COMMONWEALTH OF MASSACHUSETTS
PHILLIP W CHERRY
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REGISTERED PROFESSIONAL ENGINEER

MEMO

TO: Kim Hazavartian, PE, PTOE, Ph.D

FROM: Phillip Cherry, PE, PTOE

SUBJECT: **144 Seekonk Street Traffic Study**

DATE: **February 11, 2020**

This memorandum responds to TEPP's Traffic Peer Review dated January 28, 2020, which evaluated sight lines for the proposed driveway at the 144 Seekonk Street development ("Lakeland Hills") in Norfolk, Massachusetts based on AASHTO guidance for a 40 mph design speed. We note that the 40 mph design speed was based on speed data collected in December of 2016. Sometime in 2018 an "Intersection Ahead Sign" and 25 mph advisory plaque were installed on Seekonk Street. Speed data collected in November of 2019, after the installation of these speed calming measures, revealed an 85th percentile northbound speed of 38.5 mph, which WSP concludes is an appropriate design speed for sight distances at the proposed driveway. (Southbound sight distance were measured at approximately 36 mph). However, we have evaluated the entrance sight lines based on a 40 mph design speed at TEPP's urging in order to identify any potential sight line encroachments on adjacent properties at this higher speed so as to complete our evaluation using a conservative speed variable.

In order to identify a driveway location that limits potential sight line encroachments over adjacent private property at a 40 mph design speed, WSP has evaluated alternative driveway locations to determine the longest and clearest Stopping Sight Distance (SSD) and Intersection Sight Distance (ISDs) sight lines. Based on the evaluation of multiple alternate driveway locations, WSP has determined that relocating the proposed driveway 32.5 feet to the north along Seekonk Street is the optimal location for increased sight lines in response to TEPP's concerns.

Please see the included five (5) sight line figures that show the results of the sight line evaluations performed at the alternate driveway location. The figures also include AutoTurn based vehicle paths for a standard passenger vehicle traveling the roadway to illustrate the available width of the vehicle (object) that other drivers will be viewing. WSP maintains that by installing the previously recommended signage, lighting, and speed feedback treatments and measures, and removing shrubs and trees within public ROW and the 144 Seekonk Street property, the previously shown driveway location would provide for safe SSD and ISD in the survey conditions shown. However, the alternative driveway location presents an opportunity to further mitigate concerns regarding SSD and ISDs for the project entrance as described herein.

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FIGURE 1: STOPPING SIGHT DISTANCE

The AASHTO 40 mph SSD guidance is 305 feet. Figure 1 shows that 305 ft sight lines are available in both directions and do not encroach into private ROW at the proposed driveway relocation. Thus, at the proposed relocated driveway, SSD is met.

FIGURES 2 & 3: INTERSECTION SIGHT DISTANCE: 10 FT SETBACK FROM EDGE OF PAVEMENT

ISD should equal SSD to ensure vehicles turning from the driveway onto the main road can see vehicles on the roadway and vice versa to ensure safe turning movements. WSP evaluated the ISD at the proposed driveway relocation at setbacks of 10 and 14.5 feet from the edge of pavement.

Figure 2 shows that 305 foot sight lines are available to the north and south at a 10 foot setback from the proposed relocated driveway and do not encroach into private ROW.

In addition, WSP evaluated sight lines at 25 foot increments along a northbound vehicle path to the south of the proposed relocated driveway to show that the proposed relocated driveway location provides sight lines within public ROW along the horizontal curve in Seekonk Street at a 10 foot setback from the edge of pavement. These sight lines are illustrated in Figure 3. WSP has previously noted that a 10 foot setback from the edge of pavement would allow drivers to stop and then slowly move forward, as is typically driver behavior at driveways.

FIGURE 4: ISD, 14.5 FOOT SETBACK

WSP also evaluated the ISD at the proposed driveway relocation at a setback of 14.5 feet from the edge of pavement. Figure 4 shows that at 14.5 feet, the ISD sight lines to the south encroach 16.6 square feet inside the abutter's ROW along the horizontal curve and limit sight distance to Seekonk Street from 123 feet to 236 feet south the of the proposed relocated driveway. Sight lines would be available to 185 feet, and a 305 foot sight line would encroach 52.7 square feet outside of public ROW at a 14.5 foot setback.

A stop bar would be located such that vehicles would stop where drivers' eyes are 14.5 feet back from the traveled way. After stopping, drivers would proceed forward slowly, as is typical driver behavior. In the largest pick-up trucks, drivers' eyes are set-back approximately 7.5 feet back from the front of the vehicle, which allows for at minimum, a 2.5 foot setback for vehicles from the edge of pavement.

FIGURE 5: LEFT TURN SIGHT DISTANCE (CASE F)

WSP evaluated the available sight lines a southbound vehicle on Seekonk Street turning into the proposed driveway would have in order to see an oncoming northbound vehicle and vice versa, referred to as "Case F" by AASHTO.

Figure 5 illustrates that there would be 287.5 feet of sight line within the public ROW for a southbound left turning vehicle to see an oncoming northbound vehicle at the proposed driveway relocation. This distance equates to a travel speed of 35.6 mph using the Case F equation; both the distance and speed are approximately 11 percent less than the AASHTO 40 mph value.

However, at 287.5 feet, a northbound vehicle traveling 38.8 mph would have enough time to view, react to, and stop in front of a southbound vehicle (traveling in the opposite,

non-conflicting lane). This 38.8 mph *exceeds* the northbound speed measured in November 2019 and is only 1.2 mph less (approximately 3 percent) than 40 mph. This difference would be mitigated with signage and speed feedback signage. Also note, as left-turning vehicles move further into the northbound lane, they become more visible. Figure 1 shows SSD is maintained within ROW, indicating that northbound vehicles could safely stop if needed.

CONCLUSION

Relocating the driveway 32.5 feet to the north ensures 40 mph SSD sight lines are within public row, and that ISD is within ROW at a 10 foot setback from the edge of pavement on Seekonk Street – including at all points along the horizontal curve south of the proposed driveway. In addition, relocating the driveway increases the visibility for left-turn maneuvers (Case F) by 40 feet from the previously shown location.

MITIGATION & RESEARCH

To reduce speeds in the curve south of 144 Seekonk Street, improve safety for all Seekonk Street users, and maximize driveway visibility, the team recommends the following mitigation measures:

- Install a Speed Feedback Sign approximately 450 feet south of the proposed driveway along Seekonk Street, facing northbound traffic. Numerous studies have shown that SFS reduce roadway speeds after installation.[3] [4] [5] In addition, multiple studies indicate that SFS are most effective when placed at locations that give drivers time to react and in conjunction with signs that reinforce the need to reduce speed.[6] [7] Finally, multiple studies[1] [8] have indicated that SFS not only reduce speeds after installation, but that speed reductions are maintained years after installation.
- The Federal Highway Administration (FHWA) has a list of recommended treatments to improve sight distance at left-turns into driveways, including appropriate warning signage.[9] Thus, it is also recommended to install a W1-10 sign (see Figure 1) to supplement the SFS and notify northbound Seekonk Street drivers of the new driveway that would be located just after the horizontal curve. The W1-10 would be placed just after the SFS and would be similar to the sign below, located at 28 Rockwood Road in Norfolk, but would face the other

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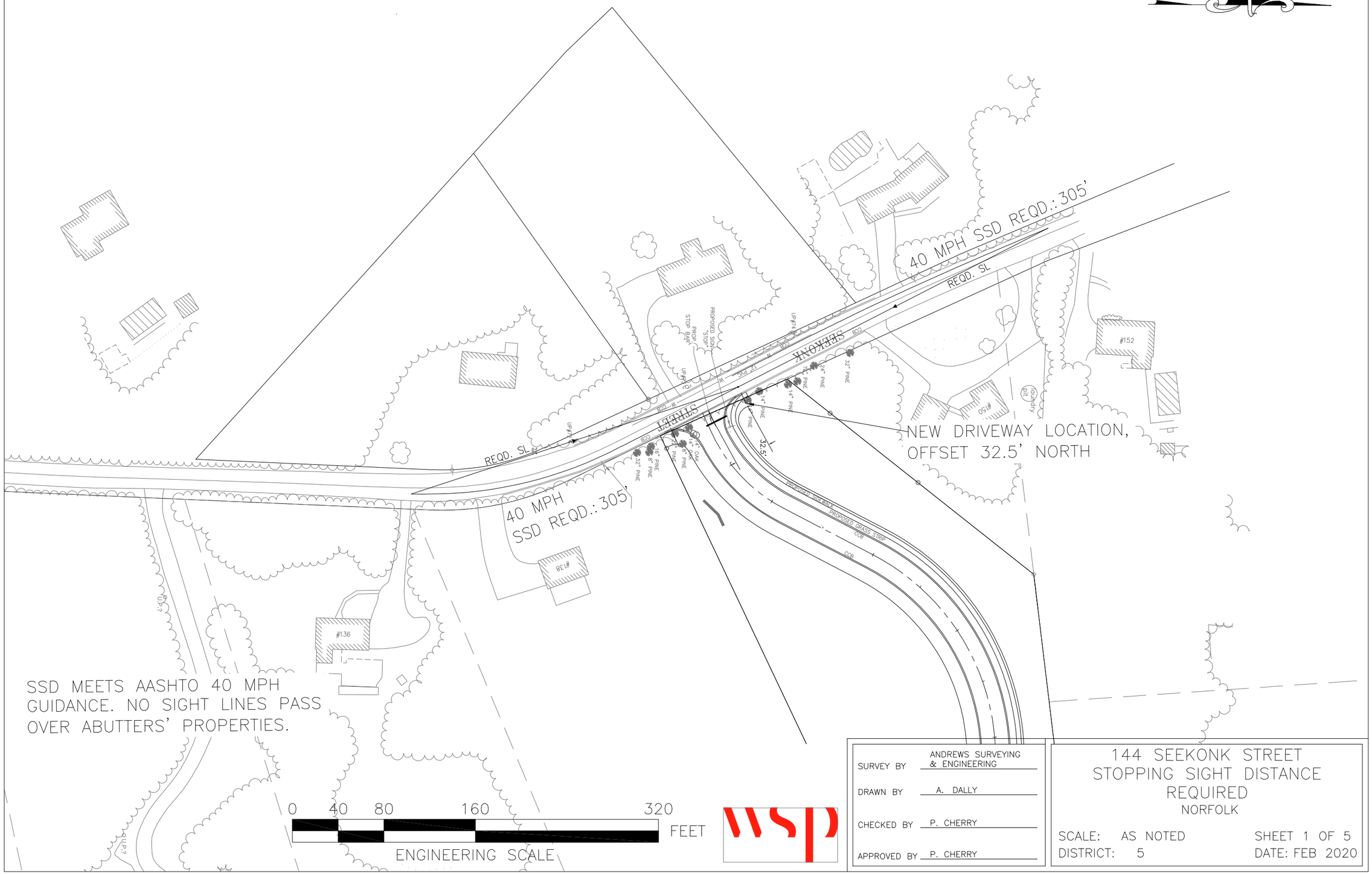
[3] https://safety.fhwa.dot.gov/speedmgt/ref_mats/fhwasa1304/Resources3/06%20-%20Spatial%20Effectiveness%20of%20Speed%20Feedback%20Signs.pdf
[4] https://www.radarsign.com/how-effective-are-radar-speed-signs/
[5] http://54.172.27.91/transportation/signs/ACRPC_SpeedFeedbackSigns_2013.pdf
[6] https://safety.fhwa.dot.gov/speedmgt/ref_mats/fhwasa1304/resources2/37%20-%20Effective%20Deployment%20of%20Radar%20Speed%20Signs.pdf
[7] https://xwalk.com/wp-content/uploads/2019/10/Radar-Sign-Case-Studies.pdf
[8] https://www.alltrafficsolutions.com/blog/avoiding-traffic-calming-debates-radar-speed-displays/
[9] https://www.fhwa.dot.gov/publications/research/safety/ihsdm/02045/6.cfm

direction and would instead have a 25 mph advisory plaque, as the existing "Intersection Ahead" sign already has a 25 mph plaque.

Figure 1: W1-10 Sign, 28 Rockwood Rd, Norfolk, MA

- Install lighting at the driveway to ensure approaching drivers can see vehicle turning in or out during periods of lower light or visibility.



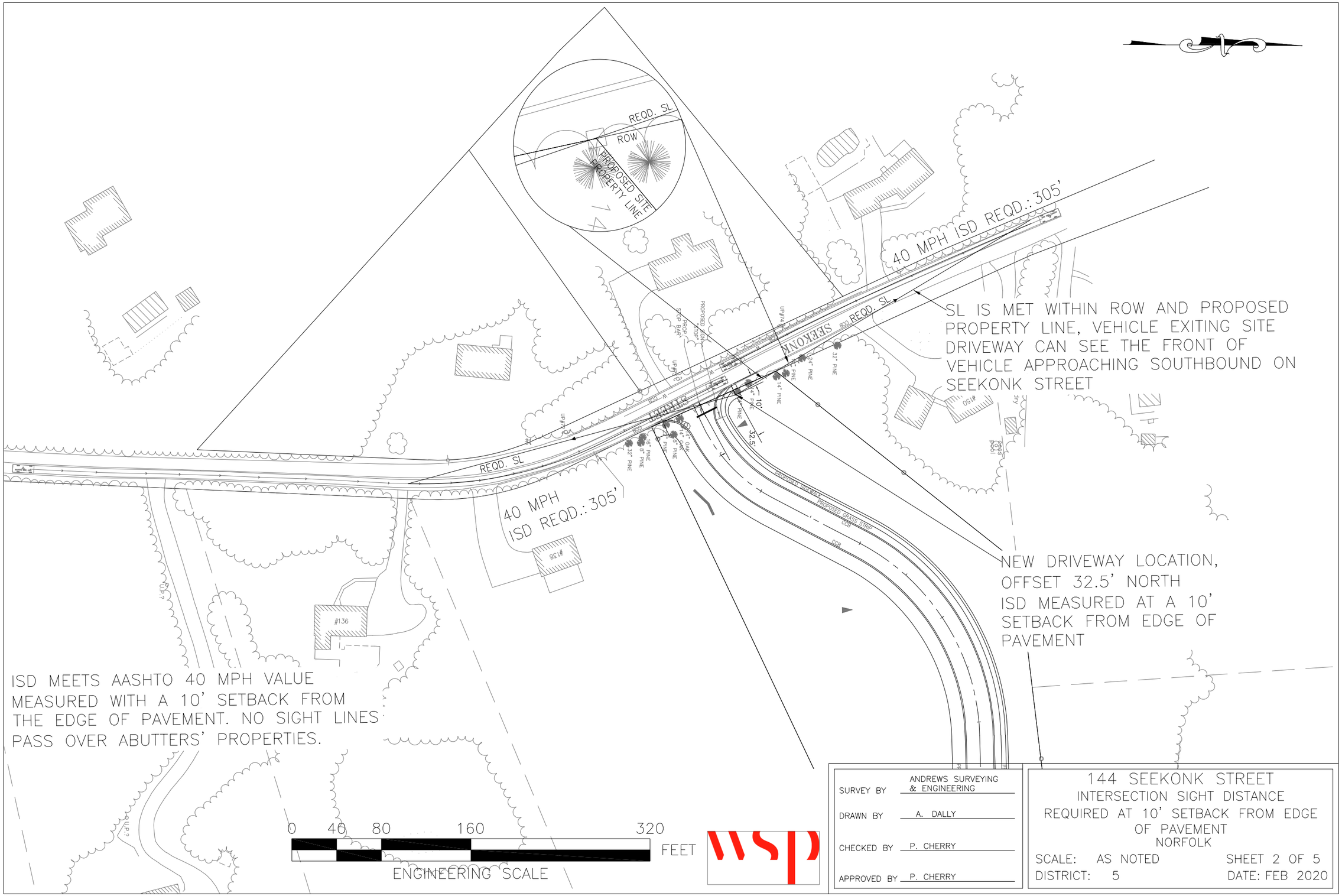
SURVEY BY	ANDREWS SURVEYING & ENGINEERING
DRAWN BY	A. DALLY
CHECKED BY	P. CHERRY
APPROVED BY	P. CHERRY

144 SEEKONK STREET STOPPING SIGHT DISTANCE REQUIRED

NORFOLK

SCALE: AS NOTED
DISTRICT: 5

SHEET 1 OF 5
DATE: FEB 2020



SURVEY BY	ANDREWS SURVEYING & ENGINEERING
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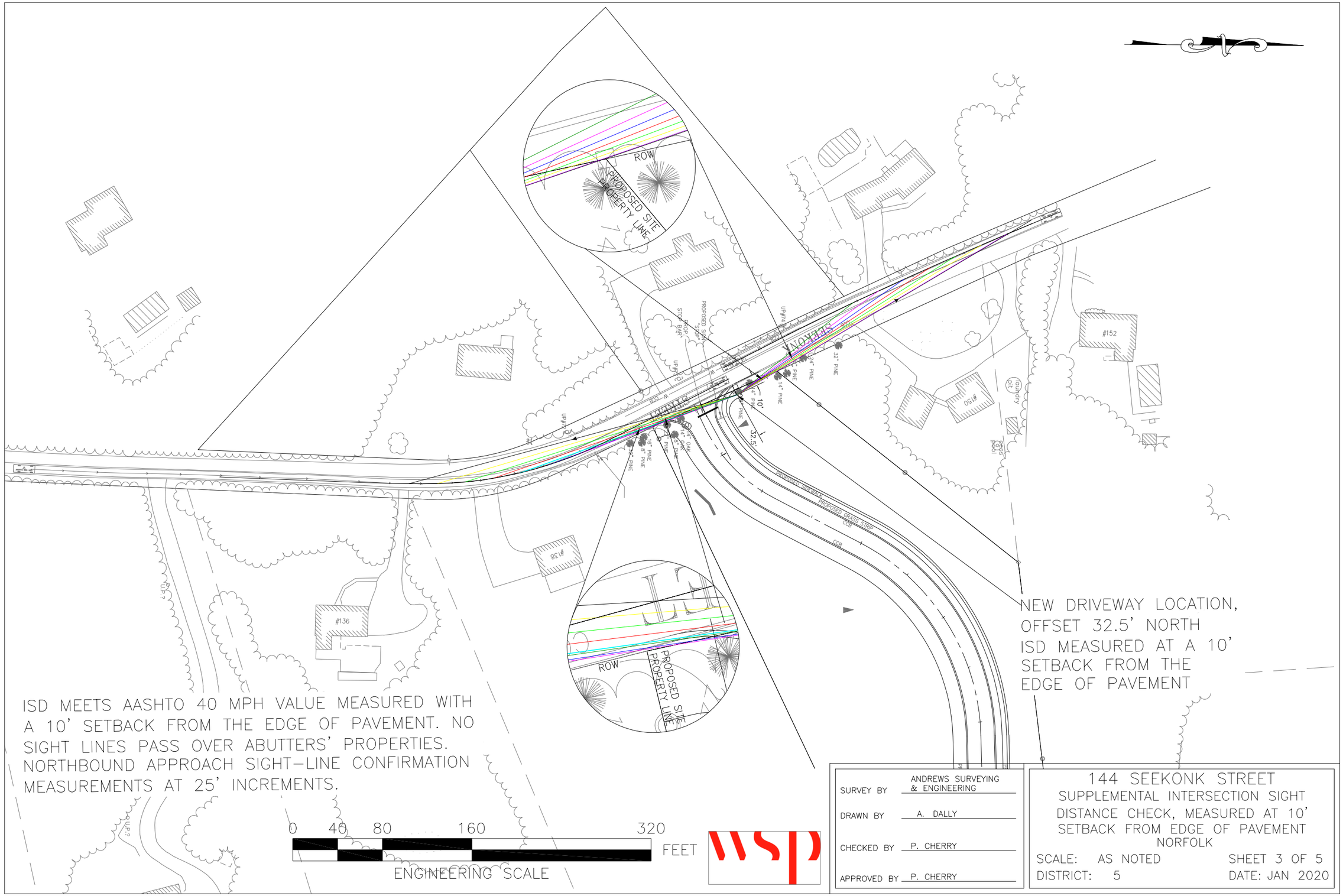
CHECKED BY	P. CHERRY
APPROVED BY	P. CHERRY

144 SEEKONK STREET
INTERSECTION SIGHT DISTANCE
REQUIRED AT 10' SETBACK FROM EDGE OF PAVEMENT
NORFOLK

SCALE: AS NOTED
DISTRICT: 5
SHEET 2 OF 5
DATE: FEB 2020



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CHECKED BY	P. CHERRY
APPROVED BY	P. CHERRY

144 SEEKONK STREET
SUPPLEMENTAL INTERSECTION SIGHT DISTANCE CHECK, MEASURED AT 10' SETBACK FROM EDGE OF PAVEMENT
NORFOLK

SCALE: AS NOTED
SHEET 3 OF 5
DISTRICT: 5
DATE: JAN 2020

ISD SIGHT-LINE (SL) WITHIN ROW AND PROPOSED PROPERTY LINE: 185'

AASHTO 40 MPH ISD: 305 FT

40 MPH SL

40 MPH SL

AASHTO 40 MPH ISD: 305 FT

40 MPH ISD SL TO NORTH ENCROACHES 52.7 SF OUTSIDE OF ROW

NEW DRIVEWAY LOCATION, OFFSET 32.5' NORTH ISD MEASURED AT A 14.5' SETBACK FROM THE EDGE OF PAVEMENT

40 MPH ISD SL TO SOUTH BETWEEN 123' AND 236' FROM DRIVEWAY ENCROACHES 16.6 SF OUTSIDE OF ROW

SL TO THE NORTH AND SOUTH ENCROACHES 16.6 AND 52.7 SQ. FT. OUTSIDE OF ROW RESPECTIVELY

0 40 80 160 320 FEET

ENGINEERING SCALE

SURVEY BY	ANDREWS SURVEYING & ENGINEERING
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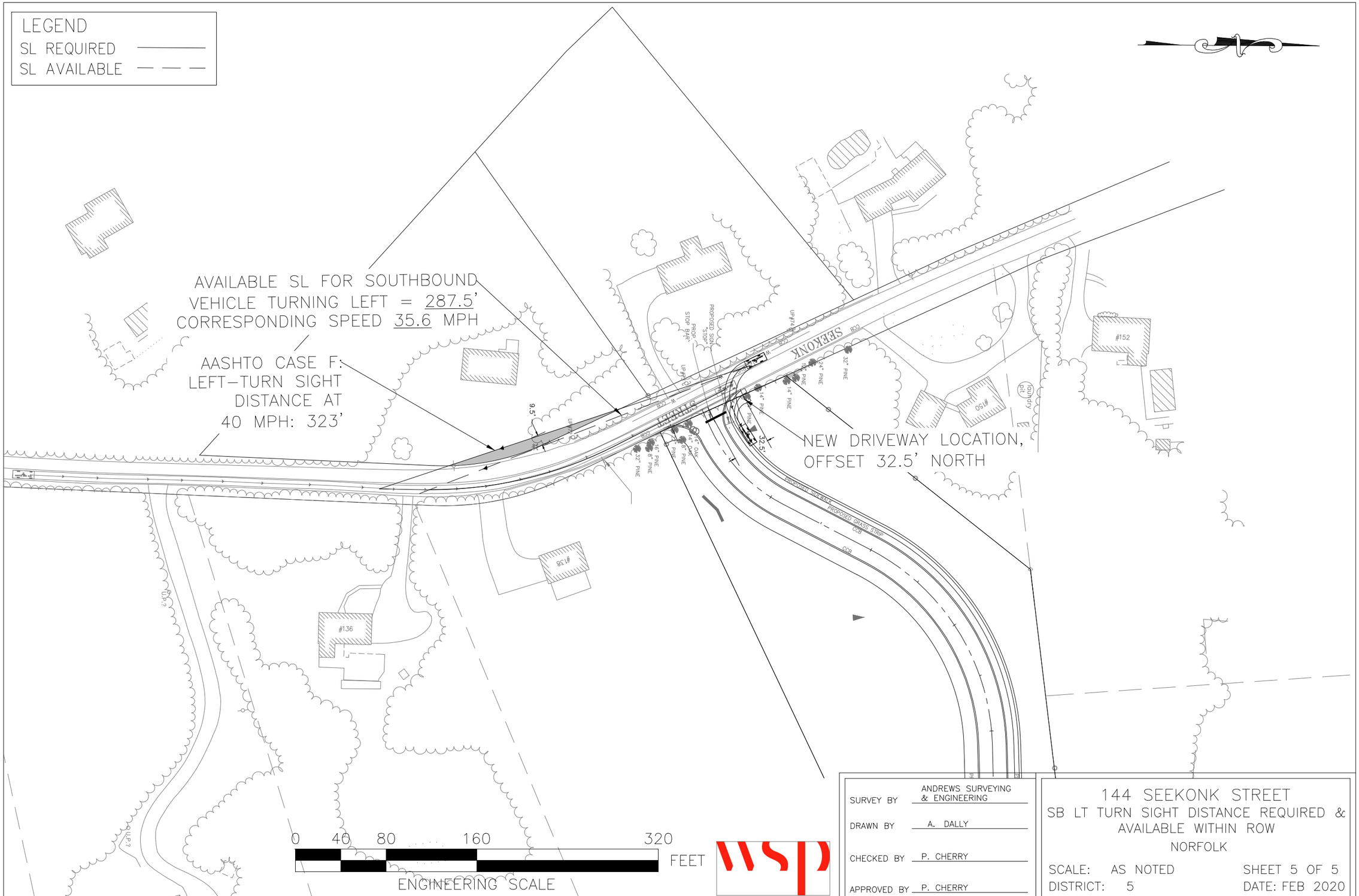
APPROVED BY	P. CHERRY

144 SEEKONK STREET
INTERSECTION SIGHT DISTANCE REQUIRED AND WITHIN ROW AT 14.5'
NORFOLK

SCALE: AS NOTED
DISTRICT: 5

SHEET 4 OF 5
DATE: FEB 2020



SURVEY BY	ANDREWS SURVEYING & ENGINEERING
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APPROVED BY	P. CHERRY

144 SEEKONK STREET
SB LT TURN SIGHT DISTANCE REQUIRED & AVAILABLE WITHIN ROW
NORFOLK

SCALE: AS NOTED
DISTRICT: 5
SHEET 5 OF 5
DATE: FEB 2020