

Appendix F – Bowling Green / Warren County Pavement Catalog

**Table F-3
Equivalent Single Axle Loads for Residential Streets**

Number of Houses Served by Street	Equivalent Single Axle Loads				
	Construction Trucks	Moving Vans	Garbage Trucks	School Buses	Total
0	0	0	6240	12000	18240
20	600	240	6240	12000	19080
40	1200	480	6240	12000	19920
60	1800	720	6240	12000	20760
80	2400	960	6240	12000	21600
100	3000	1200	6240	12000	22440
120	3600	1440	6240	12000	23280
140	4200	1680	6240	12000	24120
160	4800	1920	6240	12000	24960
180	5400	2160	6240	12000	25800
200	6000	2400	6240	12000	26640
220	6600	2640	6240	12000	27480
240	7200	2880	6240	12000	28320
260	7800	3120	6240	12000	29160
280	8400	3360	6240	12000	30000
300	9000	3600	6240	12000	30840
320	9600	3840	6240	12000	31680
340	10200	4080	6240	12000	32520
360	10800	4320	6240	12000	33360
380	11400	4560	6240	12000	34200
400	12000	4800	6240	12000	35040
420	12600	5040	6240	12000	35880
440	13200	5280	6240	12000	36720
460	13800	5520	6240	12000	37560
480	14400	5760	6240	12000	38400
500	15000	6000	6240	12000	39240

Notes:

Number of Houses Served by Street - For a loop/cul-de-sac/other low volume street, it will equal the number of houses on that street. For a continuing (through) street, it will equal the number of houses that will use the street when entering / exiting the subdivision.

Construction Trucks - Based on 20 loaded supply trucks per house and 1.5 ESALs per truck, for a total of 30 ESALs per house. Construction Trucks may be reduced or deleted if the Engineer provides a separate construction entrance into the subdivision that does not utilize the permanent streets.

Moving Vans - Based on each house selling 4 times in 20 years and each transaction involving one loaded moving van for the seller and buyer, for a total of 8 trucks per house. It assumes 1.5 ESALs per truck for a total of 12 ESALs per house.

Garbage Trucks - Based on the following for a 20-year design life:

2 garbage trucks/street/wk x 52 wks/yr x 20 yrs x 1.5 ESALs/truck = 3120 ESALs

1 recycling truck/street/wk x 52 wks/yr x 20 yrs x 1.5 ESALs/truck = 1560 ESALs

1 yard waste recycling truck/street/wk x 52 wks/yr x 20 yrs x 1.5 ESALs/truck = 1560 ESALs

Total of above = 6240 ESALs per street for garbage trucks

School Buses - Based on the following for a 20-year design life:

2 school buses/day/street x 200days/yr x 20 yrs x 1.5 ESALs/bus = 12000 ESALs per street

Warren County/Subdivision Regulations

ADOPTED 8/5/05 (EFFECTIVE 01/01/06)

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Table F-4

20-Year ESALs for Various Industrial and Commercial Developments

Land Use	Gross Floor Area (Sq. Ft.) x 1000											
	1	5	10	20	40	60	80	100	200	300	500	1,000
General Light Industrial (15% Trucks)	80,000	115,000	159,000	246,000	418,000	586,000	752,000	915,000	1,681,000	2,370,000	3,515,000	5,020,000
General Heavy Industrial (20% Trucks)	3,000	16,000	31,000	63,000	126,000	188,000	251,000	314,000	628,000	942,000	1,570,000	3,414,000
Warehousing (25% Trucks)	32,000	123,000	219,000	389,000	692,000	968,000	1,229,000	1,479,000	2,629,000	3,681,000	5,623,000	9,994,000
General Office Building (2% Trucks)	1,000	8,000	17,000	35,000	70,000	105,000	141,000	176,000	354,000	531,000	885,000	1,771,000
Retail (2% Trucks)	21,000	102,000	201,000	393,000	745,000	1,056,000	1,327,000	1,557,000	2,100,000	2,840,000	3,923,000	6,630,000

Land Use	Number of Rooms							
	10	50	100	200	400	600	800	1,000
Hotel (1% Trucks)	3,000	38,000	83,000	171,000	348,000	525,000	702,000	879,000
Motel (1% Trucks)	8,000	47,000	99,000	207,000	433,000	667,000	906,000	1,149,000

Land Use	Number of Drive Through Lanes (including ATM)					
	1	2	3	4	6	8
Banks with Drive Throughs (0.5% Trucks) (8)	23,000	45,000	68,000	90,000	135,000	180,000

Land Use	Gross Floor Area (Sq. Ft.) x 1000				
	1	2	3	4	5
Restaurants (1.5% Trucks) (8)	22,000	43,000	64,000	86,000	110,000

Land Use	Number of Pumps					
	2	4	6	8	10	12
Convenience Stores w/ Gas pumps (1.0% Trucks) (8)	119,000	238,000	356,000	475,000	594,000	713,000

Notes:

1. Number of trips generated for each type of development calculated from the Manual of Trip Generation published by the Institute of Transportation Engineers.
2. ESALs calculated by the computer program PAS 5 developed by the American Concrete Pavement Association, or as noted.
3. Trucks were assumed to be 50% C5As (TYPE 9) and 50% SU3As (TYPE 6)
4. Loaded TYPE 9s were assumed to weigh 80,000 lbs. Empty or nearly empty TYPE 9s were assumed to weigh 50,000 lbs.
5. Loaded TYPE 6s were assumed to weigh 46,000 lbs. Empty or nearly empty TYPE 6s were assumed to weigh 30,000 lbs.
6. 50% of both TYPE 9s and TYPE 6s were assumed to be empty.
7. The numbers in the table have been rounded to the nearest 1000.
8. Based on ADT x % Trucks x 365 days/yr x 20 yrs x 1.5 ESAL/truck = # ESAL

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**Table F-5
Structural Numbers**

ESALs	Structural Number						
	CBR 1	CBR 2	CBR 3	CBR 4	CBR 5	CBR 6	CBR 7
1,000	2.15	1.65	1.39	1.23	1.09	1.01	1.00
2,000	2.38	1.84	1.58	1.39	1.27	1.17	1.08
3,000	2.54	1.97	1.69	1.50	1.36	1.26	1.17
4,000	2.65	2.07	1.77	1.58	1.44	1.33	1.24
5,000	2.74	2.14	1.84	1.64	1.50	1.39	1.30
6,000	2.81	2.20	1.89	1.69	1.55	1.43	1.34
7,000	2.88	2.26	1.94	1.74	1.59	1.47	1.38
8,000	2.94	2.31	1.99	1.78	1.63	1.51	1.42
9,000	2.99	2.35	2.02	1.81	1.66	1.54	1.45
10,000	3.03	2.39	2.06	1.85	1.69	1.57	1.47
20,000	3.35	2.65	2.30	2.07	1.90	1.77	1.67
30,000	3.55	2.82	2.44	2.20	2.03	1.89	1.79
40,000	3.70	2.94	2.55	2.31	2.13	1.99	1.87
50,000	3.81	3.03	2.64	2.39	2.20	2.06	1.94
60,000	3.91	3.12	2.71	2.45	2.27	2.12	2.00
70,000	3.99	3.19	2.78	2.51	2.32	2.17	2.05
80,000	4.07	3.25	2.83	2.56	2.37	2.22	2.10
90,000	4.13	3.30	2.88	2.61	2.41	2.26	2.14
100,000	4.19	3.35	2.93	2.65	2.45	2.30	2.17
200,000	4.60	3.70	3.24	2.94	2.72	2.55	2.42
300,000	4.86	3.91	3.43	3.12	2.89	2.71	2.57
400,000	5.04	4.07	3.57	3.25	3.01	2.83	2.69
500,000	5.19	4.19	3.68	3.35	3.11	2.93	2.78
600,000	5.31	4.30	3.78	3.44	3.20	3.01	2.85
700,000	5.42	4.39	3.86	3.52	3.27	3.08	2.92
800,000	5.51	4.47	3.93	3.58	3.33	3.13	2.98
900,000	5.60	4.54	4.00	3.64	3.39	3.19	3.03
1,000,000	5.67	4.60	4.06	3.70	3.44	3.24	3.07
2,000,000	6.19	5.04	4.45	4.07	3.79	3.57	3.40
3,000,000	6.51	5.31	4.70	4.30	4.01	3.78	3.60
4,000,000	6.75	5.51	4.88	4.47	4.17	3.93	3.74
5,000,000	6.93	5.67	5.03	4.60	4.30	4.06	3.86
7,000,000	7.23	5.92	5.25	4.81	4.49	4.25	4.04
10,000,000	7.55	6.19	5.50	5.04	4.71	4.45	4.24
20,000,000	8.49	7.04	6.29	5.80	5.46	5.18	4.94
30,000,000	8.98	7.46	6.67	6.17	5.81	5.52	5.27
40,000,000	9.33	7.77	6.96	6.44	6.08	5.78	5.52
50,000,000	9.62	8.02	7.20	6.66	6.29	5.99	5.72

- Minimum Low Volume Street
- Minimum Local (Residential) Street
- Minimum Minor Collector Street
- Minimum Major Collector, Arterial, Commercial, Industrial Street

Warren County/Subdivision Regulations

ADOPTED 8/5/05 (EFFECTIVE 01/01/06)