

## Appendix C

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To: Steve Hoff, HDR City of Rapid City, South Dakota Department of Transportation	
From: Courtney Sokol, HDR Mike Forsberg, HDR	Project: Sheridan Lake Road- Jackson Boulevard to Deadwood Avenue
CC: Jody Page, HDR	
Date: December 13, 2007	Job No: 54618

RE: Traffic Volume Revisions to Sheridan Lake Road Projections

Traffic volume projections for this study were originally presented in the Technical Memorandum dated June 29, 2007, titled *Sheridan Lake Road Traffic Volume Forecasts and Operational Analysis*. Following the City of Rapid City Growth Management review of the 2030 volumes, HDR revised the TransCAD travel demand model assumptions, ADT forecasts, peak hour forecasts and peak hour intersection analysis based on updated land use and roadway cross section assumptions. The scenarios for which these changes were made are:

- 2030 Off-Peak Season No-Build Sheridan Lake Road (June 29 Memorandum Figure 10)
- 2030 Off-Peak Season Sheridan Lake Road Extension to Chicago Street (June 29 Memorandum Figure 11)
- 2030 Off-Peak Season Sheridan Lake Road Extension to Deadwood Avenue (June 29 Memorandum Figure 12)
- 2030 Peak Season No-Build Sheridan Lake Road (June 29 Memorandum Figure 13)
- 2030 Peak Season Sheridan Lake Road Extension to Chicago Street (June 29 Memorandum Figure 14)
- 2030 Peak Season Sheridan Lake Road Extension to Deadwood Avenue (June 29 Memorandum Figure 15)

#### *Land Use Assumption Changes*

During review of the projections presented in the June 29 Memorandum, HDR identified traffic analysis zones (TAZs) with decreasing trends in generated trips, when comparing the year 2000 TransCAD model to the year 2025 model. TAZs with fewer trips in the future (2025) year over the base (2000) year resulted in traffic volume projection trends that were not anticipated.

Revisions to the land use data were made by Growth Management to show expected land use trends. Growth Management supplied HDR with a revised trip table to be input into a year 2025 travel demand model. This revised trip table includes adjusted socioeconomic data for TAZs 1, 102, and 103, which are located in the vicinity of Mountain View Road and Main Street.

#### *Roadway Cross Section Assumption Changes*

The original 2025 TransCAD model from Growth Management had Mountain View Road and Jackson Boulevard as 6 or 7-lane road sections, and Sheridan Lake Road varying with a 2 or 4-lane cross section. As a result, the demand model allocated more traffic to Mountain View Road and Jackson Boulevard than to the Sheridan Lake Road extension.

In the revised 2025 demand models:

- Sheridan Lake Road has been changed to a 4-lane cross section from Jackson Boulevard to the north
- Jackson Boulevard has been changed to a 5-lane cross section from Mountain View Road to Main Street

- Mountain View Road has been changed to a 5-lane cross section from Jackson Boulevard to Omaha Street
- Omaha Street has been changed to a 6-lane cross section from Deadwood Avenue to 12<sup>th</sup> Street (previously 5 lanes from Deadwood Avenue to Mountain View Road)

### *Results and Comments*

The future year 2025 TransCAD travel demand model was revised with the land use and roadway cross section input assumptions as described above. The raw model assignment volumes were adjusted based on year 2000 ground counts to provide adjusted 2030 average daily traffic volumes (ADTs). The adjusted ADTs and existing counts were then used to develop new 2030 AM and PM peak hour turning movement volumes. The Synchro intersection operations analysis was also revised with updated peak hour volumes. The adjusted 2030 ADTs, AM and PM peak hour volumes and intersection peak hour operations are shown in Figures 1 through 6.

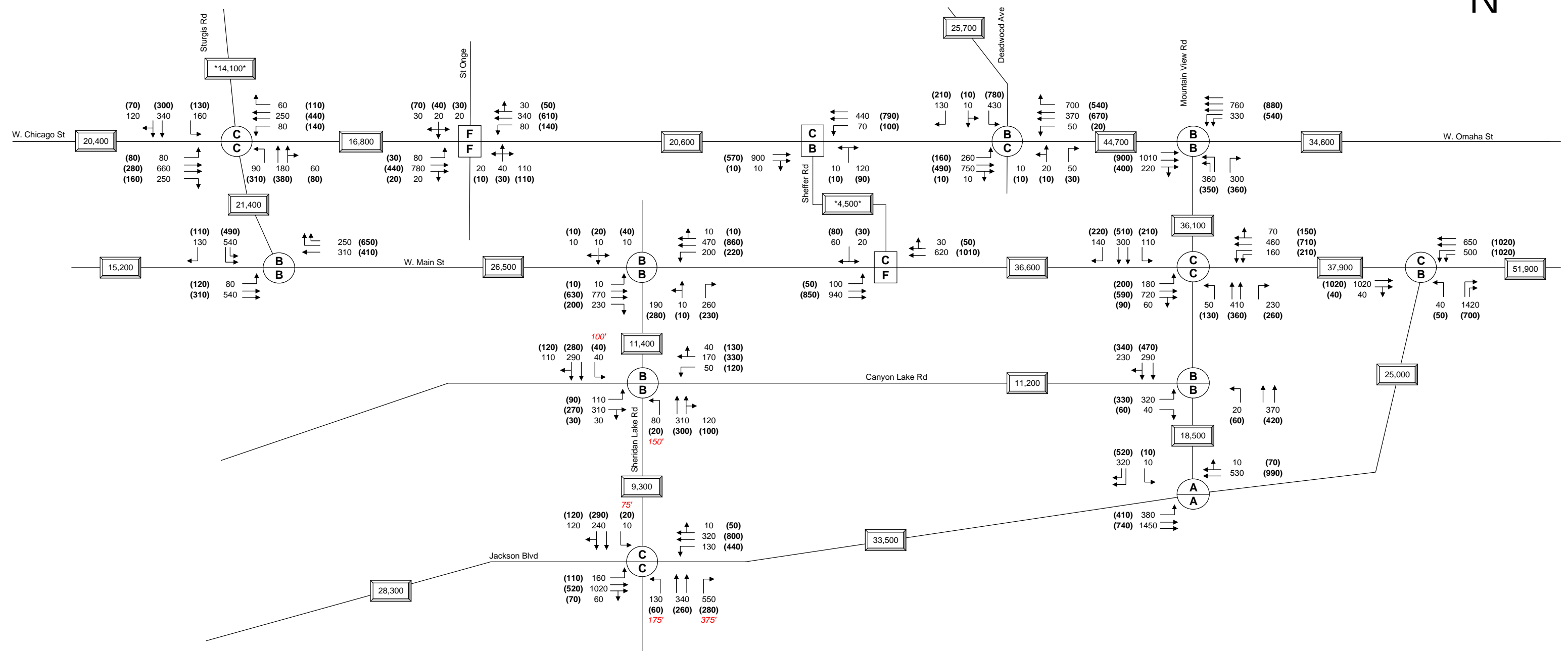
The daily volumes show that an extension of Sheridan Lake Road from Main Street to Deadwood Avenue results in increased traffic on Sheridan Lake Road and Omaha Street compared to the No-Build scenario. Volumes are shown to decrease along Main Street, Mountain View Road and Deadwood Avenue with an extension to Deadwood Avenue.

The future operational analysis is based on signal timings that are similar to existing conditions. The peak hour volumes show acceptable operations at all signalized intersections during the Off-Peak Season for all conditions of the Sheridan Lake Road extension. During the Peak Season, the following signalized intersections become deficient (Level of Service (LOS) D or worse):









- W Main Street/Jackson Boulevard (No-Build – AM Peak Hour) – LOS E
- Jackson Boulevard/Sheridan Lake Road (No-Build – PM Peak Hour) – LOS D
- Canyon Lake Road/Sheridan Lake Road (Extension to Deadwood – PM Peak Hour) – LOS D
- Jackson Boulevard/Sheridan Lake Road (Extension to Deadwood – PM Peak Hour) – LOS D

Operations along Mountain View Road are generally better than those shown in the June 29 Memorandum based on a decrease in traffic and slight modifications to the signalized intersection timings on Mountain View Road. The worst case stop controlled approach at the intersection of W Chicago Street/St Onge operates at LOS F for the AM and PM peak hours of all conditions. There are also several of the conditions where there are deficiencies at the stop controlled approaches of Sheffer Road with W Chicago Street and W Main Street. Extending Sheridan Lake Road to Deadwood Avenue eliminates these deficiencies.

Additional information on the signal timing assumptions can be found in the technical notes attachment, titled “Sheridan Lake Signalized Intersection Timing Assumptions”.



**LEGEND**

-  AM Signalized Intersection Level of Service
-  PM Signalized Intersection Level of Service
-  AM Unsignalized Intersection Worst Case Stop Controlled Approach Level of Service
-  PM Unsignalized Intersection Worst Case Stop Controlled Approach Level of Service
-  2030 ADT (Adjusted Volume)
-  2030 ADT (Raw Model Volume)
-  2030 AM Peak Hour Volume
-  2030 PM Peak Hour Volume
-  Existing Geometrics
-  Recommended Storage

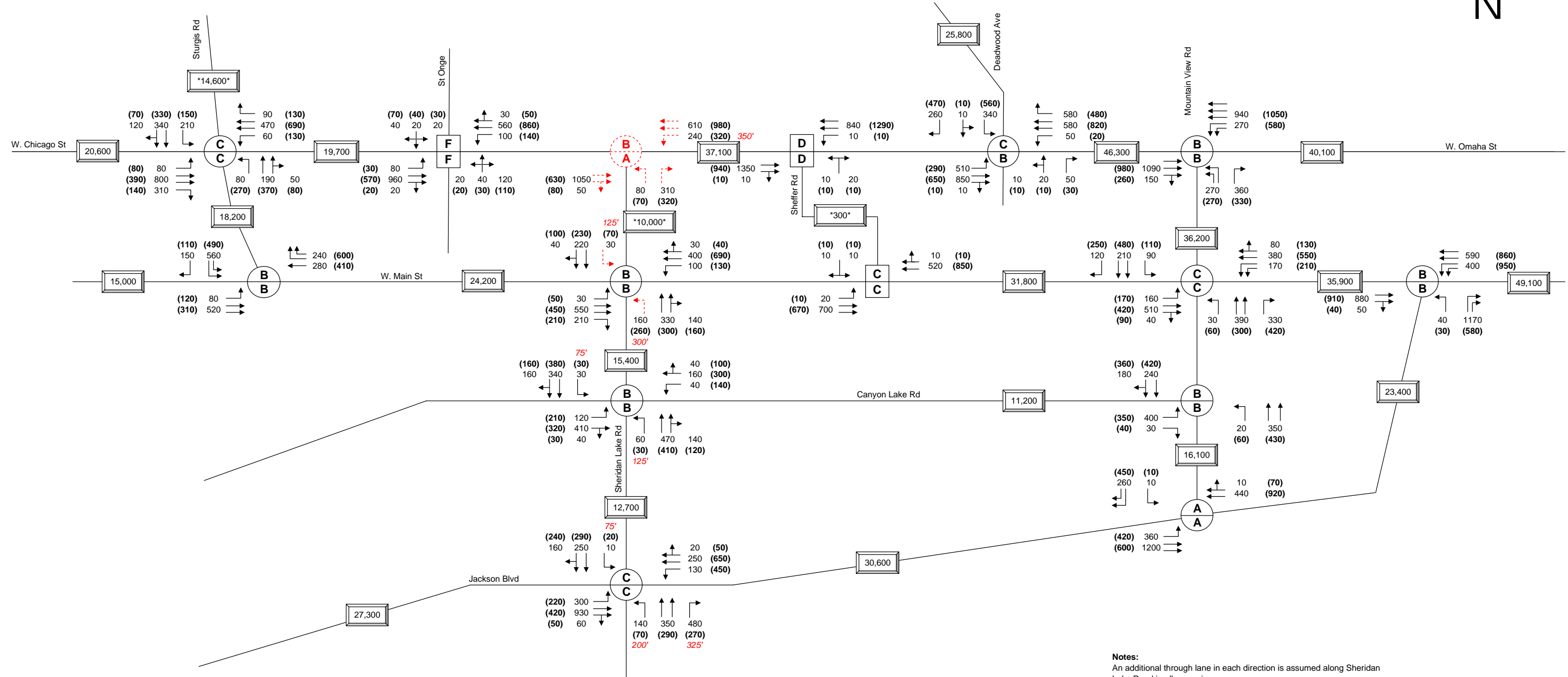
**Notes:**  
 An additional through lane in each direction is assumed along Sheridan Lake Road in all scenarios.  
 Existing turn lane storage was not considered when developing recommended storage lengths.

**Sources:**  
 1. 2006 Seasonal Factors, SDDOT, February 2007















**2030 Balanced Off-Peak Season Peak Hour Volumes, Intersection Geometrics and Intersection Levels of Service - No-Build**  
 Sheridan Lake Road, Rapid City SD

Date  
 Dec 2007  
 Figure  
 1



**LEGEND**

-  AM Signalized Intersection Level of Service
-  PM Signalized Intersection Level of Service
-  AM Unsignalized Intersection Worst Case Stop Controlled Approach Level of Service
-  PM Unsignalized Intersection Worst Case Stop Controlled Approach Level of Service
-  2030 ADT (Adjusted Volume)
-  2030 ADT (Raw Model Volume)
-  2030 AM Peak Hour Volume
-  2030 PM Peak Hour Volume
-  Existing Geometrics
-  Recommended Storage
-  Recommended Geometric Improvements
-  Recommended Signalized Intersection

**Notes:**  
 An additional through lane in each direction is assumed along Sheridan Lake Road in all scenarios.  
 Geometric improvements are shown at the intersection of W. Main St/Sheridan Lake Rd based on the extension of Sheridan Lake Rd to W. Chicago St.  
 Existing turn lane storage was not considered when developing recommended storage lengths.

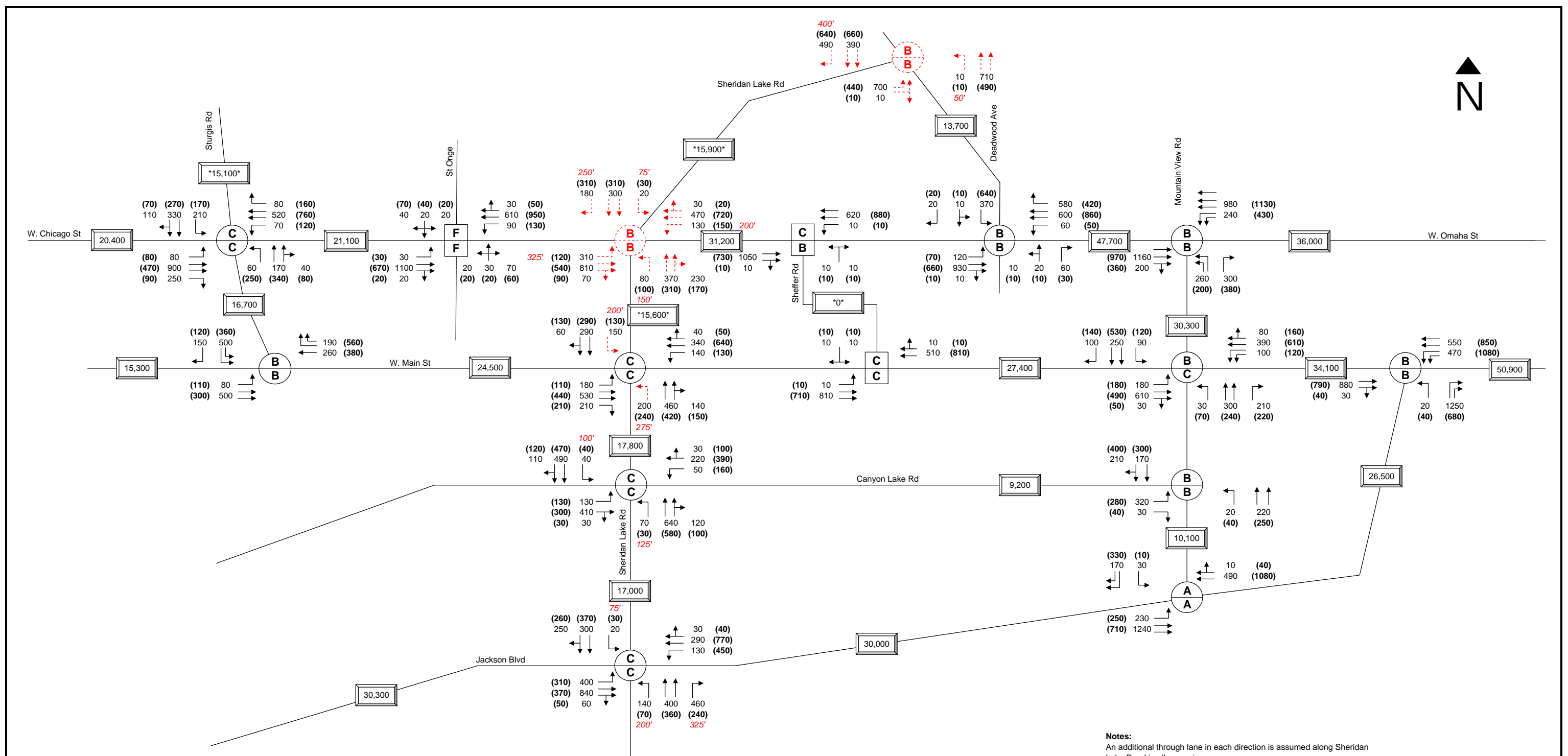
**Sources:**  
 1. 2006 Seasonal Factors, SDDOT, February 2007



**2030 Balanced Off-Peak Season Peak Hour Volumes, Intersection Geometrics and Intersection Levels of Service - Extension to W. Chicago Street**

Sheridan Lake Road, Rapid City SD

Date	Dec 2007
Figure	2



**LEGEND**

- AM Signalized Intersection Level of Service
- PM Signalized Intersection Level of Service
- AM Unsignalized Intersection Worst Case Stop Controlled Approach Level of Service
- PM Unsignalized Intersection Worst Case Stop Controlled Approach Level of Service
- 2030 ADT (Adjusted Volume)
- 2030 ADT (Raw Model Volume)
- XXX 2030 AM Peak Hour Volume
- (XXX) 2030 PM Peak Hour Volume
- Existing Geometrics
- XXX' Recommended Storage
- Recommended Geometric Improvements
- Recommended Signalized Intersection

**Notes:**  
 An additional through lane in each direction is assumed along Sheridan Lake Road in all scenarios.  
 Geometric improvements are shown at the intersection of W. Main St/Sheridan Lake Rd based on the extension of Sheridan Lake Rd to Deadwood Ave.  
 Existing turn lane storage was not considered when developing recommended storage lengths.

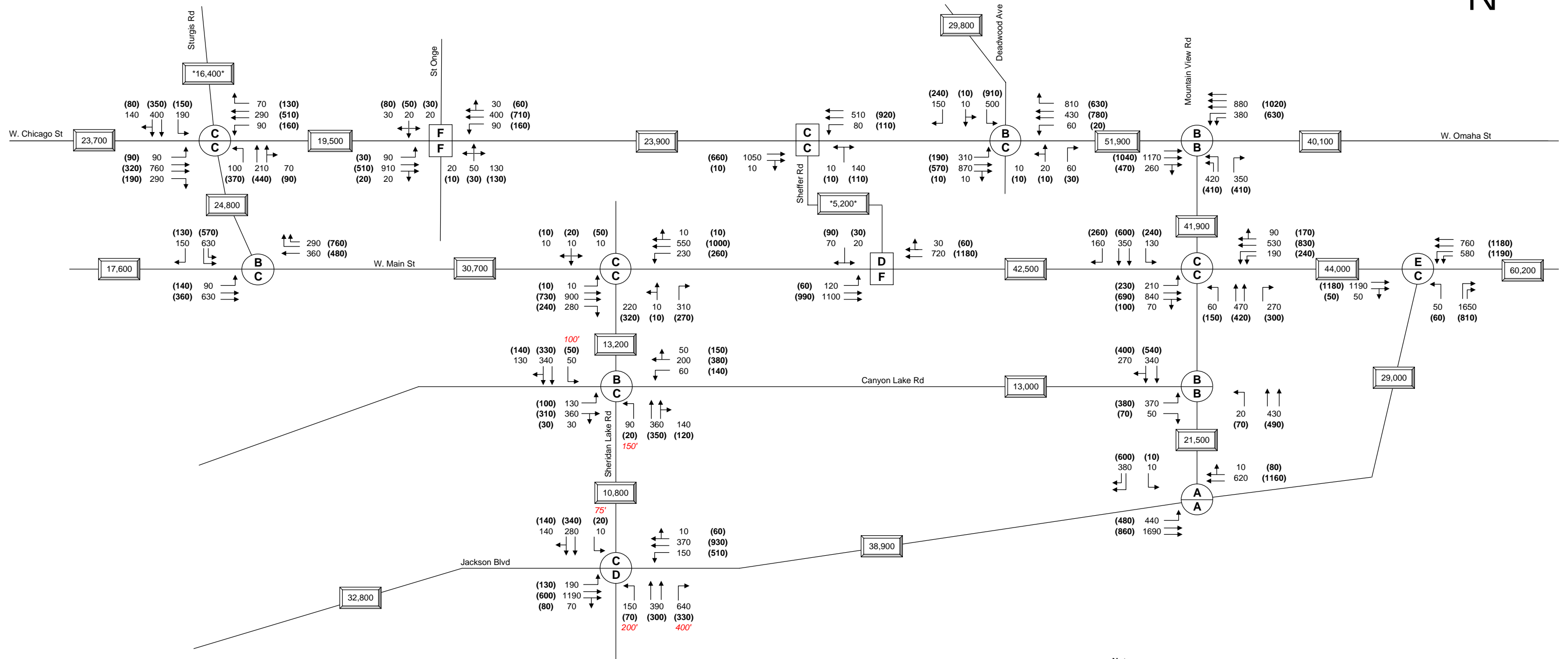
**Sources:**  
 1. 2006 Seasonal Factors, SDDOT, February 2007













**2030 Balanced Off-Peak Season Peak Hour Volumes, Intersection Geometrics and Intersection Levels of Service - Extension to Deadwood Avenue**

Sheridan Lake Road, Rapid City SD

Date	Dec 2007
Figure	3



**LEGEND**

-  AM Signalized Intersection Level of Service
-  PM Signalized Intersection Level of Service
-  AM Unsignalized Intersection Worst Case Stop Controlled Approach Level of Service
-  PM Unsignalized Intersection Worst Case Stop Controlled Approach Level of Service
-  2030 ADT (Adjusted Volume)
-  2030 ADT (Raw Model Volume)
-  2030 AM Peak Hour Volume
-  2030 PM Peak Hour Volume
-  Existing Geometrics
-  Recommended Storage

**Notes:**  
An additional through lane in each direction is assumed along Sheridan Lake Road in all scenarios.

Existing turn lane storage was not considered when developing recommended storage lengths.

All timing plans match those used for the Off-Peak Season.

**Sources:**  
1. 2006 Seasonal Factors, SDDOT, February 2007

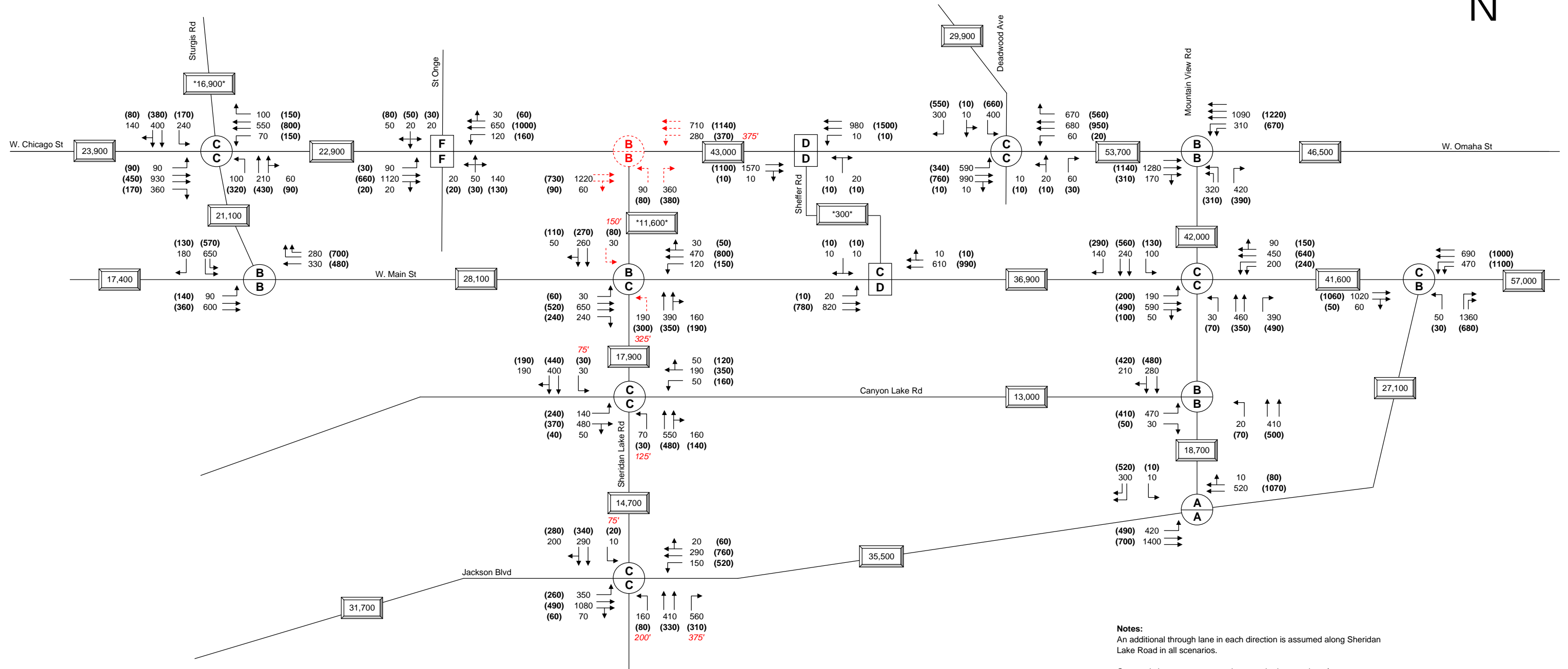


**2030 Balanced Peak Season Peak Hour Volumes, Intersection Geometrics and Intersection Levels of Service - No-Build**  
Sheridan Lake Road, Rapid City SD













Date  
Dec 2007

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Figure  
4



**LEGEND**

-  AM Signalized Intersection Level of Service
-  PM Signalized Intersection Level of Service
-  AM Unsignalized Intersection Worst Case Stop Controlled Approach Level of Service
-  PM Unsignalized Intersection Worst Case Stop Controlled Approach Level of Service
-  2030 ADT (Adjusted Volume)
-  2030 ADT (Raw Model Volume)
-  2030 AM Peak Hour Volume
-  2030 PM Peak Hour Volume
-  Existing Geometrics
-  Recommended Storage
-  Recommended Geometric Improvements
-  Recommended Signalized Intersection

**Notes:**  
 An additional through lane in each direction is assumed along Sheridan Lake Road in all scenarios.  
 Geometric improvements are shown at the intersection of W. Main St/Sheridan Lake Rd based on the extension of Sheridan Lake Rd to W. Chicago St.  
 Existing turn lane storage was not considered when developing recommended storage lengths.  
 All timing plans match those used for the Off-Peak Season.

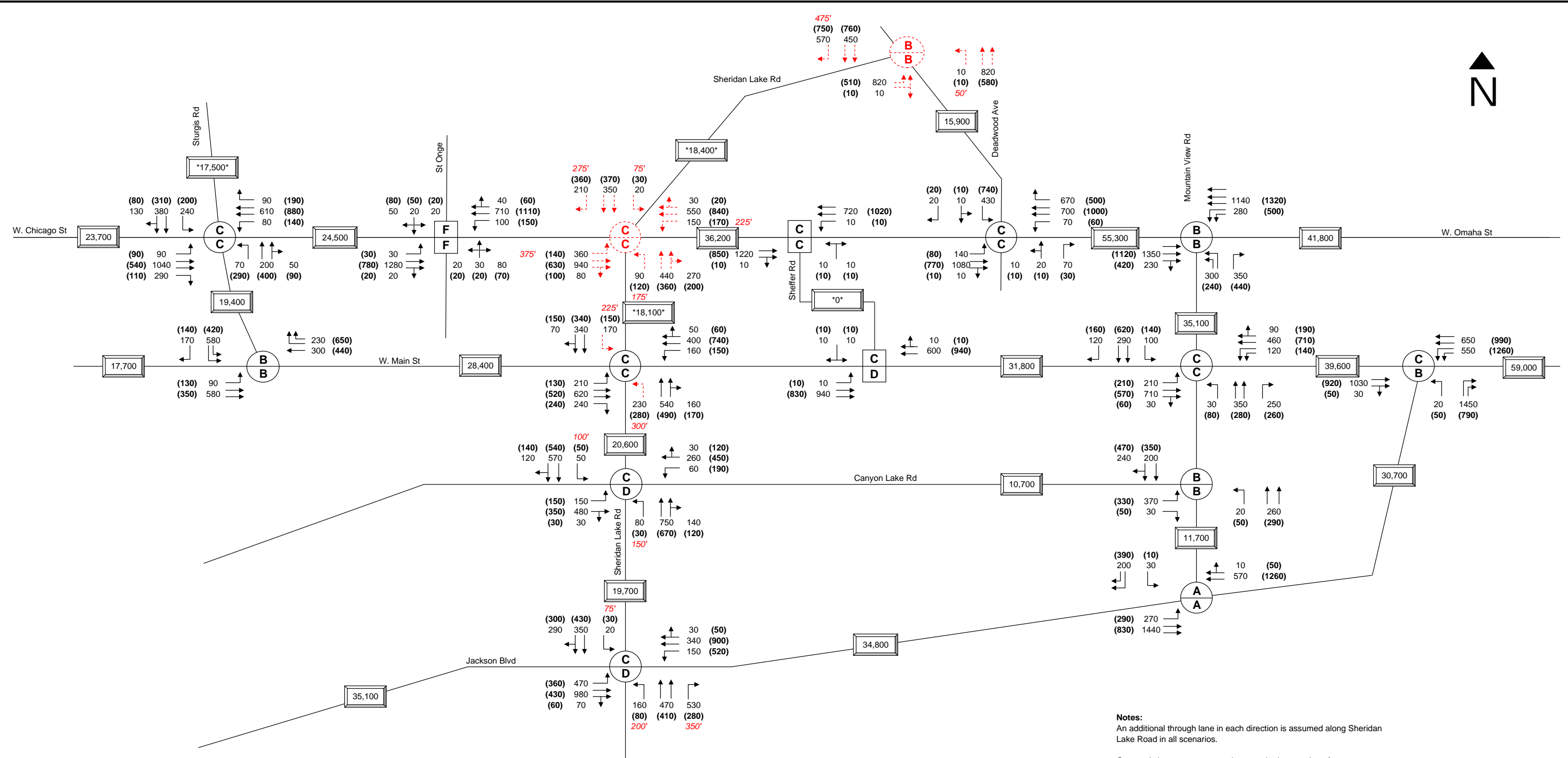
**Sources:**  
 1. 2006 Seasonal Factors, SDDOT, February 2007



**2030 Balanced Peak Season Peak Hour Volumes, Intersection Geometrics and Intersection Levels of Service - Extension to W. Chicago Street**  
 Sheridan Lake Road, Rapid City SD

Date  
 Dec 2007  
 Figure  
 5





**LEGEND**

- AM Signalized Intersection Level of Service
- PM Signalized Intersection Level of Service
- AM Unsignalized Intersection Worst Case Stop Controlled Approach Level of Service
- PM Unsignalized Intersection Worst Case Stop Controlled Approach Level of Service
- 2030 ADT (Adjusted Volume)
- 2030 ADT (Raw Model Volume)
- 2030 AM Peak Hour Volume
- 2030 PM Peak Hour Volume
- Existing Geometrics
- Recommended Storage
- Recommended Geometric Improvements
- Recommended Signalized Intersection

**Notes:**  
 An additional through lane in each direction is assumed along Sheridan Lake Road in all scenarios.  
 Geometric improvements are shown at the intersection of W. Main St/Sheridan Lake Rd based on the extension of Sheridan Lake Rd to Deadwood Ave.  
 Existing turn lane storage was not considered when developing recommended storage lengths.  
 All timing plans match those used for the Off-Peak Season.

**Sources:**  
 1. 2006 Seasonal Factors, SDDOT, February 2007



**2030 Balanced Peak Season Peak Hour Volumes, Intersection Geometrics and Intersection Levels of Service - Extension to Deadwood Avenue**

Sheridan Lake Road, Rapid City SD

Date	Dec 2007
Figure	6

## **APPENDIX**

### **Sheridan Lake Signalized Intersection Timing Assumptions**

#### **No-Build**

##### *Off-Peak Season*

Existing timings were utilized for free-running signals where the intersection would operate at LOS C or better and individual movements would operate at LOS D or better (this ended up being all free-running signals except W Chicago/Deadwood during the PM peak hour). For intersections where existing timings resulted in intersection operations worse than LOS C or individual movement operations worse than LOS D, timings were optimized to give the best LOS while not lowering the split time of any phase below that of existing. Splits and offsets were optimized for coordinated signals for both the AM and PM peak hours, resulting in different AM and PM peak timing plans for these signals (the existing 90 second cycle length was utilized since operations at these intersections were LOS C or better).

##### *Peak Season*

All timings used for the 'Off-Peak Season' condition were applied to the 'Peak Season' condition.

#### **Extension to Chicago**

##### *Off-Peak Season*

Assumed that split phasing at Sheridan Lake Road/W Main Street would be removed and NB and SB left-turn phases would be permitted/protected. Coordinated the NB movements at Sheridan Lake Road/W Chicago and used a max recall for the EB and WB through phases to be consistent with adjacent signals on W Chicago.

Existing timings were utilized for free-running signals where the intersection would operate at LOS C or better and individual movements would operate at LOS D or better (this ended up being all free-running signals except W Chicago/Deadwood during the AM and PM peak hours). For intersections where existing timings resulted in intersection operations worse than LOS C or individual movement operations worse than LOS D, timings were optimized to give the best LOS while not lowering the split time of any phase below that of existing. Splits and offsets were optimized for coordinated signals for both the AM and PM peak hours, resulting in different AM and PM peak timing plans for these signals (the existing 90 second cycle length was utilized since operations at these intersections were LOS C or better).

##### *Peak Season*

All timings used for the 'Off-Peak Season' condition were applied to the 'Peak Season' condition.

#### **Extension to Deadwood**

##### *Off-Peak Season*

Assumed that split phasing at Sheridan Lake Road/W Main Street would be removed and NB, SB and EB left-turn phases would become permitted/protected (WB left-turn phase is already permitted/protected). It was also assumed that EB, WB and NB left-turn phases at Sheridan Lake Road/W Chicago would be permitted/protected. Coordinated the NB and SB through movements

at Sheridan Lake Road/W Chicago and used a max recall for the EB and WB through phases to be consistent with adjacent signals on W Chicago. Coordinated the EB movements at Sheridan Lake Road/Deadwood.

Existing timings were utilized for free-running signals where the intersection would operate at LOS C or better and individual movements would operate at LOS D or better (this ended up being all free-running signals). For intersections where existing timings resulted in intersection operations worse than LOS C or individual movement operations worse than LOS D, timings were optimized to give the best LOS while not lowering the split time of any phase below that of existing. Splits and offsets were optimized for coordinated signals for both the AM and PM peak hours, resulting in different AM and PM peak timing plans for these signals (the existing 90 second cycle length was utilized since operations at these intersections were LOS C or better).

*Peak Season*

All timings used for the 'Off-Peak Season' condition were applied to the 'Peak Season' condition.