APPENDIX 2

TRAFFIC MEMORANDUM

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May 3, 2022 RVA 205388

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6311 Old Church Road
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Attention: Shun Cheung

Re: Growth Related Roads Detailed Design 2022
Mill Street Municipal Class Environmental Assessment (Schedule "B")
Existing Conditions Traffic Memorandum

1.0 INTRODUCTION

R.V. Anderson Associates Limited (RVA) is currently undertaking the Schedule "B" Class EA for Mill Street between Creditview Road and Mississauga Road (the study area), as part of Contract #2020-97, in the Town of Caledon.

During the consultation process, comments received from the public have included a request for a traffic study to evaluate the corridor from traffic operational and safety standpoints, to inform the development of alternatives for consideration in the EA study. RVA's traffic engineering staff have reviewed the study area and coordinated the collection of traffic speed data to support our review. This technical memorandum presents the findings of our review.

2.0 TRAFFIC DATA COLLECTION

Mill Street is a rural local road with a posted maximum speed limit of 40 km/h under the jurisdiction of the Town of Caledon. The road is oriented in a general east-west direction, connecting Mississauga Road (Regional Road 1) at its western extent and Creditview Road at its eastern extent. The surrounding area is generally rural, with land uses fronting the road including private residences, natural forested areas, and agricultural lands.

The Town of Caledon (Town) provided RVA with a historical 2017 (summer season) traffic count, showing an ADT (average daily traffic) of 189 vehicles. The Town has no collision history records available for review.

As part of this EA, the Town has requested RVA collect traffic speed data for the corridor, and video footage to document pedestrian and traffic behaviour. Therefore, automatic traffic recorders (ATRs) and traffic cameras were set up at various locations, as shown in **Figure 1**.

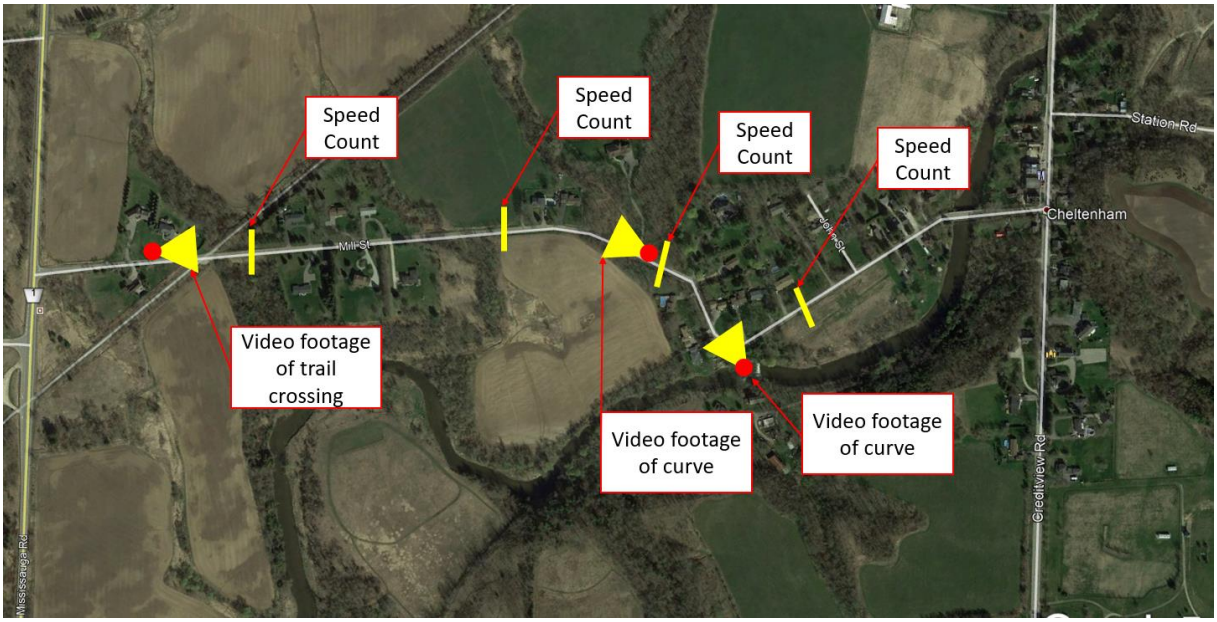

Figure 1: Data Collection Locations

The ATRs and traffic cameras were set up over a 7-day period, from August 4, 2021, to August 10, 2021. During the data collection, it was brought to the Project Team's attention that roadway closures in the wider area road network were in place, which may have diverted additional traffic onto Mill Street during the data collection. Therefore, typical daily traffic volumes may actually be lower than what was observed during this study.

Despite this potential diversion of additional traffic to the corridor during the data collection efforts, the surveys recorded ADT volumes of approximately 120-150 vehicles per day, which is lower than the historical 2017 ADT volumes (189 vehicles per day) provided by the Town.

Both the historical 2017 and current 2021 ADT data fall well below (i.e., less than 20%) of the recommended maximum threshold of 1,000 ADT for a rural local road as per the Transportation Association of Canada (TAC) Geometric Design Guide for Canadian Roads.

Furthermore, the design criteria for lane widths and clear zones being utilized in this EA study have maximum volume thresholds of 450 ADT and 750 ADT. Therefore, both the historical 2017 and current 2021 ADT fall well below the maximum volume thresholds for the adopted design criteria.

Although the Town has indicated there are no collision history records available for the study area, anecdotally some residents have noted during the study's public engagement activities that accidents and/or near misses along Mill Street have been observed. This has been considered during the review of the study corridor and collected speed data as described herein.

3.0 DESCRIPTION OF EXISTING CONDITIONS

3.2 Mill Street between Mississauga Road and the Series of Curves

The section of Mill Street from Mississauga Road to the beginning of the series of notable curves in the road's horizontal alignment is currently generally straight with a rolling vertical alignment resulting in several crests and sags in the roadway surface, as shown in **Figure 2**.

Figure 2: Rolling Roadway

The existing pavement width is approximately 6.6 metres wide in this area, which assumes 3.3-metre-wide lanes, and has a rural cross-section with generally no (or little) defined gravel shoulder. TAC recommends 1.0-metre-wide shoulders on local rural roads. This pavement width is narrower than the minimum 8.7-metre-wide width shown in the Town's design standards (Standard No.203) for a local rural road, which has 4.35-metre-wide lanes. Furthermore, this is also narrower than the narrowest pavement width and lane width permitted for a Town local road, which is 7.9 metres and 3.95 metres, respectively, as shown in Standard No.202 for a narrower 18 metres right-of-way in an urban context. The TAC Geometric Design Guide recommends travel lane widths between 3 metres to 3.7 metres for rural roads with design hour directional volumes less than 450 vehicles per hour and a posted speed limit less than 60 km/h. There are no traffic signs restricting truck traffic on Mill Street. The nearest truck traffic restrictions in the vicinity are on Mississauga Road and Creditview Road which restrict truck traffic between March 15 to May 15. Based on these considerations, and for accommodation of snow storage, snow ploughs, garbage trucks, and school buses (if any), a minimum pavement width of 6.6 metres (which assumes 3.3-metre-wide lane widths) is considered desirable for this section of Mill Street, which is consistent with existing conditions.

The only pavement marking along this section of Mill Street is the stop bar at the road's stop-controlled approach to Mississauga Road; there are currently no centreline pavement markings along the corridor. Existing signage includes a Stop sign at the Mississauga Road intersection, a Stop Ahead warning sign in approach to the intersection, and regulatory 40 km/h posted maximum speed limit signs.

The skewed crossing of the Caledon Trailway Path is uncontrolled with no supporting signage or pavement markings. This uncontrolled crossing configuration is commonly observed in other nearby crossings along the Caledon Trailway Path, including across Mississauga Road to the west and Creditview Road to the east.

The clear zone is a buffer area on the roadside that should be free of non-breakaway objects, or have those objects protected by appropriate barrier systems (i.e., guide rail, cable guiderail etc.). As per the current design and classification of the road, Mill Street should have a clear zone of approximately 2.0 to 3.0 metres as per TAC guidelines. Wooden utility poles are located on the north side of the road, which transition to the south side near the series of curves to the east. A streetlight mounted on a wooden utility pole is provided on the west side

of Mississauga Road at its intersection with Mill Street; no additional streetlighting is provided on this straight section of Mill Street. Utility poles and streetlighting are within the road clear zone.

For more details on existing substandard road elements on Mill Street, please refer to the attached design criteria.

There are no active transportation facilities along this section of the road, with pedestrians and cyclists required to share the roadway with motorized vehicles given the lack of defined shoulder.

Figure 3: Westernmost Curve

3.3 Series of Curves on Mill Street

Mill Street currently has a section of its alignment containing a series of three adjacent curves.

The westernmost curve, as shown in **Figure 3**, has a notable grade change resulting in a crest which in combination with encroaching vegetation results in restricted sightlines.

The middle curve, as shown in **Figure 4**, has physical evidence (tire marks) of vehicles oversteering into the boulevard in close proximity to the backyard privacy fence and mature trees. The roadway surface is in poor shape with numerous potholes and evidence of poor drainage.

Figure 4: Middle Curve

The easternmost curve, as shown in **Figure 5**, similarly has evidence of vehicles oversteering into the boulevard and is in poor shape with numerous potholes and evidence of poor drainage.

Due to the significant asphalt raveling at the pavement edge in this section, the pavement width is approximately 6 metres. It is reasonable to assume the pavement width here would be consistent with the rest of Mill Street, which is 6.6 metres. The resulting width assumes 3.0-metre-wide travel lanes. This lane width is narrower than the Town's recommended pavement width as noted in the previous section of this memorandum and is at the absolute minimum width for the acceptable range provided by TAC. Furthermore, given TAC design guidelines require lane widening through curves to accommodate vehicle tracking, the existing width of the pavement is considered below the recommended minimum limit

Figure 5: Easternmost Curve

recommended by TAC. Furthermore, TAC recommends 1.0-metre-wide shoulders on local rural roads, which is not provided. Based on these considerations and given the centreline radii of the curves are substandard as per TAC based on the current posted speed limit (as discussed further below), it is recommended the travel lanes should be widened to 4.0 metres at the curves.

All three of the horizontal curves have radii less than what is required by TAC for a posted speed limit of 40 km/h. The combination of back-to-back substandard horizontal curves, steep profile grades, and encroaching vegetation, limits the available decision and stopping sight distance for a motorist to see, react, and stop to safely avoid a collision with an object or pedestrian within the travelled portion of the roadway. This sightline concern, combined with the narrow pavement width through the curves and lack of pedestrian/cyclist facilities to provide separation between vulnerable road users and vehicular traffic (or refuge should a vehicle become errant through the curves under winter or wet conditions) is a safety concern. Furthermore, there is potential for vehicles to track over the centreline within the curves given the substandard radii, which creates a safety concern if pedestrians/cyclists are present, if a vehicle is stopped on the roadside, or if an opposing vehicle is travelling through the curve simultaneously.

There is no signage or pavement markings (i.e., yellow centre or white edge lines) through the curves, nor are there any curve warning signs, speed advisory signs, hidden driveway signs, chevron signs, or object marker signs. Based on a review of potential pavement marking and signage treatments recommended by the Ontario Traffic Manual (OTM), there are opportunities to improve safety through better communication of the substandard roadway geometry and roadside hazards by introducing improved pavement markings and warning signage.

For more details on existing substandard road elements on Mill Street, please refer to the attached design criteria.

There are no active transportation facilities along this section of the road, with pedestrians and cyclists required to share the roadway with motorized vehicles given the lack of defined shoulder.

3.4 Mill Street between the Series of Curves and Creditview Road

The section of Mill Street from the series of curves to Creditview Road currently consists of an intersection with John Street, the bridge over the Credit River, and a horizontal curve immediately west of the bridge. The vertical alignment has some slight crests and sags in the roadway. The pavement width is approximately 6.6 metres wide in this area, with a rural cross-section west of the bridge and an urban cross-section east of the bridge, and generally no (or little) defined gravel shoulder. TAC recommends 1.0-metre-wide shoulders on local rural roads. This lane width is narrower than the Town’s recommended pavement width as noted in the previous section of this memorandum.

The only pavement markings along this section of the road is the stop bar at the road’s stop-controlled approach to Creditview Road; there are currently no centreline pavement markings along the corridor. Existing signage includes a Stop sign at the Creditview Road intersection, regulatory 40 km/h posted maximum speed limit signs, and on-street parking restrictions just east of the bridge.

For more details on existing substandard road elements on Mill Street, please refer to the attached design criteria.

There are no active transportation facilities along this section of the road except for sidewalks along the bridge, with pedestrians and cyclists required to share the roadway with motorized vehicles through most of the corridor given the lack of defined shoulder. As shown in **Figure 6**, the bridge has no sidewalk let-downs to accommodate accessible pedestrian movement between the roadway and the sidewalk as per Accessibility for Ontarians with Disabilities Act (AODA) requirements, nor is their sufficient physical separation (i.e., a barrier) to separate pedestrians using the sidewalk from the unprotected embankments at the bridge ends (shown in **Figure 6**).

Figure 6: Bridge over Credit River

Most wooden utility poles are located on the south side of the road, with several streetlights mounted to the poles. These are also within the road clear zone.

6.0 OPERATING SPEED ANALYSIS

6.1 Speed Analysis Methodology

The 85th percentile speed (also known as the Operating Speed) is the speed at which 85% of the observed vehicles are travelling at or below. The 85th percentile is typically used in evaluating posted speed limits, as the general assumption is 85% of drivers are travelling at a speed they perceive to be safe.

Spot speed studies are used to determine the speed distribution of traffic at a specific location, with the collected data used to determine vehicle speed percentiles, most commonly being the 85^{th} percentile speed.

Spot speed data was collected at several locations along Mill Street from August 4, 2021, to August 10, 2021. The spot speed studies were conducted utilizing Automatic Traffic Recorder (ATR) devices, with each ATR deployment consisting of two parallel pneumatic tubes fastened to the roadway surface, measuring the direction of flow and traffic speed.

6.2 Speed Study Results

The results of the spot speed studies are summarized in **Table 1** below.

Table 1: Summary of Posted Speed Limits vs 85th Percentile Speeds

Location	Operating Speed		+/- 40 km/h Posted Speed Limit	
	Eastbound	Westbound	Eastbound	Westbound
Just east of Caledon Trailway Path crossing	51 km/h	53 km/h	+11 km/h	+13 km/h
Just west of westernmost curve	49 km/h	51 km/h	+9 km/h	+11 km/h
Just west of middle curve	47 km/h	42 km/h	+7 km/h	+2 km/h
Between easternmost curve and John Street	46 km/h	45 km/h	+6 km/h	+5 km/h

Just east of the Caledon Trailway Path crossing

The results indicate Operating Speeds of approximately 51-53 km/h for vehicles in the vicinity of the trail crossing, which is approximately 11-13 km/h above the posted speed limit. This variance above the posted speed limit is likely attributable to the existing roadway design, as this section of roadway has a wider pavement width and a generally straight roadway alignment.

Just west of the westernmost curve

The results indicate Operating Speeds of approximately 49-51 km/h for vehicles just west of the westernmost curve, which is approximately 9-11 km/h above the posted speed limit. These operating speeds are generally lower than what is occurring along the straight tangent section of roadway to the west near the trail crossing, which is expected given vehicles are approaching or departing the series of horizontal curves which represent a physical traffic calming feature for the corridor.

Just west of the middle curve

The results indicate Operating Speeds of approximately 42-47 km/h for vehicles just west of the middle curve, which is approximately 2-7 km/h above the posted speed limit. These operating speeds are generally lower than what is occurring along the corridor to the west, likely due to the traffic calming effect the curves are having on vehicles at this location.

Between the easternmost curve and John Street

The results indicate Operating Speeds of approximately 45-46 km/h for vehicles travelling between the easternmost curve and John Street, which is approximately 5-6 km/h above the posted speed limit. These operating speeds are similar to what is occurring in the vicinity of the curves, with vehicles travelling at lower speeds as they approach or depart the curves.

6.3 Summary of Speed Study Findings

The operating speeds of vehicles travelling on Mill Street ranges from 42km/h to 53km/h. Although the operating speed is higher than the posted speed limit, this does not necessarily indicate a speeding issue. The existing road alignment and profile geometry along the western portion of Mill Street, which exhibited the highest variance of operating speeds above the posted speed limit (up to 13 km/h above the 40 km/h posted speed limit), under typical conditions can accommodate operating speeds in excess of 40 km/h without resulting in a speeding issue requiring mitigation.

The identified variance between operating speeds and the posted speed limit is of greater concern in the vicinity of the horizontal curves given the identified substandard geometric,

operational, and safety characteristics of the road, which also do not meet TAC guidelines or Town standards for a posted speed of 40km/h. Although the existing curves provide a traffic calming effect which some local residents have communicated to RVA during consultation, the curves' substandard geometry limits sight distance and is a safety concern for all road users with a lack of active transportation accommodation. The variance between operating speed and posted speed should be reduced through improving the road geometry to meet the design requirements of the curves and through new traffic calming measures to slow down operating speed.

7.0 CONCLUSION

Although the variance between operating speeds and the posted speed limit are greatest at the western section of Mill Street in the vicinity of the trail crossing, operating speeds in this area remain below 53 km/h which in our opinion is considered generally acceptable for a relatively straight, rural length of roadway such as this section, despite it exceeding the posted speed limit of 40 km/h.

However, with respect to the section of Mill Street in the vicinity of the horizontal curves, it is our opinion that mitigation measures for the roadway and roadside area to improve safety for all road users is desirable given the combined effects of the narrow pavement width, limited sightlines, fixed objects within the clear zone, and lack of separation between vulnerable road users (pedestrians and cyclists) and vehicles in the vicinity of the curves.

Based on the findings of this study, it is recommended the proposed EA design alternatives to be considered include:

- Improve sight distances at the back-to-back curves through a combination of cutting-back encroaching vegetation, increase horizontal curve radii, and flattening steep road profile slopes.

- Maintain the existing 3.3m travel lanes through the tangent section of the road and widen to at least 4.0m at the horizontal curves to better accommodate maintenance vehicles, snow storage, potential vehicle tracking, and improve overall road user safety.

- Separation of pedestrian traffic from vehicle and cyclist traffic either by 1.5-metre-wide paved shoulders (which would not provide horizontal or vertical separation but may be sufficient for pedestrian accommodation due to low pedestrian and traffic volumes), or sidewalk/multi-use path behind standard curb and gutter (providing horizontal and vertical separation, as well as a urbanizing the roadway thus providing a traffic calming benefit by visually narrowing the roadway). The OTM requires curb facing sidewalk to be 1.8 metres wide.

- Isolated guide rail treatments at non-breakaway objects within the clear zone, and at steep road embankments.

- Yellow painted centreline and white edge lines at the horizontal curves.

- Painted sharrows for vehicular traffic to share the road with cyclists.

- Warning signage, including curve warning signs with reduced speed advisory tabs, hidden driveway signs, chevron signs at the curves, and object marker signs at unprotected non-breakaway objects within the clear zone, all as per OTM guidelines.

- Speed humps, chicanes, or other urban treatments in approach to the series of horizontal curves as a traffic calming measure.

- Sidewalk let-downs or new sidewalk connections to the existing sidewalk at the bridge per AODA requirements, with guiderail protection at the bridge ends due to the current unprotected embankments.

- Overall drainage improvements to direct stormwater runoff off the road pavement

Property and environmental impacts as well as the overall cost effectiveness of the above mitigation measures should be considered during design and implementation.

R.V. ANDERSON ASSOCIATES LIMITED

Adam Mildenberger, C.E.T., B.A.
Transportation Planner

205388 - TOWN OF CALEDON

Mill Street - Urban/Rural Reconstruction

Segments	Road Construction Type	Posted Speed km/h	Design Speed km/h	Baseline ADT Provided from Town	Growth Rate per TMP Screenline Analysis	2031 ADT
Mill St - Mississauga Rd to John St	Urban	40	50	189	0.5%*	202
Mill St - John St to Creditview Rd	Urban	Town to Confirm	Town to Confirm	189	0.5%*	202
				*Note: Negligible growth anticipated.		

RFP REQUIREMENTS	
Lanes	2
Pavement Width	9.8m

ITEM	STANDARDS						REHAB ROAD GEOMETRY	TOWN ACCEPTANCE (YES / NO)	COMMENTS	
	TAC (For Design Speed 60km/h)	TAC (For Design Speed 50km/h)	2019 DC	Town of Caledon (TofC)	Transportation Master Plan (TMP)	Existing			TOWN	RVA
CLASSIFICATION										
ROAD CLASSIFICATIONS	ULU60 / UCU60	ULU50 / UCU50	RSS-U	Local Residential			Local Residential			
DESIGN SPEED (km/h)	60	50								
POSTED SPEED (km/h)	50	40		50		40	40			Warning signs with reduced speeds can be provided for local sections of road with insufficient sight distances
NUMBER OF LANES			2			2	2			
TRAFFIC VOLUME ADT				<1000		189				
TRUCK VOLUME (%)										
HORIZONTAL ALIGNMENTS										
NC NORMAL CROWN (-0.02m/m) **R**min. (m) , e =0.04	1290	950					40			Substandard between Sta. 2+260 to Sta. 2+280. Between Sta. 1+880 to Sta. 2+040 there are two compound horizontal curves that are substandard. Alignment adjustment is constrained by road allowance and will require property acquisition. No collision history record available for Mill St.
CURVE RADIUS WITH SUPERELEV. RATE e=0.04 **R**min (m)	130	80		90						
RC REVERSE CROWN (+0.02m/m) **R**min (m) , e=0.04	185	115								
NC NORMAL CROWN (-0.02m/m) **R**min. (m) , e =0.06	1290	950								
CURVE RADIUS WITH SUPERELEV. RATE e=0.06 **R**min (m)	120	75								
RC REVERSE CROWN (+0.02m/m) **R**min (m) , e=0.06	220	135								
TAPER RATIO RIGHT TURN WITHOUT PARALLELL LANE	18:1	15:1					N/A			No auxilary lanes
TAPER LENGTH RIGHT TURN WITHOUT PAPRALLEL LANE (m)	63	53					N/A			
TAPER RATIO RIGHT TURN WITH PARALLEL LANE	14:1-17:1	11:1-17:1					N/A			
PARALLEL LANE LENGTH FOR RIGHT TURN (m)	40-90	35-75					N/A			
APPROACH TAPER RATIO LEFT TURN	15:1 - 36:1	8:1 - 30:1					N/A			
PARALLEL LANE FOR LT (m)							N/A			
CROSS SECTIONS										
ROAD WIDTH (m)			9.8-Urban / 10-Rural	7.9		7.0 - 7.4	6.6			Max road width that can be accommodated by the existing road allowance. Additional width will require property acquisition. Road is also classified as local urban with 40km/h, and narrower road with will help reduce traffic speed.
THROUGH LANE WIDTH (m)	3.0-3.7	3.0-3.7	3.5-Urban / 3.75-Rural	3.8	3.5		3.3			
RIGHT TURN LANE WIDTH (m)	3.3-3.5	3.3-3.5					N/A			No auxilary lanes
LEFT TURN LANE WIDTH (m)	3.3-3.5	3.3-3.5		3.25			N/A			
TANGENT SECTION CROSS FALL, %	2%	2%					2%			
SPLASH PAD / KILLSTRIP (m)			0				0 to 0.5			Splash pad/ kill strip may be eliminated to minimize property impact.
SIDEWALK WIDTH (m)	1.5 min	1.5 min	1.5-Urban	1.5	1.8		1.5			
BOULEVARD-DESIRABLE B/W CURB AND SIDEWALK (m)	2	2			3.0(U) OR 9.5(R)		0			Boulevard space eliminated to minimize property impact.
PAVED SHOULDER							0			No urban shoulder to minimize property impact.
TOTAL SHOULDER (m)			1.5-Rural		1.5		0			
GRANULAR SHOULDER (m)			0.6-Rural				0			No granular shoulder as road section is urban.
SHOULDER ROUNDING (m)							0.5 or 1.0			1.0m if guiderail is needed
MINIMUM DITCH DEPTH BELOW TOP OF SHOULDER (WITH SUB-DRAIN) (m)							1.0			
MINIMUM DITCH DEPTH BELOW ROAD SUB-GRADE (WITHOUT SUB-DRAIN) (m)										
DESIRABLE MIN SIDE SLOPE				4:1 OR LESS			3:1 or 2:1 MAX			Side slopes are steepened to 2:1 to minimize property impacts at some locations. Erosion control blankets, steel beam guiderail, and granular sealing will be required
BACK SLOPE							3:1 or 2:1 MAX			
FILL SLOPE WITH BARRIER							3:1 or 2:1 MAX			
FILL SLOPE WITHOUT BARRIER							3:1			
CLEARZONE (m) FOR MAX CUT SLOPE OF 3:1 - ADT UNDER 750	2.0 - 3.0	2.0 - 3.0								Existing utility within the widened road will be relocated to outside of the clearzone. Steel beam guiderails, warning signs, or speed reductions will be recommended for obstacles which cannot be relocated due to environmental (such as trees that cannot be removed) or property impacts.
CLEARZONE (m) FOR MAX FILL SLOPE OF 4:1 - ADT UNDER 750	2.0 - 3.0	2.0 - 3.0								
RIGHT OF WAY										
STANDARD ROW WIDTH (m)			26	18		13 to 26	13 to 26			
VERTICAL ALIGNMENTS										
MINIMUM GRADE (%)	0.50%	0.50%		0.75% (Urban)			0.3%			
MAXIMUM GRADE (%) (Mountainous Topograpy)	11%	15%		6%			9.5%			
SAG VERTICAL CURVE **K**min. - HEADLIGHT CONTROL	18	13		12			5			Substandard K-values for the majority section of the road. Profile adjustment between Sta. 1+200 to Sta. 1+340 to adjust K-values of the back-to-back crest and sag curves to meet Town's standards. Full depth reconstruction required for the profile adjustment. Profile adjustment for other crest and sag curves will require property
SAG VERTICAL CURVE **K**min. - COMFORT CONTROL	8-9	5-6								
CREST VERTICAL CURVE **K**min.	11	7		8			5			
DECISION SIGHT DISTANCE (m) Minimum / Desirable	170 / 235	140 / 195								
SIGHT DISTANCE FOR TURN MOVEMENT (m)										