TOWN OF CARRBORO

NORTH CAROLINA

TRANSMITTAL **PLANNING DEPARTMENT**

DELIVERED VIA: ☐ *HAND* ☐ *MAIL* ☐ *FAX* ☒ *EMAIL*

To: **David Andrews, Town Manager**
Mayor and Town Council

From: **Zachary Hallock, Transportation Planner**

Date: **October 9, 2020**

Subject: **Staff Recommendation for Speed Limit Setting on Unpaved Streets**

Summary

This document is intended to provide a summary of the staff recommendation for a process to setting speed limits on unpaved roads within the Town's jurisdiction. Review of available literature and state statues reveals there is limited guidance available, as most unpaved streets are rural and tend to have higher posted speed limits. Two sources have been used to guide consideration of speed limits: State Statutes, which regulate speed on unpaved streets (page 3) and EPA guidance on level of dust generation by average speed on unpaved streets (pages 4-6). This information was used in conjunction with an assessment of existing unpaved streets, considering length and posted speed limit, to recommend changes to minimize dust generation (page 7).

Report

In the fall of 2019, staff handled a request from a resident of Laughing Bird Lane requesting an establishment of a speed limit for that unpaved street. After consulting with residents along the street, the local preference for a speed limit of 15 MPH was established in the Town Code. More information can be found at:
https://carrboro.legistar.com/LegislationDetail.aspx?ID=4225140&GUID=DD854AF6-E6CD-4F2F-97D9-6CF48C2AB3E6

Staff have conducted additional research into guidance on the establishment of speed limits for unpaved streets. North Carolina statue does not set any statutory speed limits for unpaved roads, but does set them for roads within municipal boundaries. Volumes on unpaved streets tend to be lower and in some cases, speeds can be naturally traffic calmed due to the uneven nature of the

rough surface. Some states establish a statutory speed limit or other regulations on speed limit setting for unpaved roads, a summary of this information can be found on page 3.

The EPA provides research documenting the effects of average speed on particulate matter generation (dust) on unpaved streets and staff propose using this information to guide selection of speed limits. In summary, reducing the speed limit (or average speed) from 35 mph results in a change in dust generation of approximately -6% per every 5 mph reduction in average speed. The relevant excerpt from EPA research document can be found on pages 4-6 of this report and the full document is online at: https://www3.epa.gov/ttnchie1/ap42/ch13/bgdocs/b13s02-2.pdf

Based on the EPA research, the interest in mitigating dust generation, and the interest in promoting public safety staff will look at amending the Town Code for unpaved streets to reduce the speed limit to 25 MPH or lower, depending on the length of the street. The staff recommendations for posted speed limits for each unpaved street in Town can be found on page7 of this report. The residents of these streets will be consulted to determine if they have a preferred speed limit different from the staff recommendation, using a similar procedure to that when the speed limit on Laughing Bird Lane was changed in November of 2019. Staff plan to develop address lists for each street and mailing a survey requesting residents indicate their preferred posted speed of potential options (between 10 MPH & 25 MPH in increments of 5) with a pre-stamped envelope to return their feedback. Based on the community input received, staff will bring back town code amendments for individual streets to be approved by Council at a later date.

Summary of State Statues setting speed limits on unpaved roads

- Alabama: Statutory 35 MPH on unpaved roads (AL ST §32-5A-171)
- California: Statutory 55 MPH on two-lane undivided road, but cities may establish a speed limit on unpaved roads lower than the statutory speed limit in order to comply with air quality standards (CA Veh Code § 22365)
- Georgia: Statutory 35 MPH on unpaved roads (GA ST §40-6-181(b))
- Montana: Unpaved roads outside of urban areas cannot have a speed limit lower than 25 MPH (MT ST § 61-8-310(1)(c))
- North Dakota: 55 MPH on gravel, dirt or loose surface (NDCC§ 39-09-02(1))
- South Carolina: 40 MPH on unpaved roads (SC ST § 56-5-1520(B))
- Tennessee: School buses limited to 35 MPH on unpaved roads (TN ST § 49-6-2110(b))
- Vermont: Municipalities may set speed limits on an unpaved road no more than 50 MPH nor less than 35 MPH (VT ST Title 23 § 1007(a))
- Wyoming: 55 MPH on unpaved roads (WY ST § 31-5-301(b))

The following empirical expressions may be used to estimate the quantity in pounds (lb) of size-specific particulate emissions from an unpaved road, per vehicle mile traveled (VMT):

For vehicles traveling on unpaved surfaces at industrial sites, emissions are estimated from the following equation:

$$E = k\,(s/12)^a (W/3)^b \quad (1a)$$

The below equation is used to assess public roads

and, for vehicles traveling on publicly accessible roads, dominated by light duty vehicles, emissions may be estimated from the following:

$$E = \frac{k\,(s/12)^a (S/30)^d}{(M/0.5)^c} - C \quad (1b)$$

Holding all variables other than S and C constant, the equation simplifies to:
E = (S/30)^d - C
d is defined on page 5
C is defined on page 6

where k, a, b, c and d are empirical constants (Reference 6) given below and

E = size-specific emission factor (lb/VMT)
s = surface material silt content (%)
W = mean vehicle weight (tons)
M = surface material moisture content (%)
S = mean vehicle speed (mph)
C = emission factor for 1980's vehicle fleet exhaust, brake wear and tire wear.

The source characteristics s, W and M are referred to as correction parameters for adjusting the emission estimates to local conditions. The metric conversion from lb/VMT to grams (g) per vehicle kilometer traveled (VKT) is as follows:

1 lb/VMT = 281.9 g/VKT

The constants for Equations 1a and 1b based on the stated aerodynamic particle sizes are shown in Tables 13.2.2-2 and 13.2.2-4. The PM-2.5 particle size multipliers (k-factors) are taken from Reference 27.

Table 13.2.2-2. CONSTANTS FOR EQUATIONS 1a AND 1b

Constant	Industrial Roads (Equation 1a)			Public Roads (Equation 1b)		
	PM-2.5	PM-10	PM-30*	PM-2.5	PM-10	PM-30*
k (lb/VMT)	0.15	1.5	4.9	0.18	1.8	6.0
a	0.9	0.9	0.7	1	1	1
b	0.45	0.45	0.45	-	-	-
c	-	-	-	0.2	0.2	0.3
d	-	-	-	0.5	0.5	0.3
Quality Rating	B	B	B	B	B	B

*Assumed equivalent to total suspended particulate matter (TSP)
"-" = not used in the emission factor equation

Table 13.2.2-2 also contains the quality ratings for the various size-specific versions of Equation 1a and 1b. The equation retains the assigned quality rating, if applied within the ranges of source conditions, shown in Table 13.2.2-3, that were tested in developing the equation:

Table 13.2.2-3. RANGE OF SOURCE CONDITIONS USED IN DEVELOPING EQUATION 1a AND 1b

Emission Factor	Surface Silt Content, %	Mean Vehicle Weight		Mean Vehicle Speed		Mean No. of Wheels	Surface Moisture Content, %
		Mg	ton	km/hr	mph		
Industrial Roads (Equation 1a)	1.8-25.2	1.8-260	2-290	8-69	5-43	4-17[a]	0.03-13
Public Roads (Equation 1b)	1.8-35	1.4-2.7	1.5-3	16-88	10-55	4-4.8	0.03-13

[a] See discussion in text.

As noted earlier, the models presented as Equations 1a and 1b were developed from tests of traffic on unpaved surfaces. Unpaved roads have a hard, generally nonporous surface that usually dries quickly after a rainfall or watering, because of traffic-enhanced natural evaporation. (Factors influencing how fast a road dries are discussed in Section 13.2.2.3, below.) The quality ratings given above pertain to the mid-range of the measured source conditions for the equation. A higher mean vehicle weight and a higher than normal traffic rate may be justified when performing a worst-case analysis of emissions from unpaved roads.

The emission factors for the exhaust, brake wear and tire wear of a 1980's vehicle fleet (*C*) was obtained from EPA's MOBILE6.2 model [23]. The emission factor also varies with aerodynamic size range

as shown in Table 13.2.2-4

Table 13.2.2-4. EMISSION FACTOR FOR 1980'S VEHICLE FLEET EXHAUST, BRAKE WEAR AND TIRE WEAR

Particle Size Range[a]	*C*, Emission Factor for Exhaust, Brake Wear and Tire Wear[b] lb/VMT
$PM_{2.5}$	0.00036
PM_{10}	0.00047
PM_{30}[c]	0.00047

[a] Refers to airborne particulate matter (PM-x) with an aerodynamic diameter equal to or less than x micrometers.
[b] Units shown are pounds per vehicle mile traveled (lb/VMT).
[c] PM-30 is sometimes termed "suspendable particulate" (SP) and is often used as a surrogate for TSP.

It is important to note that the vehicle-related source conditions refer to the average weight, speed, and number of wheels for all vehicles traveling the road. For example, if 98 percent of traffic on the road are 2-ton cars and trucks while the remaining 2 percent consists of 20-ton trucks, then the mean weight is 2.4 tons. More specifically, Equations 1a and 1b are *not* intended to be used to calculate a separate emission factor for each vehicle class within a mix of traffic on a given unpaved road. That is, in the example, one should *not* determine one factor for the 2-ton vehicles and a second factor for the 20-ton trucks. Instead, only one emission factor should be calculated that represents the "fleet" average of 2.4 tons for all vehicles traveling the road.

Moreover, to retain the quality ratings when addressing a group of unpaved roads, it is necessary that reliable correction parameter values be determined for the road in question. The field and laboratory procedures for determining road surface silt and moisture contents are given in AP-42 Appendices C.1 and C.2. Vehicle-related parameters should be developed by recording visual observations of traffic. In some cases, vehicle parameters for industrial unpaved roads can be determined by reviewing maintenance records or other information sources at the facility.

In the event that site-specific values for correction parameters cannot be obtained, then default values may be used.In the absence of site-specific silt content information, an appropriate mean value from Table 13.2.2-1 may be used as a default value, but the quality rating of the equation is reduced by two letters. Because of significant differences found between different types of road surfaces and between different areas of the country, use of the default moisture content value of 0.5 percent in Equation 1b is discouraged. The quality rating should be downgraded two letters when the default moisture content value is used. (It is assumed that readers addressing industrial roads have access to the information needed to develop average vehicle information in Equation 1a for their facility.)

The effect of routine watering to control emissions from unpaved roads is discussed below in Section 13.2.2.3, “Controls”. However, all roads are subject to some natural mitigation because of rainfall and other precipitation. The Equation 1a and 1b emission factors can be extrapolated to annual

Established and Proposed Speed Limits for Unpaved Streets

Street Name	Current Speed Limit (MPH)	Length (Feet)	Proposed Speed Limit (MPH)	Dust reduction if speed limit changed (%)
OLD CEMETERY RD	35	229	10	-42%
BIKE ALLEY	10	300	10	N/A
BROAD ST	25	581	20	-9%
LAUGHING BIRD LN	15	394	15	N/A
DEER ST	25	1094	25	0%
ROBERTS ST	25	370	15	-20%
GOLDSTON DR	25	470	20	-9%
HUNTER PL	25	246	10	-32%
DILLARD ST	25	842	25	0%
BERT ST	25	487	20	-9%
PARKER ST*	25	427	15	-20%
RAINBOW DR	25	579	20	-9%
WATTERS RD	25	1267	25	0%
RAINBOW DR	25	411	15	-20%
COLSON ST	25	495	20	-9%
B ST	25	312	15	-20%
NEVILLE DR	25	341	15	-20%
HILLCREST AVE	35	598	20	-21%
DOVE ST	25	614	25	0%
HOSIERY ST	35	143	10	-42%

*GIS indicates NCDOT maintenance

No Town speed limit established, uses State Stautory speed limt

Low speed limit already established, will not change

EPA Dust Reduction Calculation

Average Speed (MPH)	Dust Reduction vs 35 MPH
10	-42%
15	-31%
20	-21%
25	-14%
30	-6%