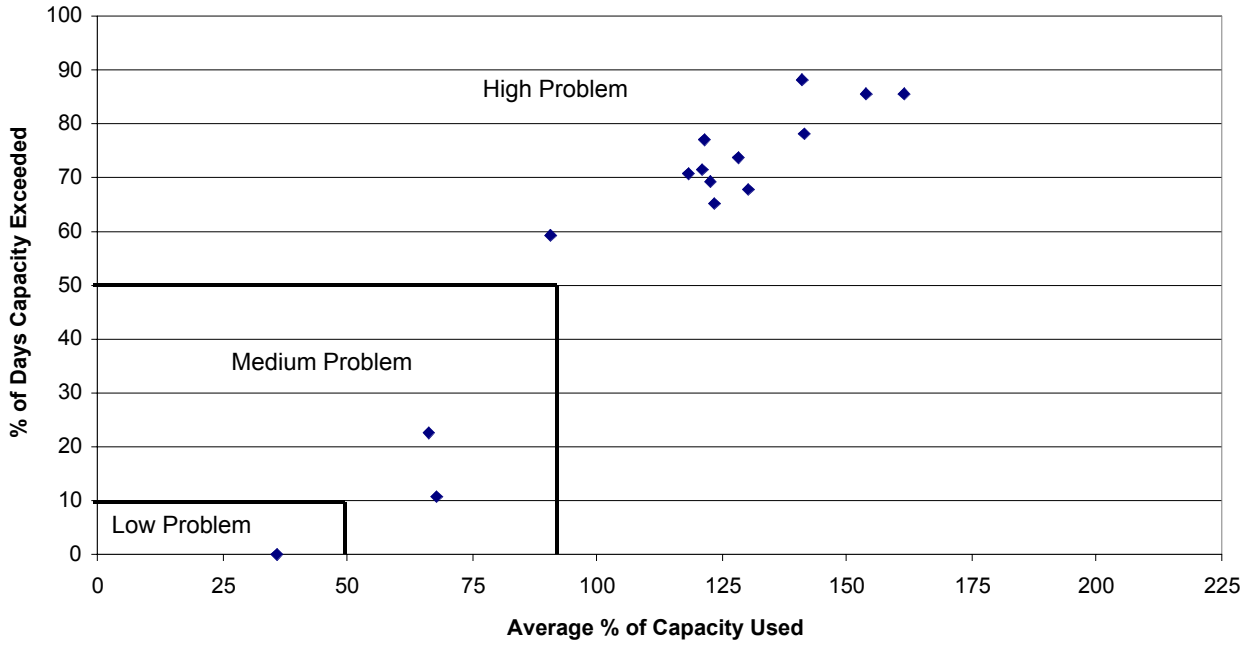


Figure 11 - Truck Parking Capacity Problem Classification (Year 2020)



4.0 FUTURE CONSIDERATIONS

4.1 FUTURE STUDY ACTIVITIES

Future study activities are summarized as follows:

1. Mn/DOT should refine evidence gathered at the anecdotal level that may have an impact on nighttime commercial vehicle parking demand, specifically the phenomenon of truckers using public rest areas or private truck stops as resting points to ensure just in time delivery to a Twin Cities Metropolitan area location. Some evidence suggests that this may be occurring with greater frequency, particularly as some receiving and shipping companies narrow the window of "on-time" delivery to as little as a fifteen-minute time slot. In order to ensure that this deadline is met, truckers may choose to drive near enough to the metro area to ensure their delivery time is met, but may need to wait some period of time before delivery can be made.

2. Focus groups could be conducted with commercial vehicle drivers to investigate the scope of the parking shortage problem and preferences of commercial drivers for various amenities and services they like to have to meet their short-term stopping and long-term parking needs. Information gathered from these discussions can be used in determining the propensity for truckers to use public or private parking spaces, and the impact these preferences may have on commercial vehicle parking demand in Minnesota.

3. With publication of the TEA-21 Section 4027 study, Mn/DOT should review the findings of this study relative to commercial vehicle parking shortfalls in Minnesota. Special attention should be paid to the results of the application of the new corridor-based, commercial truck parking demand model and to the methodology used.

4. Implementation strategies addressing the existing and current commercial vehicle parking shortfalls in Minnesota should be investigated. These could range from new construction, to modification of existing rest areas, to better driver information, to exploring public/private solutions, to using alternative sites such as park-and-ride lots, weigh stations or others.

4.2 FUTURE DATA COLLECTION REQUIREMENTS

Mn/DOT can continue its manual data collection program as it has been conducted 1996; however, this program may be slightly refocused at this time given the trends that have been observed over time.

- Data should continue to be gathered for the seven-day-a-week cycle.

- Data should continue to be gathered for 12 months of the year.

- Data collection should focus on the time period of maximum use, between midnight and 6:00 a.m., although 2:00 to 4:00 a.m. is probably the peak-period of use. Uniform collection of annual data during this period has not been possible because custodial staff do not work at most sites during these hours. The conservative projections generated through this analysis did not take into consideration adjustment for the peak use of rest areas occurring during the highest time hours without accurate data.

- Data should be collected at all locations for historical tracking.

- An enhanced program of data collection should be instituted at the thirteen most heavily-used rest areas, as identified in this study. All opportunities for enhanced data collection should be explored with Mn/DOT's Office of Alternative Transportation Services.

  – Enhanced 24-hour data collection may consist of the following:

    1. In-pavement loop detectors and axle counters that count volume and classify vehicle types could be installed at entrance and perhaps exit locations. These are connected to control cabinets where data can be electronically stored and periodically retrieved through dial-up capabilities. Data will be continuously collected remotely and will include a time-stamp to allow aggregation.

    2. As an option to in-pavement devices, pole-mounted radar volume counters and vehicle-type classifiers could be permanently installed or deployed as needed with portable units. Information collected would be similar to that collected with in-pavement loop detectors and axle counters, as described above.

3. A license plate reader system could be used to count and classify vehicle movements at rest areas. This system could also be used to determine length of stay of individual vehicles if deployed at entrance and exit locations. It could be permanently deployed at key sites or be part of a portable data collection system that could be operated where needed.

4.3 FUTURE DESIGN CONSIDERATIONS

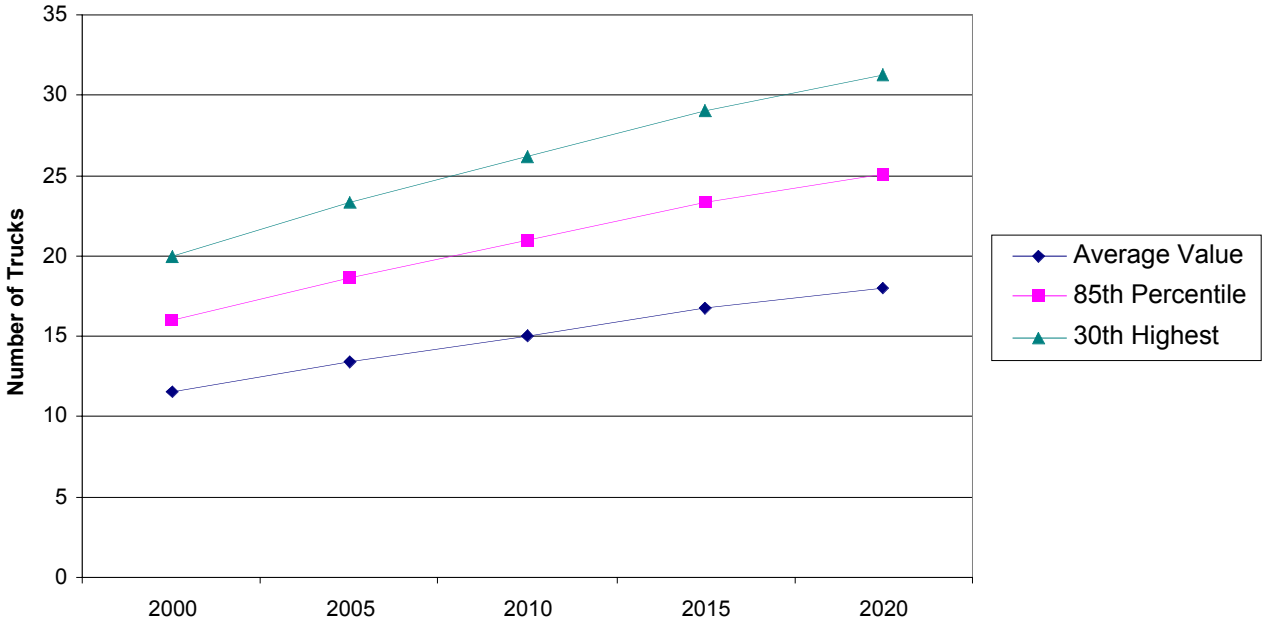
In addressing existing and forecast future capacity problems at the 15 high-use rest areas analyzed in this study, various measures may be used to determine the amount of rest area expansion necessary. In Table 8, three separate measures to calculate parking stalls necessary under any future design modifications are evaluated. These measures consist of average demand, demand at the 85th percentile and demand at the 30th highest occurrence. What can be seen is that, depending upon the measure chosen, the conclusion regarding the amount of parking stalls necessary to meet projected need changes.

TABLE 8
COMPARISON OF TRUCK COUNTS SUNDAY TO FRIDAY
(JULY 1998 - DECEMBER 2000)

Map Key Number	Safety Rest Area Name	Roadway	Number of Trucks Observed at 1-3 AM		
			Average	85th Percentile	30th Highest
1	Cass Lake	US 2	3	5	6
2	Albert Lea TIC (N.B.)	I-35	14	19	22
3	Straight River (S.B.)	I-35	11	15	19
4	Straight River (N.B.)	I-35	9	13	15
5	Heath Creek (N.B.)	I-35	14	19	23
6	New Market (S.B.)	I-35	11	16	18
7	Marion (W.B.)	I-90	28	37	40
8	Enterprise (E.B.)	I-90	12	16	20
9	Dresbach TIC (W.B.)	I-90/US 61	3	5	7
10	Lake Iverson (E.B.)	I-94	11	14	16
11	Hansel Lake (W.B.)	I-94	9	12	14
12	Lake Latoka (E.B.)	I-94	18	26	31
13	Burgen Lake (W.B.)	I-94	12	16	19
14	Elm Creek (E.B.)	I-94	15	21	24
15	St. Croix T.I.C. (W.B.)	I-94	30	40	46

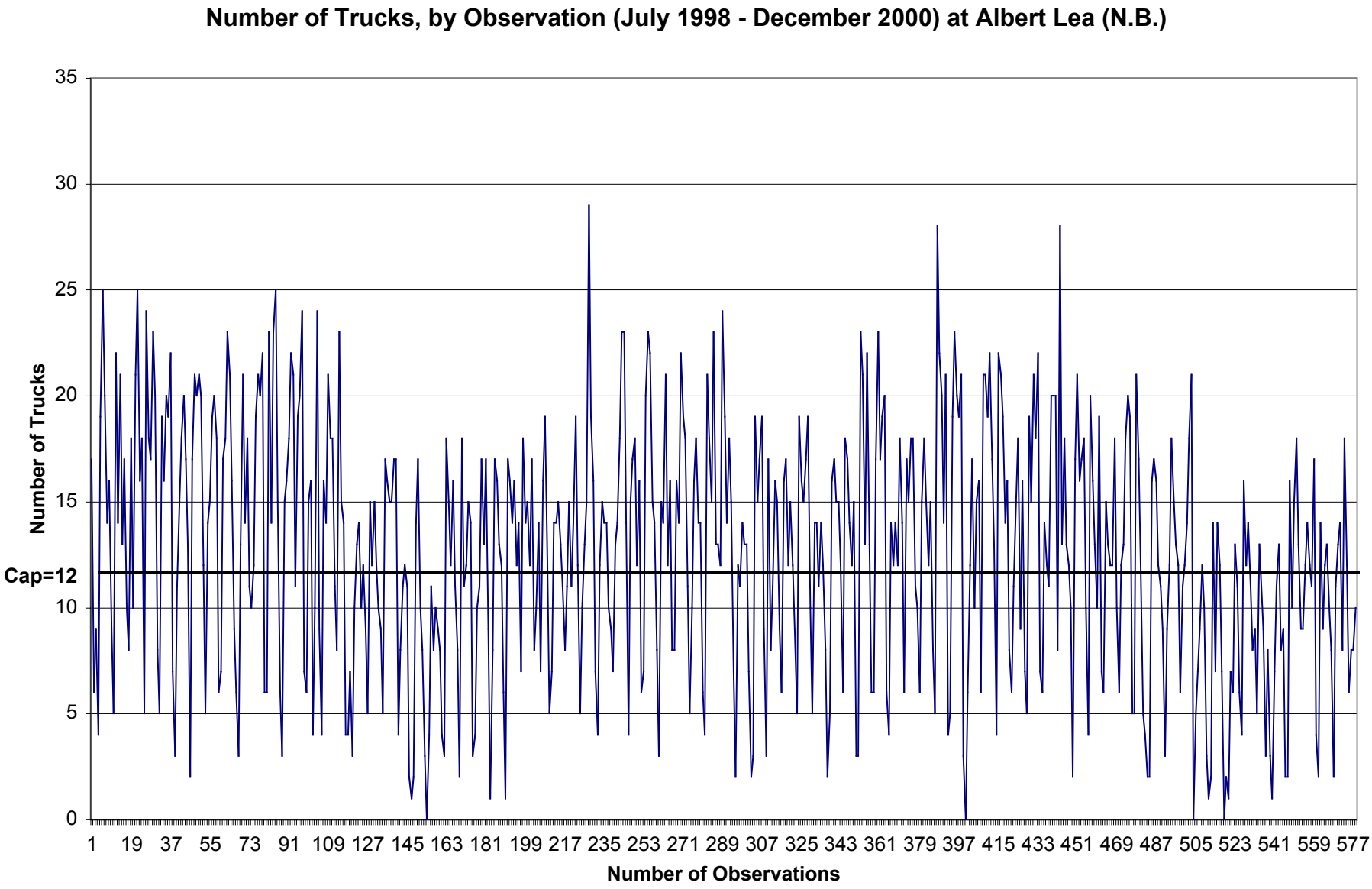
The impacts of the three various means of calculating parking stall shortage at one rest area (Enterprise, westbound) can be seen in Figure 12. This study does not recommend one method over another in terms of future design considerations for modifying these rest areas, but rather includes these separate measures to spur discussion regarding the impacts of choosing one methodology for future design over another.

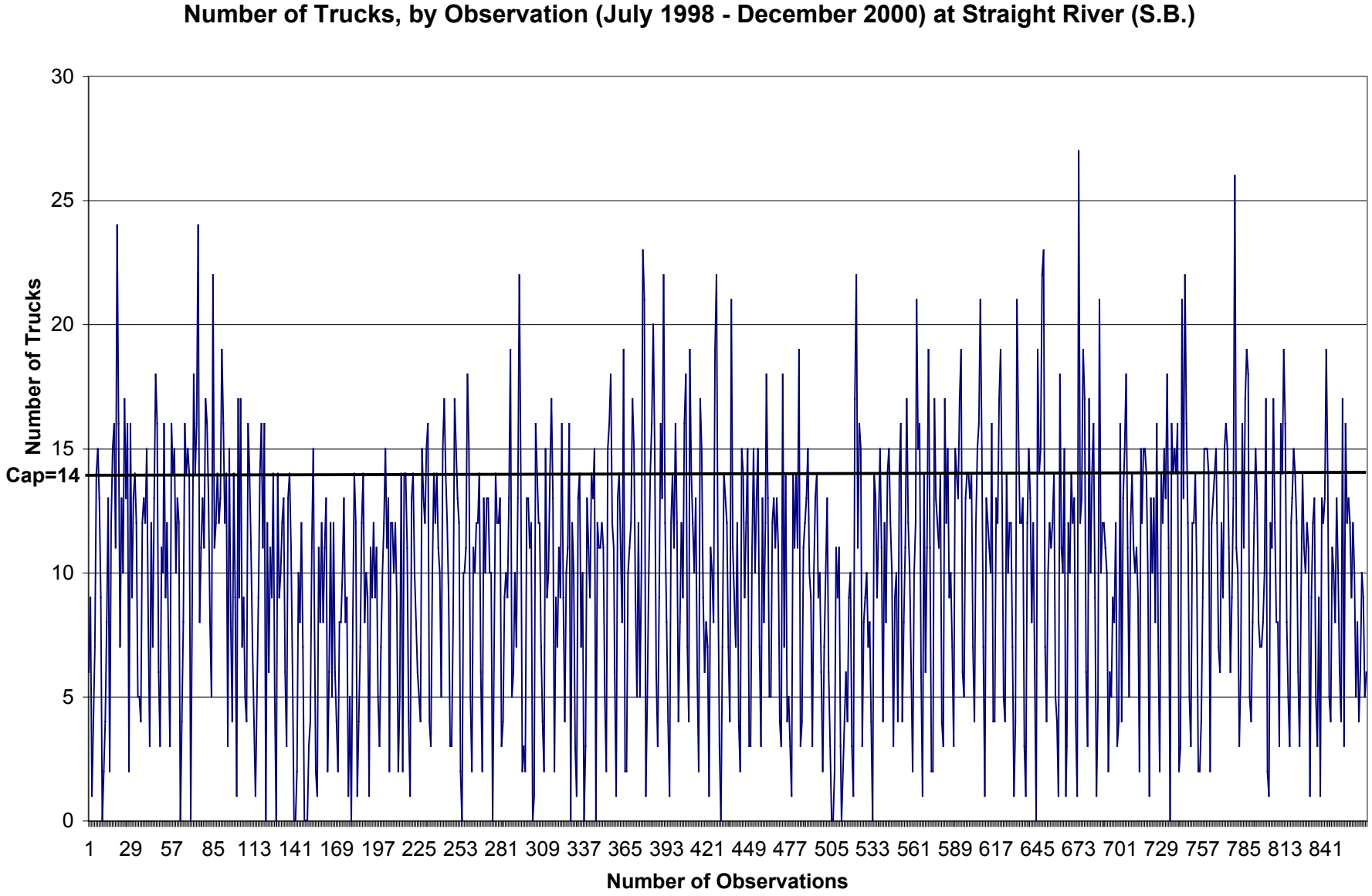
Figure 12 - Estimated Truck Parking Demand at "Enterprise (W.B.)

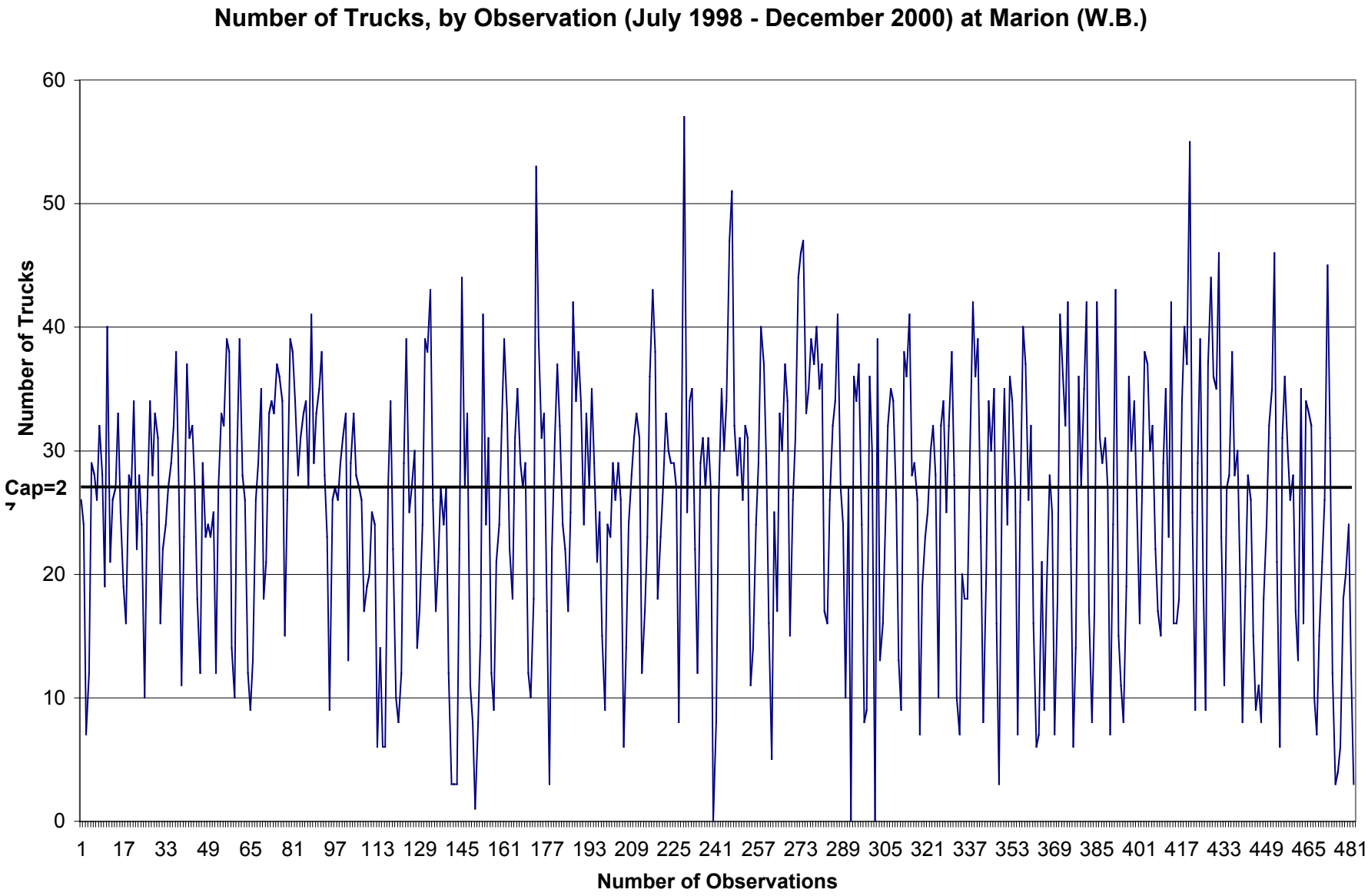


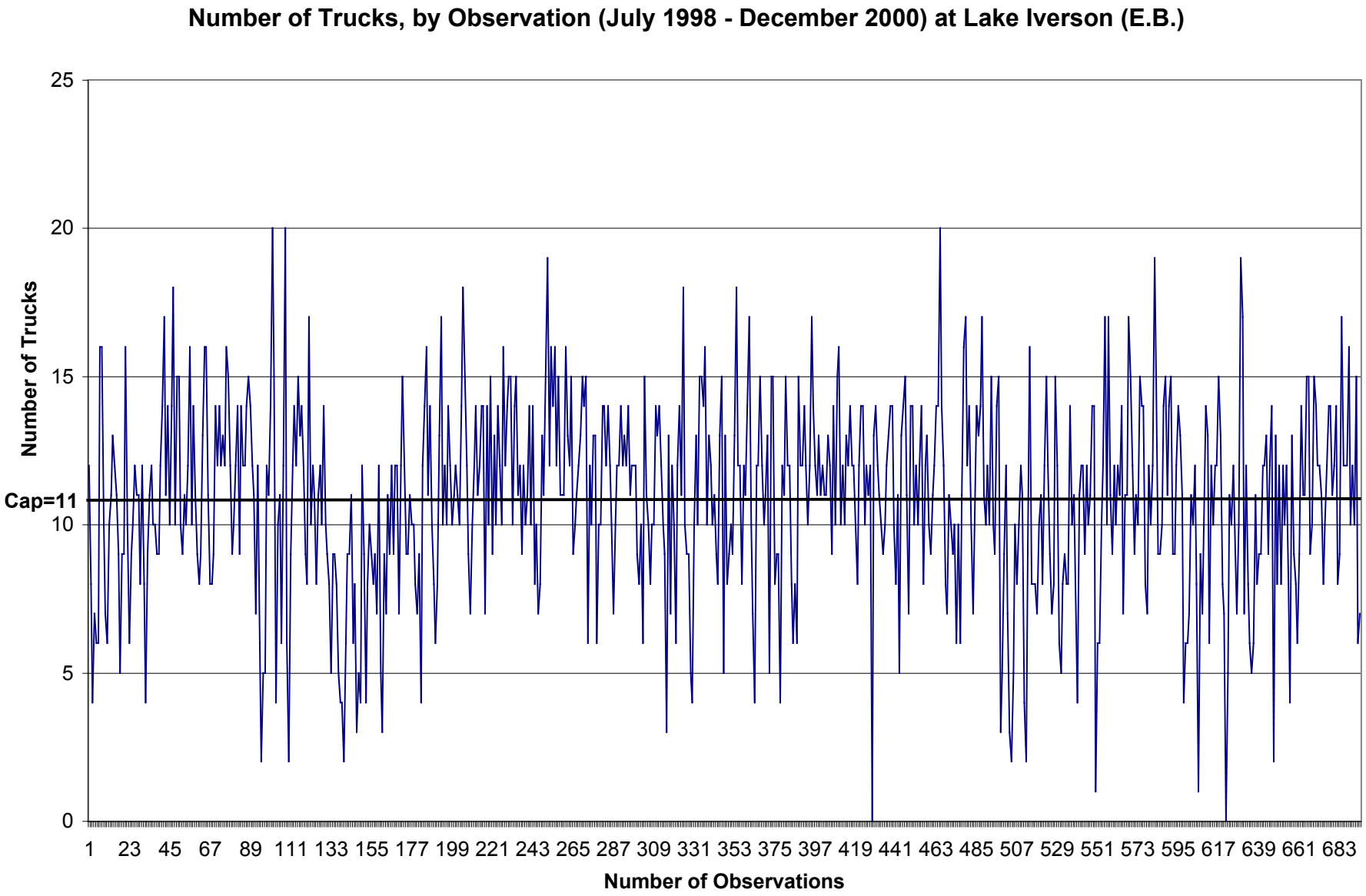
APPENDIX A

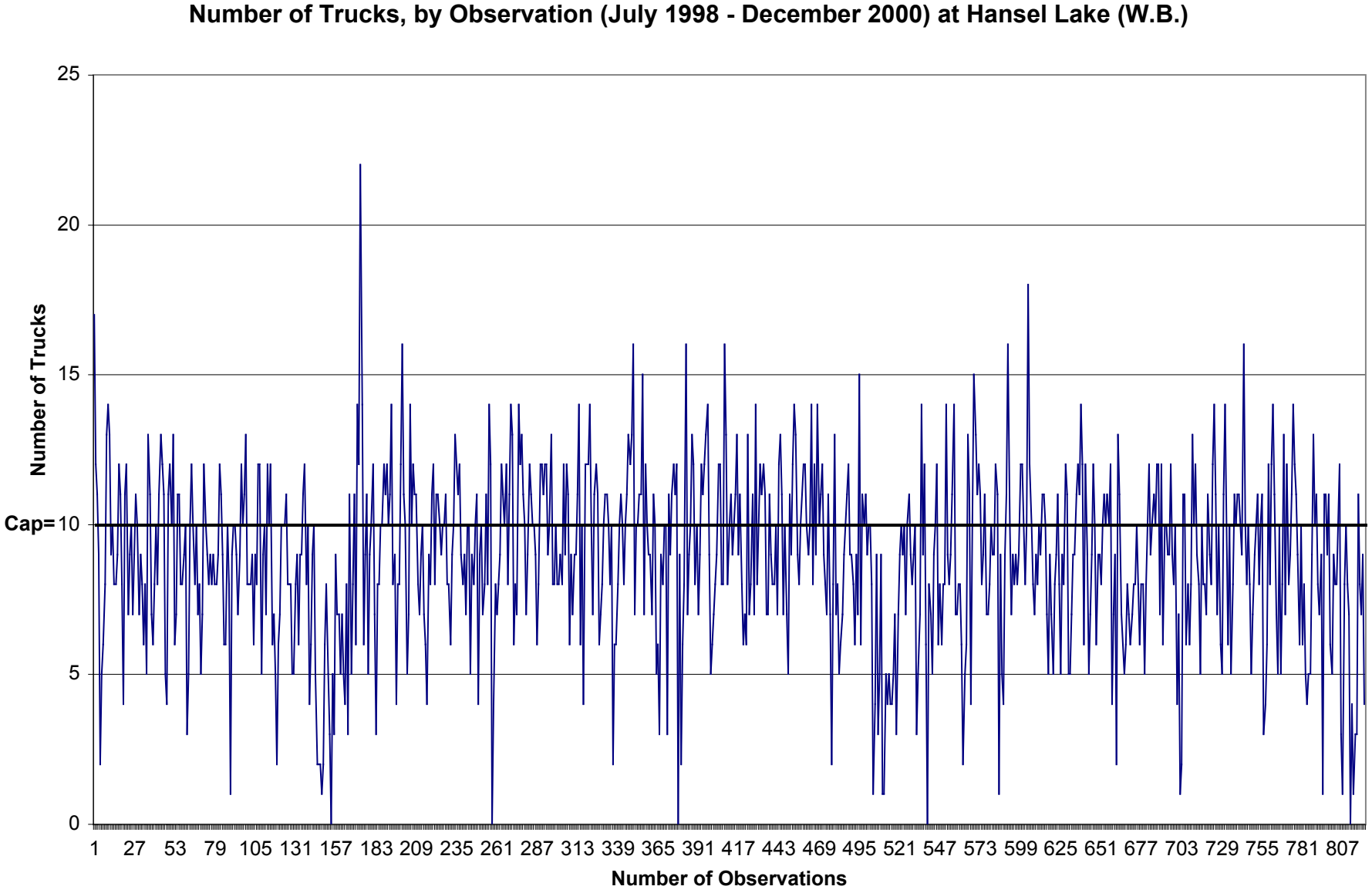
Observations by Rest Areas
(July 1998-December 2000)

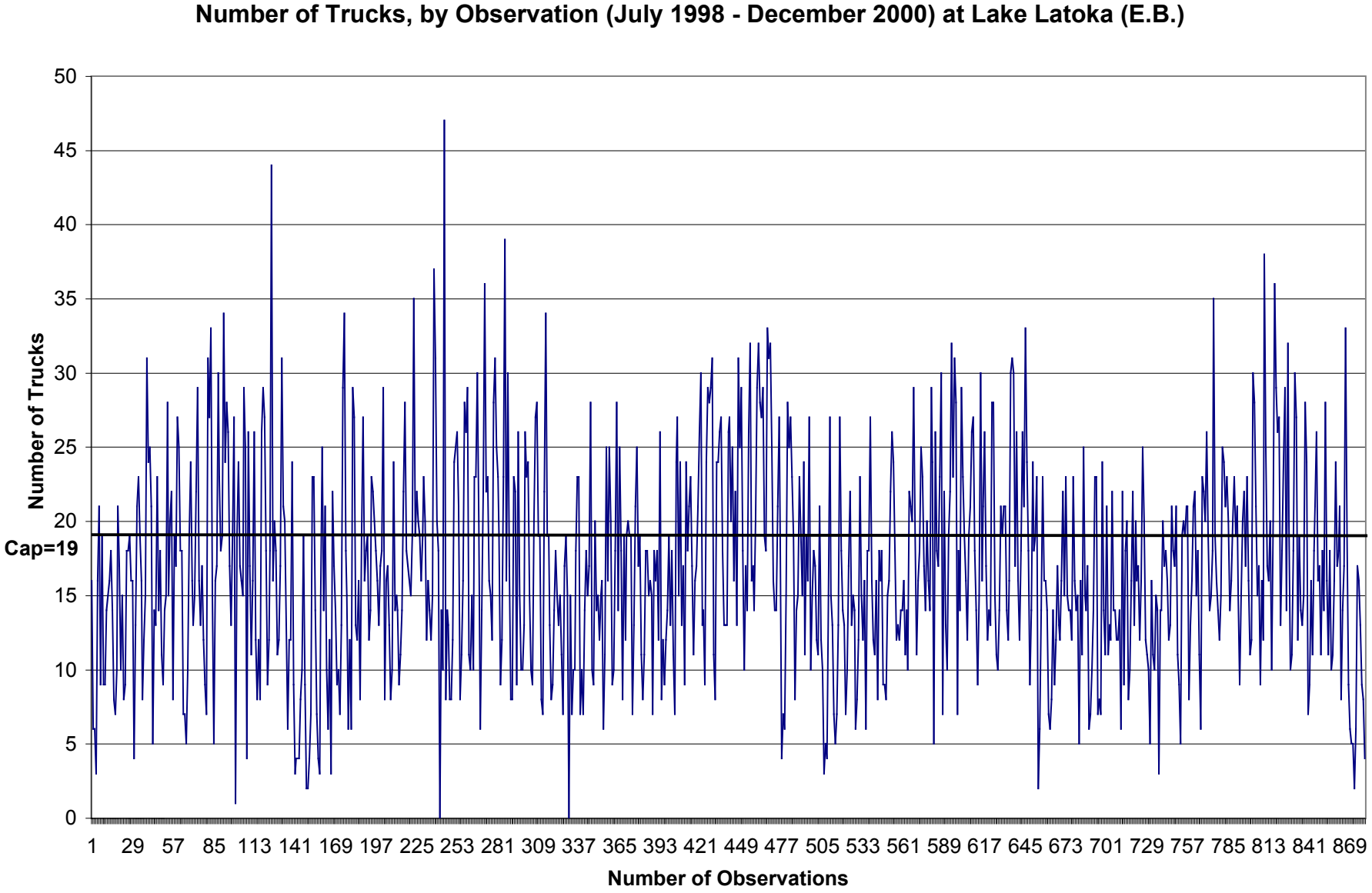

Number of Trucks, by Observation (July 1998 - December 2000) at Albert Lea (N.B.)
Number of Trucks
Cap=12
0
5
10
15
20
25
30
35
1 19 37 55 73 91 109 127 145 163 181 199 217 235 253 271 289 307 325 343 361 379 397 415 433 451 469 487 505 523 541 559 577
Number of Observations


Number of Trucks, by Observation (July 1998 - December 2000) at Straight River (S.B.)
Number of Trucks
Cap=14
0
5
10
15
20
25
30
1
29
57
85
113
141
169
197
225
253
281
309
337
365
393
421
449
477
505
533
561
589
617
645
673
701
729
757
785
813
841
Number of Observations


Number of Trucks, by Observation (July 1998 - December 2000) at Marion (W.B.)
Number of Trucks
Cap=2
0
10
20
30
40
50
60
1
17
33
49
65
81
97
113
129
145
161
177
193
209
225
241
257
273
289
305
321
337
353
369
385
401
417
433
449
465
481
Number of Observations


Number of Trucks, by Observation (July 1998 - December 2000) at Lake Iverson (E.B.)
Number of Trucks
Cap=11
0
5
10
15
20
25
1 23 45 67 89 111 133 155 177 199 221 243 265 287 309 331 353 375 397 419 441 463 485 507 529 551 573 595 617 639 661 683
Number of Observations


Number of Trucks, by Observation (July 1998 - December 2000) at Hansel Lake (W.B.)
Number of Trucks
Cap=
25
20
15
10
5
0
1 27 53 79 105 131 157 183 209 235 261 287 313 339 365 391 417 443 469 495 521 547 573 599 625 651 677 703 729 755 781 807
Number of Observations


Number of Trucks, by Observation (July 1998 - December 2000) at Lake Latoka (E.B.)
Number of Trucks
Cap=19
0
5
10
15
20
25
30
35
40
45
50
1
29
57
85
113
141
169
197
225
253
281
309
337
365
393
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477
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645
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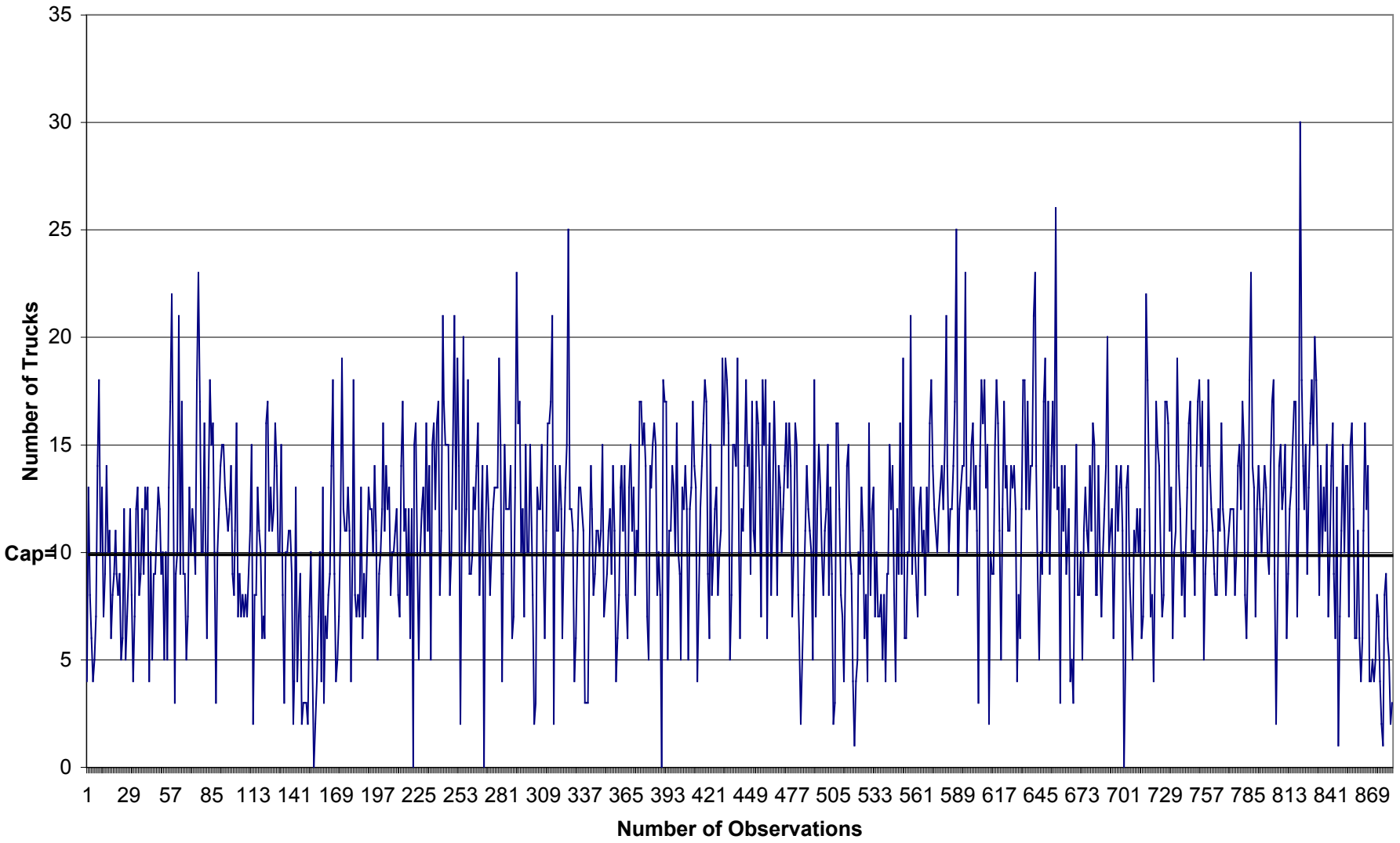
701
729
757
785
813
841
869
Number of Observations


Number of Trucks, by Observation (July 1998 - December 2000) at Burgen Lake (W.B.)
35
30
25
20
15
10
5
0
Number of Trucks
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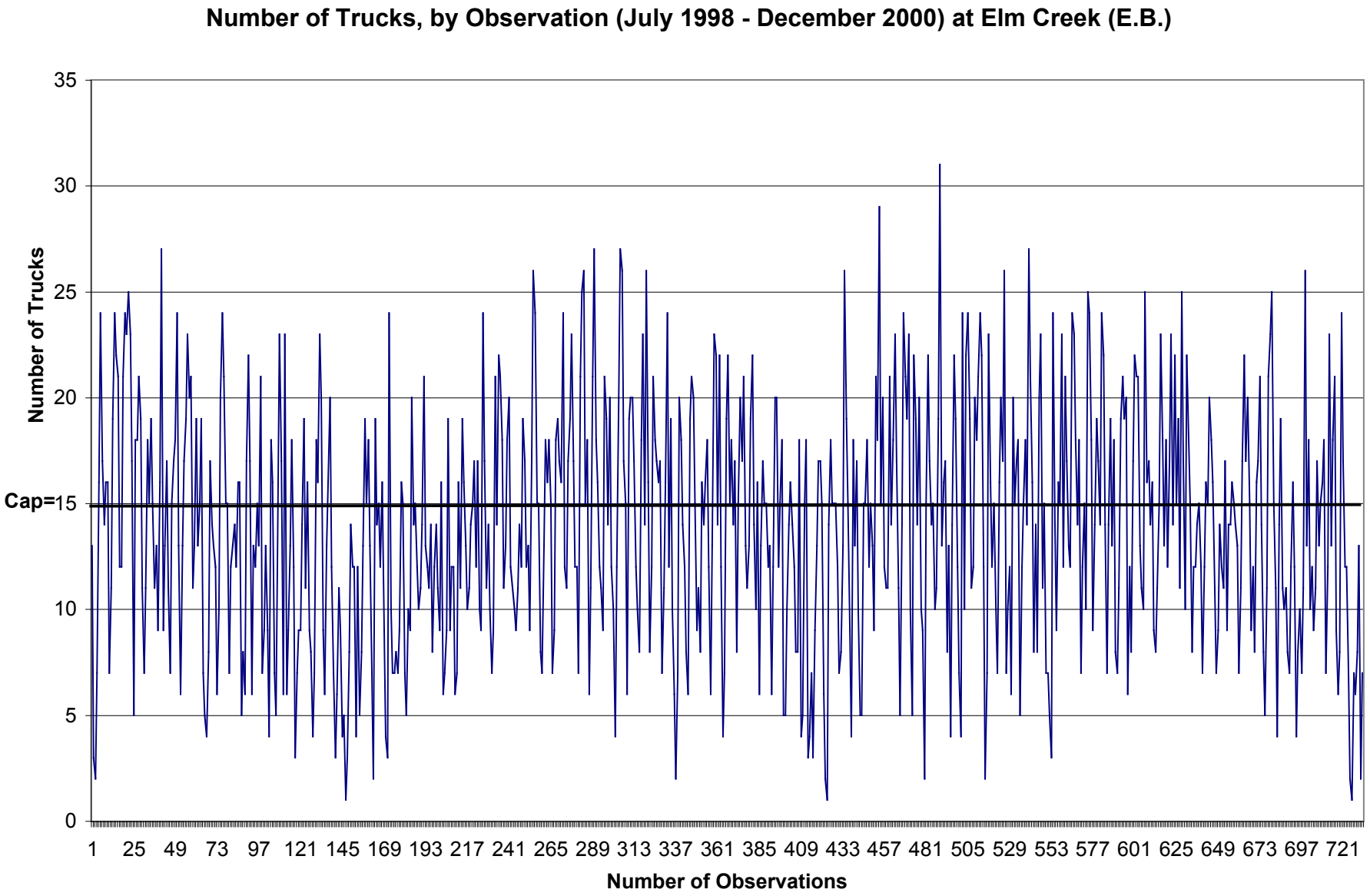
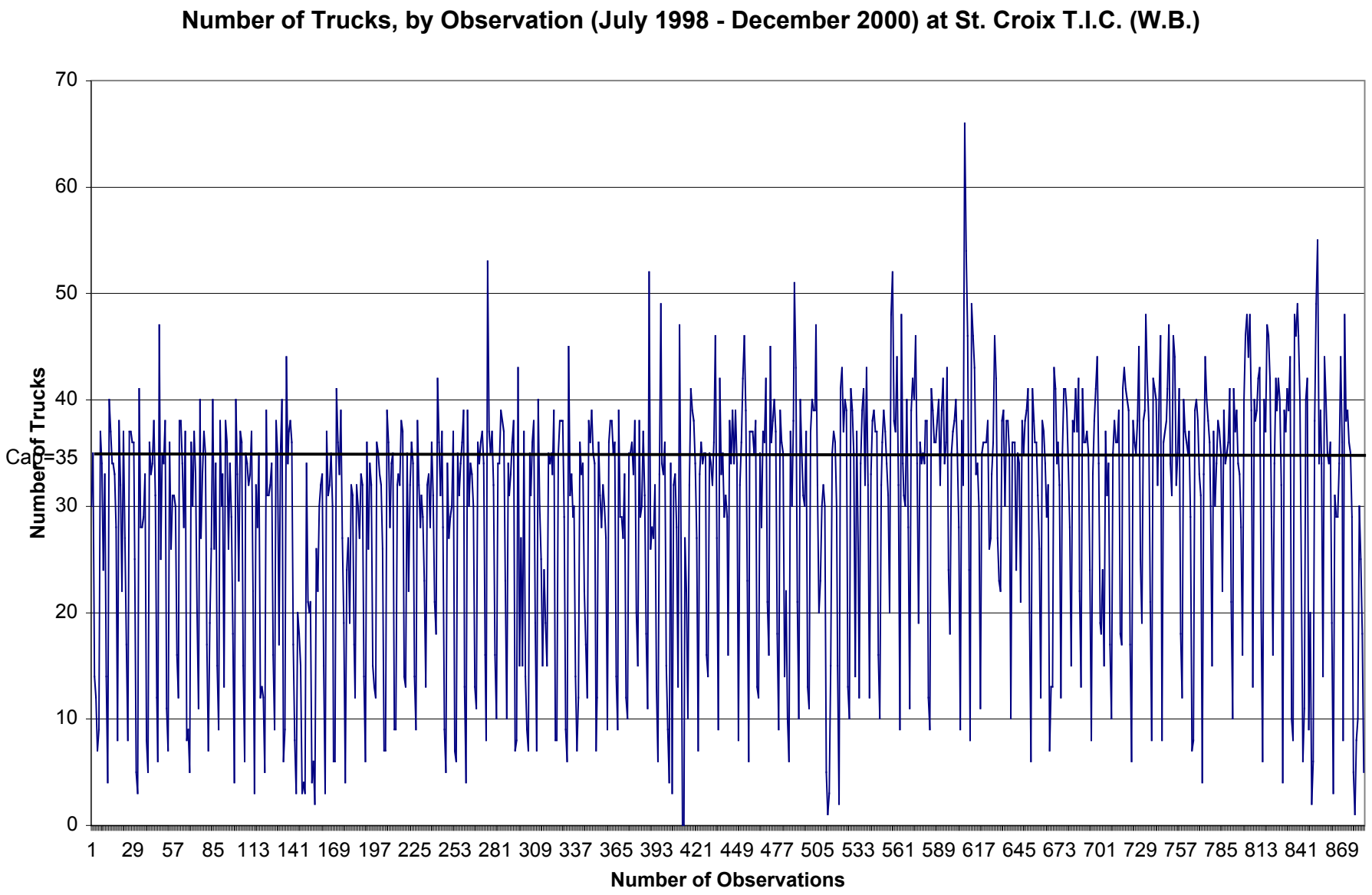
1 29 57 85 113 141 169 197 225 253 281 309 337 365 393 421 449 477 505 533 561 589 617 645 673 701 729 757 785 813 841 869
Number of Observations

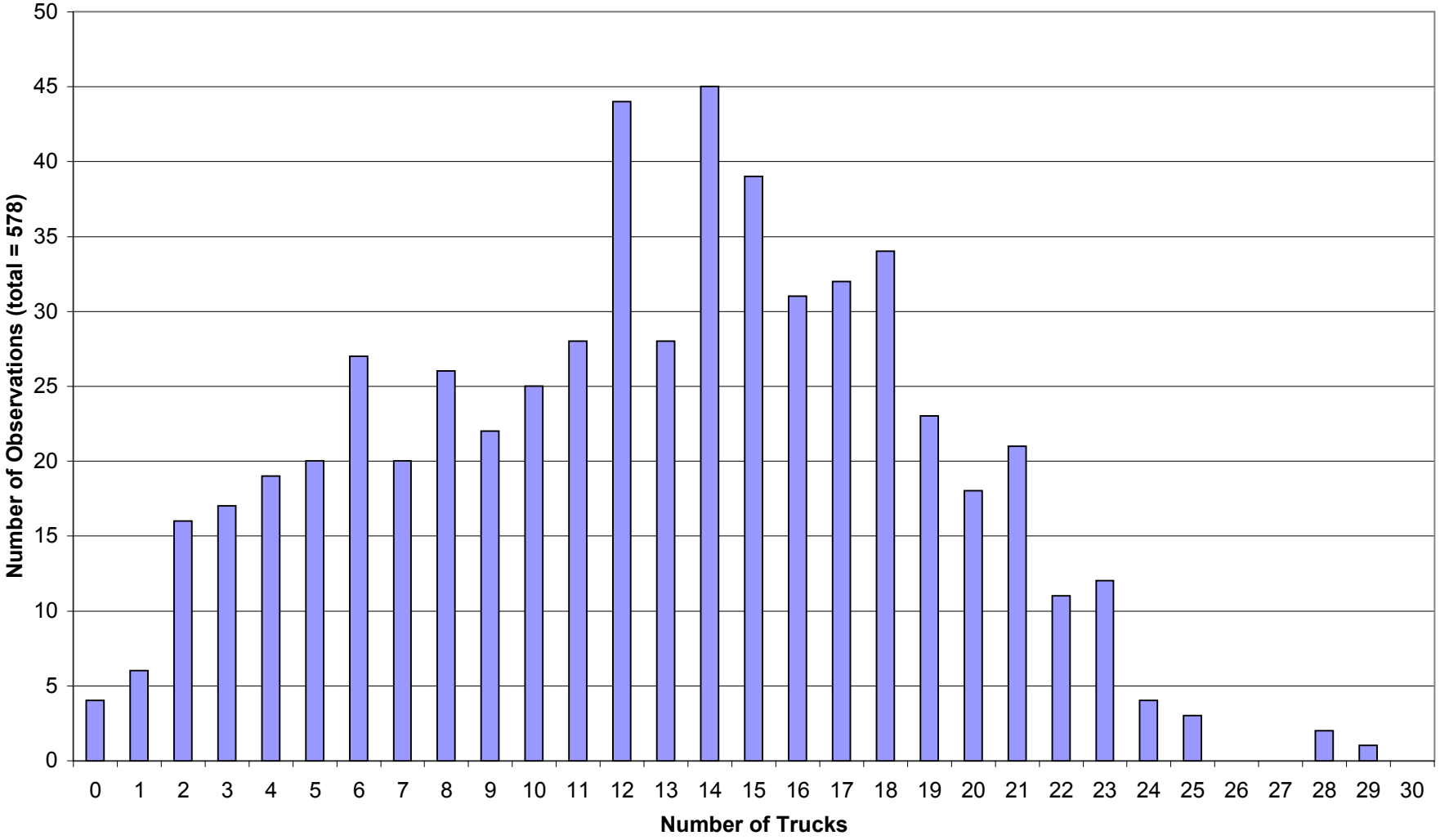

Number of Trucks, by Observation (July 1998 - December 2000) at Elm Creek (E.B.)
Number of Trucks
Cap=
0
5
10
15
20
25
30
35
1
25
49
73
97
121
145
169
193
217
241
265
289
313
337
361
385
409
433
457
481
505
529
553
577
601
625
649
673
697
721
Number of Observations


Number of Trucks, by Observation (July 1998 - December 2000) at St. Croix T.I.C. (W.B.)
70
60
50
40
Cap=35
30
20
10
0
Number of Trucks
1 29 57 85 113 141 169 197 225 253 281 309 337 365 393 421 449 477 505 533 561 589 617 645 673 701 729 757 785 813 841 869
Number of Observations

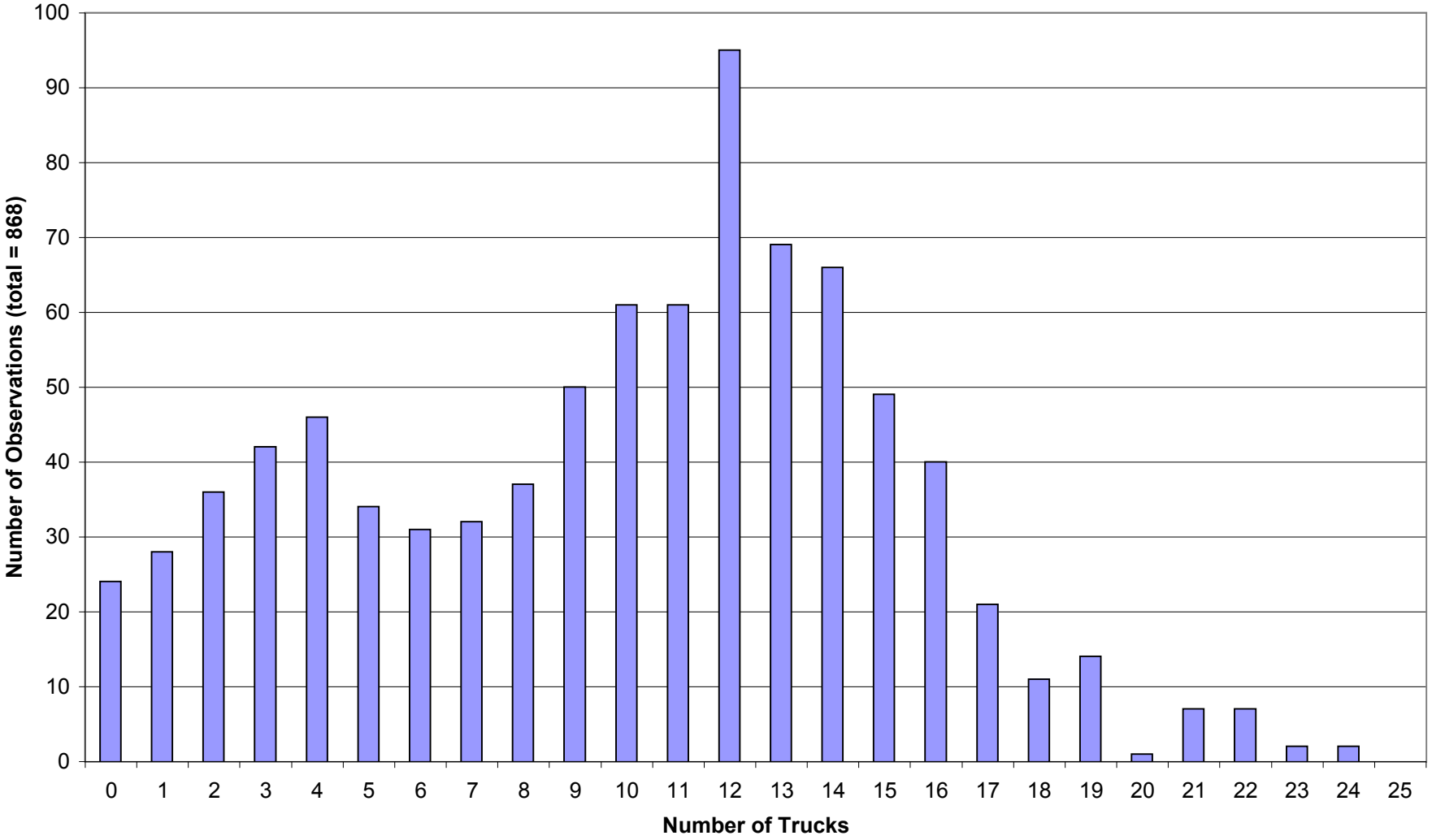
APPENDIX B

Frequency Distribution of Truck Observation By Sample Area

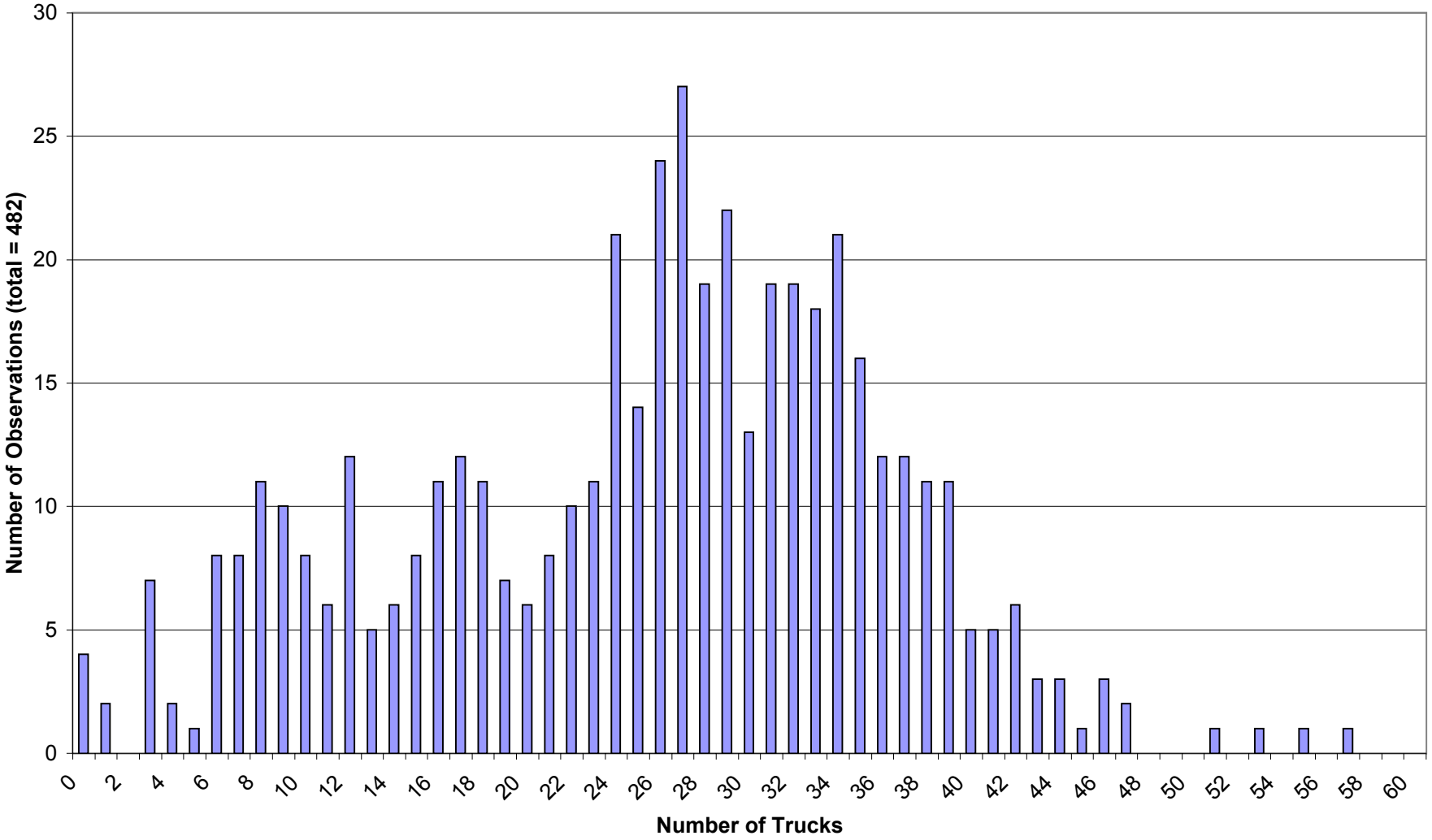
TRUCK PARKING DEMAND FREQUENCY DISTRIBUTION (JULY 1998 - DECEMBER 2000) AT ALBERT LEA TIC (N.B.)



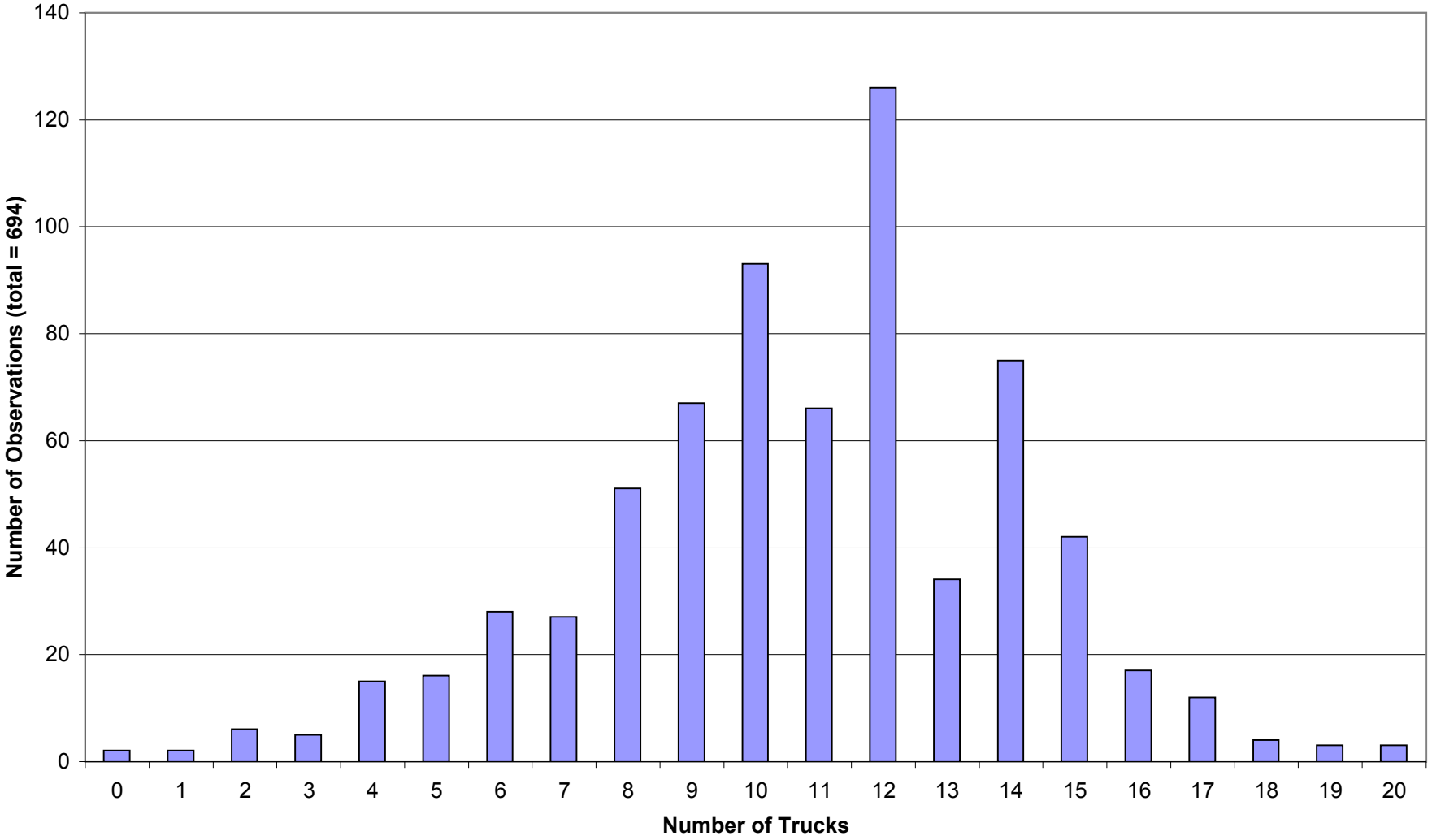
TRUCK PARKING DEMAND FREQUENCY DISTRIBUTION (JULY 1998 - DECEMBER 2000) AT STRAIGHT RIVER (S.B.)



TRUCK PARKING FREQUENCY DISTRIBUTION (JULY 1998 - DECEMBER 2000) AT MARION (W.B.)



TRUCK PARKING FREQUENCY DISTRIBUTION (JULY 1998 - DECEMBER 2000) AT LAKE IVERSON (E.B.)



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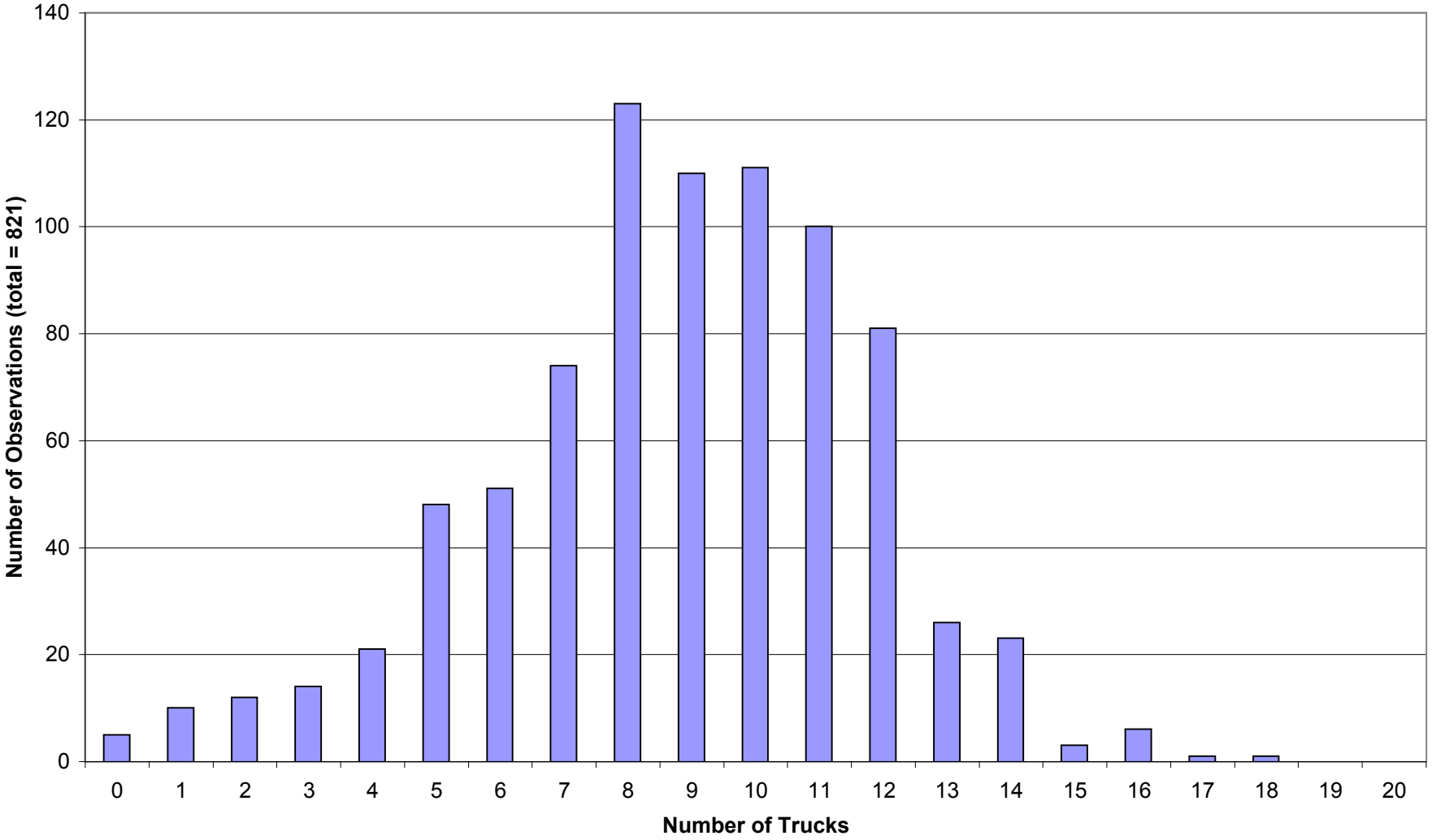

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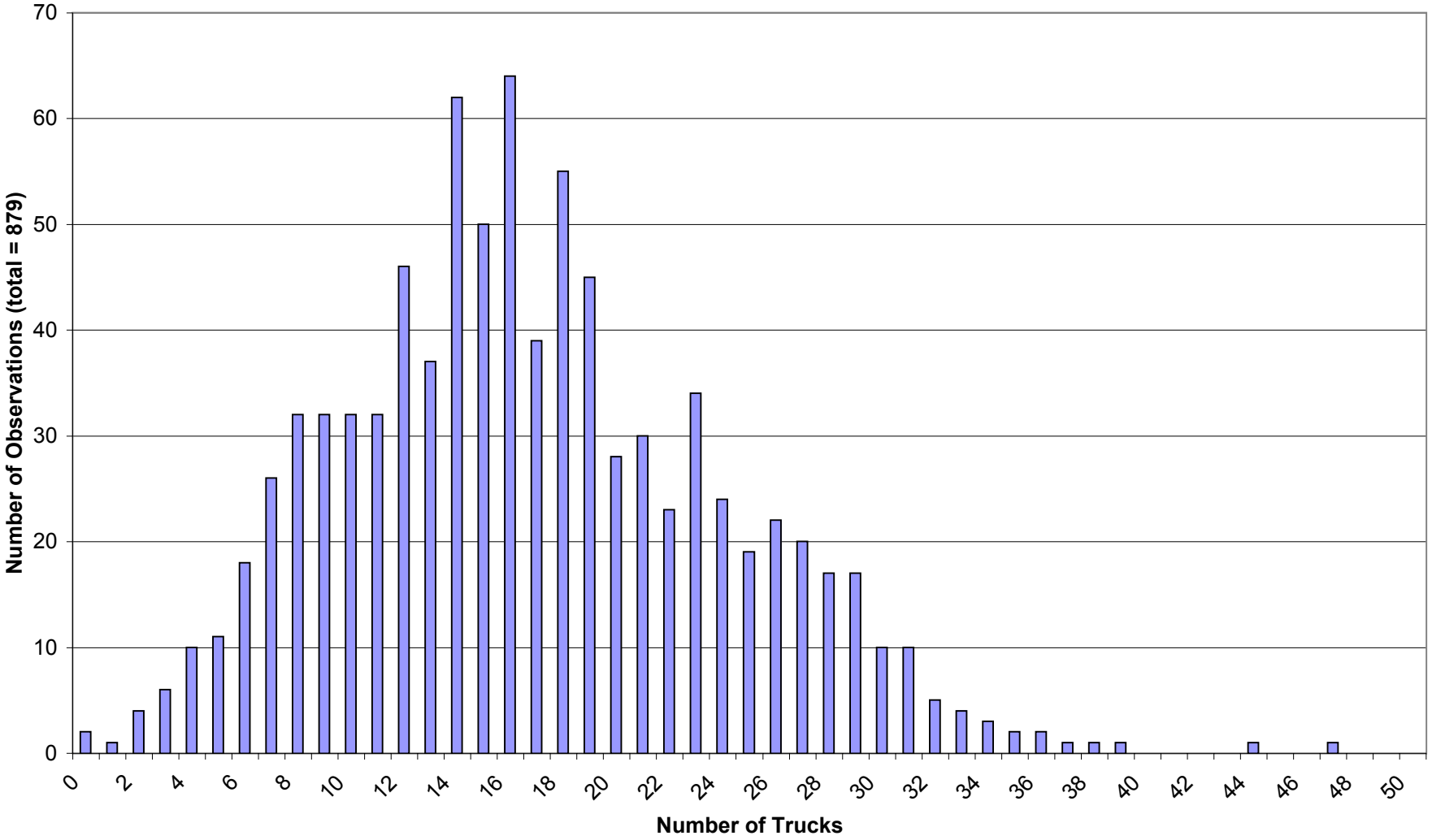

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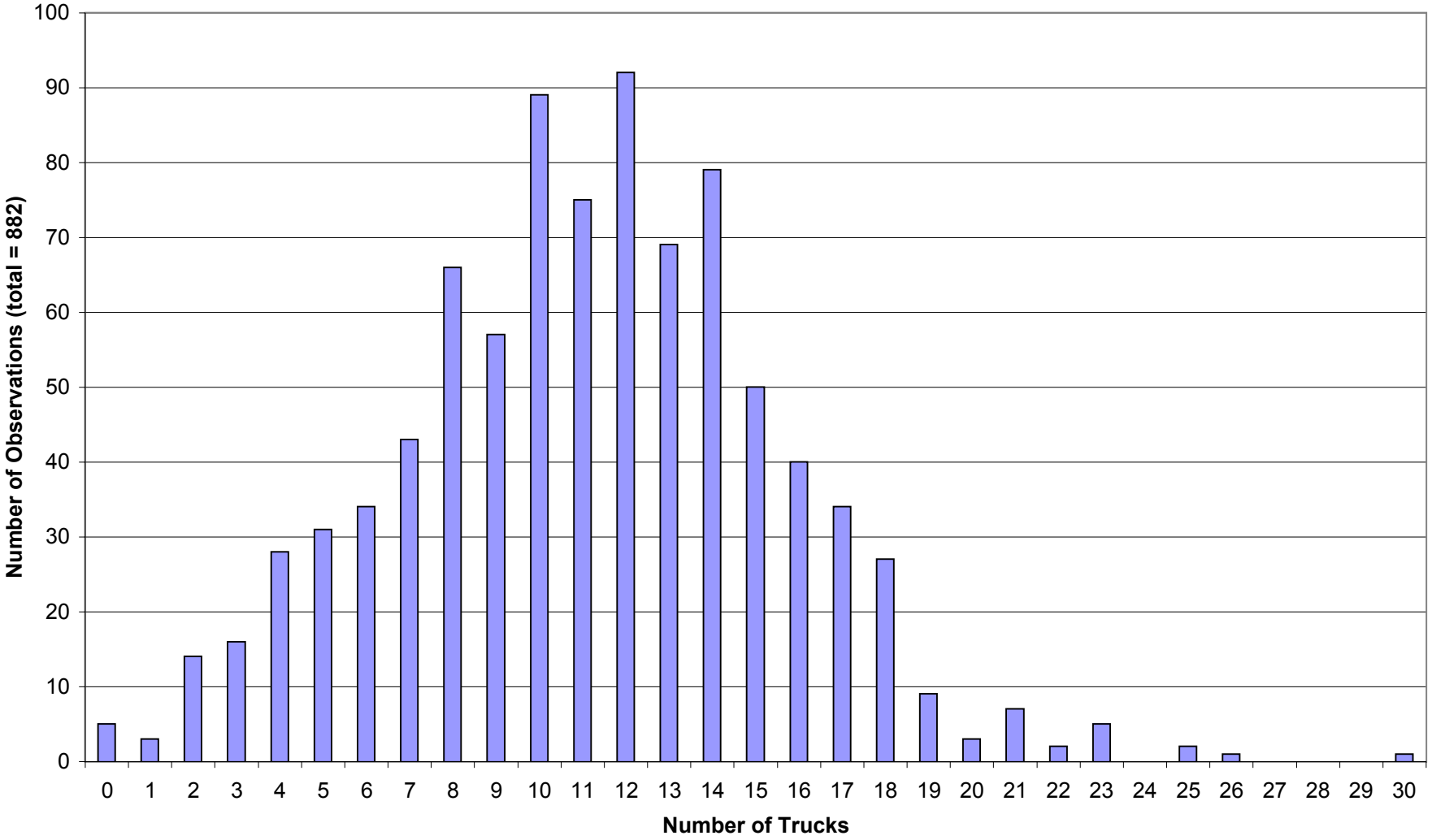

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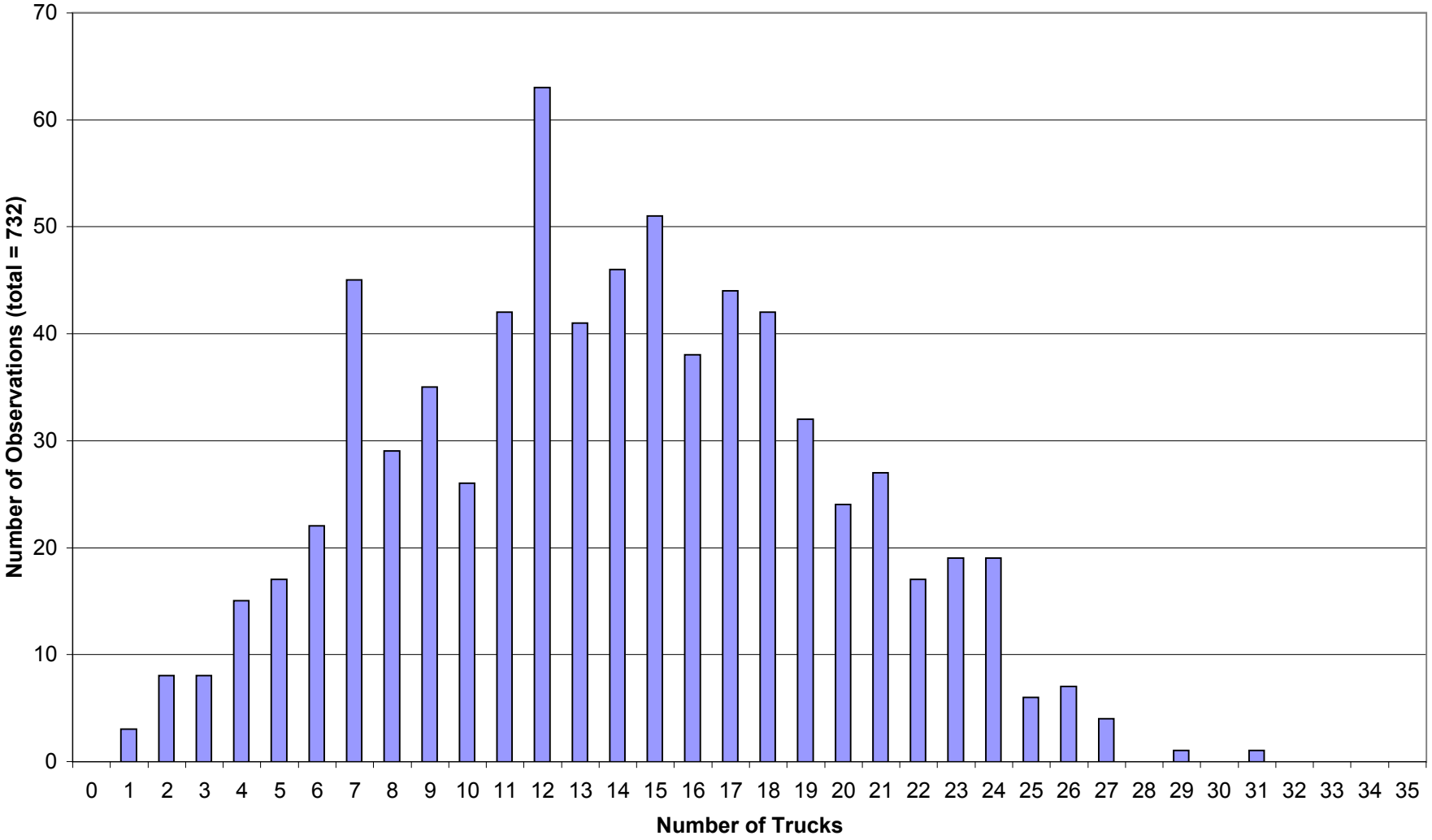

TRUCK PARKING FREQUENCY DISTRIBUTION (JULY 1998 - DECEMBER 2000) AT ST CROIX T.I.C. (W.B.)