Oregon
John A. Kitzhaber, M.D., Governor

Department of Transportation
Region 3 Traffic
100 Antelope Road 97503
Phone 541-774-6350
Fax 541-774-6349

TECHNICAL MEMORANDUM

TO: Jerry Marmon, District 8 Manager

FROM: Dan W. Dorrell, P.E., District 8 Traffic Operations Engineer

Date **May 27, 2011**

Subject: **Josephine County Fairgrounds Signal Removal on US-199**

The following report justifies removing the signal at Josephine County Fairgrounds and US-199.

The main reason ODOT supports removal of the Fairgrounds signal is for the general public's safety. This signal causes more crashes than the other two signals in close proximity which are, Ringuette to the east, and Redwood Avenue to the west. Another benefit to the removal would be that the majority of traffic on US-199, 40,000 vehicles a day commuting to and from Grants Pass, would experience less congestion and delay on their daily commute.

If the Fairgrounds signal is removed, and right-in-right-out approaches remain in its place, then we would expect the crash rate to drop substantially at this intersection. We would also expect the crash rate to drop nominally at the surrounding signals because the queues from the Fairgrounds signal would no longer extend into the influence area of the other signals that are in too close proximity to the Fairgrounds signal. This new added free flow area would allow better spacing between the Ringuette and Redwood Avenue signals. This would allow the signals to function better for progressing platoons of vehicles, which would cause less pollution in the corridor. It would also diminish the stop and start traffic in this highly congested corridor, which in turn will reduce rear-end collisions.

At ODOT our primary concern is safety for the general public. The information contained in this report leads us to believe that removal of the Fairgrounds signal would benefit the majority of traffic in this corridor.

The Redwood Avenue signal to the west of the Josephine County Fairgrounds was built in 1974. The Josephine County Fairgrounds signal was erected in 1977 and turned on in 1978. Many years later the Ringuette Street signal to the east was installed. The value of the Fairgrounds signal has diminished over the years with changes in roadway connections and growth in the surrounding area; while the importance of the Redwood Avenue and Ringuette signals has increased because of the need to have better connectivity on the west side of Grants Pass. The Fairgrounds signal handles a very small amount of traffic that accesses US-199 when compared to the Redwood Avenue or Ringuette signals. The minor amount of cars using this signal halts the extremely large amount of traffic trying to get into and out of Grants Pass multiple times a day, everyday of the year.

The Josephine County Fairgrounds signal is old and has some issues that need to be rectified soon if ODOT decides to retain this signal on US-199. This entails investing scarce funds into a signal that does not meet signal warrant volume criteria, and is one of the major impediments to commuters on US-199 travelling to and from work everyday in Grants Pass. Because of the short distance between this signal and the one at Ringuette Street and Redwood Avenue, it is very difficult to efficiently progress platoons of vehicles through the corridor. The benefit it serves for the Fairgrounds and Union Avenue is far outweighed by the detriment to the 40,000 daily commuters who endure frustration everyday because of this unwarranted signal. This entire corridor has congestion problems already, but the crux of the congestion west of OR-238 is caused by this signal. On any weekday in the afternoon one can observe an almost continuous flow of traffic coming off Sixth Street to turn west on US-199, and then progress through the Ringuette signal only to get stopped at the Fairgrounds signal. Inevitably the Fairgrounds signal gets out of sync and causes excessive traffic backups. Even with removal of the Fairgrounds signal, the distance between the Ringuette and Redwood Avenue signals is still less than the ODOT recommended standards for a highway such as US-199. This Statewide classified highway has the expressway designation which limits access and helps throughput traffic by trying to attain signals spaced at no less than one half mile increments. As stated earlier close spacing to adjacent signals is the problem with the Fairgrounds signal.

There is a very high rear-end crash rate associated with the Fairgrounds signal. Removal of the signal will not only help reduce delay for commuters everyday, it will also make this part of the US-199 corridor much safer for motorists. One of the proven ways to make a corridor safer is to install center median to limit traffic movements. We propose to make the north and south approaches to US-199 right-in right-out at the Fairgrounds & Union intersection by placing non-traversable median through the middle of the intersection parallel to US-199. A typical signal has 32 conflict points where vehicles can possibly crash. By converting US-199 and Fairgrounds & Union to right-in right-out approaches the conflicts are reduced to four, and these are the less dangerous conflicts of rear-end and side-swipe crashes. Since median was installed from Rogue Community College to Midway Avenue, the crash rate dropped substantially. In that area a fatality occurred almost every year before the median installation.

ODOT could build a channelized left-in for the Fairgrounds, but during the PM peak hours there are almost no gaps in opposing traffic to allow this movement. This could become a safety hazard, if people are attempting to make lefts without large enough gaps in opposing traffic. We do not want to build a non-signalized left into the Fairgrounds that we know will fail during a substantial portion of the day, or cause T-bone crashes and possibly potential fatalities.

The proposed U-turn at Ringuette is only seven hundred feet away, and it would allow a safe protected movement for eastbound traffic to access the Fairgrounds entrance. We have modeled the largest interstate truck and trailer, a WB-67, at Ringuette Street for U-turns, and it can make that movement with existing conditions. This movement would be allowed with the removal of the signal. There is an existing lane at Redwood Avenue to turn back to the East which can accommodate a WB-40, which is similar to a very large horse trailer.

The following attached graphs represent a three year crash history on US-199 adjacent to the Fairgrounds signal. Rear end crashes are the majority of the crashes in the vicinity of the signal. This type of crash is always prevalent when signals are spaced too close together. The crash data shows that most of the crashes are occurring in the afternoon when volumes are heavier. The data also shows most of the crashes occur during dry conditions on weekdays when commuters are coming home from work. The majority of the crashes involve what is considered to be the more competent middle age portion of the driving population. This data illustrates there is no real problem other than signals being located too close together.

All of these factors point out that the exceedingly high crash rate in this vicinity is due to the close proximity of the Fairgrounds signal to the adjacent signals. Congestion and safety would most certainly improve with the removal of the Fairgrounds signal. The signal at Ringuette, a major collector, and at Redwood Avenue, a major arterial, are too important to the transportation network on the west side of Grants Pass to be removed without facilitating a large project to establish alternate routes. The best logical solution to the high crash rate and congestion in this area, is removal of the Fairgrounds signal.


Fairgrounds Rd. - Southbound

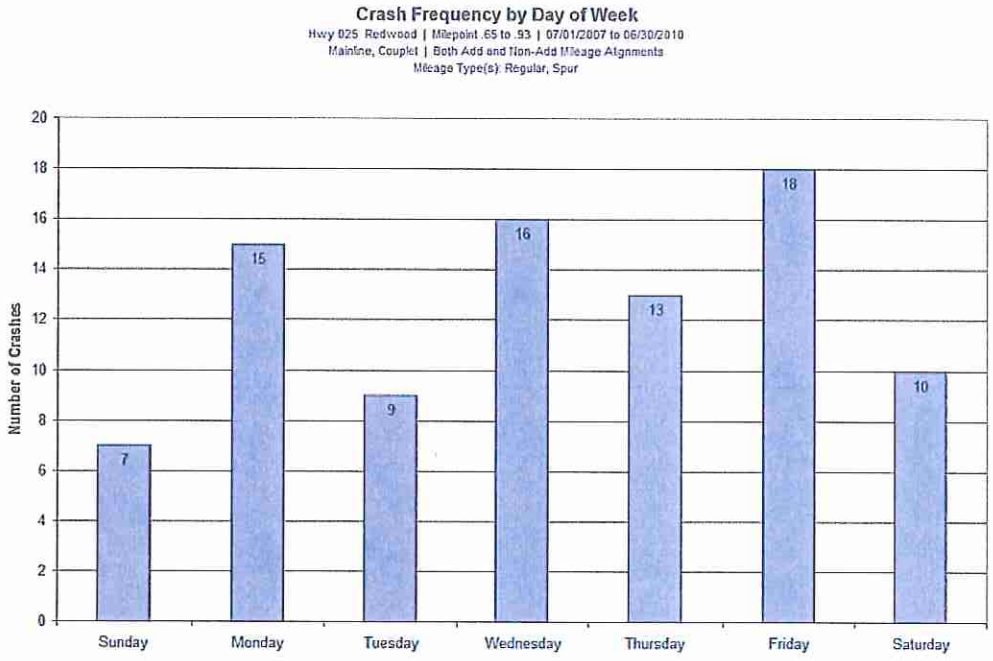

Union Ave. - Northbound


US-199 - Eastbound

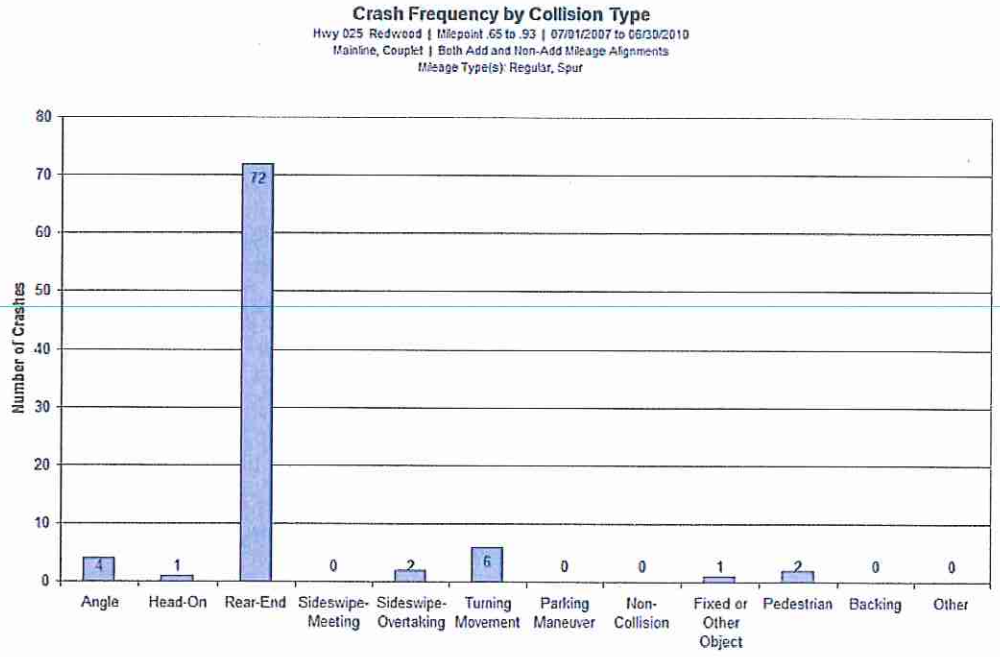

US-199 - Westbound

WB-67 = Largest semi-tractor trailer allowed on I-5 making U-turn @ Ringuette St.

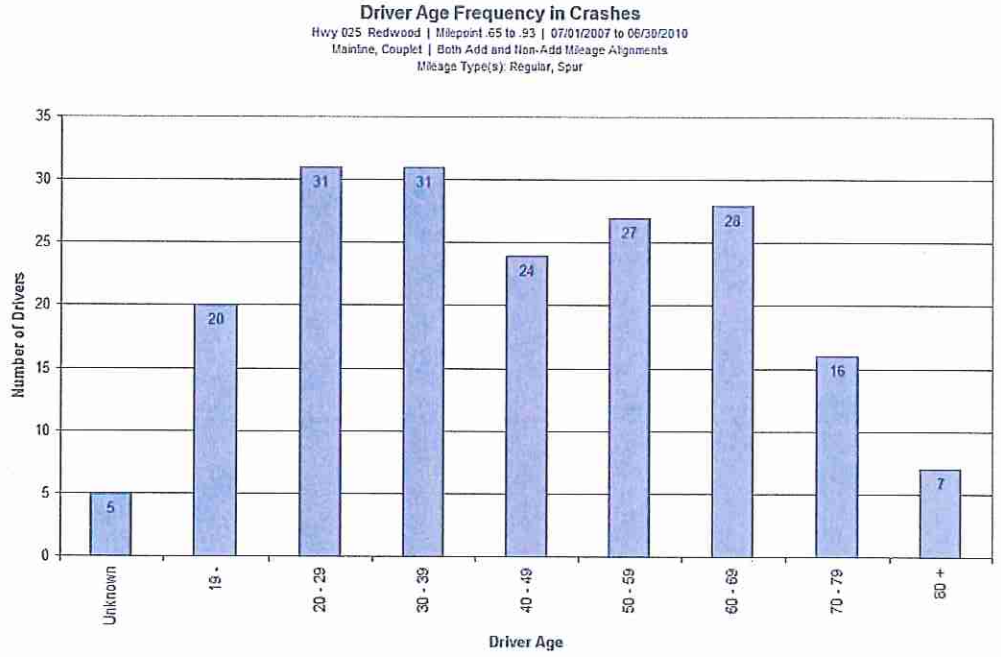
WB-40 = Large truck and horse trailer making left turn move from Redwood Ave.



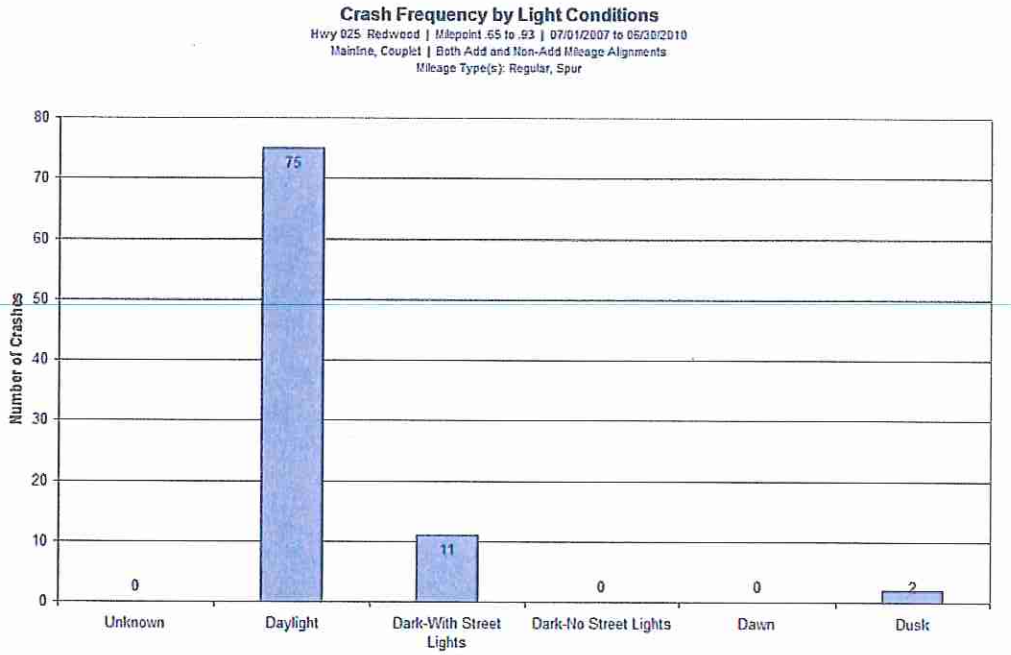
This graph illustrates that it is the daily commuters during the weekdays who have to endure the high crash rate.



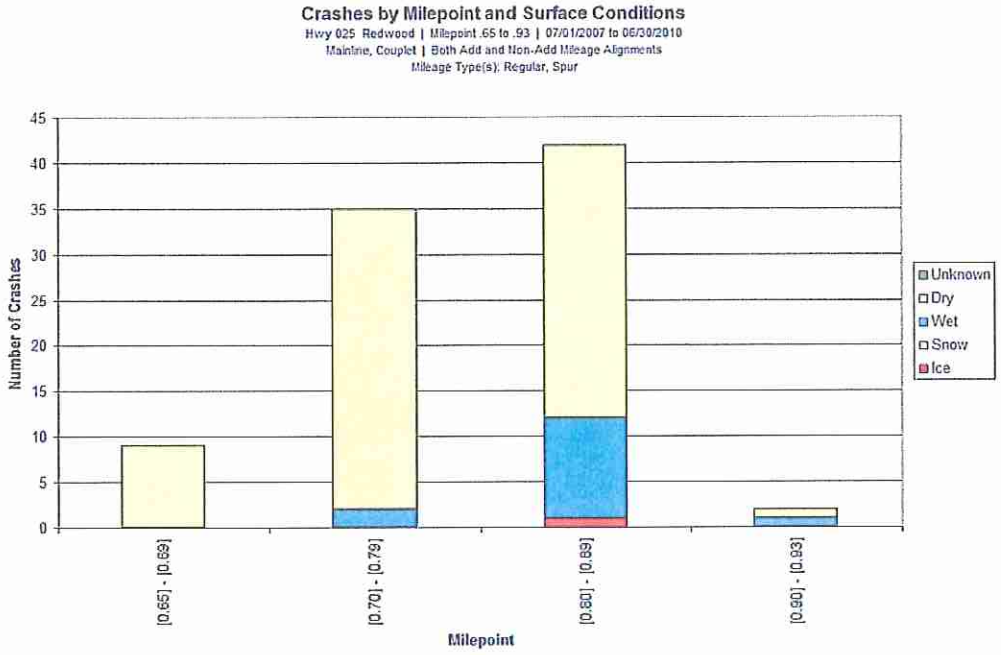
A high amount of rear end crashes like this graph illustrates is typically a result of signals that are too close in proximity.



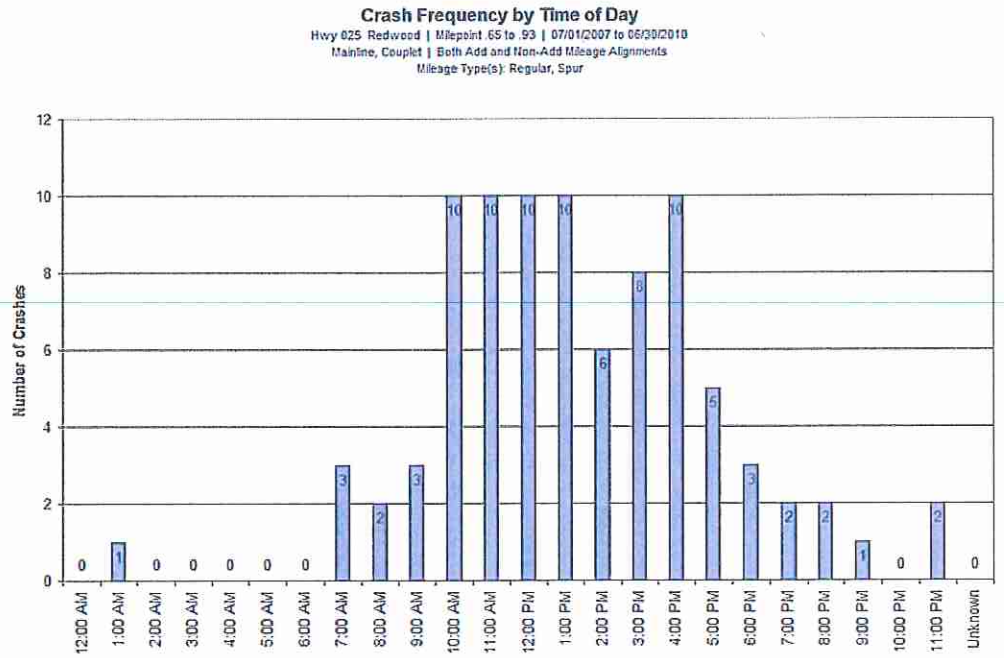
This graph illustrates that it is the more competent driving portion of the population that is involved in the crashes. In other words it is not the very young or old that are having the majority of the crashes.



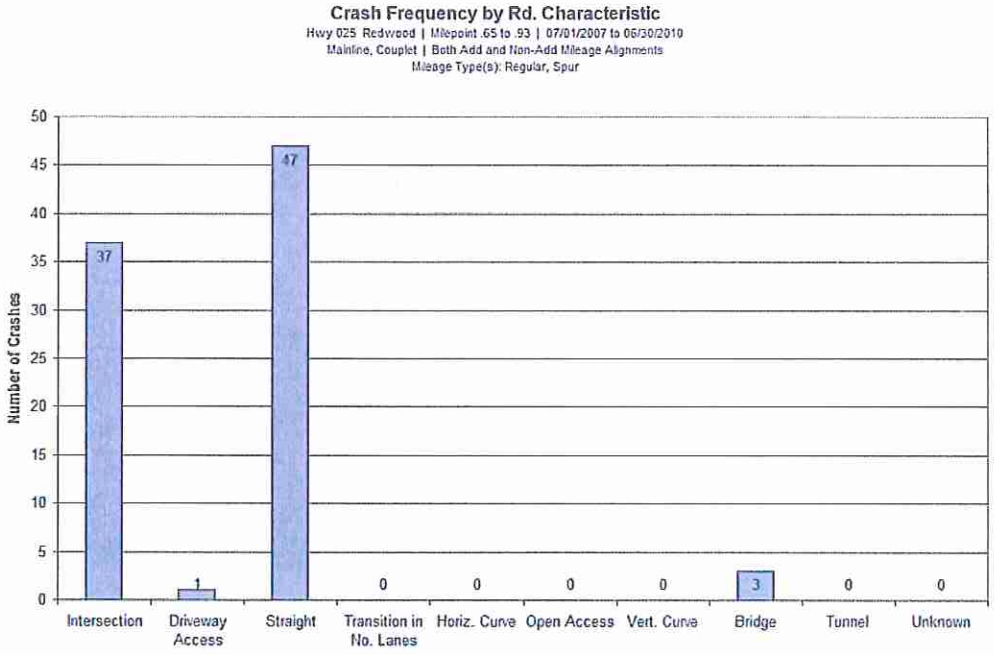
This illustrates that the crashes are not because of poor light conditions. It is just the large amount of commuter traffic having to deal with this signal and the delay it causes during the daytime hours.



This graph depicts that the high crash rate is not due to inclement weather.



This graph shows what we would expect, that the crash rate is higher during the mid-day peak period as well as the PM peak period.



This graph shows that the majority of crashes are happening within the influence area of the Fairgrounds signal. The other crashes on the straight section of roadway are also still because of the Fairgrounds signal. In a typical signal that is not over capacity these crashes would not be because of the signal. However in this case the queuing is so extensive from the Fairgrounds signal that it is also affecting data in the straight column of this graph which would normally be outside the influence area of a signal that is not over capacity so much as the Fairgrounds signal.

Supplemental Information for

Additional Questions

from the City of Grants Pass

1. What is the ADT(Average Daily Traffic) of left-turn movements into the fairgrounds;
   Our count revealed 114 lefts from 6am to 10pm. Typical practice is to multiply this number by 1.1 to get an ADT of 125.

2. What is the ADT of left-turn movements into the hospital/Shell station;
   The sixteen hour count revealed 662, and the ADT is 728.

3. The average time lost due to the fairgrounds signal;
   See the attached economic analysis.

4. The average dollars lost due to the fairgrounds signal;
   Please see the attached economic analysis report.

5. Is there a way to determine how many vehicles are making left-turn movements to do business at the Shell Station? Is there a traffic count that could be performed (a) midday and (b) PM peak that shows how many vehicles are actually doing business at the Shell Station in lieu of those turning left to do other business?
   We had our counter observe this movement during operating hours of the Shell gas station. Out of the 507 lefts that occurred while the Shell station was open, seven actually drove to the Shell gas station for refueling. Our traffic counter reported that most of the Shell's customers came from and went back to Union.

6. During the Josephine County Fair, can ODOT Traffic program the signals at US-199 and Ringuette to obtain more green time for u-turns on US-199 to visit the fair? Would this programming of the signal create any back ups at the intersection?
   We can provide a timing plan specifically for the Fair, which will help minimize queue lengths.

7. The fatality we discussed yesterday that occurred within the vicinity of US-199 and the fairgrounds--where exactly was this fatality?
   There have actually been two fatalities that we are aware of, one fatal crash was West of OR-238 in 2001, and the other occurred near Redwood Avenue in 1990.

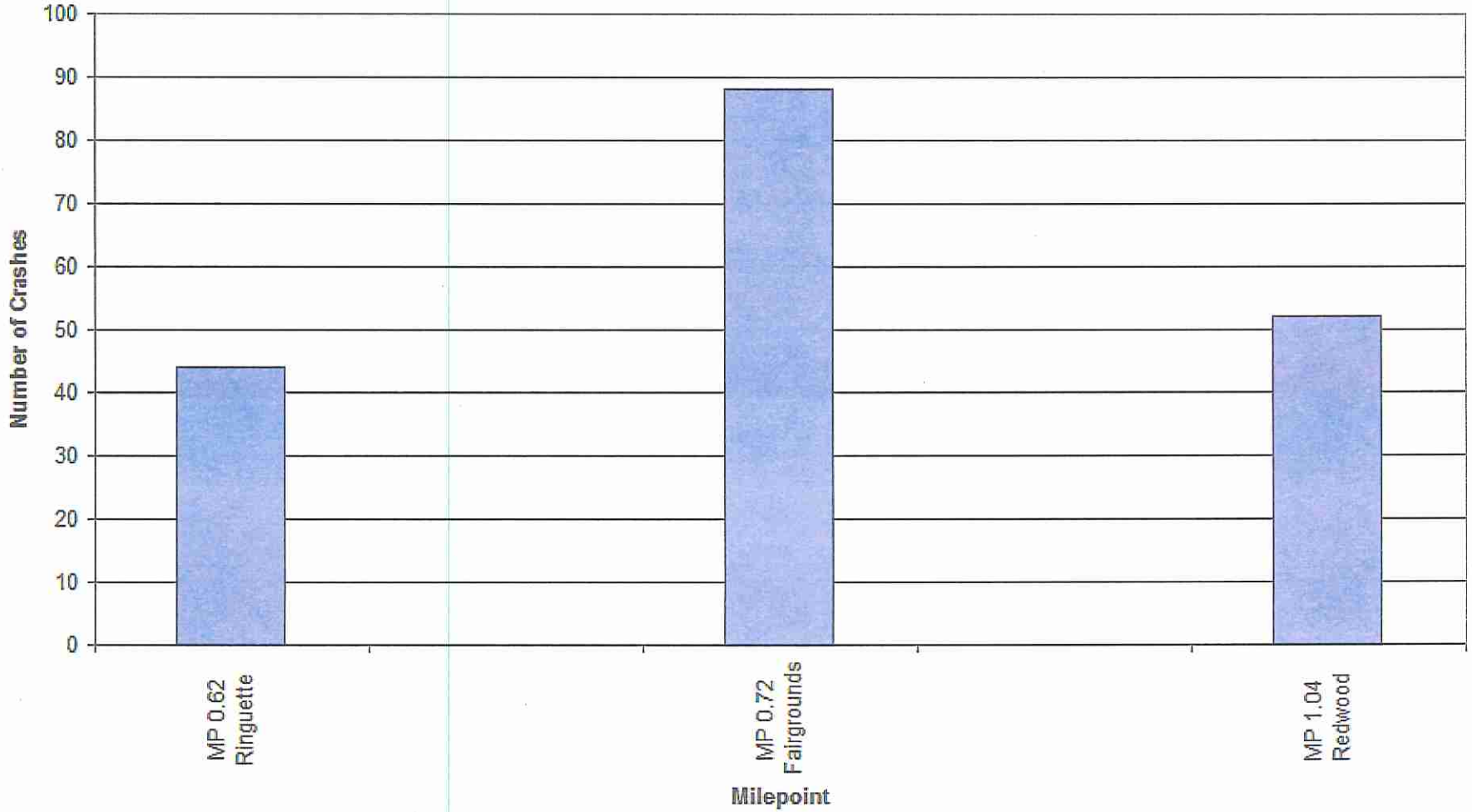
The following pages have graphs of crashes that help depict the ongoing safety issue at the US-199 & Fairgrounds signal. The first graph shows Crash Frequency by Milepoint. We have labeled the approximate milepoint of the Ringuette, Fairgrounds, and Redwood Avenue signals. It is clear to see from this graph that the majority of crashes are occurring at the Fairgrounds signal.

The next three graphs show total crashes for Ringuette, Fairgrounds, and Redwood Avenue intersections. This again clearly shows the majority of crashes are occurring at the Fairgrounds signal.

All of the following graphs assimilate data from 7-1-07 to 6-30-10, this is the most recent data ODOT has for crashes on US-199.

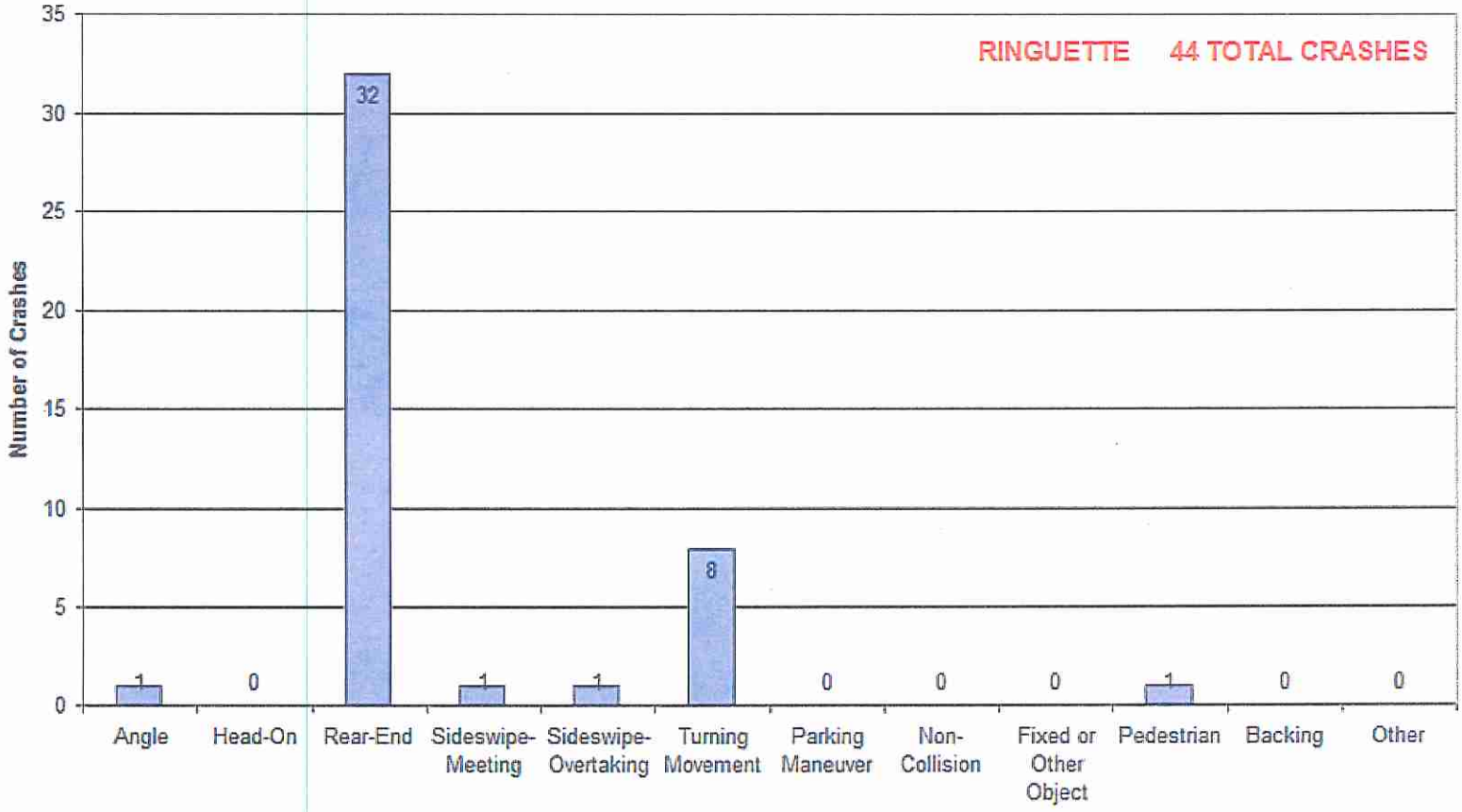
Crash Frequency by Milepoint

Hwy 025 Redwood | Milepoint .48 to 1.18 | 07/01/2007 to 06/30/2010
Mainline, Couplet | Both Add and Non-Add Mileage Alignments
Mileage Type(s): Regular, Spur



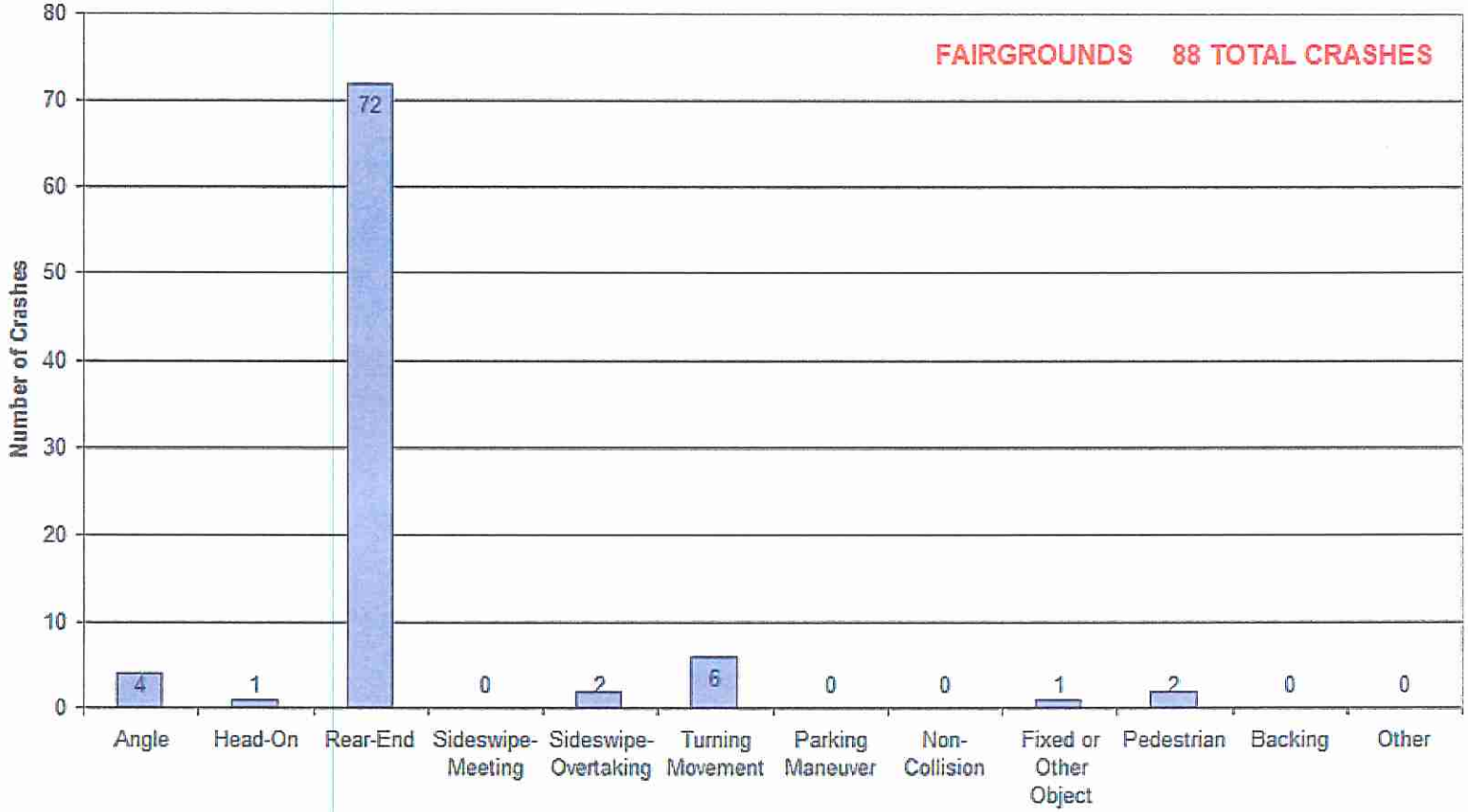
Crash Frequency by Collision Type

Hwy 025 Redwood | Milepoint .48 to .76 | 07/01/2007 to 06/30/2010
Mainline, Couplet | Both Add and Non-Add Mileage Alignments
Mileage Type(s): Regular, Spur



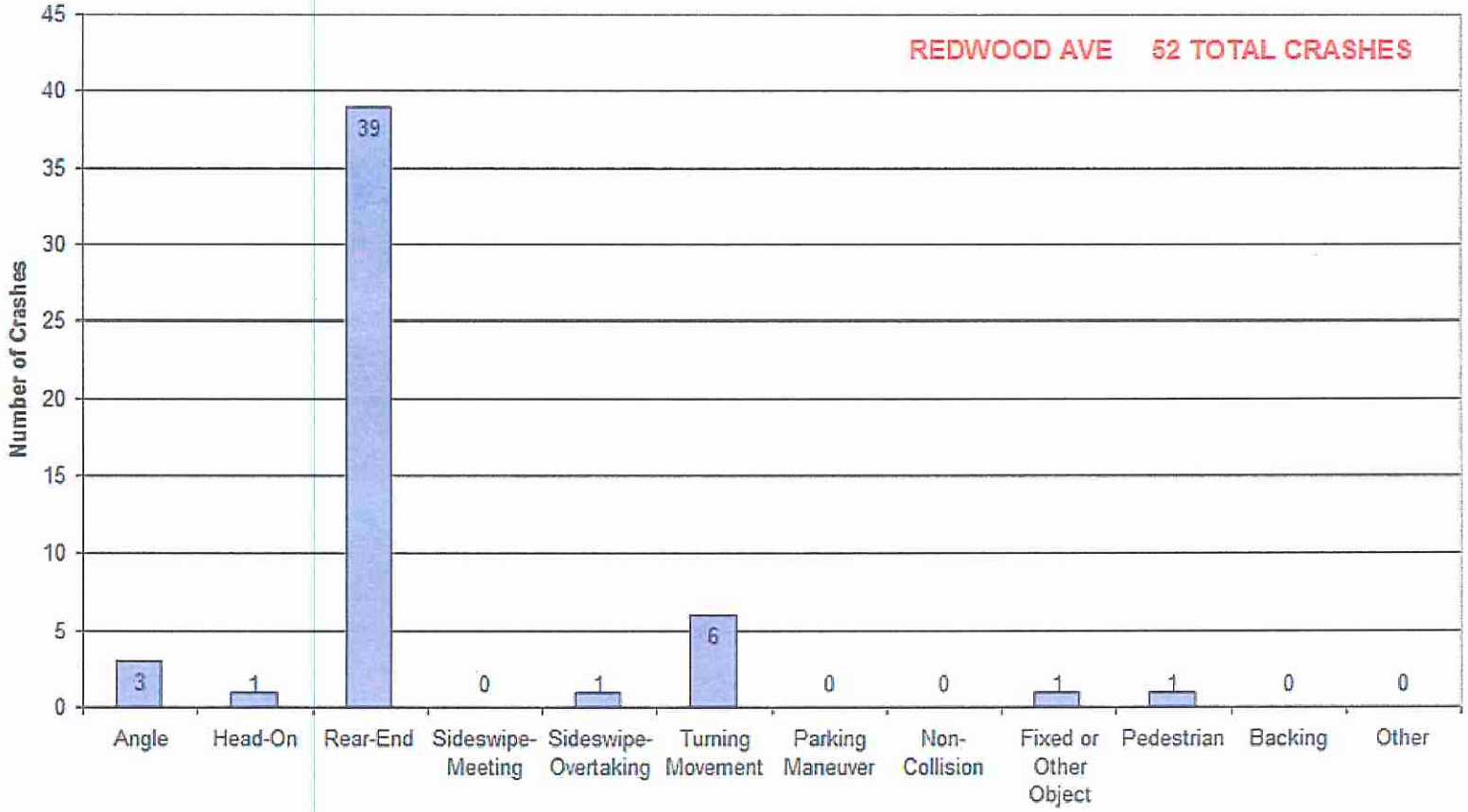
Crash Frequency by Collision Type

Hwy 025 Redwood | Milepoint .65 to .93 | 07/01/2007 to 06/30/2010
Mainline, Couplet | Both Add and Non-Add Mileage Alignments
Mileage Type(s): Regular, Spur



Crash Frequency by Collision Type

Hwy 025 Redwood | Milepoint .90 to 1.18 | 07/01/2007 to 06/30/2010
Mainline | Both Add and Non-Add Mileage Alignments
Mileage Type(s): Regular, Spur



Economic Analysis for Traffic Signal Removal

at Josephine County Fairgrounds and US-199

in Grants Pass Oregon

By Shyam Sharma, PE, PTOE
Region 3 Traffic Manager

Intersection of US 199 and Josephine County Fairgrounds
Grants Pass, OR
Economic Analysis for Traffic Signal Removal

This supplementary document provides an analysis of economic costs and benefits of traffic signal removal at the intersection of US-199 and the Josephine County Fairgrounds. The signal was installed in 1977, and is a continuous maintenance problem for ODOT. The Fairgrounds signal lost significance in terms of its connectivity in the system of highway networks after installation of the signal at the intersection of US-199 and Ringuette Street.

The analysis includes societal benefits associated with removing the signal and also the societal costs due to additional delay for rerouting traffic from both approaches of the Fairgrounds to nearby intersections. This analysis uses the National Safety Council (NSC) cost data for year 2009 (latest available NSC traffic crash costs) for unintentional injury resulting from traffic crashes on highways. While computing the societal cost due to additional delay to rerouted traffic, a **sensitivity analysis** is performed using the hourly wage of $8.75 to $25 per hour per user to provide a range of economic costs. An occupancy rate of 1.25 persons per vehicle is assumed (based on national average).

The following types of crashes and their respective costs were used in the analysis. It should be noted that the cost of crash stated here is for each crash, not for the number of injuries, as suggested by NSC.

Incapacitating Injury	$ 216,800.00
Non-incapacitating Evident Injury	$ 55,300.00
Possible Injury	$ 26,300.00
Non Injury (Property Damage Only)	$ 2,400.00

The following assumptions were made for computing the economic costs due to traffic crashes.

1. The percentage of potential conflict points reduced by removing the signal and allowing only right in – right out movements is 87.5%. This is because the right in-right out movements will have only four potential vehicle-to-vehicle conflict points at the intersection, whereas the full movement intersection has 32 potential conflict points. It will be appropriate to conservatively assume that 75% of the crashes will be reduced after removing the signal and restricting the movements to right in- right out.
2. If no improvements are made at this intersection, the crash trend will be similar in the future. However, research shows that with the increase in traffic volumes in the future, the occurrences of crashes increase non-linearly.
3. The annual cost of maintaining the signal is $5000.

There were 88 crashes during the last three years at the vicinity of this intersection, and 71 of those crashes were rear-end type. There were 42 injury crashes and 41 property damage only crashes. Since the severity of injury was not known for the remaining five crashes, they can be assumed as non-injury types for analysis purposes.

The following table provides the annual savings in societal cost by removing the Fairground signal.

Table 1. Economic Savings Due to Reduced Crashes with Signal Removal

Severity of Injuries	Number of Crashes by Severity Type (for 3 year)	Cost of crash by Type	Expected Reduction in Crashes by Signal Removal (with Rt IN/ Rt OUT) - 75%	Savings by Reduced Crashes
Type A	0	$ 216,800.00	0	$ -
Type B	11	$ 55,300.00	8.3	$ 456,225.00
Type C	31	$ 26,300.00	23.3	$ 611,475.00
Property Damage Only (PDO)	46	$ 2,400.00	34.5	$ 82,800.00
			Total Savings (for 3 years)	$1,150,500.00
			Annual Savings	**$ 383,500.00**

The maintenance cost of $5000 should be added in total savings if the signal is removed, thus resulting in a **Total Annual Savings of $388,500.**

An analysis was also performed to determine the societal cost that may occur by removing the Fairgrounds signal. The following assumptions were made to calculate the cost due to additional delay to travelers that have direct left turn and through access using the Fairgrounds signal. The exact computation of economic costs due to additional delay and congestion is extremely time-consuming. This is associated with several socio-economic variables, such as drivers' preferences on route choices, future driving patterns followed by other developments, overall economic growth and wage changes, improvement in transportation networks, etc. This analysis uses a simplistic approach without compromising the overall accuracy in the analysis.

1. Eastbound left turns (EBL) into the Fairgrounds were rerouted as U-turns at Ringuette, and finally turning as westbound right turn (WBR) into the Fairgrounds;
2. Eighteen percent (18%) of the northbound left turns (NBL) at Union were rerouted as northbound right turns (NBR) at Union followed by U-turns at Ringuette (in order to go Westbound along US 199);
3. Eighty two (82%) of the NBLs at Union were rerouted as NBLs at Ringuette.
4. All northbound through (NBT) movements from Union St were rerouted as NBRs at Union, U-turns at Ringuette and WBRs into the Fairgrounds;

5. Westbound left turns (WBL) into Union Ave from US 199 were rerouted as additional WBLs at Ringuette;
6. Southbound left turns (SBL) from the Fairgrounds were rerouted as SBLs at Ringuette. Alternatively anyone making a SBL at the Fairgrounds could make a southbound right (SBR) turn at the Fairgrounds followed by a WBR into Redwood Ave and a SBL from Redwood Ave to get EB on US 199. Either distribution/rerouting of traffic leads to similar volume to capacity (V/C) ratio at Ringuette St. because of lesser turning volumes.

Figures 1 and 2 show the peak hourly volumes for the intersections of US 199 at the Fairgrounds and US 199 at Ringuette St with and without signal removal, respectively.

Figure 1. Peak Hour Volume (Existing) - with Fairground Signal

Based on this economic analysis, the economic savings due to signal removal is $388,500, and the economic cost due to additional delay is significantly lower as shown in the sensitivity analysis using various wages per hour. This also shows that benefits of removing the signal outweigh the cost of retaining the signal at this location.

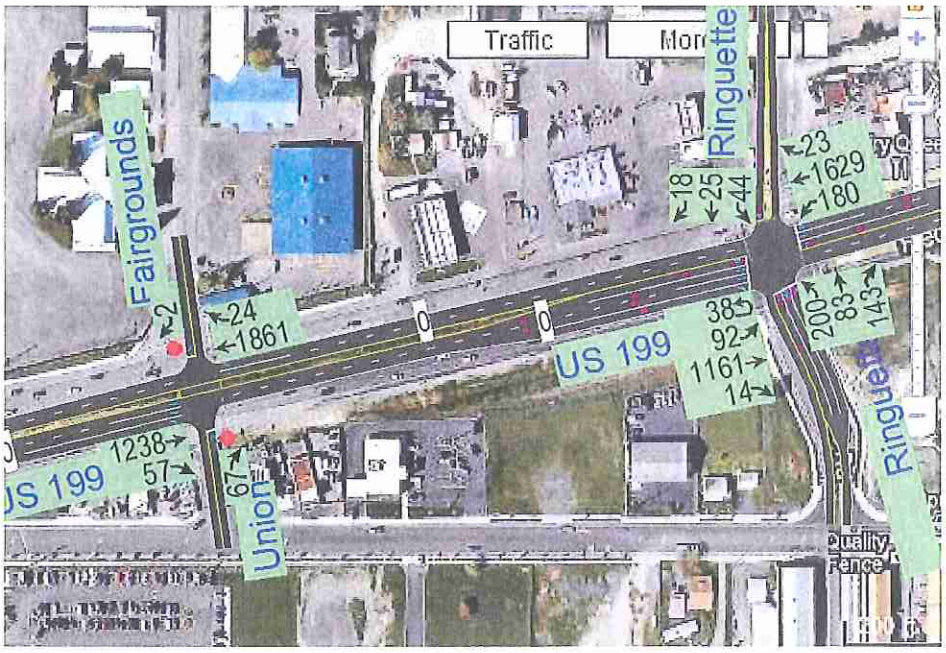


Figure 2. Peak Hour Volume (Redistributed) - with Fairground Signal Removal

Figure 3. Additional Annual Average Delay Cost for Signal Removal

Table 2. Additional Annual Average Delay Cost for Signal Removal (Sensitivity Analysis)

Additional Travel Time/Delay and Cost Analysis

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Turning Movements	16 hr Volume	Average Daily Traffic (ADT) (B*1.1)	Additional travel time delay (Sec) due to rerouting	Additional Control Delay (Sec) during peak hour	# of Cycles/hr	Total Applicable Cycles for Delay/day (F*18)	Total delay (hrs) due to Signal Control per day per vehicle (E*G*/3600)	Total Delay in Hr/day due to rerouting (D*C/3600)	Total Delay (Hrs) per Day	Delay (Veh hrs) per year	Cost per year ($8.50/hr)	Cost per year ($15/hr)	Cost per year ($20/hr)	Cost per year ($25/hr)
WBL	662	728	-	10	30	540	1.5	-	1.5	547.5	$ 5,817.2	$ 10,265.6	$ 13,687.5	$ 17,109.4
EBL	114	125	35	10	30	540	1.5	1.2	2.7	988.4	$ 10,501.3	$ 18,531.7	$ 24,708.9	$ 30,886.1
NBL	919	1011	40	10	30	540	1.5	11.2	12.7	4647.3	$ 49,377.1	$ 87,136.1	$ 116,181.5	$ 145,226.9
NBT	22	24	40	10	30	540	1.5	0.3	1.8	645.6	$ 6,860.0	$ 12,105.8	$ 16,141.1	$ 20,176.4
SBL	88	97	51	7	30	540	1.05	1.4	2.4	879.2	$ 9,341.7	$ 16,485.3	$ 21,980.5	$ 27,475.6
SBT	23	25	51	7	30	540	1.05	0.4	1.4	514.1	$ 5,462.0	$ 9,638.9	$ 12,851.8	$ 16,064.8
								Total Delay Cost			**$ 87,359.3**	**$ 154,163.5**	**$ 205,551.3**	**$ 256,939.1**