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# 1000 Speed & Traffic Impact Studies

## 1010 Minimum Criteria & Requests for Speed Changes

- 1010.1 Speed Limits
- 1010.2 Speed Zone Reappraisal

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## Policy 1010.1

# ESTABLISHMENT OF SPEED LIMITS AND ADVISORY SPEEDS

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## Introduction

The purpose of this policy is to provide the Nebraska Department of Roads with a basis for the consistent application of engineering principles to set maximum speed limits and the placement of advisory speeds. This policy will be used for establishing and recommending speed zones on the Nebraska State Highway System. The utilization of engineering policies and procedures in vehicle speed control should improve the traffic operation, encourage better and more uniform driving practices, and increase the safety of traffic movements. Please note, this policy is not intended for use with temporary traffic control zones such as construction zones. It is only intended for permanent speed zones. For information regarding work zone speed limits, please refer to DOR-OI 60-18.

## Nebraska Law

According to Nebraska State Statute, Section 60-6,190 (1), *"Whenever the Department of Roads determines, upon the basis of an engineering and traffic investigation, that any maximum speed limit is greater or less than is reasonable or safe under the conditions found to exist at any intersection, place, or part of the state highway system outside of the corporate limits of cities and villages as well as inside the corporate limits of cities and villages on freeways which are part of the state highway system, it may determine and set a reasonable and safe maximum speed limit for such intersection, place, or part of such highway which shall be the lawful speed limit when appropriate signs giving notice thereof are erected at such intersection, place, or part of highway, except that the maximum rural and freeway limits shall not be exceeded."*

For non-freeway segments within the corporate limits of cities and villages, Section 60-6, 190 (4) states that *"...incorporated cities and villages shall have the same power and duty to alter the maximum speed limits as the department if the change is based on an engineering and traffic investigation."* However, it goes on to say that these entities may not change the posted speed limit without the approval of the Department. Please note, the language in this statute is referring to cities with populations fewer than 40,000 inhabitants. For cities 40,000 or more inhabitants, the statute states that cities shall have jurisdiction over the posted speed limit on state highways after consultation with the Department (see Section 60-6,120 (2b)).

The statutory maximum speed limits for the different types of roadways throughout Nebraska can be found in Section 60-6,186 of the Nebraska Rules of the Road. Additional information regarding speed limits can be found in Sections 60-6,185 thru 60-6,190 of the Nebraska Rules of the Road.



# ESTABLISHMENT OF SPEED LIMITS AND ADVISORY SPEEDS

Policy 1010.1

## Speed Zone Reappraisal

As guidance, the *Manual on Uniform Traffic Control Devices* (MUTCD) states, "At least once every five years, States and local agencies should reevaluate non-statutory speed limits on segments of their roadways that have undergone a significant change in roadway characteristics or surrounding land use since the last review." These changes would include, but not be limited to: elimination of parking, addition of lanes, signal coordination, and changes in roadside development. If no significant changes have occurred within five years of a previous study, then the amount of time between studies will be determined by the Traffic Engineering Division on a case-by-case basis.

When requested, a speed zone reappraisal may be conducted by the Nebraska Department to determine if the current speed limits are appropriate. All requests will be forwarded to the Traffic Engineering Division, who is the Office of Primary Responsibility for these requests. The Traffic Engineering Division, with the help of other divisions (if deemed necessary), will perform the engineering study of the highway segment in question.

Alternatively, governing bodies of cities and villages may have their own traffic engineering study performed for non-freeway facilities within their corporate limits to determine if the current speed limit is still appropriate. These studies must be conducted in the same or similar manner to those used by the NDOR and formal approval from NDOR is required before any changes are granted.

## Engineering and Traffic Study

If the maximum speed limit is changed, the new limit shall be established on the basis of an engineering and traffic study performed or approved by the Traffic Engineering Division. At a minimum, the engineering study shall include an analysis of the current speed distribution of free-flowing vehicles. The speed limit within a speed zone should be set to the nearest 5 MPH increment to the 85<sup>th</sup> percentile speed or the upper limit of the 10 MPH pace speed of free-flowing vehicles. Lastly, the study should adhere to practices found in the *ITE Traffic Control Device Handbook* and/or *ITE Manual of Transportation Engineering Studies*. It shall also adhere to guidance found in the MUTCD. This includes requirements that the engineering study be performed by a licensed professional engineer or under the direct supervision of a licensed professional engineer.

Other factors that may be considered when establishing speed limits include, but are not limited to, the following:

1. Roadway geometry including: vertical and horizontal alignment, and sight distance;
2. Roadside development, including location and number of access points;
3. Road and shoulder characteristics;
4. Pedestrian and bicycle activity;
5. Speed limits on adjoining highway segments;
6. Crash experience;
7. Traffic volume and composition, traffic control, and parking practices;
8. Design speed of the roadway.



# ESTABLISHMENT OF SPEED LIMITS AND ADVISORY SPEEDS

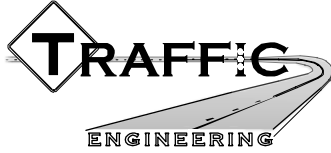
Policy 1010.1

When considering a highway segment for a 65 MPH speed limit, the existing roadway shall have a minimum surfaced shoulder width of six feet, and/or be designated on the State's Priority Commercial System. Other highway segments, not part of the Priority Commercial System, with a narrower or no surfaced shoulder may be considered for a 65 MPH speed limit when recommended by an engineering study and approved by the Deputy Director of Engineering. When applicable, the beginning and end of a speed zone should be placed at a logical terminus. These termini should be, but are not limited to: highway junctions, changing land use, and changes in highway cross-sections.

## Advisory Speeds

Advisory speeds should be used to inform motorists of isolated roadway conditions that may require operating speeds which are lower than the posted speed limit. This could include conditions related to stopping sight distance and design geometry. The determination of whether a road segment or feature, such as a curve, requires an advisory speed should be accomplished through a review of roadway geometry. If used, the appropriate warning signs and/or advisory plaques shall be in compliance with the State of Nebraska's Supplement to the Manual on Uniform Traffic Control Devices adopted by the Nebraska Department of Roads. The following bullets provide specific guidance on when to consider the use of advisory speed signs.

- Horizontal Curves: Advisory speed plaques should be used whenever the differential between the advisory speed and the posted speed limit is 5 mph or greater. Ball bank studies should be performed in accordance with Procedure 1021. Additional guidance can be found in Section 2C.08 of the 2009 MUTCD. In the absence of a ball bank study, the design speed of the curve may be used to determine whether an advisory speed plaque is recommended.
- Vertical Curves: Advisory speed signs may be used where there is insufficient sight distance (intersection or stopping sight distance) for intersections that are located downstream of a crest vertical curve. This does not include residential driveways and/or field entrances. Lastly, advisory speed signs should only be used when the difference in posted speed and speed related to the available sight distance equals or exceeds 10 mph.



**Procedure.1010.2**

## SPEED ZONE REAPPRAISAL

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A speed study is initiated by request, or upon completion of a highway improvement project per Traffic Engineering Procedure 1010.1, or as needed per Section 2B.13 of the MUTCD. The following are guidelines to the Speed Zone Appraisal process with some variation depending on circumstance:

1. Assistant Traffic Engineer assigns the work to an Analyst.
2. Existing speed zone documents are reviewed.
3. Data collection is scheduled, collected in the field, and then downloaded to speed software for statistical analysis. This yields 85th percentile speed, upper limit, 10 mph pace, average speed, etc., which should be compared to previously collected statistical results when available.
4. Land use, crash history, new speed data, etc. are considered and the need for a change in the speed limits is evaluated by the Analyst.
  - If a change is not needed, the process is completed and documents are filed.
  - If a change is needed, the process continues.
5. The speed and sign plats are prepared:

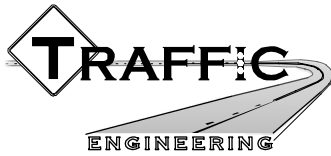
These two plats coexist in one Microstation file. The signing is shown on level 10. This level is toggled off for the speed plat.

Data is added to the speed plat using the symbols shown in the legend to indicate the speed, location, and date.

The corporate boundaries are investigated, to see whether or not the boundaries have changed since the previous speed zone plat was produced.

On the plat, an asterisk is used to indicate speed zones outside the corporate limits. A number is used to indicate adjacent speed zone authorizations in effect.

Signs are depicted with symbols on level 10. The sign size is per TEP 212.2. A capital X represents an R2-1-30 speed limit sign. A filled circle represents an R2-1-24 speed limit sign. A diamond represents a W3-5-36 speed reduction sign. (Larger signs are used on expressways and freeways. (ref TEP 212.2 and MUTCD table 2B-1)). A legend is used to define the sign symbology.



Reference post locations are added to indicate where the speed limit change is to occur. The reference locations are found in the Highway Reference Log Book, the Urban Reference Log Book, or by manually calculating distances using either of these log books as references.

The speed zone change location should be referenced to an existing street or dimensioned to a street. The description of the zone should be recommended to the governing body to be included in a speed zone ordinance or resolution. The ordinance or resolution number and a copy of the document is made part of the authorization for inside the corporate limits.

The speed limit values are placed in the area of the sign symbols. The numbers are oriented to be read in the direction of travel. For example, a speed limit number for the southbound direction in a plat where north is at the top of the page, is rotated upside down. Likewise, a speed limit for westbound traffic is rotated 90 degrees, and for eastbound traffic 270 degrees.

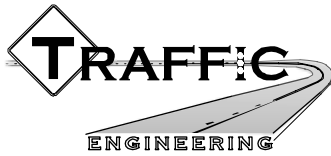
On county plats, specific sign locations are not explicitly shown; the speed zone limits are specified with reference post locations thus inferring the sign locations. NDOR maintenance forces are instructed via Traffic Engineering Procedure 212.1 to install additional rural signs.

Sign frequency is significantly higher in the corporate area environment, typically recurring every several blocks. Videolog should be reviewed, or an on-site visit made, to ascertain all current and valid signing locations are captured in the sign plat. Signs are required at the speed zone boundaries, at corporate limits, at departures from major intersections, on the departing legs of highway junctions, and at county lines (ref MUTCD Section 2B.18).

When a speed zone is changed on an established plat, the plat is often redone, so multiple plats for the same area can be eliminated. The preferred scale is 1" = 1000'. The preferred size for a plat is letter size, as that is easier to store in the plat books. Other paper size can be used when necessary for larger corporate or spur plats. In those instances, the final paper print is folded to fit in the plat books.

The drafting conventions used include a line weight of 12 and line style of 3 for the speed zone trapezoid lines. The color red is typically reserved for level 10, signing and dimensions that locate the signs.

The speed plat shall include the engineer's stamp. In Microstation, the stamp is placed on a level that can be toggled off, so it does not appear on the signing plat. The engineer's seal is made not visible. A note is to be placed in the bottom right corner of the title block boundary reading "Original Approved by ...." and date.



6. There are two types of authorization forms, one for "Inside Corporate Area" and the other "Outside Corporate Area". Blank forms can be found on the server at traffic on \\Dorimage1\Traffic

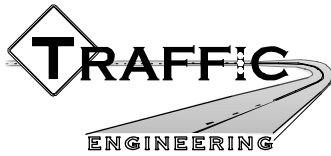
Old forms that say "Determination and Declaration", or "Authorization" and make reference to outdated state statutes should be replaced when a new study or project is completed. All superseded declarations and authorizations should be noted on the new plat.

Speed authorizations for locations inside or outside corporate areas are typically written in a manner that not only addresses the changes for specific locations, but also renews all other locations. Example: One zone inside, or outside, the corporate limits is changed from 45 to 35 mph, and two other zones inside, or outside, the corporate limits are not to be changed. Regardless of this, all three areas are included in the authorization. This practice facilitates historical review by reinitializing the established limits with each release. The number of current plats is kept to a minimum, essentially two, i.e. one outside of corporate limits, and one inside corporate limits (at least for the smaller cities).

Also, when reviewing an authorization, one should look for zones that, when established were outside of corporate limits, but are now inside due to boundary changes. Those zones would need to be included in the new speed zone ordinance as well as the new authorization for inside the corporate limits. Thus, the new authorization will be accurate with the current set of circumstances and will correct errors that may exist in the current authorization.

The speed authorization must have a unique number assigned. A number is assigned from the speed authorization number database Excel file located on \\Dorimage1\Traffic\Speed Zone Authorization\SZA Number Record.xls. Enter the appropriate information into the Excel database fields.

7. Speed Authorization is prepared and plats are checked.
8. Corrections are made to the Speed Authorizations and plats before they continue through the sequence.
9. The speed plat is stamped by a licensed engineer.
10. The Analyst requests the signatures for the State Traffic Engineer and the NDOR Director. A note of explanation is included for their review along with the authorization and plats if needed.



## SPEED ZONE REAPPRAISAL

Procedure.1010.2

11. Upon return of the signed authorization and plat, correspondence is prepared for distribution of the speed zone authorization. They are distributed to the following entities:
  - City or Village Clerk
  - County Sheriff
  - State Patrol
  - District Engineer
  - District Operations & Maintenance Manager
  - Area Maintenance Superintendent
  - District Traffic Engineer (D-5 through D-8)
  - Office (3): Job File - 1 copy; County File - 1 copy; Administrative Assistant - original
12. The Analyst or Engineer prepares an Action Report and a more detailed speed plat with sign locations to go with the Area Maintenance Superintendent copy.
13. District Maintenance forces install the signs.
14. The Area Maintenance Superintendent returns the Action Report with the completion date filled in.
15. The speed zone authorization and plats are scanned into pdf files for inclusion in the Falcon document management system. Those scanned files in Falcon are only adjusted to fit a good view as a pdf. Sometimes they need to be shrunk down proportionately, or split into separate sheets for viewing purposes.

For read-access of plats and authorizations, open Falcon, go to "Environments", click on "Traffic Details", open "Speed Zone" Folder, and scroll down to the County Name folder. If the authorization isn't listed under the County folder it may be found in the Corporate area folder.

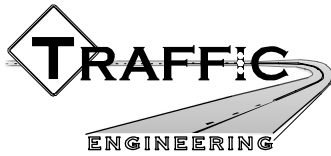
Once an authorization is approved, the Falcon "current" files are updated per the Microstation plat.

The Microstation plat (.dgn) is saved on the Traffic server (T:\te03\city\_speed for city plats, and at T:\te03\cnty\_speed for county plats). These files are write-accessible only to Traffic Engineering.

16. The current authorizations are kept accessible to Traffic Engineering in the files of the Traffic Engineering Administrative Assistant. The Administrative Assistant marks "Superseded" on the superseded authorization. Falcon files are moved from "current" location to the "Superseded County" or "Superseded City" folder as appropriate. The new authorization number is written onto the superseded authorization in both the county file cabinet and the signing 3-ring binder.

The correspondence files are kept in the same areas as the plat files. On their initiative, hard copies are kept by the Analyst and P.E.





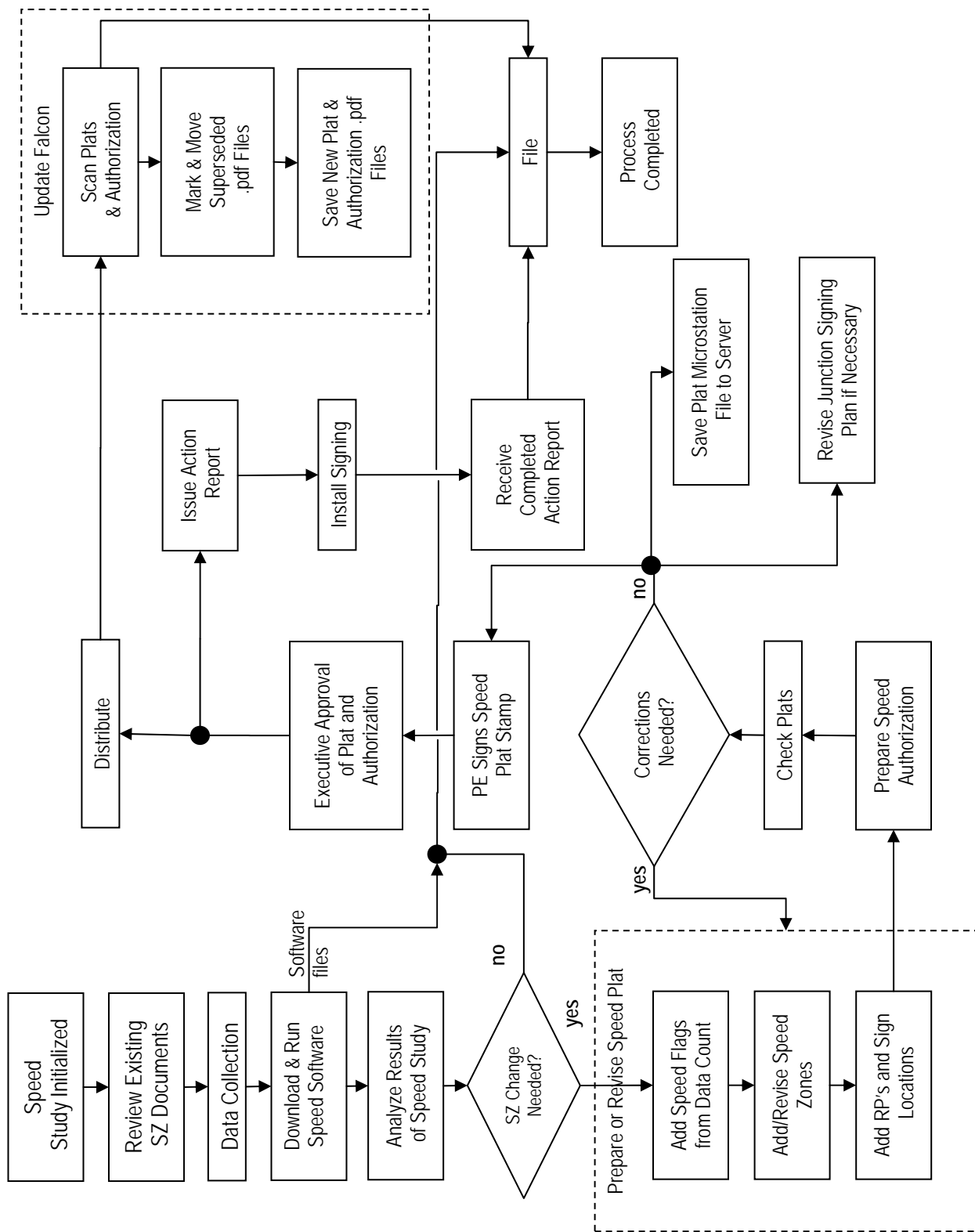
The completed action report is filed with the speed plat original, in case it ever becomes necessary to retrieve the date of the actual installation of signing.

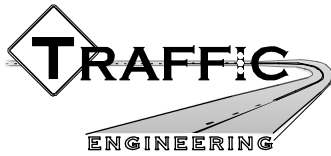
The Analyst or Engineer adds the date of sign installation (from the completed action report) to the SZA number record.

The Speed Software files are saved to the server. These are accessible only to Traffic Engineering-Lincoln and the District Traffic Engineer.

17. The Microstation dgn files of old computer plats are not retained. Only the latest editions are kept on the server. The plats are saved to T:\te03\city\_speed for city plats, and at T:\te03\cnty\_speed for county plats.
18. The junction signing plans should be checked against the speed zone plats, to detect any inconsistencies, and to determine if the junction signing plan requires revision.

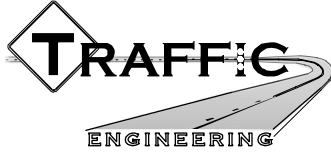
See pages 6 and 7 for Speed Zone Reappraisal Flowchart Summary and Tracking Sheet.





### Speed Zone Reappraisal Tracking Sheet

Date Completed	Action	To Be Completed By:			
		Traffic Analyst	Admin. Assistant	Traffic Technician	Assistant TE or District TE
	Speed Study Initialized and Assigned				X
	Review Existing Speed Zone Documents	X			
	Data Collection Assigned	X			
	Data Collection Completed and Downloaded			X	
	Run Speed Software and Analyze. Speed Software Results Filed. All Completed. (End of procedure if no change is needed)	X			
	Speed Plat Prepared and Save Plat Microstation File to Server			X	
	Speed Authorization Number Logged and Speed Authorization Completed	X			
	Plat and Authorization Checked	X			
	PE Signed Plat	X			
	Submitted for Executive Approval	X			
	Executive Approval Completed	X			
	Action Report Issued	X			
	Distribution Completed		X		
	Documents Scanned, Falcon Database Updated, and Superseded Documents Marked and Filed		X		
	Signs Installed, Action Report Returned Completed, Sign Install Date Noted on SZA Spreadsheet and Action Report Sent to File	X			
	Junction Signing Plan Checked Against Speed Plats			X	



**Procedure.1021**

# BALL-BANK INDICATOR OR SLOPEMETER

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A ball-bank indicator is used for the measurement of lateral acceleration to set speeds on curves that avoid driver discomfort.

The 2003 Edition of the MUTCD\* indicates in modern vehicles the 85th percentile speed on horizontal curves yields an approximate ball-bank reading of 16 degrees\*. The MUTCD's statement is made without stipulation relative to speed.

AASHTO\*\* refers to several tests which, in contrast to the MUTCD, specify ball-bank and accelerometer readings relative to speed. These are less than the 2003 MUTCD support value.

The values shown below shall be applied in NDOR Traffic Engineering testing:

Trial Run Speed (mph)	Ball-bank reading (deg)
<= 20	14
25 and 30	12
>=35	10

After completing multiple successful trials, the correct advisory speed limit should be installed using current MUTCD signing guidance.

\* Ref MUTCD, 2003 Ed. section 2C.36

\*\* AASHTO A Policy On Geometric Design of Highways and Streets 2004, pgs 134-135.

**Procedure.1031**

# LAND DEVELOPMENT REVIEW PROCESS

