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MEMORANDUM
MONTANA DEPT. OF TRANSPORTATION
BILLINGS DISTRICT
BILLINGS, MONTANA

Montana Department of Transportation
PO Box 201001
Helena, MT 59620-1001

MASTER FILE
COPY

To: Bruce Barrett – Billings District Administrator

From: DB Danielle C. Bolan, P.E. - Traffic Engineer

Date: November 15, 2004

Subject: Secondary 416 – Blue Creek Road
Speed Limit Investigation

Please present the following information to county officials and local law enforcement for review and comment. Inform them that we would prefer to receive all comments in writing within the next sixty days. In order to carry a proposed speed limit recommendation to the Montana Transportation Commission it is essential that local officials submit comments. Their comments along with the Department's final recommendations will be presented to the Montana Transportation Commission for action.

In response to numerous calls and concerns voiced about the speed limit on Blue Creek Road Yellowstone County Commissioners requested a speed limit investigation and recommendations for changes if applicable. This investigation began near the South Billings Boulevard Interchange and continued south to the intersection with Vandaveer Road, an approximate distance of 4.4 miles. The study area consists of portions of both Urban Route 1013 and Secondary 416.

Blue Creek Road is a rural secondary highway that is an extension of South Billings Boulevard. It serves a rural residential area, as well as continuing south to an intersection with Prior Road. The intersection with Vandaveer Road is located at milepost 3.8 (Secondary 416) and marks the southern boundary of the majority of the residential development located in the surrounding environment. The vast majority of the development sets back from the roadway and is accessed via local roads that intersect Blue Creek Road. Of exception is the Blue Creek Elementary School located along the west side of the roadway near milepost 3.1. A previous speed limit investigation was conducted in 1995 establishing a special 50 mph speed zone in front of the school. With the 50 mph speed zone in place Yellowstone County officials invoked a school zone speed limit of 40 mph for the am and pm school crossing periods. The school zone speed limit is deployed through the use of 50 mph / 40 mph variable message speed limit signs equipped with bouncing ball flashing beacons.

In 1998 at the request of county officials the Department conducted a second study just south of the South Billings Boulevard Interchange. That study resulted in a 50 mph speed zone being established from the end of the existing 45 mph speed zone to a point south of the intersection with Hill Crest Road (mp 1.2). There are numerous intersections with local

roads within this segment just south of the Yellowstone River as well as some commercial development. The remainder of the study area from Hill Crest Road to the school zone and south of the school zone is statutorily 70 mph. This area has experienced additional growth since our 1998 investigation.

The roadway was reconstructed in 1983 under project RS 416-1(3) and improved in 1995. The design speed is 50 mph. The typical section consists of two 12-foot travel lanes with 6-foot shoulders in each direction. There is a two-way-left-turn lane in the more densely developed area south of the Yellowstone River within the existing 50 mph speed zone. For the overall route the terrain is flat to rolling with a few horizontal curves.

Accident History

The accident experience was reviewed for three-year period from January 1, 2001 to December 31, 2003. During this period there were 31 accidents reported within the study area. The accident rate is 2.22 accidents per million vehicle miles traveled. This is above the statewide average of 1.73 accidents per million vehicle miles for rural secondary highways. The following table lists the accident types by location.

	<u>Angle</u>	<u>Rearend</u>	<u>Single Veh.</u>	<u>Other</u>
Intersection	6	6	2	1
Non-intersection	0	2	13	1

Twenty-nine of the 31 accidents occurred between milepost 0.0 and milepost 2.0. Most of the conflicts within this segment fall within the boundaries of the existing 50 mph speed zone. There were no accidents reported from milepost 2.0 to milepost 3.3. The Blue Creek School is located within the accident free segment.

There are no definable accident trends that pinpoint a correctable condition.

Travel Speeds

Vehicular travel speeds were sampled at ten locations to develop a speed profile. The following table lists the 85th percentile speeds and the pace of the traffic stream by location beginning at the 45 mph to 50 mph speed limit transition and continuing south to the intersection with Vandaveer Road at milepost 3.8.

<u>Location</u>	<u>85th percentile Speed</u>	<u>Pace of Traffic Stream & Percent</u>
45 mph to 50 mph Transition	Northbound 51 mph Southbound 50 mph	41 mph – 51 mph (70%) 41 mph – 51 mph (66%)
Riverfront Park (50 mph zone)	Northbound 53 mph Southbound 54 mph	44 mph – 54 mph (67%) 44 mph – 54 mph (59%)

<u>Location</u>	<u>85th percentile Speed</u>	<u>Pace of Traffic Stream & Percent</u>
Just south of the River (50 mph zone)	Northbound 57 mph Southbound 51 mph	47 mph – 57 mph (63%) 41 mph – 51 mph (69%)
Quanta Lane (50 mph zone)	Northbound 51 mph Southbound 52 mph	41 mph – 51 mph (58%) 41 mph – 51 mph (60%)
50 mph to 70 mph Transition	Northbound 62 mph Southbound 57 mph	49 mph – 59 mph (56%) 46 mph – 56 mph (61%)
Near Marian Road (milepost 1.8)	Northbound 65 mph Southbound 63 mph	52 mph – 62 mph (48%) 52 mph – 62 mph (51%)
North of Briarwood Blvd. (milepost 2.2)	Northbound 62 mph Southbound 61 mph	46 mph – 56 mph (45%) 49 mph – 59 mph (54%)
South of Robindale Dr. (milepost 2.7)	Northbound 67 mph Southbound 66 mph	52 mph – 62 mph (48%) 55 mph – 65 mph (50%)
Blue Creek School Zone (50 mph / 40 mph)	Northbound 57 mph Southbound 58 mph	44 mph – 54 mph (55%) 47 mph – 57 mph (55%)
Vandaveer Road (milepost 3.7)	Northbound 74 mph Southbound 65 mph	58 mph – 68 mph (40%) 52 mph – 62 mph (47%)

Along the northern portion of the study area the 50 mph speed zone is functioning successfully in representing traffic operation from the intersection with the South Frontage Road to the intersection with Hill Crest Road. The 50 mph speed limit was just below the 85th percentile speeds at nearly every location sampled. There was also a reputable proportion of the traffic stream traveling within the pace along this segment.

From the end of the 50 mph speed zone to the Blue Creek School zone the 85th percentile speeds and the upper limit of the pace are consistently below the statutory 70 mph speed limit posted along this segment. A 60 mph speed limit would best reflect the trend in the travel speed statistics collected at four locations.

The 50 mph speed zone in front of the Blue Creek School is 7 mph to 8 mph below the 85th percentile speeds. Additional compliance in the 50 mph speed zone is desirable for effective operation. South of the Blue Creek School zone at the intersection with Vandaveer Road there is a 9 mph directional difference in the travel speeds. Furthermore, the pace of the traffic stream was identified as being 3 mph to 6 mph below the 85th percentile speeds at this location.

Conclusions and Recommendations

The results of this investigation have identified that the existing 50 mph speed limit on the north end of the study area and the 50 mph / 40 mph special school speed limits are below the

prevailing 85th percentile speeds typically used in setting speed limits. The 50 mph speed zone is right in line with traffic operation. However, additional compliance in the Blue Creek School speed zone is desirable.

As for the remainder of the study area it is functioning the safest with only two reported accidents in the last three years. The travel speeds along this segment are consistently well below the posted statutory 70 mph speed limit. A 60 mph speed limit would be just below the typical 85th percentile speeds and the upper limit of the pace. It would also maintain the preferred 10 mph incremental change in the speed limits to reflect traffic operation. Based on the results of this investigation we recommend the following 60 mph speed limits for Blue Creek Road.

A 60 mph speed limit beginning at station 424+00, project S 132(6) (the end of the 50 mph speed zone approved in 1998) and continuing south to station 326+00, project RS 416-1(3), an approximate distance of 2.045 miles.

The 50 mph / 40 mph special school speed zone for the Blue Creek School will remain in effect as approved in 1996.

A 60 mph speed limit beginning at station 302+00, project RS 416-1(3) and continue south to station 284+00, an approximate distance of 1,800 feet.

DCB:DRB:TRF:s416rpt

attachments

copies: D.E. Williams
D.R. Bailey

SPEED ZONE STUDY

station number 1 NB in BILLINGS
BLUE CR RD

the 85th percentile speed is 73.29 mph
the total number of vehicles in the sample is 800
the average speed of this sample is 64.48 mph
the standard deviation of this sample is 8.90 mph
the standard error of the mean is 0.315 mph
the upper limit of the pace is 68 mph
the lower limit of the pace is 58 mph
the number of vehicles in the pace is 317
the percent of vehicles in the pace is 39.63
the 7th percentile speed = 52.04 mph
the 50th percentile speed = 64.21 mph
the 90th percentile speed = 75.77 mph
the 93rd percentile speed = 77.77 mph

SPEED ZONE STUDY

station number 1 SB in BILLINGS
BLUE CR RD

the 85th percentile speed is 64.82 mph
the total number of vehicles in the sample is 818
the average speed of this sample is 57.14 mph
the standard deviation of this sample is 7.81 mph
the standard error of the mean is 0.273 mph
the upper limit of the pace is 62 mph
the lower limit of the pace is 52 mph
the number of vehicles in the pace is 384
the percent of vehicles in the pace is 46.94
the 7th percentile speed = 45.53 mph
the 50th percentile speed = 56.95 mph
the 90th percentile speed = 67.11 mph
the 93rd percentile speed = 68.81 mph

SPEED ZONE STUDY

station number 2 NB in BILLINGS
BLUE CR RD

the 85th percentile speed is 56.64 mph
the total number of vehicles in the sample is 974
the average speed of this sample is 49.27 mph
the standard deviation of this sample is 8.85 mph
the standard error of the mean is 0.284 mph
the upper limit of the pace is 54 mph
the lower limit of the pace is 44 mph
the number of vehicles in the pace is 533
the percent of vehicles in the pace is 54.72
the 7th percentile speed = 35.06 mph
the 50th percentile speed = 50.17 mph
the 90th percentile speed = 58.73 mph
the 93rd percentile speed = 60.28 mph

SPEED ZONE STUDY

station number 2 SB in BILLINGS
BLUE CR RD

the 85th percentile speed is 57.95 mph
the total number of vehicles in the sample is 991
the average speed of this sample is 50.44 mph
the standard deviation of this sample is 8.87 mph
the standard error of the mean is 0.282 mph
the upper limit of the pace is 57 mph
the lower limit of the pace is 47 mph
the number of vehicles in the pace is 544
the percent of vehicles in the pace is 54.89
the 7th percentile speed = 38.76 mph
the 50th percentile speed = 51.17 mph
the 90th percentile speed = 59.55 mph
the 93rd percentile speed = 60.96 mph

SPEED ZONE STUDY

station number 3 NB in BILLINGS
BLUE CR RD

the 85th percentile speed is 66.72 mph
the total number of vehicles in the sample is 555
the average speed of this sample is 59.06 mph
the standard deviation of this sample is 7.54 mph
the standard error of the mean is 0.320 mph
the upper limit of the pace is 62 mph
the lower limit of the pace is 52 mph
the number of vehicles in the pace is 264
the percent of vehicles in the pace is 47.57
the 7th percentile speed = 47.92 mph
the 50th percentile speed = 59.02 mph
the 90th percentile speed = 68.23 mph
the 93rd percentile speed = 69.74 mph

SPEED ZONE STUDY

station number 3 SB in BILLINGS
BLUE CR RD

the 85th percentile speed is 66.41 mph
the total number of vehicles in the sample is 460
the average speed of this sample is 59.51 mph
the standard deviation of this sample is 7.20 mph
the standard error of the mean is 0.336 mph
the upper limit of the pace is 65 mph
the lower limit of the pace is 55 mph
the number of vehicles in the pace is 232
the percent of vehicles in the pace is 50.43
the 7th percentile speed = 48.10 mph
the 50th percentile speed = 59.88 mph
the 90th percentile speed = 67.76 mph
the 93rd percentile speed = 69.47 mph

SPEED ZONE STUDY

station number 4 NB in BILLINGS
BLUE CR RD

the 85th percentile speed is 61.68 mph
the total number of vehicles in the sample is 42083
the average speed of this sample is 53.35 mph
the standard deviation of this sample is 7.86 mph
the standard error of the mean is 0.172 mph
the upper limit of the pace is 56 mph
the lower limit of the pace is 46 mph
the number of vehicles in the pace is 944
the percent of vehicles in the pace is 45.32
the 7th percentile speed = 42.48 mph
the 50th percentile speed = 52.71 mph
the 90th percentile speed = 64.08 mph
the 93rd percentile speed = 65.90 mph

SPEED ZONE STUDY

station number 4 SB in BILLINGS
BLUE CR RD

the 85th percentile speed is 60.87 mph
the total number of vehicles in the sample is 42107
the average speed of this sample is 54.19 mph
the standard deviation of this sample is 6.42 mph
the standard error of the mean is 0.140 mph
the upper limit of the pace is 59 mph
the lower limit of the pace is 49 mph
the number of vehicles in the pace is 41132
the percent of vehicles in the pace is 53.73
the 7th percentile speed = 44.73 mph
the 50th percentile speed = 54.16 mph
the 90th percentile speed = 62.42 mph
the 93rd percentile speed = 63.78 mph

SPEED ZONE STUDY

station number 5 NB in BILLINGS
BLUE CR RD

the 85th percentile speed is 65.14 mph
the total number of vehicles in the sample is 2300
the average speed of this sample is 57.87 mph
the standard deviation of this sample is 7.20 mph
the standard error of the mean is 0.150 mph
the upper limit of the pace is 62 mph
the lower limit of the pace is 52 mph
the number of vehicles in the pace is 1109
the percent of vehicles in the pace is 48.22
the 7th percentile speed = 47.18 mph
the 50th percentile speed = 57.82 mph
the 90th percentile speed = 66.93 mph
the 93rd percentile speed = 68.00 mph

SPEED ZONE STUDY

station number 5 SB in BILLINGS
BLUE CR RD

the 85th percentile speed is 63.43 mph
the total number of vehicles in the sample is 2369
the average speed of this sample is 56.40 mph
the standard deviation of this sample is 6.79 mph
the standard error of the mean is 0.139 mph
the upper limit of the pace is 62 mph
the lower limit of the pace is 52 mph
the number of vehicles in the pace is 1201
the percent of vehicles in the pace is 50.70
the 7th percentile speed = 46.42 mph
the 50th percentile speed = 56.31 mph
the 90th percentile speed = 64.88 mph
the 93rd percentile speed = 66.43 mph

SPEED ZONE STUDY

station number 6 NB in BILLINGS.

BLUE CR RD

the 85th percentile speed is 61.80 mph
the total number of vehicles in the sample is 1997
the average speed of this sample is 55.49 mph
the standard deviation of this sample is 6.46 mph
the standard error of the mean is 0.145 mph
the upper limit of the pace is 59 mph
the lower limit of the pace is 49 mph
the number of vehicles in the pace is 1117
the percent of vehicles in the pace is 55.93
the 7th percentile speed = 46.39 mph
the 50th percentile speed = 55.19 mph
the 90th percentile speed = 63.72 mph
the 93rd percentile speed = 64.94 mph

SPEED ZONE STUDY

station number 6 SB in BILLINGS

BLUE CR RD

the 85th percentile speed is 56.58 mph
the total number of vehicles in the sample is 2023
the average speed of this sample is 51.02 mph
the standard deviation of this sample is 5.90 mph
the standard error of the mean is 0.131 mph
the upper limit of the pace is 56 mph
the lower limit of the pace is 46 mph
the number of vehicles in the pace is 1228
the percent of vehicles in the pace is 60.70
the 7th percentile speed = 42.24 mph
the 50th percentile speed = 51.01 mph
the 90th percentile speed = 58.03 mph
the 93rd percentile speed = 58.91 mph

SPEED ZONE STUDY

station number 7 NB in BILLINGS
BLUE CR RD

the 85th percentile speed is 51.37 mph
the total number of vehicles in the sample is 4293
the average speed of this sample is 45.52 mph
the standard deviation of this sample is 6.01 mph
the standard error of the mean is 0.092 mph
the upper limit of the pace is 51 mph
the lower limit of the pace is 41 mph
the number of vehicles in the pace is 2489
the percent of vehicles in the pace is 57.98
the 7th percentile speed = 36.59 mph
the 50th percentile speed = 45.82 mph
the 90th percentile speed = 52.85 mph
the 93rd percentile speed = 53.73 mph

SPEED ZONE STUDY

station number 7 SB in BILLINGS
BLUE CR RD

the 85th percentile speed is 51.97 mph
the total number of vehicles in the sample is 4317
the average speed of this sample is 46.18 mph
the standard deviation of this sample is 5.91 mph
the standard error of the mean is 0.090 mph
the upper limit of the pace is 51 mph
the lower limit of the pace is 41 mph
the number of vehicles in the pace is 2609
the percent of vehicles in the pace is 60.44
the 7th percentile speed = 37.01 mph
the 50th percentile speed = 46.55 mph
the 90th percentile speed = 53.23 mph
the 93rd percentile speed = 53.99 mph

SPEED ZONE STUDY

station number 8 NB in BILLINGS
BLUE CR RD

the 85th percentile speed is 56.64 mph
the total number of vehicles in the sample is 2630
the average speed of this sample is 51.25 mph
the standard deviation of this sample is 6.00 mph
the standard error of the mean is 0.117 mph
the upper limit of the pace is 57 mph
the lower limit of the pace is 47 mph
the number of vehicles in the pace is 1651
the percent of vehicles in the pace is 62.78
the 7th percentile speed = 42.87 mph
the 50th percentile speed = 51.59 mph
the 90th percentile speed = 58.10 mph
the 93rd percentile speed = 59.26 mph

SPEED ZONE STUDY

station number 8 SB in BILLINGS
BLU CR RD

the 85th percentile speed is 51.41 mph
the total number of vehicles in the sample is 2567
the average speed of this sample is 46.42 mph
the standard deviation of this sample is 5.77 mph
the standard error of the mean is 0.114 mph
the upper limit of the pace is 51 mph
the lower limit of the pace is 41 mph
the number of vehicles in the pace is 1759
the percent of vehicles in the pace is 68.52
the 7th percentile speed = 38.34 mph
the 50th percentile speed = 46.64 mph
the 90th percentile speed = 53.04 mph
the 93rd percentile speed = 54.03 mph

SPEED ZONE STUDY

station number 9 NB in BILLINGS
BLUE CR RD

the 85th percentile speed is 53.13 mph
the total number of vehicles in the sample is 4614
the average speed of this sample is 47.53 mph
the standard deviation of this sample is 6.68 mph
the standard error of the mean is 0.098 mph
the upper limit of the pace is 54 mph
the lower limit of the pace is 44 mph
the number of vehicles in the pace is 4309
the percent of vehicles in the pace is 67.17
the 7th percentile speed = 36.79 mph
the 50th percentile speed = 48.58 mph
the 90th percentile speed = 54.08 mph
the 93rd percentile speed = 55.28 mph

SPEED ZONE STUDY

station number 9 SB in BILLINGS
BLUE CR RD

the 85th percentile speed is 54.32 mph
the total number of vehicles in the sample is 4688
the average speed of this sample is 48.02 mph
the standard deviation of this sample is 7.07 mph
the standard error of the mean is 0.103 mph
the upper limit of the pace is 54 mph
the lower limit of the pace is 44 mph
the number of vehicles in the pace is 4275
the percent of vehicles in the pace is 58.81
the 7th percentile speed = 35.66 mph
the 50th percentile speed = 48.90 mph
the 90th percentile speed = 55.89 mph
the 93rd percentile speed = 56.83 mph

SPEED ZONE STUDY

station number 10 NB in BILLINGS
BLUE CR RD

the 85th percentile speed is 50.84 mph
the total number of vehicles in the sample is 4092
the average speed of this sample is 46.23 mph
the standard deviation of this sample is 4.95 mph
the standard error of the mean is 0.077 mph
the upper limit of the pace is 51 mph
the lower limit of the pace is 41 mph
the number of vehicles in the pace is 2854
the percent of vehicles in the pace is 69.75
the 7th percentile speed = 39.22 mph
the 50th percentile speed = 46.24 mph
the 90th percentile speed = 52.23 mph
the 93rd percentile speed = 53.17 mph

SPEED ZONE STUDY

station number 10 SB in BILLINGS
BLUE CR RD

the 85th percentile speed is 50.36 mph
the total number of vehicles in the sample is 4224
the average speed of this sample is 45.36 mph
the standard deviation of this sample is 5.08 mph
the standard error of the mean is 0.078 mph
the upper limit of the pace is 51 mph
the lower limit of the pace is 41 mph
the number of vehicles in the pace is 2795
the percent of vehicles in the pace is 66.17
the 7th percentile speed = 37.79 mph
the 50th percentile speed = 45.38 mph
the 90th percentile speed = 51.51 mph
the 93rd percentile speed = 52.68 mph