## I. INTRODUCTION

The City of Albuquerque – Department of Municipal Development (Engineering Division and Traffic Engineering Division) was requested to conduct a speed study along Baldwin Avenue in northeast Albuquerque.

## II. PROJECT PURPOSE

A speed study on Baldwin Avenue was conducted between Eubank Boulevard and Morris Street to determine the following:

- Evaluate the 85th percentile speed along Baldwin Avenue
- Determine from the speed study if there is a speeding along Baldwin Avenue from Eubank Boulevard to Morris Street
- If speed humps are warranted based on the City's Neighborhood Traffic Management Program

As part of this study, an evaluation and cataloging of existing roadway conditions, collection of historical ADT and crash data, field speed surveys at four (4) locations within the study area, and evaluation the survey data will be completed.

## III. PROJECT DESCRIPTION

The study area will be a 0.5 mile section of Baldwin Avenue between Eubank Boulevard and Morris Street.

Please refer to Figures III.A.1 below showing the project area.

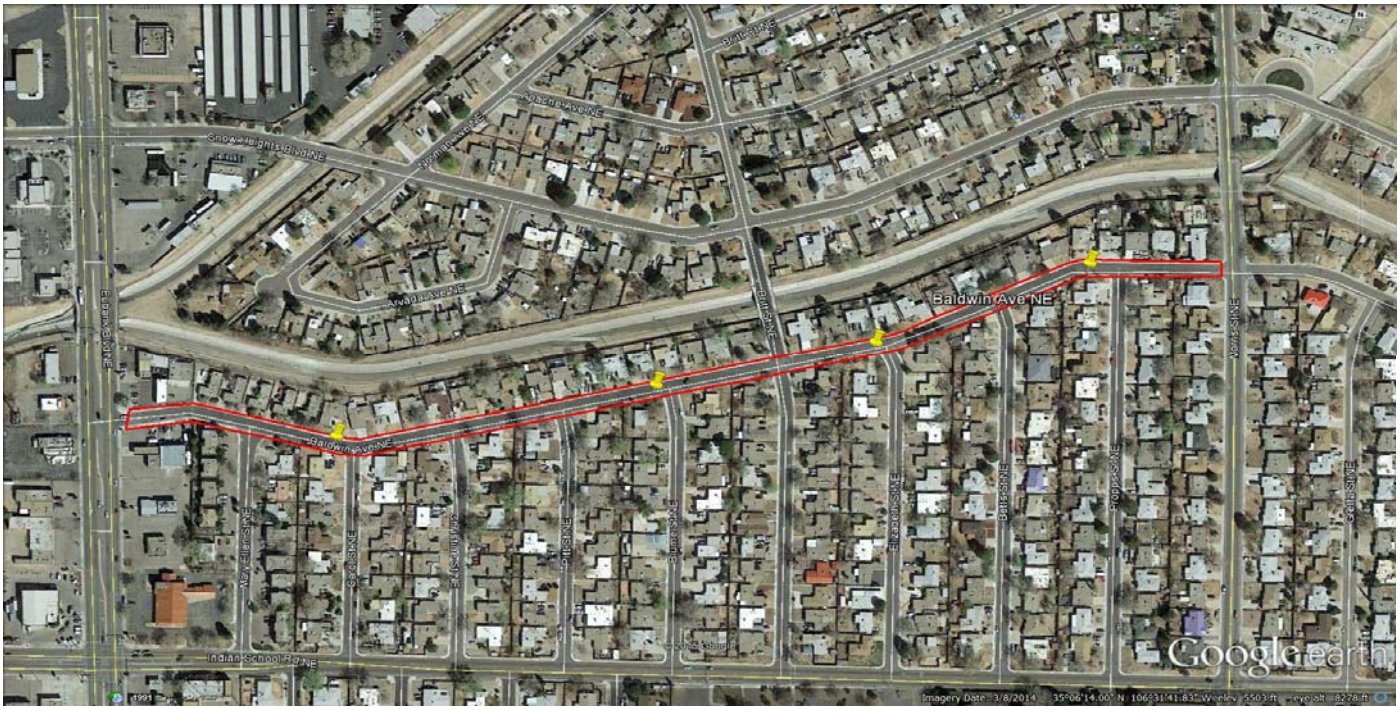


***Figure III.A.1***
***Project Vicinity Map***

## IV. BACKGROUND OF SPEED LIMITS

Speed limits are established on roadways of virtually all classifications, from interstate freeways to low-volume local streets. The primary purpose of speed limits is to give motorists clear instruction as to what is a reasonable speed for them to drive at while traveling on a given roadway.

Among regulatory signage, speed limit signs arguably contain the most critical information that motorists need to be informed of while driving (next to stop signs, which are considered the highest impact regulatory sign). Drivers unfamiliar with a roadway often do not realize what characteristics the roadway has, and properly established speed limit signs give them the information they need to drive the roadway safely.

The NMDOT has guidelines for analyzing and establishing posted speed limits; the following text is based on one such example:

Realistic posted speed limits are of public importance for many reasons:

- They invite public compliance by conforming to the behavior or the driving majority
- They give clear reminders of safe and reasonable speeds to non-conforming violators
- They offer the most effective tool for law enforcement of safe driving
- They will minimize public antagonism toward law enforcement that results from unreasonable regulations

Improperly, or artificially low, posted speed limits can cause problems for state and local agencies for several reasons:

- They do not encourage voluntary compliance, since they do not reflect the behavior of the majority
- They make the behavior of the majority unlawful
- They maximize public antagonism toward law enforcement, since the perception is that the police are enforcing a “speed trap”
- They create a bad image for a community in the eyes of visitors/tourists

### IV.A SETTING SPEED LIMITS

In accordance with Section 66-7-303 of the New Mexico Criminal and Traffic Law Manual, the speed limit on state highways shall be set by the Cabinet Secretary of the Department of Transportation, based on an engineering survey and traffic investigation that includes the following parameters:

- Spot speed studies (typically consisting of 100 vehicles)
- Roadway geometry/number of lanes
- Roadside environment and characteristics
- Building setbacks (if within a commercial business district)
- Driveway and intersection spacing/density
- Historical crash data for the roadway study area

Many speed limits are established using the theory of the 85th percentile. Out of the (typically) 100 vehicles surveyed, beginning with the fastest vehicle speed recorded the 15th vehicle from that speed is determined to show where the 85th percentile speed is. This is assuming that most drivers (85%) drive within reasonable limits. The posted speed limit can then be established and is usually the 5-mph increment just below the 85th percentile speed. For example, if the 85th percentile speed has been determined by an engineering survey to be 47 mph, the posted speed would be 45 mph. This method of posting speed limits allows for a reasonable posted speed limit that can be enforced by local agencies, without creating a speed trap.

For surveys with a different amount than 100 vehicles, the 85th percentile speed is determined by the following formula: 100/15 = # of vehicles surveyed/X (where x is the vehicle at the 85th percentile). For example, a 50 vehicle survey would result in:

100/15 = 50/X
X = 7.5, or the 8th vehicle in the survey

Other methods are frequently used to further analyze the posting of speed limits – these are the mode, median and geometric mean:

- The mode is the most frequently clocked vehicle speed in a given survey – for example, in a 100 vehicle survey where 12 vehicles were clocked traveling 55 mph and no other speed was observed as frequently, the mode is 55 mph.

- The median is the numerical midpoint of a given survey – in a survey of 100 vehicles, the speeds of the 50th and 51st vehicles are added and divided by 2 to obtain the median speed. If the 50th vehicle of such a survey was traveling 56 mph and the 51st vehicle was also traveling 56 mph, the resulting median speed would be (56+56)/2 = 112/2 = 56 mph.

- The geometric mean is described as follows: "*an average of a set of numbers that is calculated by multiplying all the numbers ("n"), and taking the nth root of the total."*

  Formula for Geometric Mean**:**
  Geometric Mean = $((X_1)(X_2)(X_3).....(X_N))^{1/N}$

  where
  X = Individual Score (speed)
  N = Sample size (Number of scores)

  Geometric Mean Example: To find the Geometric Mean of speeds 31, 32, 35, 38, and 40 mph.

  Step 1: N = 5, the total number of values. Find 1/N.
  1/N = 0.2

  Step 2: Determine Geometric Mean using the formula.
  $((31)(32)(35)(38)(40))^{0.2} = (52{,}774{,}400)^{0.2}$
  Geometric Mean = 35.03 mph

In most cases, the geometric mean of a speed study will be of similar value of the median, often within 1 to 2 mph on either side of the median. In the above example, the median speed would be the third vehicle surveyed (55 mph), and the geometric mean is 55.09 mph.

## IV.B STUDY AREA

The study area is along Baldwin Avenue between beginning at Eubank Boulevard and ending at Morris Street. Within the study area the existing speed limit along Baldwin Avenue is 25 mph.

Traffic counts and speed data was collected at four (4) locations along Baldwin Avenue. Traffic/speed count locations were collected at the following locations:

- Location #1: Baldwin Avenue west of Carol Street
- Location #2: Baldwin Avenue west of Blume Street
- Location #3: Baldwin Avenue west of Elizabeth Street
- Location #4: Baldwin Avenue west of Propps Street

The AADT for the four locations listed above are listed below:

| Location | AADT | | |
|---|---|---|---|
| | **Lane 1 (EB)** | **Lane 3 (WB)** | **AADT** |
| #1 | 396 | 384 | 780 |
| #2 | 349 | 358 | 707 |
| #3 | 367 | 326 | 693 |
| #4 | 311 | 372 | 683 |
| **TOTALS** | **356** | **360** | **716** |

***Table IV.B***
***AADT Count Data Results***

Baldwin Avenue study area ranges from 356 to 360 vehicles per day.

Traffic count data is located in Appendix A.

The speed survey segments are described in more detail below, beginning with the westernmost portion of the corridor at Eubank Boulevard and terminating at Morris Street. Each study segment will have descriptions of roadside environment, driveway and intersection density and photographs illustrating the study segment. From the westerly terminus of the study area, each survey segment is described as follows:

## IV.B.1 – SEGMENT 1: BALDWIN AVENUE BETWEEN EUBANK BOULEVARD AND CAROL STREET

This segment of the study area is ROW width of 43'. A breakdown of the ROW is listed below:

- 30' asphalt pavement
- 2.5' curb and gutter
- 4' sidewalk

Sidewalk, curb and gutter exist on both sides of Baldwin Avenue. Below is a photo showing the cross-section listed above.

***Figure IV.B.1***
***Baldwin Avenue west of Carol Street***

There is one intersection (Mary Ellen Street) and 11 driveways (4 commercial, 7 residential) within this segment of the study area. Driveways access 2 commercial businesses and 7 residential homes.

Results of the speed study for Segment 1 is listed below:

| Location #1 | Lane 1 (EB) | Lane 3 (WB) | Comb Total |
|---|---|---|---|
| Average | 18.5 | 20.4 | 19.4 |
| 50th Percentile | 21.3 | 22.6 | 21.8 |
| 10mph Pace | 23.3 | 25.2 | 24.2 |
| 85th Percentile | 27.1 | 28.4 | 27.9 |

***Table IV.B.1***
***Location #1 Speed Study Results***

## IV.B.2 – SEGMENT 2: BALDWIN AVENUE BETWEEN CAROL STREET AND BLUME STREET

This segment of the study area is ROW width of 42'. A breakdown of the ROW is listed below:

- 30' asphalt pavement
- 2.5' curb and gutter
- 3.5' sidewalk

Sidewalk, curb and gutter exist on both sides of Baldwin Avenue. Below is a photo showing the cross-section listed above.

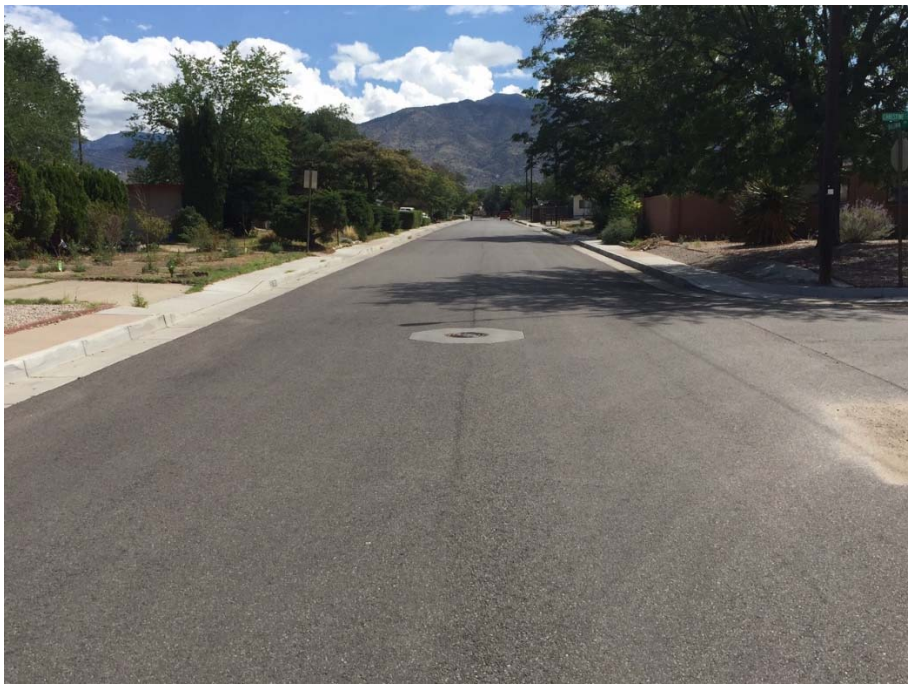

***Figure IV.B.2***
***Baldwin Avenue west of Blume Street***

There are two (2) intersections (Christine Street & Pitt Street) and 15 driveways within this study area. All driveways provide access to residential homes.
Results of the speed study for Segment 2 is listed below:

| Location #2 | Lane 1 (EB) | Lane 3 (WB) | Comb Total |
|---|---|---|---|
| Average | 23.2 | 21.1 | 22.2 |
| 50th Percentile | 24.7 | 23.1 | 23.9 |
| 10mph Pace | 27.6 | 26.3 | 27 |
| 85th Percentile | 31.6 | 29 | 29.9 |

***Table IV.B.2***
***Location #2 Speed Study Results***

## IV.B.3 – SEGMENT 3: BALDWIN AVENUE BETWEEN BLUME STREET AND ELIZABETH STREET

This segment of the study area is ROW width of 42'. A breakdown of the ROW is listed below:

- 30'asphalt pavement
- 2.5' curb and gutter
- 3.5' sidewalk

Sidewalk, curb and gutter exist on both sides of Baldwin Avenue. Below is a photo showing the cross-section listed above.

***Figure IV.B.3***
***Baldwin Avenue west of Elizabeth Street***

There is one (1) intersections (Britt Street) and 11 driveways within this study area. All driveways provide access to residential homes. The intersection at Baldwin Avenue and Britt Street is a STOP controlled (four-way). While conducting field inventory of the corridor, it was noted that there were at least three (3) instances where traffic along Baldwin Avenue did not obey the STOP signs and appeared to be speeding thru the intersection.

Results of the speed study for Segment 3 is listed below:

| Location #3 | Lane 1 (EB) | Lane 3 (WB) | Comb Total |
|---|---|---|---|
| Average | 18 | 19.7 | 18.8 |
| 50th Percentile | 21 | 22 | 21 |
| 10mph Pace | 22.7 | 23.7 | 23.2 |
| 85th Percentile | 24.7 | 27.1 | 25.9 |

***Table IV.B.3***
***Location #3 Speed Study Results***

## IV.B.4 – SEGMENT 4: BALDWIN AVENUE BETWEEN ELIZABETH STREET AND PROPP STREET

This segment of the study area is ROW width of 42'. A breakdown of the ROW is listed below:

- 30' asphalt pavement
- 2.5' curb and gutter
- 3.5' sidewalk

Sidewalk, curb and gutter exist on both sides of Baldwin Avenue. Below is a photo showing the cross-section listed above.

***Figure IV.B.4***
***Baldwin Avenue west of Propps Street***

There is one (1) intersection (Betts Street) and 10 driveways within this study area. All driveways provide access to residential homes.

Results of the speed study for Segment 4 is listed below:

| Location #4 | Lane 1 (EB) | Lane 3 (WB) | Comb Total |
|---|---|---|---|
| Average | 20.9 | 20.4 | 20.6 |
| 50th Percentile | 22.7 | 22.4 | 22.6 |
| 10mph Pace | 24.8 | 24.4 | 24.5 |
| 85th Percentile | 28.2 | 27.6 | 27.8 |

***Table IV.B.4***
***Location #4 Speed Study Results***

Speed study results for all four locations are listed in Appendix B.

## V. CRASH DATA

Crash data was requested from the Traffic Safety Bureau at New Mexico Department of Transportation. NMDOT stated that there were no reported crashes along Baldwin Avenue within the study area. The only crashes that were reported were at the intersections of Eubank Boulevard/Baldwin Avenue and Morris Street/Baldwin Avenue.

## VI. SPOT SPEED STUDY RESULTS

When considering establish a new posted speed limit, or revising an existing posted speed limit, on a given roadway a survey of traffic speeds is critical to determine a reasonably posted speed limit.

But before a posted speed limit can be modified, analysis must be conducted to ascertain whether or not the speed limit can be adjusted without resulting in further increases of motorists' travel speeds. Motorists usually drive at speeds that they feel safe, based on the observable roadway conditions; this means that if a roadway is wide, flat and straight, the motorist will drive at a speed they feel comfortable based on what they observe as opposed to what a speed limit sign would say. To elaborate further, a four-lane street that is flat and straight with no unusual conditions that has a posted speed of 30 mph would probably result in most motorists traveling well over that posted speed, because the roadway conditions dictate that they could safely drive much faster.

In the case of Baldwin Avenue between Eubank Boulevard and Morris Street, the posted speed limit is 25 mph, and roadway conditions throughout the corridor are fairly consistent: controlled access, good pavement condition with wide (11') travel lanes, and on-street parking. Thus, there are no unusual roadway conditions through the corridor.

Also, over 700 vehicles were surveyed at four (4) locations within the study area. The surveyed vehicles showed that 30% of those surveyed vehicles were traveling higher than the posted speed limit (i.e. greater than 26 mph). Segment #2 was to have shown to have the highest percentage (44%) of the traffic exceeding the 25 mph posted speed limit. Segment #3 was to have shown the lowest percentage (17%) of traffic exceeding the 25 mph posted speed limit. This 85% percentile speeds measured for the corridor (both directions) of 27.9 mph indicates that the 25 mph speed limit on the study area of Baldwin Avenue is probably a reasonably posted speed limit. The survey results essentially make lawbreakers of 30% of the motorists who use this roadway.

Results of the speed study for the entire study area is listed below:

| Corridor Totals | Lane 1 (EB) | Lane 3 (WB) | Comb Total |
|---|---|---|---|
| Average | 20.2 | 20.4 | 20.3 |
| 50th Percentile | 22.4 | 22.5 | 22.3 |
| 10mph Pace | 24.6 | 24.9 | 24.7 |
| 85th Percentile | 27.9 | 28.0 | 27.9 |

***Table VI.1***
***Baldwin Avenue Speed Study Results***

## VII. U.S. LIMITS SPEED LIMIT PROGRAM

U.S. Limits is an FHWA sponsored program used to analyze speed limits. This program calculates a recommended speed limit based on the criteria given, which is listed on the website as follows:

- *density of surrounding development (e.g. high density, low density or rural);*
- *frequency of roadside access (e.g. number of residential driveways, commercial, industrial, shopping, and special activity properties, and the number and type of intersecting roads);*
- *road function (e.g. traffic movement vs. access to abutting properties);*
- *road characteristics (e.g. paved width, divided or undivided, lane width and number of lanes, sight restrictions);*
- *road conditions and important high speed road characteristics (e.g. interchange spacing, AADT, shoulders);*
- *existing vehicle operating speeds;*
- *adjoining speed limits; and*
- *any special conditions that may exist on the road section (e.g. adverse alignment, pedestrian and roadside activities, high crash rates, etc).*

This analysis was used for Baldwin Avenue. Based on the data entered for the above-listed categories, the program concluded that a 20 mph posted speed limit was warranted for the corridor. The output sheet is shown in Appendix C – U.S. Limits Output.

This site can be accessed at http://www.uslimits.com

## VIII. CONCLUSION

After evaluating the traffic and speed study data collected through the project area, it apparent that none of criteria outlined in Section II, Paragraph 3, Item #2 of the City's Neighborhood Traffic Management Plan has been met for traffic calming management.