Chapter 3
GRAND REGION SUMMARY
PERFORMANCE MEASURE DEFINITIONS

**Total Delay**

Delay is calculated by taking the difference between actual speeds when they fall below 60 mph and the posted speed limit for freeways posted at 70 mph. This is to take out the delay caused by the lower average speeds from commercial vehicles.

**Total Delay per Mile**

Delay per mile is calculated by taking the total delay and dividing it by the length of the freeway. This was performed for each route in each TSC.

**Non-Recurring/Recurring Delay**

Non-recurring delay is calculated by taking the difference between the actual speed (any time the speed falls below 60 mph) and the average speed. Recurring is measured by taking the difference of the total delay and non-recurring delay.

**User Delay Cost**

User Delay Costs (UDC) is calculated by multiplying delay x hourly volume x hourly user cost. Delay is calculated by taking the difference between actual speeds when they fall below 60 mph and the posted speed limit. Hourly volumes are derived from Average Daily Traffic (ADT) and Commercial Average Daily Traffic (CADT). Hourly user costs are based on Federal Highway Administration (FHWA) publication number FHWA-SA-98-079, “Life-Cycle Cost Analysis in Pavement Design.”

**Congestion**

Congestion is calculated as the number of hours below 45 mph per Traffic Message Channel (TMC). A TMC is a standard for delivering real-time traffic information. They vary from tenths of a mile long to several miles long.

**Weighted Congestion**

Number of congestion hours multiplied by the segment length. Congestion along longer segments will get more consideration than congestion along shorter segments.
Figure 1

2013 Grand Region User Delay Cost per Mile

UDC per Mile
- < $25,000
- $25,000 - $50,000
- $50,000 - $100,000
- > $100,000
Figure 2

2013 Grand Region Congestion Hours Northbound/Eastbound

Congestion Hours
- < 50
- 50 - 100
- 100 - 150
- > 150
Figure 3

2013 Grand Region Congestion Hours
Southbound/Westbound

Congestion Hours
- Green: < 50
- Yellow: 50 - 100
- Orange: 100 - 150
- Red: > 150
Figure 4

Grand Rapids TSC I-96 Corridor
User Delay Cost

Total UDC
2012: $6,607,225
2013: $8,314,869

2012 UDC:
$6,607,225

2013 UDC:
$8,314,869
Figure 5

Grand Rapids TSC I-96 Eastbound
Average Weekday AM Peak Speed

Grand Rapids TSC I-96 Eastbound
Average Weekday PM Peak Speed
Figure 6

Grand Rapids TSC I-96 Westbound
Average Weekday AM Peak Speed

Grand Rapids TSC I-96 Westbound
Average Weekday PM Peak Speed
Figure 7
Figure 8

Grand Rapids TSC I-96 Corridor - Westbound
2012 Congestion

Grand Rapids TSC I-96 Corridor - Westbound
2013 Congestion
Figure 9
Figure 10

Grand Rapids TSC I-196 Eastbound
Average Weekday AM Peak Speed

Grand Rapids TSC I-196 Eastbound
Average Weekday PM Peak Speed
Figure 11

Grand Rapids TSC I-196 Westbound
Average Weekday AM Peak Speed

Grand Rapids TSC I-196 Westbound
Average Weekday PM Peak Speed
Figure 12

Grand Rapids TSC I-196 Corridor - Eastbound
2012 Congestion

Grand Rapids TSC I-196 Corridor - Eastbound
2013 Congestion
Figure 14

Grand Rapids TSC M-6 Corridor User Delay Cost

2012 User Delay Cost
- Recurring: 44%
- Non Recurring: 56%
2012 UDC: $2,856,880

2013 User Delay Cost
- Recurring: 34%
- Non Recurring: 66%
2013 UDC: $3,341,115

Total UDC:
2012: $2,856,880
2013: $3,341,115
Figure 15

Grand Rapids TSC M-6 Eastbound
Average Weekday AM Peak Speed

Grand Rapids TSC M-6 Eastbound
Average Weekday PM Peak Speed
Figure 16

Grand Rapids TSC M-6 Westbound
Average Weekday AM Peak Speed

Average Speed (mph)

L-386 Interchange
8TH AVE SW/517
WILSON AVE SW/517
FARMACEUTICAL AVE SW/517
US-131 Interchange
US-131/517
517/515 Interchange
1-196 Interchange

2012
2013

Grand Rapids TSC M-6 Westbound
Average Weekday PM Peak Speed

Average Speed (mph)

L-386 Interchange
8TH AVE SW/517
WILSON AVE SW/517
FARMACEUTICAL AVE SW/517
US-131 Interchange
US-131/517
517/515 Interchange
1-196 Interchange

2012
2013
Figure 17

Grand Rapids TSC M-6 Corridor - Eastbound
2012 Congestion

Grand Rapids TSC M-6 Corridor - Eastbound
2013 Congestion
Figure 19

Grand Rapids TSC US-131 Corridor
User Delay Cost

2012 User Delay Cost:
- Recurring: $18,277,380
- Non-Recurring: $1,279,787

Total UDC:
2012: $23,438,456

2013 User Delay Cost:
- Recurring: $7,550,101
- Non-Recurring: $23,463,178

Total UDC:
2013: $22,982,724
Figure 20

Grand Rapids TSC US-131 Northbound
Average Weekday AM Peak Speed

Grand Rapids TSC US-131 Northbound
Average Weekday PM Peak Speed
Figure 21

Grand Rapids TSC US-131 Southbound
Average Weekday AM Peak Speed

Grand Rapids TSC US-131 Southbound
Average Weekday PM Peak Speed
Figure 22

Grand Rapids TSC US-131 Corridor - Northbound
Summer Friday Peak Speed

- Peak Hour
  - 2012: 17:00
  - 2013: 16:00
  - Ave: 17:00

Grand Rapids TSC US-131 Corridor - Southbound
Summer Sunday Peak Speed

- Peak Hour
  - 2012: 18:00
  - 2013: 22:00
  - Ave: 21:00
Figure 23

Grand Rapids TSC US-131 Corridor - Northbound
2012 Congestion

Figure 23

Grand Rapids TSC US-131 Corridor - Northbound
2013 Congestion
Figure 24

Grand Rapids TSC US-131 Corridor - Southbound
2012 Congestion

Grand Rapids TSC US-131 Corridor - Southbound
2013 Congestion
Figure 25

Muskegon TSC I-96 Corridor
User Delay Cost

2012 User Delay Cost

- Recurring
- Non Recurring

2012 UDC: $2,024,285

2013 User Delay Cost

- Recurring
- Non Recurring

2013 UDC: $3,452,488

Total UDC:

2012: $2,024,285
2013: $3,452,488
Figure 26

Muskegon TSC I-96 Eastbound
Average Weekday AM Peak Speed

Muskegon TSC I-96 Eastbound
Average Weekday PM Peak Speed
Figure 27

Muskegon TSC I-96 Westbound
Average Weekday AM Peak Speed

Muskegon TSC I-96 Westbound
Average Weekday PM Peak Speed
Figure 28

Muskegon TSC I-96 Corridor - Eastbound
2012 Congestion

Muskegon TSC I-96 Corridor - Eastbound
2013 Congestion
Figure 30

Muskegon TSC I-196 Corridor
User Delay Cost

Total UDC
2012: $1,922,477
2013: $2,938,607

Muskegon TSC I-196 Corridor
2012 User Delay Cost

Recurring  Non Recurring
Truck $97,182
Car $410,613
Truck $209,530
Car $1,145,152

2012 UDC: $1,922,477

Muskegon TSC I-196 Corridor
2013 User Delay Cost

Recurring  Non Recurring
Truck $137,937
Car $631,285
Truck $419,189
Car $1,770,196

2013 UDC: $2,938,607
Figure 31

Muskegon TSC I-196 Eastbound
Average Weekday AM Peak Speed

Muskegon TSC I-196 Eastbound
Average Weekday PM Peak Speed
Figure 32

Muskegon TSC I-196 Westbound
Average Weekday AM Peak Speed

Muskegon TSC I-196 Westbound
Average Weekday PM Peak Speed
Figure 33

Muskegon TSC I-196 Corridor - Eastbound
2012 Congestion

Muskegon TSC I-196 Corridor - Eastbound
2013 Congestion
Figure 34

Muskegon TSC I-196 Corridor - Westbound
2012 Congestion

Muskegon TSC I-196 Corridor - Westbound
2013 Congestion
Figure 35

Muskegon TSC US-31 Corridor
2012 User Delay Cost

- Recurring: $2,979,620
- Non-Recurring: $224,946
- Truck: $170,099

2012 UDC: $5,980,676

Muskegon TSC US-31 Corridor
2013 User Delay Cost

- Recurring: $3,539,123
- Non-Recurring: $287,577
- Truck: $202,137
- Car: $3,069,093

2013 UDC: $7,067,930
Figure 36

Muskegon TSC US-31 Northbound
Average Weekday AM Peak Speed

Muskegon TSC US-31 Northbound
Average Weekday PM Peak Speed
Figure 37

Muskegon TSC US-31 Southbound
Average Weekday AM Peak Speed

Muskegon TSC US-31 Southbound
Average Weekday PM Peak Speed
Figure 39

Muskegon TSC US-31 Corridor - Southbound
2012 Congestion

Muskegon TSC US-31 Corridor - Southbound
2013 Congestion
Providing the highest quality integrated transportation services for economic benefit and improved quality of life.