COLLIER
ENGINEERING CO., INC.
CONSULTING • DESIGN • CONSTRUCTION

July 20, 2016

Metropolitan Government of Nashville and Davidson County
Department of Public Works (MPW)
750 South Fifth Street
Nashville, TN 3726

Attn: Mr. Mark Macy, P.E.

Re: Recommendations for Pavement and Roadway Improvements
Burnett Road and Swinging Bridge Road
Nashville, TN

Dear Mr. Macy:

Collier Engineering Company, Inc. (Collier) has evaluated existing conditions relative to pavement, rudiments of roadway geometry, and a snapshot of daily traffic for selected segments of the subject roadways, and herewith submits the data and our conclusions. The field tasks associated with our services included:

- Obtain representative cores to assess pavement section thickness (asphalt pavement and underlying stone) and subgrade support at selected locations along Burnett Road and Swinging Bridge Road;
- Perform measurements of roadway widths within the subject reaches of the named roads; and,
- Conduct a 24-hour (1-day) traffic study on the subject corridor to obtain counts and classifications of vehicular passes.

The purpose of this commission is to summarize the field data and provide recommendations for pavement and roadway geometry improvements in light of impacts of increased traffic and additional pavement loading to be realized with a proposed quarry, which we understand includes future expansion to include production of other construction/building materials.

Existing Conditions

Pavements

Near surface conditions at fifteen (15) selected locations on the subject roads were assessed via thin wall coring. Approximate locations are noted on the attached sketch Figure 1. Cores of the pavement (asphalt concrete (AC) and at some locations, Portland cement concrete (PCC) were obtained with a 4-inch bit and the relative thickness of underlying crushed mineral aggregate were physically measured at these locations. In addition, the relative support strength of immediate soil subgrades was assessed at five locations using a Dynamic Cone Penetrometer (DCP).

The DCP is a manually-operated device which utilizes a rod-mounted, sliding weight dropped via repeated blows to drive the tip into subgrade materials. The number of blows required to advance the unit through a predetermined length are visually counted and recorded. This information is generally correlated to N-values (blow counts) derived from standard penetration testing (SPT), which is an industry-standard procedure for drive sampling of cohesive and non-cohesive soil.

The coring and field testing results are tabulated below. Each AC core displayed discernible layers of the surface/wearing and underlying binder/base courses, and the separate thicknesses are noted.

TABLE 1 – CORING SUMMARY: BURNETT ROAD AND SWINGING BRIDGE ROAD

Core No. [1]	Surface course thickness (in.)	Binder course thickness (in.)	Base course or PCC thickness (in.)	DCP results	Latitude [2]	Longitude
1	2	3	4 ½ AC base	7	36°16'2"	86°39'25"
2	1 ½	3 ¼		4	36°16'2"	86°39'30"
3	1 ¾	1 ¾	6 ½ PCC	3	36°16'18"	86°39'47"
4	1 ¾	1 ½	8 PCC		36°16'28"	86°39'57"
5	1 ¾	2	6 ½ PCC		36°16'35"	86°40'7"
6	1 ½	2			36°16'45"	86°40'6"
7	1 ¾	2			36°16'51"	86°39'51"
8	1 ½	1 ½			36°16'59"	86°39'42"
9	1 ½	2			36°16'56"	86°39'46"
10	2 ½	2 ½			36°16'48"	86°40'1"
11	3	3 ¾			36°16'39"	86°40'7"
12	2	2			36°16'31"	86°40'1"
13	1 ½	1 ½	8 PCC	5	36°16'28"	86°39'55"
14	1 ½	2	5 ½ PCC	3	36°16'17"	86°39'43"
15	1 ¾	4			36°16'8"	86°39'30"

1. Observed/measured stone thickness was noted to be about 2 inches thick below the concrete underlayment, where noted. Stone thickness of 6 to 8 inches was noted at the core locations where concrete was absent.
2. Latitude/longitude coordinates were obtained with a smart phone app with a reported ground level accuracy of about 12 feet.

Our cursory review along both road corridors revealed indications of typically low to moderate, but occasionally moderate-to-severe, distress is present in the pavement surface. The distress is predominately expressed as block and transverse cracking resulting from apparent shrinkage and reduced strength instigated by exposure and oxidation. Other defects were observed including fatigue-related longitudinal cracking in wheel paths, alligator cracking, and edge cracking. An

assessment to obtain an updated OCI value (Overall Condition Index) was beyond our authorized scope of service so they were retrieved from the Metro Public Works Paving Office from the CarteGraph Pavement Management System. Condition index numbers reported to us are:

- Burnett Road (Swinging Bridge to Cinder Road)..... OCI = 66.1
- Swinging Bridge Road (Burnett Road to Bridgeway Avenue..... OCI = 65.58

Per the above, we assume an OCI value of 66 for both roads, which is considered a Fair pavement condition. In our opinion, the observed conditions and values are equitable to conclusions as would be attained via Pavement Condition Index (PCI) survey in accordance with ASTM D6433-11 (*Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys*).

As noted on Table 1 and delineated on Figure 1, the surficial asphalt concrete within a near half-mile long segment of Swinging Bridge Road is underlain by PCC. The PCC cores contained through-section cracks at three of the five locations where this material was encountered. Further, the visible defects in the surficial AC pavement appear to be similar in extent and severity as in other roadway areas not underlain by the PCC layer. The purpose of the PCC layer is unknown but was perceptibly installed either to accommodate high traffic loading or volume from adjacent existing industry and/or to help span yielding subgrades. In that light, the DCP values from the related cores overlapping with AC/PCC pavement are typically low, which relate to lower strength subgrades.

Roadway Width

Road widths were obtained manually using a tape and/or wheel measuring unit. Widths for both roadways were recorded along with notes relative to transition between variable lane/road widths and apparent available shoulder. The results and study areas are shown graphically on attached Figure 1, and are summarized in the following tables.

TABLE 2 – MEASURED ROAD WIDTH ALONG SWINGING BRIDGE ROAD [1]

Station (ft.) [2]	Width	Notes
0	39 ft. to 42 ft.	Transition begins at Station 0 and ends at Station 332
332	31 ft. to 34 ft.	
1088	23 ft.	No shoulder; begin transition at Sta. 753, end at Sta. 1088
1443	26 ft. to 33 ft.	Shoulder on right
1831	20	
4950	20	No shoulder

1. Between Swinging Bridge Road/Old Hickory Boulevard at Industrial Drive and Burnett Road.
2. Stationing is reference to approximate locations of transitions.

TABLE 3 – MEASURED ROAD WIDTH ALONG BURNETT ROAD [1]		
Station (ft.) [2]	**Width**	**Notes**
0	106 ft.	Intersection; begin transition at Sta. 0 and ends at Sta. 294
294	29 ft. to 35 ft.	3 ft. shoulders left and right
1253	36 ft.	No shoulder; begin transition at Sta. 1064, end at Sta. 1253
1635	29 ft.	No shoulder; begin transition at Sta. 1476, end at Sta. 1635
1848	20	No shoulder
~3000+	20	No shoulder

1. Between Swinging Road and northern end of subject quarry site.
2. Stationing is reference to approximate locations of transitions.

As tabularized above and illustrated on Figure 1, the existing widths of the Swinging Bridge Road and Burnett Road segments that are germane to this study vary in width from 36 feet to 29 feet for much of the roads, but both roads have significant stretches that are approximately 20 feet wide. Those narrow and substandard sections include about 1,150 of Burnett Road and nearly 3,200 feet of Swinging Bridge Road.

Traffic

Existing traffic volume and mix were recorded on July 18-19, 2016 between the hours of 6 AM and 6 PM central time. The data were obtained via a combination of 24-hour automated data gathering spanning the two days and visual counts during daylight hours on July 18. Total traffic counts obtained via automated means on Burnett Road was approximately 1,000 total vehicles and 1,800 vehicles on Swinging Bridge Road. Passenger vehicle trips on both roads were near 900 and 1,100 cars/pickups for Burnett and Swinging Bridge Roads, respectively. The *visual counting* yielded the following totals for large trucks, which are expected to impose greater impact to existing pavement.

- Five axles or more (~semi-trucks) .....31 (about half were loaded)
- Two to 3 axles (~dump trucks) .....18 (half were loaded)

Other noted vehicles or traffic utilizing these roads include occasional buses and motorcycles, which constitute a very low percentage in the traffic mix and in turn, minimal impact on overall traffic loading and impacts. When looking at pavement damage that is calculated in Equivalent Axle Loadings and AASHTO outlines that as a single 18 kip loaded axle. This would give a loaded dump truck an ESAL loading of close to 4 ESALs and a loaded concrete truck an ESAL value of about 2.6 while a passenger car has a value of 0.0002. This shows that a single loaded tri axle dump truck does the damage of 20,000 passenger cars.

Pavement Analyses

Reference is made in this discussion to correspondence to Metro from a report commissioned by Terracon, dated October 15, 2015. That document is attached to this report.

Based on our observations and coring results and per the AASHTO guide, the layer coefficient (A_1) for the existing asphalt along both roads is assumed to be 0.3. Per the snapshot traffic count noted above and excluding any traffic growth, the current roads would conservatively be expected to incur, within the next year, roughly 63,000 Equivalent Single Axle Loads (ESALs), per the *AASHTO 1993 Pavement Design Guide* protocol. In light of the existing pavement conditions, we estimate that the current pavement section could theoretically sustain about 46,000 ESALs. Accordingly, we anticipate the current pavement would tentatively require substantial rehabilitation or overlay in about 8 months or less.

The Terracon report recommends at least 4 inch overlay to accommodate the expected increase in truck traffic. That recommendation is based on 310 trucks per day over a 20 year pavement life. In light of the current pavement section, such an overlay would increase the existing asphalt pavement section to at least 7 inches. We note this is the minimum recommended thickness for industrial roads per Metro (MPW) standards and seems in line with industry practices with regard to paving cross sections in industrial areas.

Other than the perceived limits (presumed based on the coring results) and thickness of the PCC underlayment, little is known about this layer other than the cracking and the advanced deterioration noted in three of the PCC cores. Aspects such as joint spacing, dowel configuration (if any), and reinforcing are unknown. For the purposes of our assessment, the structural capacity of PCC layer is discounted to that of asphalt binder or base.

Conclusions and Recommendations

Metro Standard Drawing ST-261 requires Non-Residential Collector Streets to exhibit 24 ½ feet of asphalt width in addition to Curb and Gutter throughout the length of the project. Moreover, TDOT Standard Drawing RD-TS-2 specifies 24 feet wide travel lanes based on the traffic we project after build out of this facility with a minimum of a 4'-6' shoulder. Further, our understanding of the 2004 edition of the *AASHTO Policy on Geometric Design of Highways and Streets,* and Exhibit 5-5 on page 383 in particular, requires that roads with an ADT of over 2000 should be 24 feet wide with 6 feet wide shoulders which will be the case at build out of this facility. Page 393 of that same policy also states that travel way widths on local roads and streets in industrial areas should be 12 feet wide unless "severe limitations" exist. In our opinion, no known limitations or restrictions are present that could be deemed severe, and a 24 feet wide section should be constructed at all locations where current road width is less than that dimension.

During our study, we also identified in this area some recreational traffic as well as other businesses in the area. We understand the initial activities at the proposed facility would be

production of processed stone by quarry operations. Reportedly, current operations would be augmented in the future to generate other commercial building materials and products. The addition of the stated 310 or more trucks/day initially in addition to trucks for asphalt, concrete and masonry block materials would require the affected roadway sections to have a travel width of not less than 24 feet, per the above-referenced 2004 AASHTO publication. We recommend the widened/improved road should include 4 to 6 feet of stabilized shoulder to ensure safe traffic operation in the area and a turn lane at the facility to ensure safe turning movements of the large vehicles in and out of this facility. We also suggest an analysis of the intersection of Burnett Road and Swinging Bridge Road be done to ensure that turning movements can be accommodated without encroaching into oncoming travel lanes.

The existing pavement depths through the area of interest are also a concern with an average of about 3 to 4 of flexible pavement in most areas. We reiterate the pavement is categorized as Fair condition and the visible surface typically exhibits varying levels and types of defects. In our opinion, the road will likely qualify for complete repaving within a couple of years or less. With the stipulated number of trucks to be introduced to the subject roads, we concur with the Terracon report and their statements and recommendations including their calculated ESAL loading. Terracon recommends a minimum 7" inch thick asphalt cross section should be incorporated to sustain the planned traffic. Provided the current road segments are overlaid to develop asphalt pavement at least 7 inches thick, the improved roads should provide a useful service life and would materially comply with the parameters of the MPW Paving Office Business Plan, which calls for resurfacing on a 16 year cycle. We also suggest the addition of PG82-22 liquid to modify the new asphalt pavement. Use of such modifications has been incorporated as part of Standard Operating Procedures for the pavement program inside Davidson County in situations where high concentrations of heavy loads are present. This modification of the liquid asphalt binder in the mix significantly increases tensile strength. The reduction in paving section would be minimal, but the observed benefits would perceptibly include reduced rutting, shoving, or other defects caused by heavy wheel loads.

As alluded to in previous text, MPW Standard Drawing ST-261 requires 10" crushed mineral aggregate, 4" bituminous base Type A, 2" of bituminous base type BM2, and 1.5" of asphaltic concrete surface for these type roads. We estimate the cost to widen the substandard sections to 24 feet, provide 4 feet wide stabilized shoulders, and to install 4" of new pavement throughout would be on the order of $750,000 to $1M. That includes construction of the shoulder areas, installing the Type A mix up to current road surface grade in the widened areas, and placement of 2.5" of BM2 and 1.5" of D mix to finished grade over the entire roadway. All the asphalt binder in the new roadway section should be done in a PG82-22 liquid again to retard any rutting or other damage.

In summary, the current pavement is expected to deteriorate exponentially with the addition of truck traffic, and a minimum overlay of 4 inches is recommended. Further, the affected road segments should be widened to comply with current design standards as well as to accommodate future increases in truck loading and volume. It does appear that this work could

be accomplished reasonably within the existing Rights of Way and this work should be completed prior to the inception of the commercial operation and the addition of the heavy traffic loading and large vehicles. The improved pavement and roadway would be necessary to provide for the safety of the current and proposed road users including local residents and adjacent industry.

We appreciate the opportunity to be of service to you. If you have any questions concerning this correspondence, or if we may be of further service to you in any way, please do not hesitate to contact us.

Sincerely,
Collier Engineering Company, Inc.

J. Samuel Vance, P.E.
Geotechnical Manager

Chad A. Collier, P.E.
President

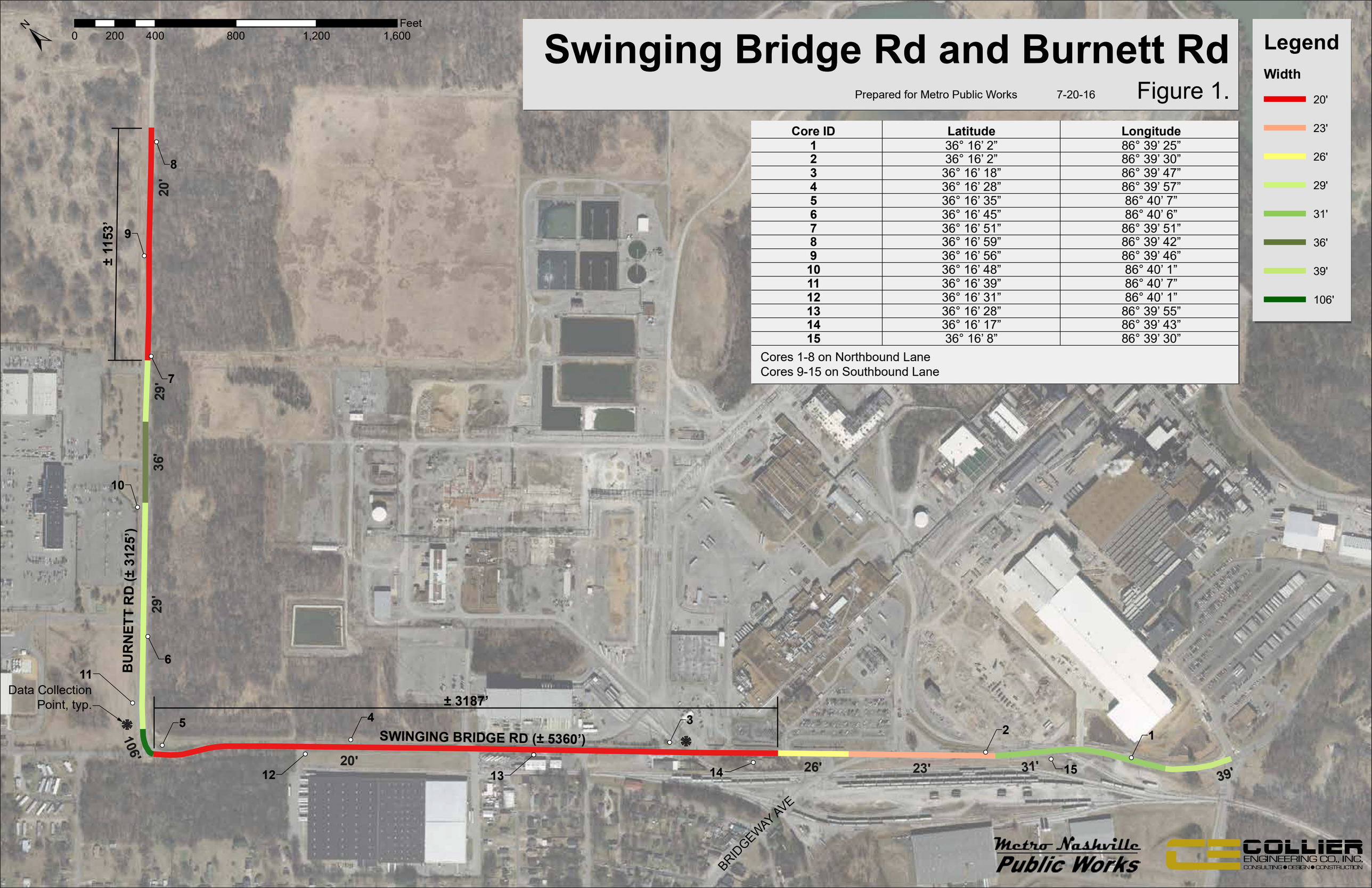
Attachments:	Figure 1	Road Widths and Coring Location Sketch
	Figure 2	Terracon Report dated October 12, 2015
	Figures 3 and 4	Automated traffic counts
	Figure 5	Metro STD drawing ST-261
	Figure 6	TDOT STD drawing RD-TS-1

FIGURE 1

Swinging Bridge Rd and Burnett Rd

Prepared for Metro Public Works 7-20-16

Figure 1.



Core ID	Latitude	Longitude
1	36° 16' 2"	86° 39' 25"
2	36° 16' 2"	86° 39' 30"
3	36° 16' 18"	86° 39' 47"
4	36° 16' 28"	86° 39' 57"
5	36° 16' 35"	86° 40' 7"
6	36° 16' 45"	86° 40' 6"
7	36° 16' 51"	86° 39' 51"
8	36° 16' 59"	86° 39' 42"
9	36° 16' 56"	86° 39' 46"
10	36° 16' 48"	86° 40' 1"
11	36° 16' 39"	86° 40' 7"
12	36° 16' 31"	86° 40' 1"
13	36° 16' 28"	86° 39' 55"
14	36° 16' 17"	86° 39' 43"
15	36° 16' 8"	86° 39' 30"

Cores 1-8 on Northbound Lane
Cores 9-15 on Southbound Lane

FIGURE 2

October 27, 2015

Collier Engineering
5560 Franklin Pike Circle
Brentwood, TN 37027

Attn: Mr. Chad Collier, P .E.

Re: Pavement Engineering Services
Burnett Road Project Study
Old Hickory, TN
Terracon Project No.: 18156609

Dear Mr. Collier:

As requested, Terracon Consultants, Inc. (Terracon) evaluated existing pavement section thickness for support of proposed future traffic on Burnett Road. The work was performed in general accordance with our Master Services Agreement dated September 25, 2015, and subsequent Task Order dated October 27, 2015. The assessment consisted of the following tasks:

1. Visual survey of the current pavement condition
2. Review of provided documentation concerning traffic and pavement section thickness at select locations,
3. Estimation of the modulus values for the various pavement and subgrade layers, and
4. Modeling of the pavement structure using the AASHTO 1993 design method under the provided traffic load.

The purpose of this study was to determine an asphalt overlay thickness for the existing pavement on Burnett Road.

1.0 EXISTING PAVEMENT CONDITION

A cursory visual survey was conducted to assess the pavement condition which is a valuable input in the overlay design procedure.

The dominant distress type observed was block cracking, which is the product of asphalt concrete oxidation with time. Another observed distress was weathering which is the wearing away of the asphalt binder and fine aggregate. Fatigue cracking was noted in some locations as well as longitudinal and transverse cracking. Site condition pictures can be found in Exhibit 1.

Terracon was provided a Pavement Condition Index (PCI) score of about 64 for Burnett Road which is considered a Fair pavement condition.

2.0 PAVEMENT THICKNESS AND SUBGRADE SUPPORT

Asphalt concrete thicknesses were provided to Terracon for Burnett Road (see following table). An estimated 8 inch thickness was provided to Terracon for the underlying aggregate base.

Core No. [1]	Asphalt Concrete Thickness (in)	Aggregate Base Thickness (in)	Estimated Subgrade Support (CBR)[1]
C-1	3 ½	8	5
C-2	3 5/8	8	5
C-3	4 ½	8	5
C-4	3	8	5
C-5	3 ½	8	5
Avg.	≈ 3 ½	8	5

For subgrade support a CBR value of 5 was assumed for this pavement thickness calculation.

3.0 PAVEMENT MODELING

The pavement overlay thickness was calculated using the AASHTO 1993 condition survey design method for AC overlays. The appropriate inputs for this approach are described below.

- Traffic inputs were provided to Terracon as part of a traffic study of the project. A total of 310 truck daily trips (in and out) were estimated at a gross vehicle weight of about 42 kips empty (driving in) and 74 kips loaded (driving out). Additionally a total of 54 employee trips, presumably in passenger vehicles, were recorded. These values were used to estimate the total 20 year Equivalent Single Axle Load (ESAL) as shown in Exhibit 2. Note that the state of Tennessee "Motor Carrier Manual" weight restrictions were used. The total ESALs were estimated at 0.4 million entering and 3.77 million leaving. No traffic growth was considered.
- An existing asphalt layer coefficient (A_1) of 0.3 was assumed based on the existing pavement condition and the AASHTO 1993 Condition survey method recommendations.
- A stone base layer coefficient of 0.14 was used.
- The underling subgrade CBR value of 5 was estimated based on conversations with Collier Engineering which is equivalent to a subgrade modulus of about 7200 psi.
- The design reliability was specified at 85% and the standard deviation at 0.45.
- The new asphalt layer was assigned a coefficient of 0.44.

4.0 CONCLUSIONS

The results indicate that in order for the Burnett Road to support the estimated quarry truck loading for 20 years the existing pavement requires the following asphalt overlay thicknesses. Calculations are shown on Exhibits 3a and 3b. Additionally, it was found that localized patching of the existing pavement is required in some areas of the pavement.

Traffic Lane	ESAL's (million)	Overlay Thickness (in)
Inbound	0.4	1½
Outbound	3.77	4

If the existing pavement conditions will not allow the placement of the above overlay thickness. Terracon recommends the reconstruction of the pavement using the following pavement section. Calculations are shown on Exhibits 3c and 3d. Additionally, the road cross section should meet minimum travel lane and shoulder width requirements to satisfy TDOT protocol for this and similar roadways.

Material[1]	Asphalt Section Thickness (inches)	
	Inbound Traffic	Outbound Traffic
Asphalt Surface	2	2
Asphalt Binder	2½	5
Aggregate Base	7	8
Total Pavement Section	**11 ½**	**15**

1. Asphalt concrete aggregates and base course materials should conform to the following TDOT material specifications.
   - Section 411 for Surface Course, Grading E
   - Section 307 for Hot Mix Asphalt Leveling Course, Grading B-M
   - Section 303 for Aggregate Base Course material, Class A, Grading D

5.0 GENERAL COMMENTS

The analysis presented in this report is based upon the data obtained from the "Traffic Impact Study" performed by Wiser Consultants and from a visual survey conducted by Terracon Consultants. The results of this analysis illustrated in Exhibit 3 are based on several assumptions and simplified design relationships, and should be considered a relative indication of future traffic capacity, actual results may vary significantly. If greater reliability is required, we recommend more detailed analysis including falling weight deflectometer testing of the pavement.

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical and pavement engineering practices. No warranties, either expressed or implied, are intended or made.

We appreciate the opportunity to be of service to you on this project. Please contact the undersigned at 615-333-6444 with any questions concerning this report.

Sincerely,
Terracon Consultants, Inc.

Peter Nabhan, E.I.T
Staff Materials Engineer

Timothy G. LaGrow, P.E.
Vice President, Regional Manager

Attachments: Exhibit 1 – Site Photographs
Exhibit 2 – Traffic Calculations
Exhibit 3 – Pavement Thickness Calculations

Exhibit 1 – Site Photographs

Photo 1. **High Severity transverse cracking observed.**

Photo 2. **Medium to high severity longitudinal cracking observed in both lanes at this location**

Photo 3. **Medium Severity block cracking was observed at several locations in the project.**

Photo 4. **Medium severity weathering was noted along the project.**

Exhibit 2a– ESALs Calculation-Loaded Trucks

AASHTO 1993 ESAL Calculator for Flexible Pavements

Vehicle Description	Traffic Volume: Quantity in the Design Lane	Traffic Volume: Days per Week	Traffic Volume: Weeks per Year	Analysis Period (years)	Axle Load and Type: Axle 1 (kips)		Axle 2 (kips)		Axle 3 (kips)		Gross Weight (pounds)	Equivalency Factors: Axle 1	Equivalency Factors: Axle 2	Equivalency Factors: Axle 3	ESAL's
Passenger car	27	6	52	20	2	S	2	S			4,000	0.0002	0.0002	0	67
Pick-up truck or van					2	S	4	S			6,000	0.0002	0.002	0	0
Recreational vehicle					4	S	4	S			8,000	0.002	0.002	0	0
School bus					6	S	14	S			20,000	0.011	0.354	0	0
TARC bus					8	S	14	S			22,000	0.036	0.354	0	0
Greyhound MC-12 bus					13.4	S	18.4	S	6	S	37,800	0.3045	1.112	0.011	0
Package delivery truck					4	S	14	S			18,000	0.002	0.354	0	0
Beverage delivery truck					6	S	12	S	12	S	30,000	0.011	0.189	0.189	0
Garbage/dumpster truck					20	S	35	T			55,000	1.56	1.23	0	0
Concrete truck (full)					20	S	48	R			68,000	1.56	1.015	0	0
Dump truck (full)					20	S	48	R			68,000	1.56	1.015	0	0
Semi-tractor (no trailer)					8	S	2	T			10,000	0.036	0	0	0
Semi-tractor trailer (empty)					8	S	8	T	6	T	22,000	0.036	0.003	0.001	0
Semi-tractor trailer					12	S	34	T	34	T	80,000	0.189	1.08	1.08	0
Concrete Trucks	30	6	52	20	20	S	34	T		T	54,000	1.56	1.08	0	494,208
Quarry/ Asphalt Trucks	125	6	52	20	20	S	20	S	34	T	74,000	1.56	1.56	1.08	3,276,000
Vehicle type H10					4	S	16	S			20,000	0.002	0.613	0	0
Vehicle type H15					6	S	24	S			30,000	0.011	3.43	0	0
Vehicle type H20					8	S	32	S			40,000	0.036	12.4	0	0
Vehicle type 3					16	S	34	T			50,000	0.613	1.08	0	0
Vehicle type HS15					6	S	24	S	24	S	54,000	0.011	3.43	3.43	0
Vehicle type HS20					8	S	32	S	32	S	72,000	0.036	12.4	12.4	0
Vehicle type 3S2					10	S	31	T	31	T	72,000	0.09	0.7445	0.7445	0

Terminal Serviceability, r_t	2.0
Assumed Structural Number, SN	3
Traffic Growth Rate, %/yr	0

Summary:		
	Total AASHTO ESAL's	3,770,275
	Superpave	
	Traffic Category	Rural Low Volume

Project: Burnett Road Project Study Location: Old Hickory, TN

Job No.: 18156609 Date: 10/27/2015

Exhibit 2b– ESALs Calculation-Empty Trucks

AASHTO 1993 ESAL Calculator for Flexible Pavements

Vehicle Description	Traffic Volume: Quantity in the Design Lane	Traffic Volume: Days per Week	Traffic Volume: Weeks per Year	Analysis Period (years)	Axle Load and Type: Axle 1 (kips)		Axle 2 (kips)		Axle 3 (kips)		Gross Weight (pounds)	Equivalency Factors: Axle 1	Equivalency Factors: Axle 2	Equivalency Factors: Axle 3	ESAL's
Passenger car	27	6	52	20	2	S	2	S			4,000	2E-04	2E-04	0	67
Pick-up truck or van					2	S	4	S			6,000	2E-04	0.002	0	0
Recreational vehicle					4	S	4	S			8,000	0.002	0.002	0	0
School bus					6	S	14	S			20,000	0.011	0.354	0	0
TARC bus					8	S	14	S			22,000	0.036	0.354	0	0
Greyhound MC-12 bus					13.4	S	18.4	S	6	S	37,800	0.305	1.112	0.011	0
Package delivery truck					4	S	14	S			18,000	0.002	0.354	0	0
Beverage delivery truck					6	S	12	S	12	S	30,000	0.011	0.189	0.189	0
Garbage/dumpster truck					20	S	35	T			55,000	1.56	1.23	0	0
Concrete truck (full)					20	S	48	R			68,000	1.56	1.015	0	0
Dump truck (full)					20	S	48	R			68,000	1.56	1.015	0	0
Semi-tractor (no trailer)					8	S	2	T			10,000	0.036	0	0	0
Semi-tractor trailer (empty)					8	S	8	T	6	T	22,000	0.036	0.003	0.001	0
Semi-tractor trailer					12	S	34	T	34	T	80,000	0.189	1.08	1.08	0
Concrete Trucks	30	6	52	20	10	s	24	T		T	34,000	0.09	0.26	0	65,520
Quarry/ Asphalt Trucks	125	6	52	20	8	S	8	S	26	T	42,000	0.036	0.036	0.36	336,960
Vehicle type H10					4	S	16	S			20,000	0.002	0.613	0	0
Vehicle type H15					6	S	24	S			30,000	0.011	3.43	0	0
Vehicle type H20					8	S	32	S			40,000	0.036	12.4	0	0
Vehicle type 3					16	S	34	T			50,000	0.613	1.08	0	0
Vehicle type HS15					6	S	24	S	24	S	54,000	0.011	3.43	3.43	0
Vehicle type HS20					8	S	32	S	32	S	72,000	0.036	12.4	12.4	0
Vehicle type 3S2					10	S	31	T	31	T	72,000	0.09	0.745	0.745	0

Terminal Serviceability, r_t	2.0
Assumed Structural Number, SN	3
Traffic Growth Rate, %/yr	0

Summary:		
	Total AASHTO ESAL's	402,547
	Superpave	
	Traffic Category	Rural Low Volume

Project: Burnett Road Project Study Location: Old Hickory, TN

Job No.: 18156609 Date: 10/27/2015

Exhibit 3a– Overlay Thickness Calculation- Loaded Trucks

Terracon

5217 Linbar Drive, Suite 309
Nashville, TN 37211

Overlay Design

Condition Survey Method, AASHTO Page 102-111
(Sheet not protected)

Existing Pavement Section

			Original SN	Coefficients * (condition)	Estimated SN_{eff}
T_{ac} =	3.5	a_1 =	0.4	0.3	1.05
T_{base} =	8.0	a_2 =	0.14	0.14	1.12
Milling Depth	0.0 in	Total	2.52		2.17

*** Estimate Structural number by comparing pavement condition with Table 5.2 at right**

Traffic, ESALs (design) 3,770,000

Subgrade Modulus 7200 psi

SN_f =	3.94
Reliability =	85%
Standard Deviation =	0.45
Servicability Loss =	2.2

Solve for SN

New Asphalt a_1 = 0.44

Overlay Thickness = $(SN_f - SN_{eff})/a_1$ = 4.00 inches

ref: Page III-95 AASHTO

Rounded to next 1/4 inch

Exhibit 3b– Overlay Thickness Calculation- Empty Trucks

Terracon

5217 Linbar Drive, Suite 309
Nashville, TN 37211

Overlay Design

Condition Survey Method, AASHTO Page 102-111
(Sheet not protected)

Existing Pavement Section

			Original SN	Coefficients * (condition)	Estimated SN_{eff}
T_{ac} =	3.5	a_1 =	0.4	0.3	1.05
T_{base} =	8.0	a_2 =	0.14	0.14	1.12
Milling Depth	0.0 in	Total	2.52		2.17

*** Estimate Structural number by comparing pavement condition with Table 5.2 at right**

Traffic, ESALs (design)	402,547	Subgrade Modulus	7200 psi

SN_f =	2.83
Reliability =	85%
Standard Deviation =	0.45
Servicability Loss =	2.2

Solve for SN

New Asphalt a_1 = 0.44

Overlay Thickness = $(SN_f - SN_{eff})/a_1$ = 1.50 inches

ref: Page III-95 AASHTO

Rounded to next 1/4 inch

Exhibit 3c– Reconstructed Pavement Thickness Calculation-Loaded Trucks

Pavement Design (AASHTO 1993 Method)

Design Inputs			Asphalt			Concrete	
CBR, Calculated Mr	5.0	Mr =	7157	psi	K =	141	pci
Sugrade Support Used		Mr =	7200	psi	K =	125	pci
Reliability (%) =			85			85	
Standard Deviation		So =	0.45			0.35	
Initial Serviceability =		Po =	4.2			4.5	WM = 4.2
Terminal Serviceability =		P_t =	2.0			2.5	WM = 2.0
Design Serviceability Loss, =		ΔPSI =	2.2			2.0	

Asphalt Layer Coefficients		
a_1 =	0.44	AC Surface and Binder
a_2 =	0.40	AC Base
a_2 =	0.14	Aggregate Base
a_3 =	0.08	Subbase

Concrete Compressive Strength	4000	psi
Modulus of Elasticity of Concrete =	3,605	ksi
Modulus of Rupture of Concrete: =	580	psi
Load Transfer ("J" Factor)	4.2	See Table 1
Drainage Coefficient	1.0	See Table 2

Pavement Thickness Designs

Traffic Category - Flexible Pavement

Asphalt Section Traffic (18 kip ESAL) = 3,770,275 *Calculated ESALs =* **3,770,275**

Flexible Pavement Section	Drainage, m	D_i	
AC Surface + Binder		3.0	in
Asphalt Base		4.0	in
Aggregate Base	1.0	8.0	in
Subbase	1.0		in

Solve for SN required

Structural Number **4.04** OK

Required 3.94

Exhibit 3d– Reconstructed Pavement Thickness Calculation-Empty Trucks

Pavement Design (AASHTO 1993 Method)

Design Inputs			Asphalt			Concrete	
CBR, Calculated Mr	5.0	Mr =	7157	psi	K =	141	pci
Sugrade Support Used		Mr =	7200	psi	K =	125	pci
Reliability (%) =			85			85	
Standard Deviation		So =	0.45			0.35	
Initial Serviceability =		Po =	4.2			4.5	WM = 4.2
Terminal Serviceability =		P_t =	2.0			2.5	WM = 2.0
Design Serviceability Loss, =		ΔPSI =	2.2			2.0	

Asphalt Layer Coefficients		
a_1 =	0.44	AC Surface and Binder
a_2 =	0.40	AC Base
a_2 =	0.14	Aggregate Base
a_3 =	0.08	Subbase

Concrete Compressive Strength	4000	psi
Modulus of Elasticity of Concrete =	3,605	ksi
Modulus of Rupture of Concrete: =	580	psi
Load Transfer ("J" Factor)	4.2	See Table 1
Drainage Coefficient	1.0	See Table 2

Pavement Thickness Designs

Traffic Category - Flexible Pavement
Asphalt Section Traffic (18 kip ESAL) = 402,547 *Calculated ESALs =* **402,547**

Flexible Pavement Section	Drainage, m	D_i	
AC Surface + Binder		2.0	in
Asphalt Base		2.5	in
Aggregate Base	1.0	7.0	in
Subbase	1.0		in

Solve for SN required

Structural Number 2.86 OK

Required 2.83

FIGURES 3 AND 4

Collier Engineering

5560 Franklin Pike Cir
Brentwood, TN 37027

Swinging Bridge Rd, W of Bridgeway Ave

EB - Swinging Bridge Rd

Start Time	Bikes	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classe	Total
07/17/16	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
01:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
02:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
03:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
04:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
05:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
06:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
07:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
08:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
09:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11:00	4	18	7	0	0	1	0	0	0	0	0	0	0	1	31
12 PM	1	32	3	0	0	1	0	0	0	0	0	0	0	0	37
13:00	6	38	2	0	0	1	0	0	0	0	0	0	0	0	47
14:00	10	39	3	0	1	0	0	0	0	0	0	0	0	0	53
15:00	4	44	8	0	0	0	0	0	0	0	0	0	0	3	59
16:00	4	43	5	0	0	4	0	0	0	0	0	0	0	1	57
17:00	1	45	4	0	0	1	0	0	0	0	0	0	0	2	53
18:00	4	60	11	0	0	0	1	0	0	0	0	0	0	0	76
19:00	1	38	2	0	0	0	0	0	0	0	0	0	0	0	41
20:00	5	40	7	0	0	1	0	0	0	0	0	0	0	3	56
21:00	4	19	2	0	0	0	0	0	0	0	0	0	0	1	26
22:00	3	6	3	0	0	0	0	0	0	0	0	0	0	0	12
23:00	0	10	0	0	0	1	0	0	0	0	0	0	0	0	11
Total	47	432	57	0	1	10	1	0	0	0	0	0	0	11	559
Percent	8.4%	77.3%	10.2%	0.0%	0.2%	1.8%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%	
AM Peak	11:00	11:00	11:00			11:00								11:00	11:00
Vol.	4	18	7			1								1	31
PM Peak	14:00	18:00	18:00		14:00	16:00	18:00							15:00	18:00
Vol.	10	60	11		1	4	1							3	76

Collier Engineering
5560 Franklin Pike Cir
Brentwood, TN 37027

Swinging Bridge Rd, W of Bridgeway Ave

EB - Swinging Bridge Rd

Start Time	Bikes	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classe	Total
07/18/16	0	6	2	0	0	1	0	0	0	0	0	0	0	0	9
01:00	0	1	1	0	0	0	0	0	0	0	0	0	0	0	2
02:00	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
03:00	0	4	2	0	0	1	0	0	0	0	0	0	0	0	7
04:00	0	2	2	0	0	2	0	0	0	0	0	0	0	0	6
05:00	0	9	0	0	1	0	0	0	0	0	0	0	0	2	12
06:00	2	28	5	0	0	1	0	0	0	0	0	0	0	0	36
07:00	6	13	5	0	1	6	0	0	1	1	0	0	0	4	37
08:00	3	22	2	0	2	4	0	0	0	0	0	0	0	5	38
09:00	3	21	4	0	0	6	0	0	0	0	0	0	0	1	35
10:00	3	24	10	0	5	4	0	0	0	0	0	0	0	2	48
11:00	4	50	14	0	1	4	0	0	1	0	0	0	0	3	77
12 PM	0	42	11	0	2	2	0	0	0	0	0	0	0	0	57
13:00	0	36	3	0	1	3	0	0	1	0	0	0	0	4	48
14:00	1	38	8	1	2	2	0	0	0	0	0	0	0	1	53
15:00	1	56	16	0	1	1	0	0	0	0	0	0	0	0	75
16:00	2	70	14	0	0	1	0	0	1	0	0	0	0	3	91
17:00	2	53	8	0	1	1	0	0	0	0	0	0	0	3	68
18:00	2	44	8	0	1	1	0	0	0	0	0	0	0	1	57
19:00	1	36	8	0	0	0	0	0	0	0	0	0	0	2	47
20:00	1	42	4	0	0	1	0	0	0	0	0	0	0	1	49
21:00	0	19	3	0	0	0	0	0	0	0	0	0	0	0	22
22:00	0	8	1	0	0	0	0	0	0	0	0	0	0	0	9
23:00	0	11	4	0	0	1	0	0	0	0	0	0	0	0	16
Total	31	637	135	1	18	42	0	0	4	1	0	0	0	32	901
Percent	3.4%	70.7%	15.0%	0.1%	2.0%	4.7%	0.0%	0.0%	0.4%	0.1%	0.0%	0.0%	0.0%	3.6%	
AM Peak	07:00	11:00	11:00		10:00	07:00			07:00	07:00				08:00	11:00
Vol.	6	50	14		5	6			1	1				5	77
PM Peak	16:00	16:00	15:00	14:00	12:00	13:00			13:00					13:00	16:00
Vol.	2	70	16	1	2	3			1					4	91

Collier Engineering
5560 Franklin Pike Cir
Brentwood, TN 37027

Swinging Bridge Rd, W of Bridgeway Ave

EB - Swinging Bridge Rd

Start Time	Bikes	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classe	Total
07/19/16	1	8	1	0	0	2	0	0	0	0	0	0	0	0	12
01:00	0	4	0	0	0	0	0	0	0	0	0	0	0	0	4
02:00	0	3	2	0	0	0	0	0	0	0	0	0	0	0	5
03:00	0	4	1	0	0	0	0	0	0	0	0	0	0	0	5
04:00	0	2	2	0	0	2	0	0	0	0	0	0	0	0	6
05:00	0	12	2	0	1	1	0	0	0	0	0	0	0	1	17
06:00	1	35	7	0	0	2	0	0	0	0	0	0	0	1	46
07:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
08:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
09:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
12 PM	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
13:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
14:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
15:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
16:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
17:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
18:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
19:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
20:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
21:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
22:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
23:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Total	2	68	15	0	1	7	0	0	0	0	0	0	0	2	95
Percent	2.1%	71.6%	15.8%	0.0%	1.1%	7.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.1%	
AM Peak	00:00	06:00	06:00		05:00	00:00								05:00	06:00
Vol.	1	35	7		1	2								1	46
PM Peak															
Vol.															
Grand Total	80	1137	207	1	20	59	1	0	4	1	0	0	0	45	1555
Percent	5.1%	73.1%	13.3%	0.1%	1.3%	3.8%	0.1%	0.0%	0.3%	0.1%	0.0%	0.0%	0.0%	2.9%	

Collier Engineering
5560 Franklin Pike Cir
Brentwood, TN 37027

Swinging Bridge Rd, W of Bridgeway Ave

WB - Swinging Bridge Rd

Start Time	Bikes	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classe	Total
07/17/16	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
01:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
02:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
03:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
04:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
05:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
06:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
07:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
08:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
09:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11:00	0	2	22	0	17	0	0	2	0	0	0	0	0	2	45
12 PM	1	2	26	0	18	2	0	4	0	0	0	0	0	0	53
13:00	0	3	34	0	19	0	0	4	0	0	0	0	0	1	61
14:00	0	3	21	0	24	0	0	1	0	0	0	0	0	1	50
15:00	1	1	27	0	25	1	0	3	0	0	0	0	0	0	58
16:00	1	6	29	0	20	2	0	0	0	0	0	0	0	0	58
17:00	0	5	32	0	34	0	0	1	1	0	0	0	0	4	77
18:00	0	1	18	0	23	0	0	0	0	0	0	0	0	4	46
19:00	0	7	14	0	24	1	0	1	0	0	0	0	0	1	48
20:00	1	2	17	0	11	1	0	0	0	0	0	0	0	1	33
21:00	0	1	11	0	10	0	0	0	0	0	0	0	0	0	22
22:00	0	0	8	0	5	0	0	0	0	0	0	0	0	0	13
23:00	0	1	4	0	3	0	0	0	1	0	0	0	0	0	9
Total	4	34	263	0	233	7	0	16	2	0	0	0	0	14	573
Percent	0.7%	5.9%	45.9%	0.0%	40.7%	1.2%	0.0%	2.8%	0.3%	0.0%	0.0%	0.0%	0.0%	2.4%	
AM Peak		11:00	11:00		11:00			11:00						11:00	11:00
Vol.		2	22		17			2						2	45
PM Peak	12:00	19:00	13:00		17:00	12:00		12:00	17:00					17:00	17:00
Vol.	1	7	34		34	2		4	1					4	77

Collier Engineering
5560 Franklin Pike Cir
Brentwood, TN 37027

Swinging Bridge Rd, W of Bridgeway Ave

WB - Swinging Bridge Rd

Start Time	Bikes	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classe	Total
07/18/16	0	0	1	0	4	1	0	0	0	0	0	0	0	0	6
01:00	0	0	3	0	2	0	0	0	0	0	0	0	0	1	6
02:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03:00	0	0	1	0	3	2	0	0	0	0	0	0	0	1	7
04:00	2	0	5	0	2	1	0	0	0	0	0	0	0	0	10
05:00	1	3	32	0	37	1	0	0	0	0	0	0	0	2	76
06:00	0	3	31	0	24	0	0	0	0	0	0	0	0	2	60
07:00	2	2	15	4	20	2	0	0	1	0	0	0	0	4	50
08:00	1	1	14	2	8	2	0	1	0	0	0	0	0	2	31
09:00	1	1	12	3	24	1	0	0	1	0	0	0	0	1	44
10:00	1	1	12	3	14	1	0	0	0	0	0	0	0	5	37
11:00	3	0	18	2	29	3	0	0	0	0	0	0	0	3	58
12 PM	1	3	39	1	26	1	0	2	0	0	0	0	0	3	76
13:00	1	0	17	1	18	3	0	0	0	0	0	0	0	0	40
14:00	1	0	23	1	16	1	0	0	0	0	0	0	0	3	45
15:00	2	1	23	1	19	1	0	0	1	0	0	0	0	2	50
16:00	0	3	19	0	25	2	0	2	0	0	0	0	0	0	51
17:00	2	5	39	1	35	2	0	1	0	0	0	0	0	2	87
18:00	0	2	17	1	22	0	0	0	0	0	0	0	0	0	42
19:00	0	0	18	0	22	0	0	0	0	0	0	0	0	2	42
20:00	0	0	17	0	16	1	0	0	0	0	0	0	0	0	34
21:00	0	1	10	0	7	0	0	0	0	0	0	0	0	0	18
22:00	0	0	5	0	5	0	0	0	0	0	0	0	0	0	10
23:00	2	0	7	0	8	2	0	0	0	0	0	0	0	1	20
Total	20	26	378	20	386	27	0	6	3	0	0	0	0	34	900
Percent	2.2%	2.9%	42.0%	2.2%	42.9%	3.0%	0.0%	0.7%	0.3%	0.0%	0.0%	0.0%	0.0%	3.8%	
AM Peak	11:00	05:00	05:00	07:00	05:00	11:00		08:00	07:00					10:00	05:00
Vol.	3	3	32	4	37	3		1	1					5	76
PM Peak	15:00	17:00	12:00	12:00	17:00	13:00		12:00	15:00					12:00	17:00
Vol.	2	5	39	1	35	3		2	1					3	87

Collier Engineering
5560 Franklin Pike Cir
Brentwood, TN 37027

Swinging Bridge Rd, W of Bridgeway Ave

WB - Swinging Bridge Rd

Start Time	Bikes	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classe	Total
07/19/16	0	0	4	0	3	1	0	0	0	0	0	0	0	0	8
01:00	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
02:00	0	0	0	0	5	1	0	0	0	0	0	0	0	0	6
03:00	0	0	1	0	2	1	0	0	0	0	0	0	0	0	4
04:00	1	1	5	0	5	1	0	0	0	0	0	0	0	0	13
05:00	0	1	40	0	33	0	0	0	0	0	0	0	0	0	74
06:00	1	4	28	1	26	1	0	2	0	0	0	0	0	3	66
07:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
08:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
09:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
12 PM	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
13:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
14:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
15:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
16:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
17:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
18:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
19:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
20:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
21:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
22:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
23:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Total	2	6	78	1	75	5	0	2	0	0	0	0	0	3	172
Percent	1.2%	3.5%	45.3%	0.6%	43.6%	2.9%	0.0%	1.2%	0.0%	0.0%	0.0%	0.0%	0.0%	1.7%	
AM Peak	04:00	06:00	05:00	06:00	05:00	00:00		06:00						06:00	05:00
Vol.	1	4	40	1	33	1		2						3	74
PM Peak															
Vol.															
Grand Total	26	66	719	21	694	39	0	24	5	0	0	0	0	51	1645
Percent	1.6%	4.0%	43.7%	1.3%	42.2%	2.4%	0.0%	1.5%	0.3%	0.0%	0.0%	0.0%	0.0%	3.1%	

Collier Engineering
5560 Franklin Pike Cir
Brentwood, TN 37027

Swinging Bridge Rd, W of Bridgeway Ave

EB - Swinging Bridge Rd, WB - Swinging Bridge Rd

Start Time	Bikes	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classe	Total
07/17/16	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
01:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
02:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
03:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
04:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
05:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
06:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
07:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
08:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
09:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11:00	4	20	29	0	17	1	0	2	0	0	0	0	0	3	76
12 PM	2	34	29	0	18	3	0	4	0	0	0	0	0	0	90
13:00	6	41	36	0	19	1	0	4	0	0	0	0	0	1	108
14:00	10	42	24	0	25	0	0	1	0	0	0	0	0	1	103
15:00	5	45	35	0	25	1	0	3	0	0	0	0	0	3	117
16:00	5	49	34	0	20	6	0	0	0	0	0	0	0	1	115
17:00	1	50	36	0	34	1	0	1	1	0	0	0	0	6	130
18:00	4	61	29	0	23	0	1	0	0	0	0	0	0	4	122
19:00	1	45	16	0	24	1	0	1	0	0	0	0	0	1	89
20:00	6	42	24	0	11	2	0	0	0	0	0	0	0	4	89
21:00	4	20	13	0	10	0	0	0	0	0	0	0	0	1	48
22:00	3	6	11	0	5	0	0	0	0	0	0	0	0	0	25
23:00	0	11	4	0	3	1	0	0	1	0	0	0	0	0	20
Total	51	466	320	0	234	17	1	16	2	0	0	0	0	25	1132
Percent	4.5%	41.2%	28.3%	0.0%	20.7%	1.5%	0.1%	1.4%	0.2%	0.0%	0.0%	0.0%	0.0%	2.2%	
AM Peak	11:00	11:00	11:00		11:00	11:00		11:00						11:00	11:00
Vol.	4	20	29		17	1		2						3	76
PM Peak	14:00	18:00	13:00		17:00	16:00	18:00	12:00	17:00					17:00	17:00
Vol.	10	61	36		34	6	1	4	1					6	130

Collier Engineering
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Swinging Bridge Rd, W of Bridgeway Ave

EB - Swinging Bridge Rd, WB - Swinging Bridge Rd

Start Time	Bikes	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classe	Total
07/18/16	0	6	3	0	4	2	0	0	0	0	0	0	0	0	15
01:00	0	1	4	0	2	0	0	0	0	0	0	0	0	1	8
02:00	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
03:00	0	4	3	0	3	3	0	0	0	0	0	0	0	1	14
04:00	2	2	7	0	2	3	0	0	0	0	0	0	0	0	16
05:00	1	12	32	0	38	1	0	0	0	0	0	0	0	4	88
06:00	2	31	36	0	24	1	0	0	0	0	0	0	0	2	96
07:00	8	15	20	4	21	8	0	0	2	1	0	0	0	8	87
08:00	4	23	16	2	10	6	0	1	0	0	0	0	0	7	69
09:00	4	22	16	3	24	7	0	0	1	0	0	0	0	2	79
10:00	4	25	22	3	19	5	0	0	0	0	0	0	0	7	85
11:00	7	50	32	2	30	7	0	0	1	0	0	0	0	6	135
12 PM	1	45	50	1	28	3	0	2	0	0	0	0	0	3	133
13:00	1	36	20	1	19	6	0	0	1	0	0	0	0	4	88
14:00	2	38	31	2	18	3	0	0	0	0	0	0	0	4	98
15:00	3	57	39	1	20	2	0	0	1	0	0	0	0	2	125
16:00	2	73	33	0	25	3	0	2	1	0	0	0	0	3	142
17:00	4	58	47	1	36	3	0	1	0	0	0	0	0	5	155
18:00	2	46	25	1	23	1	0	0	0	0	0	0	0	1	99
19:00	1	36	26	0	22	0	0	0	0	0	0	0	0	4	89
20:00	1	42	21	0	16	2	0	0	0	0	0	0	0	1	83
21:00	0	20	13	0	7	0	0	0	0	0	0	0	0	0	40
22:00	0	8	6	0	5	0	0	0	0	0	0	0	0	0	19
23:00	2	11	11	0	8	3	0	0	0	0	0	0	0	1	36
Total	51	663	513	21	404	69	0	6	7	1	0	0	0	66	1801
Percent	2.8%	36.8%	28.5%	1.2%	22.4%	3.8%	0.0%	0.3%	0.4%	0.1%	0.0%	0.0%	0.0%	3.7%	
AM Peak	07:00	11:00	06:00	07:00	05:00	07:00		08:00	07:00	07:00				07:00	11:00
Vol.	8	50	36	4	38	8		1	2	1				8	135
PM Peak	17:00	16:00	12:00	14:00	17:00	13:00		12:00	13:00					17:00	17:00
Vol.	4	73	50	2	36	6		2	1					5	155

Collier Engineering
5560 Franklin Pike Cir
Brentwood, TN 37027

Swinging Bridge Rd, W of Bridgeway Ave

EB - Swinging Bridge Rd, WB - Swinging Bridge Rd

Start Time	Bikes	Cars & Trailer	2 Axle Long	Buses	2 Axle 6 Tire	3 Axle Single	4 Axle Single	<5 Axl Double	5 Axle Double	>6 Axl Double	<6 Axl Multi	6 Axle Multi	>6 Axl Multi	Not Classe	Total
07/19/16	1	8	5	0	3	3	0	0	0	0	0	0	0	0	20
01:00	0	4	0	0	1	0	0	0	0	0	0	0	0	0	5
02:00	0	3	2	0	5	1	0	0	0	0	0	0	0	0	11
03:00	0	4	2	0	2	1	0	0	0	0	0	0	0	0	9
04:00	1	3	7	0	5	3	0	0	0	0	0	0	0	0	19
05:00	0	13	42	0	34	1	0	0	0	0	0	0	0	1	91
06:00	2	39	35	1	26	3	0	2	0	0	0	0	0	4	112
07:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
08:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
09:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
12 PM	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
13:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
14:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
15:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
16:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
17:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
18:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
19:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
20:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
21:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
22:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
23:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Total	4	74	93	1	76	12	0	2	0	0	0	0	0	5	267
Percent	1.5%	27.7%	34.8%	0.4%	28.5%	4.5%	0.0%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	1.9%	
AM Peak	06:00	06:00	05:00	06:00	05:00	00:00		06:00						06:00	06:00
Vol.	2	39	42	1	34	3		2						4	112
PM Peak Vol.															
Grand Total	106	1203	926	22	714	98	1	24	9	1	0	0	0	96	3200
Percent	3.3%	37.6%	28.9%	0.7%	22.3%	3.1%	0.0%	0.8%	0.3%	0.0%	0.0%	0.0%	0.0%	3.0%	

Collier Engineering
5560 Franklin Pike Cir
Brentwood, TN 37027

Burnett Rd, N of Swinging Bridge Rd

SB - Burnett Rd

Start Time	Cars Motor	2 Axle Trailer	Long	2 Axle Buses	3 Axle 6 Tire	4 Axle Single	<5 Axl Single	5 Axle Doubl	>6 Axl Doubl	<6 Axl Doubl	6 Axle Multi	>6 Axl Multi	Not Multi	Bicycl	Class	Total
07/17/16	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
01:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
02:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
03:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
04:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
05:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
06:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
07:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
08:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
09:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11:00	0	13	8	0	0	0	0	0	0	0	0	0	0	0	0	21
12 PM	0	25	6	0	0	0	0	2	0	0	0	0	0	0	0	33
13:00	0	34	7	0	0	0	0	0	0	0	0	0	0	0	0	41
14:00	1	38	11	0	0	0	0	0	0	0	0	0	0	0	0	50
15:00	0	41	17	0	3	0	0	2	0	0	0	0	0	0	1	64
16:00	1	35	16	0	2	0	0	3	0	0	0	0	0	0	0	57
17:00	1	44	15	0	2	0	0	0	0	0	0	0	0	0	0	62
18:00	0	33	20	0	0	0	0	1	0	0	0	0	0	0	0	54
19:00	0	21	16	0	0	0	0	2	0	0	0	0	0	0	0	39
20:00	1	24	8	0	0	0	0	1	0	0	0	0	0	0	0	34
21:00	1	12	9	0	1	0	0	2	0	0	0	0	0	0	0	25
22:00	2	3	1	0	0	0	0	0	0	0	0	0	0	0	0	6
23:00	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	4
Total	7	325	136	0	8	0	0	13	0	0	0	0	0	0	1	490
Percent	1.4%	66.3%	27.8%	0.0%	1.6%	0.0%	0.0%	2.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	

Collier Engineering
5560 Franklin Pike Cir
Brentwood, TN 37027

Burnett Rd, N of Swinging Bridge Rd

SB - Burnett Rd

Start Time	Cars Motor	2 Axle Trailer	Long	2 Axle Buses	3 Axle 6 Tire	4 Axle Single	<5 Axl Single	5 Axle Doubl	>6 Axl Doubl	<6 Axl Doubl	6 Axle Multi	>6 Axl Multi	Not Multi	Bicycl	Class	Total
07/18/1																
6	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
01:00	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
02:00	0	2	0	0	0	0	0	1	0	0	0	0	0	0	0	3
03:00	0	2	3	0	0	1	0	0	0	0	0	0	0	0	0	6
04:00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
05:00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
06:00	0	2	1	0	1	1	0	0	0	0	0	0	0	1	0	6
07:00	0	6	1	0	1	3	0	0	2	0	0	0	0	2	0	15
08:00	0	7	4	1	2	1	0	0	0	0	0	0	0	0	1	16
09:00	0	13	5	0	1	1	0	1	0	0	0	0	0	0	0	21
10:00	0	13	7	1	2	2	0	0	1	0	0	0	0	0	3	29
11:00	0	30	10	0	1	1	0	1	1	0	0	0	0	2	2	48
12 PM	0	16	10	0	3	1	0	3	0	0	0	0	0	0	0	33
13:00	0	24	10	0	2	2	0	0	1	0	0	0	0	0	1	40
14:00	0	24	5	1	0	1	0	3	0	0	0	0	0	0	0	34
15:00	0	30	10	0	3	1	0	0	0	0	0	0	0	0	1	45
16:00	0	29	13	0	1	0	0	2	0	0	0	0	0	0	1	46
17:00	2	34	15	0	1	0	0	0	0	0	0	0	0	0	1	53
18:00	0	11	6	1	2	0	0	0	0	0	0	0	0	0	0	20
19:00	0	19	10	0	1	0	0	0	0	0	0	0	0	0	0	30
20:00	1	26	7	0	1	0	0	1	0	0	0	0	0	0	0	36
21:00	0	15	4	0	0	0	0	0	0	0	0	0	0	0	0	19
22:00	0	5	6	0	0	0	0	0	0	0	0	0	0	0	0	11
23:00	0	4	2	0	0	0	0	0	0	0	0	0	0	0	0	6
Total	3	314	132	4	22	15	0	12	5	0	0	0	0	5	10	522
Percent	0.6%	60.2%	25.3%	0.8%	4.2%	2.9%	0.0%	2.3%	1.0%	0.0%	0.0%	0.0%	0.0%	1.0%	1.9%	

Collier Engineering
5560 Franklin Pike Cir
Brentwood, TN 37027

Burnett Rd, N of Swinging Bridge Rd

SB - Burnett Rd

Start Time	Cars Motor	2 Axle Trailer	Long	2 Axle Buses	3 Axle 6 Tire	4 Axle Single	<5 Axl Single	5 Axle Doubl	>6 Axl Doubl	<6 Axl Doubl	6 Axle Multi	>6 Axl Multi	Not Multi	Bicycl	Class	Total
07/19/1																
6	0	6	1	0	0	0	0	0	0	0	0	0	0	0	0	7
01:00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
02:00	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	3
03:00	0	2	1	0	0	0	0	0	0	0	0	0	0	0	0	3
04:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05:00	0	5	1	0	1	0	0	0	0	0	0	0	0	0	0	7
06:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
07:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
08:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
09:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
12 PM	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
13:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
14:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
15:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
16:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
17:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
18:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
19:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
20:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
21:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
22:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
23:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Total	0	15	5	0	1	0	0	0	0	0	0	0	0	0	0	21
Percent	0.0%	71.4%	23.8%	0.0%	4.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Total	10	654	273	4	31	15	0	25	5	0	0	0	0	5	11	1033
Percent	1.0%	63.3%	26.4%	0.4%	3.0%	1.5%	0.0%	2.4%	0.5%	0.0%	0.0%	0.0%	0.0%	0.5%	1.1%	

Collier Engineering
5560 Franklin Pike Cir
Brentwood, TN 37027

Burnett Rd, N of Swinging Bridge Rd

NB - Burnett Rd

Start Time	Cars Motor	2 Axle Trailer	Long	2 Axle Buses	3 Axle 6 Tire	4 Axle Single	<5 Axl Single	5 Axle Doubl	>6 Axl Doubl	<6 Axl Doubl	6 Axle Multi	>6 Axl Multi	Not Multi	Bicycl	Class	Total
07/17/16	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
01:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
02:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
03:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
04:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
05:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
06:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
07:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
08:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
09:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11:00	0	23	15	0	0	0	0	3	0	0	0	0	0	0	0	41
12 PM	0	40	14	0	1	0	0	2	0	0	0	0	0	0	0	57
13:00	1	42	12	0	2	0	0	3	0	0	0	0	0	0	0	60
14:00	0	37	14	0	1	0	0	3	0	0	0	0	0	0	0	55
15:00	0	36	19	0	3	0	0	2	0	0	0	0	0	0	1	61
16:00	1	25	15	0	5	0	0	1	0	0	0	0	0	0	0	47
17:00	1	28	15	0	0	0	0	0	0	0	0	0	0	0	1	45
18:00	0	25	9	0	1	0	0	1	0	0	0	0	0	0	0	36
19:00	1	15	10	0	0	0	0	1	0	0	0	0	0	0	0	27
20:00	1	9	6	0	0	0	0	0	0	0	0	0	0	0	0	16
21:00	0	6	5	0	0	0	0	0	0	0	0	0	0	0	0	11
22:00	2	1	1	0	0	0	0	0	0	0	0	0	0	0	0	4
23:00	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
Total	7	287	136	0	13	0	0	16	0	0	0	0	0	0	2	461
Percent	1.5%	62.3%	29.5%	0.0%	2.8%	0.0%	0.0%	3.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	

Collier Engineering
5560 Franklin Pike Cir
Brentwood, TN 37027

Burnett Rd, N of Swinging Bridge Rd

NB - Burnett Rd

Start Time	Cars Motor	2 Axle Trailer	Long	2 Axle Buses	3 Axle 6 Tire	4 Axle Single	<5 Axl Single	5 Axle Doubl	>6 Axl Doubl	<6 Axl Doubl	6 Axle Multi	>6 Axl Multi	Not Multi	Bicycl	Class	Total
07/18/1																
6	0	1	1	0	1	0	0	1	0	0	0	0	0	0	0	4
01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:00	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2
03:00	0	2	1	0	0	1	0	0	0	0	0	0	0	0	0	4
04:00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
05:00	0	5	4	0	1	0	0	0	0	0	0	0	0	0	0	10
06:00	0	4	2	0	0	0	0	0	0	0	0	0	0	0	0	6
07:00	0	17	13	1	4	2	0	0	0	0	0	0	0	0	0	37
08:00	1	30	8	0	0	1	0	1	0	0	0	0	0	0	1	42
09:00	1	19	7	0	3	2	0	0	1	0	0	0	0	0	0	33
10:00	0	17	9	1	2	1	0	1	1	0	0	0	0	0	1	33
11:00	0	24	9	0	3	1	0	2	2	0	0	0	0	0	0	41
12 PM	0	20	11	0	3	0	0	2	0	0	0	0	0	0	1	37
13:00	0	30	12	1	4	2	0	1	1	0	0	0	0	0	0	51
14:00	0	26	7	0	0	0	0	3	1	0	0	0	0	0	0	37
15:00	0	29	7	0	5	2	0	0	1	0	0	0	0	2	1	47
16:00	0	18	13	0	1	0	0	2	0	0	0	0	0	0	0	34
17:00	2	13	5	1	1	0	0	1	0	0	0	0	0	0	0	23
18:00	0	17	5	0	1	0	0	0	0	0	0	0	0	0	0	23
19:00	0	8	7	0	3	0	0	0	0	0	0	0	0	0	0	18
20:00	0	16	6	0	1	0	0	0	0	0	0	0	0	0	0	23
21:00	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	2
22:00	0	6	3	0	0	0	0	0	0	0	0	0	0	0	0	9
23:00	0	5	1	0	1	0	0	0	0	0	0	0	0	0	0	7
Total	4	310	133	4	34	12	0	14	7	0	0	0	0	2	4	524
Percent	0.8%	59.2%	25.4%	0.8%	6.5%	2.3%	0.0%	2.7%	1.3%	0.0%	0.0%	0.0%	0.0%	0.4%	0.8%	

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Brentwood, TN 37027

Burnett Rd, N of Swinging Bridge Rd

NB - Burnett Rd

Start Time	Cars Motor	2 Axle Trailer	Long	2 Axle Buses	3 Axle 6 Tire	4 Axle Single	<5 Axl Single	5 Axle Doubl	>6 Axl Doubl	<6 Axl Doubl	6 Axle Multi	>6 Axl Multi	Not Multi	Bicycl	Class	Total
07/19/1																
6	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	4
01:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02:00	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	3
03:00	0	2	2	0	0	0	0	0	0	0	0	0	0	0	0	4
04:00	0	4	0	0	1	0	0	1	0	0	0	0	0	0	0	6
05:00	0	4	5	0	0	0	0	0	0	0	0	0	0	0	0	9
06:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
07:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
08:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
09:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
12 PM	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
13:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
14:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
15:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
16:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
17:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
18:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
19:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
20:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
21:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
22:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
23:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Total	0	15	9	0	1	0	0	1	0	0	0	0	0	0	0	26
Percent	0.0%	57.7%	34.6%	0.0%	3.8%	0.0%	0.0%	3.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Total	11	612	278	4	48	12	0	31	7	0	0	0	0	2	6	1011
Percent	1.1%	60.5%	27.5%	0.4%	4.7%	1.2%	0.0%	3.1%	0.7%	0.0%	0.0%	0.0%	0.0%	0.2%	0.6%	

Collier Engineering
5560 Franklin Pike Cir
Brentwood, TN 37027

Burnett Rd, N of Swinging Bridge Rd

SB - Burnett Rd, NB - Burnett Rd

Start Time	Cars Motor	2 Axle Trailer	Long	2 Axle Buses	3 Axle 6 Tire	4 Axle Single	<5 Axl Single	5 Axle Doubl	>6 Axl Doubl	<6 Axl Doubl	6 Axle Multi	>6 Axl Multi	Not Multi	Bicycl	Class	Total
07/17/16	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
01:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
02:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
03:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
04:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
05:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
06:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
07:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
08:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
09:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11:00	0	36	23	0	0	0	0	3	0	0	0	0	0	0	0	62
12 PM	0	65	20	0	1	0	0	4	0	0	0	0	0	0	0	90
13:00	1	76	19	0	2	0	0	3	0	0	0	0	0	0	0	101
14:00	1	75	25	0	1	0	0	3	0	0	0	0	0	0	0	105
15:00	0	77	36	0	6	0	0	4	0	0	0	0	0	0	2	125
16:00	2	60	31	0	7	0	0	4	0	0	0	0	0	0	0	104
17:00	2	72	30	0	2	0	0	0	0	0	0	0	0	0	1	107
18:00	0	58	29	0	1	0	0	2	0	0	0	0	0	0	0	90
19:00	1	36	26	0	0	0	0	3	0	0	0	0	0	0	0	66
20:00	2	33	14	0	0	0	0	1	0	0	0	0	0	0	0	50
21:00	1	18	14	0	1	0	0	2	0	0	0	0	0	0	0	36
22:00	4	4	2	0	0	0	0	0	0	0	0	0	0	0	0	10
23:00	0	2	3	0	0	0	0	0	0	0	0	0	0	0	0	5
Total	14	612	272	0	21	0	0	29	0	0	0	0	0	0	3	951
Percent	1.5%	64.4%	28.6%	0.0%	2.2%	0.0%	0.0%	3.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	

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Burnett Rd, N of Swinging Bridge Rd

SB - Burnett Rd, NB - Burnett Rd

Start Time	Cars Motor	2 Axle Trailer	Long	2 Axle Buses	3 Axle 6 Tire	4 Axle Single	<5 Axl Single	5 Axle Doubl	>6 Axl Doubl	<6 Axl Doubl	6 Axle Multi	>6 Axl Multi	Not Multi	Bicycl	Class	Total
07/18/1																
6	0	1	2	0	1	0	0	1	0	0	0	0	0	0	0	5
01:00	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	2
02:00	0	3	1	0	0	0	0	1	0	0	0	0	0	0	0	5
03:00	0	4	4	0	0	2	0	0	0	0	0	0	0	0	0	10
04:00	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	2
05:00	0	6	4	0	1	0	0	0	0	0	0	0	0	0	0	11
06:00	0	6	3	0	1	1	0	0	0	0	0	0	0	1	0	12
07:00	0	23	14	1	5	5	0	0	2	0	0	0	0	2	0	52
08:00	1	37	12	1	2	2	0	1	0	0	0	0	0	0	2	58
09:00	1	32	12	0	4	3	0	1	1	0	0	0	0	0	0	54
10:00	0	30	16	2	4	3	0	1	2	0	0	0	0	0	4	62
11:00	0	54	19	0	4	2	0	3	3	0	0	0	0	2	2	89
12 PM	0	36	21	0	6	1	0	5	0	0	0	0	0	0	1	70
13:00	0	54	22	1	6	4	0	1	2	0	0	0	0	0	1	91
14:00	0	50	12	1	0	1	0	6	1	0	0	0	0	0	0	71
15:00	0	59	17	0	8	3	0	0	1	0	0	0	0	2	2	92
16:00	0	47	26	0	2	0	0	4	0	0	0	0	0	0	1	80
17:00	4	47	20	1	2	0	0	1	0	0	0	0	0	0	1	76
18:00	0	28	11	1	3	0	0	0	0	0	0	0	0	0	0	43
19:00	0	27	17	0	4	0	0	0	0	0	0	0	0	0	0	48
20:00	1	42	13	0	2	0	0	1	0	0	0	0	0	0	0	59
21:00	0	16	5	0	0	0	0	0	0	0	0	0	0	0	0	21
22:00	0	11	9	0	0	0	0	0	0	0	0	0	0	0	0	20
23:00	0	9	3	0	1	0	0	0	0	0	0	0	0	0	0	13
Total	7	624	265	8	56	27	0	26	12	0	0	0	0	7	14	1046
Percent	0.7%	59.7%	25.3%	0.8%	5.4%	2.6%	0.0%	2.5%	1.1%	0.0%	0.0%	0.0%	0.0%	0.7%	1.3%	

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Burnett Rd, N of Swinging Bridge Rd

SB - Burnett Rd, NB - Burnett Rd

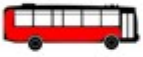
Start Time	Cars Motor	2 Axle Trailer	Long	2 Axle Buses	3 Axle 6 Tire	4 Axle Single	<5 Axl Single	5 Axle Doubl	>6 Axl Doubl	<6 Axl Doubl	6 Axle Multi	>6 Axl Multi	Not Multi	Bicycl	Class	Total
07/19/1																
6	0	10	1	0	0	0	0	0	0	0	0	0	0	0	0	11
01:00	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
02:00	0	2	4	0	0	0	0	0	0	0	0	0	0	0	0	6
03:00	0	4	3	0	0	0	0	0	0	0	0	0	0	0	0	7
04:00	0	4	0	0	1	0	0	1	0	0	0	0	0	0	0	6
05:00	0	9	6	0	1	0	0	0	0	0	0	0	0	0	0	16
06:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
07:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
08:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
09:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
10:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
11:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
12 PM	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
13:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
14:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
15:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
16:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
17:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
18:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
19:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
20:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
21:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
22:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
23:00	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Total	0	30	14	0	2	0	0	1	0	0	0	0	0	0	0	47
Percent	0.0%	63.8%	29.8%	0.0%	4.3%	0.0%	0.0%	2.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Total	21	1266	551	8	79	27	0	56	12	0	0	0	0	7	17	2044
Percent	1.0%	61.9%	27.0%	0.4%	3.9%	1.3%	0.0%	2.7%	0.6%	0.0%	0.0%	0.0%	0.0%	0.3%	0.8%	

Class 1
Motorcycles

Class 2
Passenger cars

Class 3
Four tire, single unit

Class 4
Buses



Class 5
Two axle, six tire, single unit

Class 6
Three axle, single unit

Class 7
Four or more axle, single unit

Class 8
Four or less axle, single trailer

Class 9
5-Axle tractor semitrailer

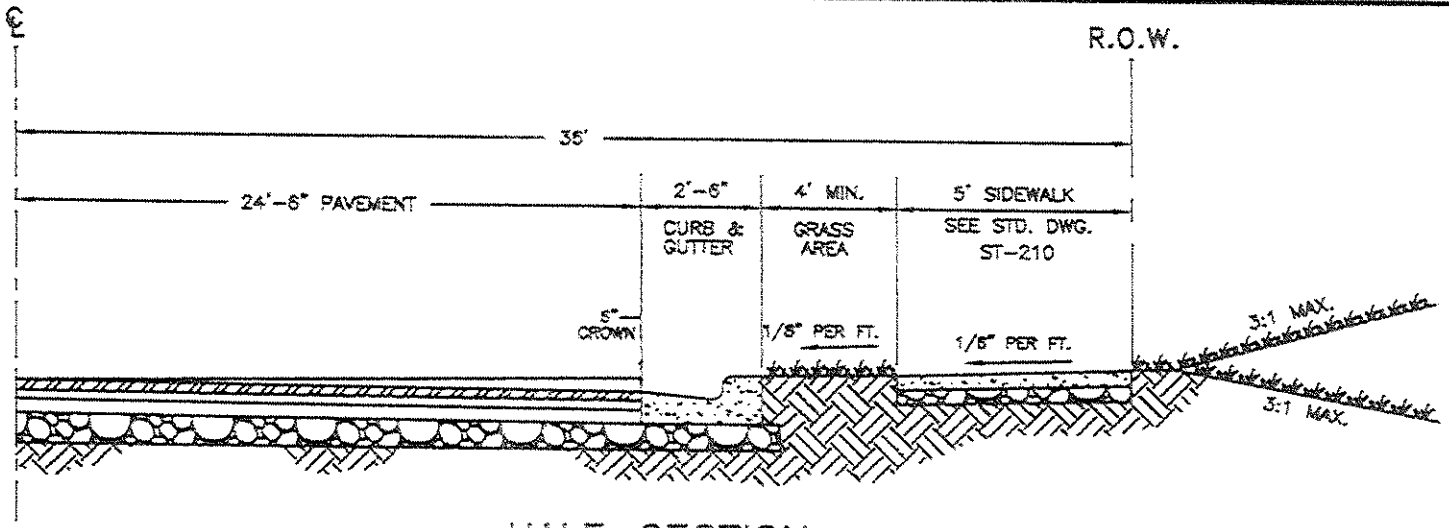
Class 10
Six or more axle, single trailer

Class 11
Five or less axle, multi trailer

Class 12
Six axle, multi-trailer

Class 13
Seven or more axle, multi-trailer

FIGURE 5



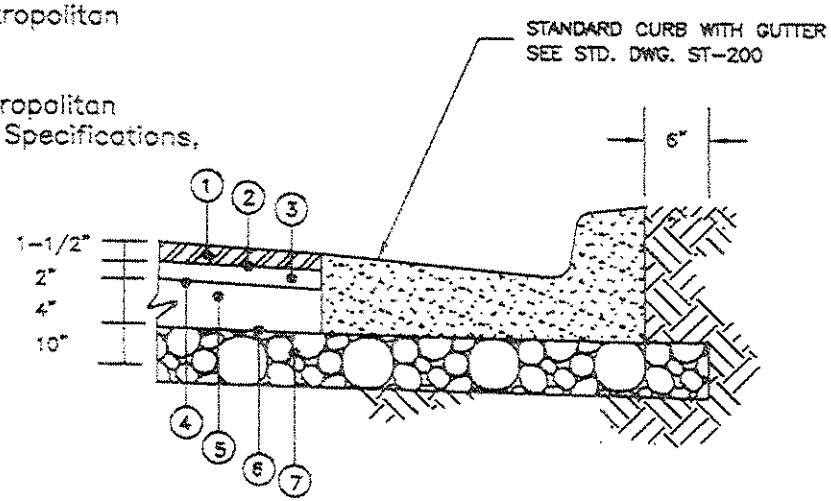
HALF - SECTION

General Notes

1. Placement of sidewalks shall be in accordance with the Subdivision Regulations of the Metropolitan Planning Commission, latest revision.
2. Construction shall conform to the Metropolitan Department of Public Works Technical Specifications, latest revision.

PAVEMENT SCHEDULE

1. 1-1/2" ASPHALTIC CONCRETE SURFACE (411D)
2. TACK COAT (SS-1)
3. 2" BITUMINOUS BINDER (B-M2)
4. TACK COAT (SS-1)
5. 4" BITUMINOUS BASE (307A)
6. PRIME COAT (RS-2)
7. 10" STONE (GRADING D PUG MILL MIX)



PAVEMENT COURSES

NOT TO SCALE

METROPOLITAN GOVERNMENT OF NASHVILLE AND DAVIDSON COUNTY
DEPARTMENT OF PUBLIC WORKS

ASST. DIR. ENG.: Mark Mary DATE: 5/3/01
DIRECTOR: R. D. Lane DATE: 5/8/01

NON-RESIDENTIAL COLLECTOR STREET (72' R.O.W.)

DWG. NO. ST-261

REVISED: 04/09/01

FIGURE 6

DESIGN LOADING: ALL NEW AND REHABILITATED BRIDGES SHALL BE DESIGNED FOR HS-20 LOADING.

FOR NEW ROUTE CONSTRUCTION OR ROUTE RECONSTRUCTION PROJECTS:

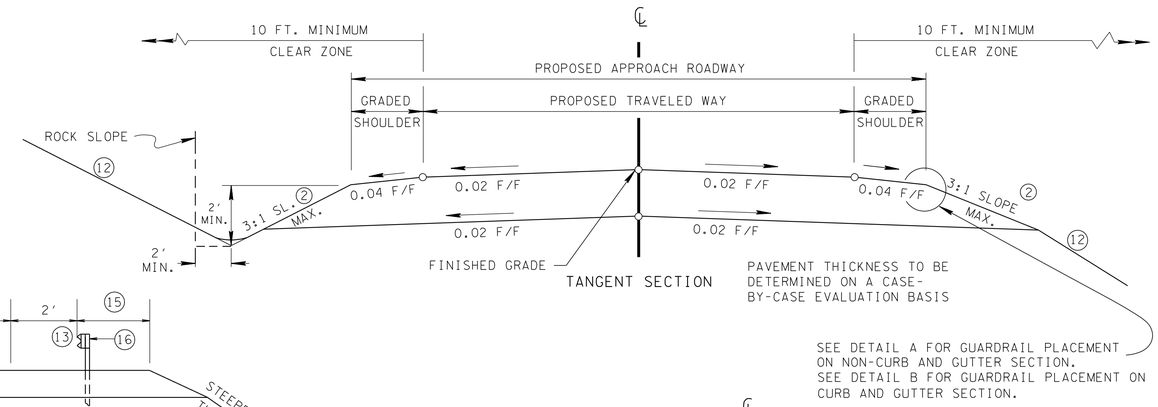
THE MINIMUM CLEAR WIDTH FOR NEW BRIDGES SHALL BE EQUAL TO THE FULL WIDTH OF THE APPROACH ROADWAY (CURB-TO-CURB OR FULL SHOULDER WIDTH AS APPLICABLE).

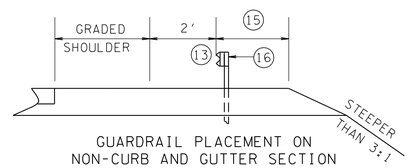
① CLEAR ROADWAY WIDTHS FOR BRIDGE REPLACEMENT AND REHABILITATION PROJECTS (PAGE 427, TABLE V-9)		
DHV	CURRENT ADT	MINIMUM CLEAR ROADWAY WIDTH OF BRIDGE
———	400 AND UNDER	TRAVELED WAY + 4 FT. (2 FT. EACH SIDE)
UNDER 400	OVER 400	TRAVELED WAY + 6 FT. (3 FT. EACH SIDE)
400 OR GREATER	———	APPROACH ROADWAY WIDTH

③ MINIMUM STRUCTURAL CAPACITIES AND MINIMUM ROADWAY WIDTHS FOR EXISTING BRIDGES TO REMAIN IN PLACE (PAGE 428, TABLE V-10)			
DHV	CURRENT ADT	DESIGN LOADING (STRUCTURAL CAPACITY)	④ ROADWAY CLEAR WIDTH (FEET)
———	0-50	H-10	20
———	51-250	H-15	20
100-200	250+	H-15	22
200-400	———	H-15	24
OVER 400	———	H-15	28

⑤ MINIMUM RURAL DESIGN SPEEDS	CURRENT ADT UNDER 50	CURRENT ADT 50-250	CURRENT ADT 250-400	CURRENT ADT 400 AND OVER	DHV 100-200	DHV OVER 200
LEVEL TOPO	30	30	40	50	50	50
ROLLING TOPO	⑥ 20	30	30	40	40	40
MOUNTAINOUS TOPO	⑥ 20	⑥ 20	⑥ 20	30	30	30

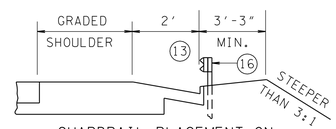
DESIGN STANDARDS (FOR GIVEN DESIGN SPEED)			DESIGN SPEEDS (MPH) 20	30	40	50	60	⑦ MINIMUM WIDTH OF GRADED SHOULDERS FOR ALL SPEEDS (FEET)
⑦ MINIMUM AND DESIRABLE WIDTH OF TRAVELED WAY IN RURAL AREAS (FEET)		MINIMUM	18	18	20	20	20	2
		DESIRABLE	22	22	22	22	22	
	CURRENT ADT 250-400	MINIMUM	20	20	20	20	22	2
		DESIRABLE	22	22	22	22	22	
	CURRENT ADT OVER 400	MINIMUM	⑭ 20	⑭ 20	⑭ 22	22	22	⑭ 4
		DESIRABLE	22	22	22	22	24	
	DHV 100-200	MINIMUM	20	20	22	22	22	6
		DESIRABLE	22	22	22	22	24	
	DHV 200-400	MINIMUM	22	22	22	24	24	6
		DESIRABLE	22	22	22	24	24	
	DHV 400 AND OVER	MINIMUM	24	24	24	24	24	8
		DESIRABLE	24	24	24	24	24	
MAXIMUM CURVATURE (DEGREES) 0.04 MAX. S.E.			45°00′	19°00′	10°00′	6°00′	3°45′	
MAXIMUM CURVATURE (DEGREES) 0.06 MAX. S.E.			49°15′	21°00′	11°15′	6°45′	4°15′	
MAXIMUM CURVATURE (DEGREES) 0.08 MAX. S.E.			53°30′	22°45′	12°15′	7°30′	4°45′	
MAXIMUM CURVATURE (DEGREES) 0.10 MAX. S.E.			58°00′	24°45′	13°15′	8°15′	5°15′	
⑧ MAXIMUM RURAL GRADES %	LEVEL TOPO		———	7	7	6	5	
	ROLLING TOPO		11	10	9	8	6	
	MOUNTAINOUS TOPO		16	14	12	10	———	
⑩ MINIMUM STOPPING SIGHT DISTANCE (FEET)			125	200	275-325	400-475	525-650	
⑨ MINIMUM "K" VALUE (PAGE 421; TABLE V-2)	CREST VERTICAL CURVE		10	30	60-80	110-160	190-310	
	SAG VERTICAL CURVE		20	40	60-70	90-110	120-160	
PASSING SIGHT DISTANCE (FEET)(PAGE 422, TABLE V-3)			800	1100	1500	1800	2100	
⑨ MINIMUM "K" VALUE FOR CREST VERTICAL CURVE			210	400	730	1050	1430	
SUPERELEVATION			SEE STANDARD DRAWINGS RD-SE-2 & RD-SE-3					





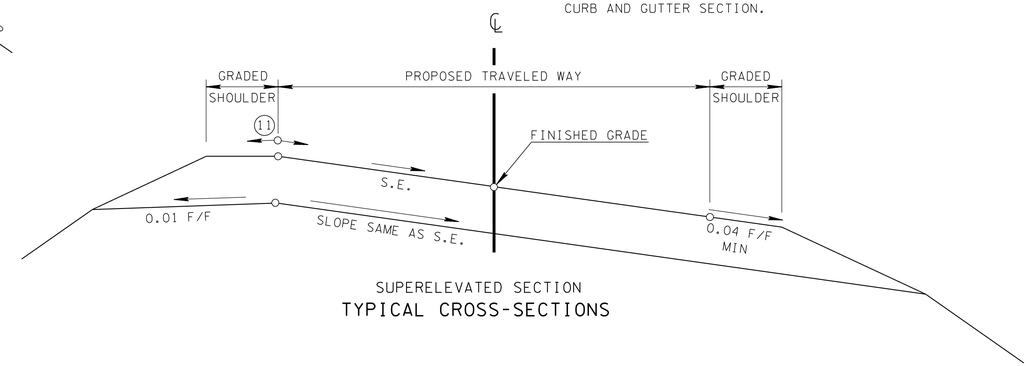
GUARDRAIL PLACEMENT ON NON-CURB AND GUTTER SECTION

DETAIL A



GUARDRAIL PLACEMENT ON CURB AND GUTTER SECTION

DETAIL B



SUPERELEVATED SECTION

TYPICAL CROSS-SECTIONS

REV. 5-28-87: CHANGED SUPER-ELEVATION DRAWING REFERENCE.

REV. 2-2-88: REVISED FOOTNOTE ①.

REV. 11-9-88: CHANGED SHOULDER SLOPE.

REV. 9-10-90: REDREW SHEET. REORGANIZED SHEET AND UPDATED TO 1990 POLICY.

☐ REV. 12-18-91: REVISED FOOTNOTE NOS. ② AND ⑮.

☐ REV. 12-18-97: CHANGED MINIMUM SHOULDER WIDTH TABLE AND GENERAL NOTE ⑭.

☐ REV. 3-20-02: ADDED SPECIAL NOTE.

☐ REV. 3-31-03: CHANGED EFFECTIVE DATE IN SPECIAL NOTE.

FOOTNOTES

① IF AN EXISTING APPROACH ROADWAY WIDTH IS GREATER THAN THE MINIMUM WIDTH DERIVED FROM THIS TABLE, THE NEW BRIDGE SHALL HAVE A CLEAR WIDTH EQUAL TO THE EXISTING APPROACH WIDTH OR THE WIDTH AS DETERMINED FROM THE DESIGN STANDARDS TABLE ON THIS SHEET, WHICHEVER IS LESS.

② 4:1 FOR 40 MILES PER HOUR OR GREATER WITH A DHV OF 100 OR GREATER.

③ THESE STRUCTURES SHOULD BE ANALYZED INDIVIDUALLY, TAKING INTO CONSIDERATION THE CLEAR WIDTH PROVIDED, TRAFFIC VOLUMES, REMAINING LIFE OF THE STRUCTURE, PEDESTRIAN VOLUMES, SNOW STORAGE, DESIGN SPEED, ACCIDENT RECORD, AND OTHER PERTINENT FACTORS.

④ CLEAR WIDTH BETWEEN CURBS OR RAILS, WHICHEVER IS LESS, MINIMUM CLEAR WIDTHS UP TO TWO FEET NARROWER MAY BE USED ON ROADS WITH FEW TRUCKS. IN NO CASE SHALL THE MINIMUM CLEAR WIDTH BE LESS THAN THE APPROACH TRAVELED WAY WIDTH.

⑤ RURAL PAGE 421, TABLE V-1. FOR URBAN DESIGN SEE PAGE 434.

⑥ USE OF 20 MILES PER HOUR DESIGN SPEED ON RURAL ROADS IS NOT DESIRABLE AND EFFORTS SHOULD BE MADE TO AVOID ITS USE.

⑦ RURAL PAGE 426, TABLE V-8. FOR URBAN DESIGN SEE PAGE 436-437.

⑧ RURAL PAGE 423, TABLE V-4. FOR URBAN DESIGN SEE PAGE 435.

⑨ "K" VALUE IS A COEFFICIENT BY WHICH THE ALGEBRAIC DIFFERENCE IN GRADE MAY BE MULTIPLIED TO DETERMINE THE LENGTH IN FEET OF THE VERTICAL CURVE.

⑩ ANY LENGTH OF STOPPING SIGHT DISTANCE WITHIN THE RANGE OF VALUES ESTABLISHED ON PAGE 421, TABLE V-2, IS ACCEPTABLE FOR A SPECIFIC SPEED. HOWEVER, VALUES APPROACHING OR EXCEEDING THE UPPER LIMIT OF THE RANGE SHOULD BE USED AS THE BASIS FOR DESIGN WHEREVER CONDITIONS PERMIT.

⑪ THE SLOPES OF THE SHOULDER AND ROADWAY PAVEMENT SHALL NOT EXCEED AN ALGEBRAIC DIFFERENCE OF 0.07 FOOT PER FOOT.

⑫ SEE STANDARD DRAWING RD-S-11 (CASE II) FOR DESIRABLE SLOPES & NOTE REGARDING GEOLOGICAL RECOMMENDATIONS.

⑬ FOR LESS THAN 100 DHV OR ON BRIDGE REPLACEMENT AND REHABILITATION PROJECTS 2 FOOT OFFSET TO FACE OF GUARDRAIL AND/OR FACE OF CURB MAY BE ELIMINATED.

⑭ IN MOUNTAINOUS TERRAIN OR SECTIONS WITH HEAVY EARTHWORK WHEN THE ADT IS BETWEEN 400 AND 600 THE GRADED WIDTH OF SHOULDER IN CUTS MAY BE DECREASED TO 2 FEET, BUT IN NO CASE SHOULD THE TRAVELED WAY WIDTH BE LESS THAN 18 FEET.

⑮ USE 3′-3″ MINIMUM WHEN SLOPE FROM OUTSIDE EDGE OF SHOULDER TO SUBGRADE IS 3:1. 3′-3″ MINIMUM IS NOT REQUIRED WHEN USING SLOPES OF 4:1 WITH COMBINATION OF PAVEMENT AND BASE TWELVE (12) INCHES OR GREATER IN DEPTH.

⑯ SEE GUARDRAIL STANDARD DRAWINGS FOR TYPICAL GUARDRAIL PLACEMENT.

SPECIAL NOTE

THIS DRAWING IS NOT TO BE UTILIZED FOR NEW DESIGN PROJECTS BEGUN AFTER OCTOBER 1, 2002.

GENERAL NOTES

Ⓐ FOR SPECIFIC CONDITIONS NOT COVERED ON THIS SHEET, REFERENCE SHOULD BE MADE TO "A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS AND STREETS" 1990.

Ⓑ PAGE NUMBERS REFERRED TO ON THIS DRAWING ARE FROM THE ABOVE REFERENCE.

Ⓒ REFERENCE SHOULD ALSO BE MADE TO THE AASHTO "ROADSIDE DESIGN GUIDE".

Ⓓ THE CURRENT ADT MAY BE USED FOR THE DESIGN SPEED IF THE DESIGN HOURLY VOLUME FOR THE DESIGN YEAR IS LESS THAN 100, OTHERWISE THE DHV SHOULD BE USED.

Ⓔ FOR CORNER SIGHT DISTANCE AT RURAL INTERSECTIONS SEE PAGE 432, TABLE V-11.

Ⓕ IF NO ABOVE GROUND UTILITIES ARE INVOLVED, MINIMUM RIGHT-OF-WAY SHALL BE TRAVELED WAY PLUS CLEAR ZONE (10 FEET EACH SIDE). FOR URBAN DESIGN SEE PAGE 443-444.

Ⓖ IF ABOVE GROUND UTILITIES ARE INVOLVED, MINIMUM RIGHT-OF-WAY SHALL BE SUFFICIENT TO ACCOMMODATE THE UTILITIES OUTSIDE THE CLEAR ZONE.

Ⓗ DESIRABLE RIGHT-OF-WAY IS SLOPE LINES PLUS TEN FEET.

☐ MINOR REVISION -- FHWA APPROVAL NOT REQUIRED.

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

DESIGN STANDARDS FOR LOCAL ROADS AND STREETS

11-15-86 RD-TS-1