

Technical Memorandum

July 18, 2023

Project# 27656

To: Eric Imes, Public Works Director
Morrow County
365 West Highway 74
Lexington, OR 97839

From: Matt Hughart, AICP and Darren Hippenstiel, P.E.

CC: David Shiflett, Rowan Digital Infrastructure

RE: Tower Road Traffic Volume Forecast

BACKGROUND

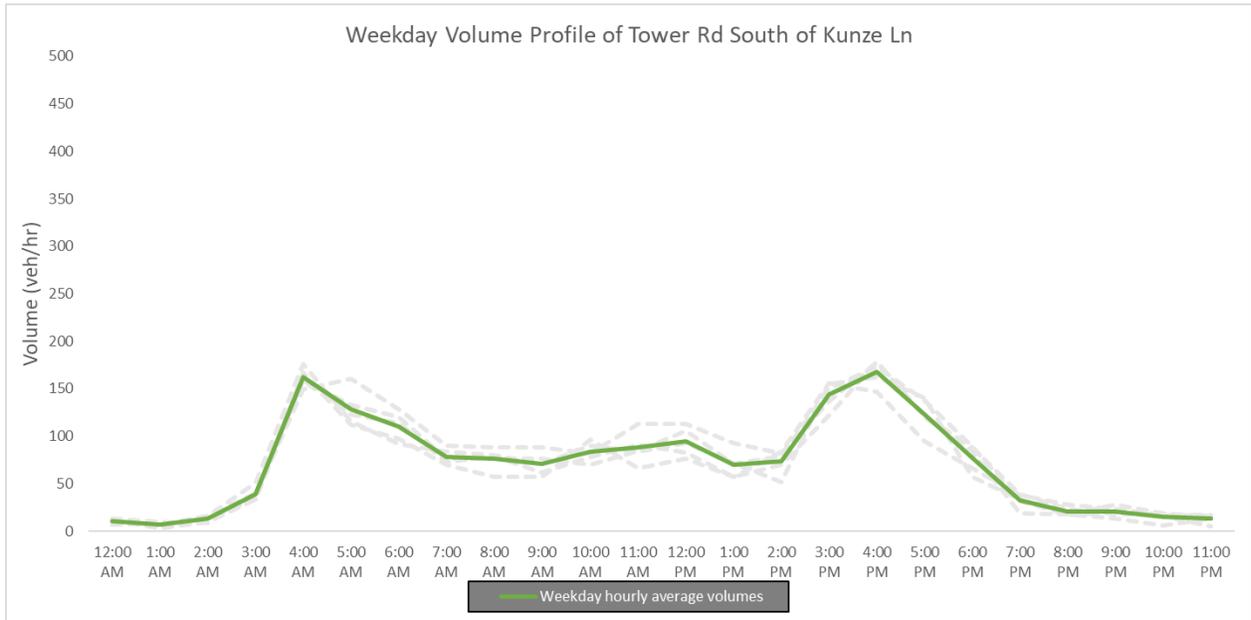
Kittelison & Associates, Inc. prepared and submitted a transportation assessment for a proposed zone change/data center on a parcel located off Tower Road in Morrow County. This transportation assessment supported a land use amendment proposal to change approximately 275 acres of Exclusive Farm Use (EFU) zoned land to the General Industrial (MG) zone. The zone change is necessary to allow for the proposed construction of a 1,125,000 square-foot data center complex.

The transportation assessment focused primarily on the post construction traffic impacts of the data center complex to address Oregon's Transportation Planning Rule (TPR) and Morrow County's MCZO 3.070(E) Traffic Impact Analysis study requirements under the General Industrial zone. To address construction traffic-related comments and questions raised by Morrow County Public Works staff, a detailed assessment of the anticipated construction traffic volumes and their impacts on Tower Road was prepared. The findings from this analysis are documented herein.

TRAFFIC VOLUMES AND CONSTRUCTION TRAFFIC ESTIMATES

Existing daily traffic volume and vehicle classification counts were performed on Tower Road from July 6, 2023 to July 12, 2023 using tube counters. These counters were placed on Tower Road south of Kunze Lane to assess the existing conditions of this critical 8-mile segment of Tower Road. A graphical summary of the average weekday traffic volume profile is shown in Exhibit 1 with a complete summary of the counts provided in Appendix A. As shown in the exhibit, volumes on this segment of Tower Road are relatively low with two distinct peak travel periods around 4:00 AM and 4:00 PM. These peak travel periods are most likely reflective of commuting activity associated with several large dairy farms located along the corridor.

Exhibit 1 – Average Daily Weekday Volume Profile of Tower Road South of Kunze Lane



Using this same data, average daily truck traffic was quantified and summarized according to the Federal Highway Administration (FHWA) vehicle classification summary as shown in Exhibit 2. Generally, average daily truck traffic is counted under FHWA Class 4 through Class 13 vehicles. Class 1 through Class 3 vehicles are discounted from the equivalent single axle load (ESAL) calculation as they are generally accepted to have a negligible contribution to the overall ESAL calculation.

Exhibit 2 - FHWA Vehicle Category Classifications

Class 1 Motorcycles		Class 7 Four or more axle, single unit	
Class 2 Passenger cars		Class 8 Four or less axle, single trailer	
Class 3 Four tire, single unit		Class 9 5-Axle tractor semitrailer	
Class 4 Buses		Class 10 Six or more axle, single trailer	
Class 5 Two axle, six tire, single unit		Class 11 Five or less axle, multi trailer	
Class 6 Three axle, single unit		Class 12 Six axle, multi-trailer	
		Class 13 Seven or more axle, multi-trailer	

Source: Federal Highway Administration

With the average number of daily trucks determined, Oregon Department of Transportation (ODOT) methodology was followed to convert daily truck traffic into annual ESALs, as shown in the *2019 ODOT Pavement Design Guide*. Table 1 summarizes the results of this calculation process.

Table 1 – Existing Tower Road ESAL Calculation Summary

Vehicle Class	Percent of ADT	Number of Trucks*	Percent Total Trucks	ESAL Factor**	Directional Factor	Year 2023 ESAL's
1	0.70%	12		0		0
2	32.00%	549		0		0
3	12.55%	215		0		0
4	3.79%	65	6.91%	246	0.55	8,795
5	28.77%	494	52.55%	104	0.55	28,257
6	8.60%	148	15.74%	284	0.55	23,118
7	0.20%	3	0.32%	757	0.55	1,249
8	2.31%	40	4.26%	253	0.55	5,566
9	1.75%	30	3.19%	466	0.55	7,689
10	2.95%	51	5.43%	561	0.55	15,736
11	0.02%	0	0.00%	603	0.55	0
12	0.19%	3	0.32%	546	0.55	901
13	6.20%	106	11.28%	1037	0.55	60,457
Truck Count:		940	100%		Total ESAL:	151,767
*Bi-directional Truck Traffic						
**ESAL factor per ODOT pavement design guide, 2019 Table 8						

The ESAL calculation shown in Table 1 is for one year of existing Tower Road traffic. A typical pavement design analysis for flexible pavement (asphalt concrete pavement) is 20 years. The amount of ESAL contribution over the life of a pavement is typically grown through the design year (i.e. year 20) at an assumed growth rate, anticipating development. Considering traffic demand on this segment of Tower Road is unlikely to measurably change, a growth rate of 0% was used and a 20-year design ESAL was calculated by adding the ESALs for successive years. The total 20-year ESAL was determined to be approximately 3,035,000. See *Appendix B for a detailed breakdown of the existing traffic analysis and ESAL calculation*.

In order to determine the contribution of ESALs to Tower Road due to the proposed data center construction effort, analysis of the anticipated construction traffic was necessary. Based on other similar data center projects in the area, Rowan Digital Infrastructure was able to provide a general summary of the anticipated construction traffic. These include flatbed trucks for the delivery of heavy equipment (e.g. bulldozer, excavator, crane, etc.), flatbed trucks for delivery of building materials (e.g. steel, plumbing, drywall, electrical equipment, other building materials), other material delivery vehicles (e.g. dump truck for aggregate, cement mixer, etc.), and vehicles for workers/laborers working at the site (e.g. personal vehicles, pickup trucks, etc.). *Appendix C contains a detailed breakdown of the anticipated construction traffic estimates for the site*.

Based on similar projects, a summary of total construction vehicles was prepared, broken out by class of vehicle. This analysis was completed for two phases of the project: Phase 1 being the initial site preparation/grading and Phase 2 being the construction of the building. The total construction traffic was then combined for both phases of construction and reduced to an average daily construction traffic estimate. The same ODOT ESAL and directional factors that were used as in the existing Tower Road traffic data summary were applied to determine an estimated construction specific ESAL count. Table 2 summarizes the estimated construction traffic ESAL calculation.

Table 2 - Construction Traffic ESAL Calculation Summary

Vehicle Class	Percent of ADT	Number of Trucks*	Percent Total Trucks	ESAL Factor**	Directional Factor	Year 2023 ESAL's
1	0.00%	0		0		0
2	0.00%	0		0		0
3	0.00%	148		0		0
4	0.00%	0	0.00%	246	0.55	0
5	0.00%	0	0.00%	104	0.55	0
6	0.00%	26	92.51%	284	0.55	4,100
7	0.00%	0	0.00%	757	0.55	0
8	0.00%	0	0.00%	253	0.55	0
9	0.00%	2	7.49%	466	0.55	545
10	0.00%	0	0.00%	561	0.55	0
11	0.00%	0	0.00%	603	0.55	0
12	0.00%	0	0.00%	546	0.55	0
13	0.00%	0	0.00%	1037	0.55	0
Truck Count:		28	100%		Total ESAL:	4,645
*Bi-directional Truck Traffic						
**ESAL factor per ODOT pavement design guide, 2019 Table 8						

The ESAL calculation shown in Table 2 is for the entire duration of site construction and for all vehicles anticipated to visit the site and use Tower Road during that period. Since construction was assumed to be approximately 7 months in duration, the ESAL calculation is not grown over 20-years like a typical design calculation. See Appendix D for a detailed breakdown of the calculation.

FINDINGS

Based on the analysis of existing Tower Road traffic and construction-related traffic expected during the assumed site construction period, the amount of new construction ESALs is estimated to contribute less than two tenths of one percent of the total ESALs over a typical 20-year design life. The effect of construction traffic on the pavements' remaining life, in comparison to the background traffic, is estimated to be relatively minimal.

Appendix A – Tower Road Traffic Counts

APPENDIX A - QUALITY COUNTS REPORT - BACKGROUND TRAFFIC DATA													

Type:	Vehicle Classification Data												
Location:	Tower Rd btwn south of Boardman Airport Ln												
Specific Location:													
City/State:	Not Found No												
QCJobNo:	16264503												
Date:	Jul 6 2023 - Jul 12 2023												
Direction:	NB/ SB												
Comments:													

Date:	Jul 6 2023														
	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7	Class 8	Class 9	Class 10	Class 11	Class 12	Class 13	Counted as Class 6	
Start Time	Bikes	Cars & Trailers	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 Classed	Total
12:00 AM	0	3	0	0	1	0	0	0	0	0	0	0	0	3	5
1:00 AM	0	2	0	0	0	0	0	0	0	0	0	0	0	1	2
2:00 AM	0	7	2	1	1	0	0	0	1	0	0	0	0	2	16
3:00 AM	0	25	10	0	13	0	0	0	0	0	0	0	0	2	51
4:00 AM	2	94	39	1	38	1	0	0	0	0	0	0	0	1	176
5:00 AM	2	55	23	2	29	0	1	0	0	1	0	0	0	3	116
6:00 AM	0	31	8	2	36	3	0	0	1	2	0	0	0	5	92
7:00 AM	2	19	6	6	22	2	0	7	2	3	0	0	10	5	84
8:00 AM	0	9	7	5	25	1	0	4	3	6	0	0	12	8	80
9:00 AM	0	11	7	2	20	0	0	2	1	3	0	1	15	9	71
10:00 AM	3	10	7	3	31	2	0	2	2	5	0	1	12	12	90
11:00 AM	2	8	14	8	26	0	0	1	0	4	0	0	10	11	84
12:00 PM	0	16	14	10	33	0	0	1	3	2	0	1	6	7	93
1:00 PM	0	8	6	4	26	1	1	2	1	3	0	0	12	8	72
2:00 PM	0	18	1	5	15	0	0	1	3	1	0	0	5	3	52
3:00 PM	0	41	31	2	58	0	0	6	1	2	0	0	10	4	155
4:00 PM	0	76	29	2	41	0	0	2	2	2	0	0	4	4	162
5:00 PM	1	61	19	2	37	3	0	0	1	6	0	0	3	7	140
6:00 PM	1	17	13	1	19	1	0	0	0	2	0	0	0	3	57
7:00 PM	1	8	3	3	12	0	0	0	1	2	0	0	0	3	33
8:00 PM	0	3	3	0	2	1	0	0	0	2	0	0	2	4	17
9:00 PM	0	7	1	1	3	0	0	1	0	1	0	0	2	4	20
10:00 PM	0	3	2	2	4	0	0	0	0	1	0	0	2	2	16
11:00 PM	0	3	0	1	0	0	0	0	0	0	0	0	0	1	5
Day Total	14	535	245	63	492	15	2	29	22	48	0	3	122	109	1699
Percent	0.82%	31.49%	14.42%	3.71%	28.96%	0.88%	0.12%	1.71%	1.29%	2.83%	0.00%	0.18%	7.18%	6.42%	
ADT	6357														
AM Peak	10:00 AM	11:00 AM	11:00 AM	9:00 AM	11:00 AM	10:00 AM	11:00 AM	10:00 AM	9:00 AM	5:00 AM	4:00 AM	6:00 AM	9:00 AM	11:00 AM	11:00 AM
Volume	19	107	46	29	50	13	17	32	50	1	2	1	15	29	355
PM Peak	2:00 PM	5:00 PM	5:00 PM	12:00 PM	4:00 PM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	7:00 PM	5:00 PM	12:00 PM	12:00 PM	2:00 PM	12:00 PM
Volume	22	162	72	30	66	15	16	47	60	2	2	0	11	36	446

Date:	Jul 7 2023														
	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7	Class 8	Class 9	Class 10	Class 11	Class 12	Class 13	Counted as Class 6	
Start Time	Bikes	Cars & Trailers	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 Classed	Total
12:00 AM	0	1	1	1	1	0	0	0	0	0	0	0	0	3	7
1:00 AM	0	1	0	0	1	0	0	0	0	0	0	0	2	4	8
2:00 AM	0	8	2	1	0	0	0	0	0	0	0	0	1	2	14
3:00 AM	0	22	4	0	2	0	0	0	1	0	0	0	2	2	33
4:00 AM	1	89	33	1	35	0	0	5	0	0	0	0	0	3	167
5:00 AM	0	61	17	1	25	1	0	0	0	0	0	0	2	5	112
6:00 AM	2	28	10	3	35	1	0	1	2	1	0	0	6	8	97
7:00 AM	0	9	6	8	27	1	0	2	0	2	0	0	8	7	70
8:00 AM	1	7	7	6	16	0	0	4	1	3	0	0	7	5	57
9:00 AM	0	5	8	4	18	2	0	4	0	2	0	0	10	4	57
10:00 AM	0	23	9	5	29	1	0	5	2	2	0	0	9	11	96
11:00 AM	1	9	4	3	27	2	1	2	1	1	0	1	7	7	66
12:00 PM	0	9	13	1	28	3	0	0	2	3	0	1	9	7	76
1:00 PM	0	2	7	6	23	3	0	1	1	3	0	0	5	6	57
2:00 PM	1	15	7	12	34	2	0	1	0	1	0	1	5	5	84
3:00 PM	0	50	29	1	57	0	0	3	1	1	0	1	7	6	156
4:00 PM	0	74	18	4	36	2	0	1	1	1	0	0	3	7	147
5:00 PM	1	36	14	1	32	0	0	1	1	4	0	0	1	4	95
6:00 PM	2	22	14	3	18	0	0	0	0	3	0	0	0	4	66
7:00 PM	0	16	6	2	8	0	0	0	0	1	0	0	1	4	38
8:00 PM	1	5	0	3	8	2	0	1	1	1	0	0	1	5	28
9:00 PM	0	5	3	5	4	0	0	0	0	1	0	0	3	2	23
10:00 PM	0	3	2	2	2	0	0	0	0	4	0	0	0	4	17
11:00 PM	0	6	0	0	1	0	0	1	0	2	0	0	1	5	16
Day Total	10	506	214	73	467	20	1	32	14	36	0	4	90	120	1587
Percent	0.63%	31.88%	13.48%	4.60%	29.43%	1.26%	0.06%	2.02%	0.88%	2.27%	0.00%	0.25%	5.67%	7.56%	
ADT	6254														
AM Peak	11:00 AM	11:00 AM	11:00 AM	11:00 AM	11:00 AM	10:00 AM	8:00 AM	11:00 AM	8:00 AM	5:00 AM	5:00 AM	12:00 AM	10:00 AM	10:00 AM	11:00 AM
Volume	28	139	73	30	58	13	7	27	45	1	2	0	14	17	422
PM Peak	2:00 PM	4:00 PM	2:00 PM	2:00 PM	4:00 PM	7:00 PM	1:00 PM	3:00 PM	12:00 PM	5:00 PM	11:00 PM	12:00 PM	1:00 PM	1:00 PM	4:00 PM
Volume	25	195	81	28	73	17	9	34	46	3	3	0	14	15	489

Date:	Jul 8 2023														
	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7	Class 8	Class 9	Class 10	Class 11	Class 12	Class 13	Counted as Class 6	
Start Time	Bikes	Cars & Trailers	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 Classed	Total
12:00 AM	0	1	0	1	0	0	0	0	0	0	0	0	0	2	3
1:00 AM	0	1	1	0	3	0	0	0	0	3	0	0	0	0	2
2:00 AM	0	4	2	0	0	0	0	0	0	2	0	0	0	2	10
3:00 AM	0	27	3	0	0	0	0	0	0	0	0	0	0	1	31
4:00 AM	0	79	42	0	33	0	0	0	0	0	0	0	0	0	154
5:00 AM	0	43	12	0	13	1	1	0	0	1	0	0	0	3	74
6:00 AM	2	12	6	3	13	0	2	1	0	1	0	0	0	7	47
7:00 AM	0	9	5	3	12	0	0	1	0	1	0	0	0	2	33
8:00 AM	0	3	2	6	6	0	0	0	1	1	0	0	2	7	28
9:00 AM	1	1	1	2	8	0	0	0	0	0	0	0	0	6	19
10:00 AM	0	8	16	3	18	2	0	2	0	0	0	0	1	8	58
11:00 AM	0	12	8	2	10	0	0	1	0	2	0	0	2	4	41
12:00 PM	0	17	16	3	15	0	0	1	0	1	0	0	0	6	59
1:00 PM	0	14	16	0	21	0	0	4	2	0	0	0	2	6	65
2:00 PM	0	6	5	2	11	0	0	0	0	1	0	0	0	3	28
3:00 PM	0	20	6	1	9	0	0	0	0	2	0	0	2	2	42
4:00 PM	2	63	12	2	17	0	0	0	0	2	0	1	0	3	102
5:00 PM	0	35	5	0	23	0	0	0	0	1	0	0	0	7	71
6:00 PM	0	3	6	0	3	0	0	0	0	0	0	0	0	5	17
7:00 PM	0	6	1	0	3	0	0	0	0	1	0	0	0	3	14
8:00 PM	0	3	2	1	3	1	0	0	0	0	0	0	0	2	12
9:00 PM	0	5	6	0	2	0	0	0	0	1	0	0	0	4	18
10:00 PM	0	3	1	2	1	0	0	0	0	2	0	0	0	1	10
11:00 PM	0	4	0	0	1	0	0	0	0	1	0	0	1	5	12
Day Total	5	379	174	31	225	4	3	10	3	23	0	1	12	92	962
Percent	0.52%	39.40%	18.09%	3.22%	23.39%	0.42%	0.31%	1.04%	0.31%	2.39%	0.00%	0.10%	1.25%	9.56%	
ADT	4845														
AM Peak	10:00 AM	11:00 AM	11:00 AM	11:00 AM	11:00 AM	7:00 AM	1:00 AM	11:00 AM	11:00 AM	8:00 AM	3:00 AM	12:00 AM	12:00 AM	11:00 AM	11:00 AM
Volume	11	131	50	23	44	9	4	28	34	2	2	0	4	7	336
PM Peak	5:00 PM	1:00 PM	12:00 PM	6:00 PM	3:00 PM	1:00 PM	12:00 PM	12:00 PM	2:00 PM	3:00 PM	12:00 PM	12:00 PM	12:00 PM	2:00 PM	12:00 PM
Volume	17	191	70	18	44	9	5	39	31	1	0	0	3	9	369

Date:	Jul 9 2023															
	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7	Class 8	Class 9	Class 10	Class 11	Class 12	Class 13	Counted as Class 6		
Start Time	Bikes	Cars & Trailers	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 Classed	Total	
12:00 AM	0	1	0	0	2	0	0	0	0	0	0	0	0	0	1	4
1:00 AM	0	0	0	1	0	0	0	0	0	0	0	0	0	0	4	5
2:00 AM	0	6	1	1	1	0	0	0	0	0	0	0	0	2	11	
3:00 AM	0	19	2	0	0	0	0	0	0	0	0	0	0	4	25	
4:00 AM	0	58	5	0	9	0	0	0	0	0	0	0	1	2	75	
5:00 AM	0	33	8	0	5	0	0	0	0	0	0	0	0	2	48	
6:00 AM	0	9	2	1	7	0	0	0	0	1	0	0	0	3	23	
7:00 AM	0	5	0	0	6	0	0	0	0	2	0	0	0	3	16	
8:00 AM	0	3	3	1	2	0	0	1	0	1	0	0	0	5	16	
9:00 AM	0	1	2	1	2	0	0	0	0	0	0	0	2	3	11	
10:00 AM	0	4	0	0	2	0	0	1	0	2	0	0	1	4	14	
11:00 AM	0	6	0	1	3	0	0	0	0	0	0	0	2	4	16	
12:00 PM	0	6	0	1	5	0	0	0	0	0	0	0	1	2	15	
1:00 PM	0	4	3	0	4	0	0	0	0	1	0	0	0	3	15	
2:00 PM	0	7	1	0	2	0	0	0	0	1	0	0	0	2	13	
3:00 PM	0	24	10	0	1	0	0	0	0	0	0	0	2	4	41	
4:00 PM	0	44	13	0	9	0	0	0	0	1	0	0	0	3	70	
5:00 PM	0	33	6	1	7	0	0	0	0	1	0	0	0	2	50	
6:00 PM	0	9	4	2	5	0	0	0	0	1	0	0	0	1	22	
7:00 PM	0	2	2	1	1	0	0	0	0	1	0	0	0	2	9	
8:00 PM	0	2	1	0	4	0	0	0	0	0	0	0	2	2	11	
9:00 PM	0	3	0	0	4	0	0	0	0	1	0	0	1	2	11	
10:00 PM	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	
11:00 PM	0	5	0	1	1	0	0	0	0	3	0	0	1	4	15	
Day Total	0	284	63	12	83	0	0	2	0	16	0	0	13	64	537	
Percent	0.00%	52.89%	11.73%	2.23%	15.46%	0.00%	0.00%	0.37%	0.00%	2.98%	0.00%	0.00%	2.42%	11.92%		
ADT	5351															
AM Peak	11:00 AM	11:00 AM	11:00 AM	11:00 AM	11:00 AM	10:00 AM	4:00 AM	9:00 AM	10:00 AM	9:00 AM	10:00 AM	12:00 AM	10:00 AM	9:00 AM	11:00 AM	
Volume	14	134	63	13	33	9	2	28	38	1	1	0	4	7	333	
PM Peak	4:00 PM	1:00 PM	1:00 PM	1:00 PM	2:00 PM	4:00 PM	1:00 PM	2:00 PM	7:00 PM	2:00 PM	12:00 PM	12:00 PM	6:00 PM	12:00 PM	1:00 PM	
Volume	19	214	80	22	74	10	9	32	40	1	0	0	7	13	473	

Date:	Jul 10 2023														
	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7	Class 8	Class 9	Class 10	Class 11	Class 12	Class 13	as Class 6	
Start Time	Bikes	Cars & Trailers	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 Classed	Total
12:00 AM	0	0	1	0	0	2	0	0	0	1	0	0	1	4	9
1:00 AM	0	1	1	1	0	0	0	0	0	0	0	0	1	3	7
2:00 AM	0	6	1	1	0	0	0	0	0	3	0	0	3	2	16
3:00 AM	0	29	3	1	0	0	0	0	1	2	0	0	1	3	40
4:00 AM	0	86	30	1	33	0	0	2	0	2	0	0	1	4	159
5:00 AM	1	72	20	1	19	2	0	0	1	0	1	0	1	5	123
6:00 AM	0	46	6	5	46	0	0	2	2	1	0	0	1	5	114
7:00 AM	1	8	11	3	29	2	0	1	4	5	0	0	3	6	73
8:00 AM	0	9	11	7	28	1	0	4	1	1	0	0	6	11	79
9:00 AM	0	2	5	1	25	2	1	5	4	4	0	0	6	7	62
10:00 AM	1	8	8	5	29	2	0	3	4	3	0	0	6	9	78
11:00 AM	0	8	12	6	35	1	0	2	3	7	0	0	6	11	91
12:00 PM	2	13	9	3	33	1	1	2	2	1	0	0	9	7	83
1:00 PM	0	5	3	3	16	0	1	4	2	4	0	1	10	8	57
2:00 PM	2	8	5	3	25	1	1	1	4	1	0	2	4	13	70
3:00 PM	0	35	23	3	44	1	0	2	3	2	0	0	4	5	122
4:00 PM	2	85	22	2	57	2	0	1	1	0	0	0	2	5	179
5:00 PM	1	68	10	1	33	0	0	1	1	1	0	0	0	4	120
6:00 PM	0	46	12	1	12	1	0	0	0	3	0	0	3	6	84
7:00 PM	0	4	1	1	5	0	0	0	0	2	0	0	2	4	19
8:00 PM	0	2	0	2	7	1	0	0	0	1	0	0	2	3	18
9:00 PM	0	4	1	1	3	1	0	0	0	1	0	0	1	1	13
10:00 PM	0	5	0	0	0	0	0	0	0	0	0	0	0	1	6
11:00 PM	0	4	1	1	0	0	0	0	1	1	0	0	0	5	13
Day Total	10	554	196	53	479	20	4	30	34	46	1	3	73	132	1635
Percent	0.61%	33.88%	11.99%	3.24%	29.30%	1.22%	0.24%	1.83%	2.08%	2.81%	0.06%	0.18%	4.46%	8.07%	
ADT	6363														
AM Peak	10:00 AM	11:00 AM	9:00 AM	9:00 AM	10:00 AM	10:00 AM	9:00 AM	10:00 AM	11:00 AM	9:00 AM	12:00 AM	12:00 AM	9:00 AM	10:00 AM	11:00 AM
Volume	25	126	56	31	59	24	10	30	43	2	2	0	10	12	370
PM Peak	3:00 PM	5:00 PM	2:00 PM	12:00 PM	12:00 PM	1:00 PM	1:00 PM	12:00 PM	3:00 PM	12:00 PM	3:00 PM	12:00 PM	1:00 PM	4:00 PM	2:00 PM
Volume	30	179	73	31	64	17	14	37	61	1	3	0	10	18	472

Date:	Jul 11 2023														
	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7	Class 8	Class 9	Class 10	Class 11	Class 12	Class 13	Counted as Class 6	
Start Time	Bikes	Cars & Trailers	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 Classed	Total
12:00 AM	0	2	0	2	0	0	1	0	0	0	0	0	2	4	11
1:00 AM	0	0	0	1	0	0	0	0	0	0	0	0	0	2	3
2:00 AM	0	5	0	0	1	0	0	0	0	0	0	0	0	4	10
3:00 AM	0	28	2	1	0	0	0	0	0	0	0	0	0	2	33
4:00 AM	0	88	32	0	34	0	0	0	0	0	1	0	2	2	159
5:00 AM	0	79	20	2	23	0	1	0	1	1	0	1	1	4	133
6:00 AM	3	43	10	4	34	2	0	2	3	3	0	0	6	10	120
7:00 AM	0	9	7	5	33	0	0	2	4	3	0	0	4	9	76
8:00 AM	1	6	7	4	28	1	0	4	2	6	0	0	9	8	76
9:00 AM	0	9	4	5	27	1	0	4	4	8	0	0	8	6	76
10:00 AM	0	6	7	2	26	2	2	6	2	6	0	1	4	6	70
11:00 AM	0	11	6	6	26	1	0	3	6	5	0	1	11	9	85
12:00 PM	0	16	13	2	40	1	0	7	2	2	0	1	10	12	106
1:00 PM	3	7	4	8	25	2	1	2	1	4	0	0	5	9	71
2:00 PM	1	8	3	8	28	2	0	5	3	4	0	0	9	8	79
3:00 PM	0	50	23	2	50	1	0	2	3	5	0	0	8	6	150
4:00 PM	1	70	28	4	50	0	1	5	2	1	0	0	4	7	173
5:00 PM	2	71	17	0	38	1	0	2	0	0	0	0	1	6	138
6:00 PM	0	46	12	0	21	0	0	3	0	3	0	0	0	4	89
7:00 PM	1	4	3	1	12	0	0	2	0	3	0	0	0	6	32
8:00 PM	1	3	2	3	0	0	0	0	0	1	0	0	5	3	18
9:00 PM	0	6	2	1	6	2	0	1	0	2	0	0	4	4	28
10:00 PM	0	6	1	0	3	0	0	2	0	1	0	0	3	3	19
11:00 PM	0	5	0	1	0	0	0	0	0	2	0	0	3	4	15
Day Total	13	578	203	62	505	16	6	52	33	60	1	4	99	138	1770
Percent	0.73%	32.66%	11.47%	3.50%	28.53%	0.90%	0.34%	2.94%	1.86%	3.39%	0.06%	0.23%	5.59%	7.80%	
ADT	5988														
AM Peak	10:00 AM	11:00 AM	10:00 AM	8:00 AM	11:00 AM	10:00 AM	10:00 AM	11:00 AM	10:00 AM	11:00 AM	6:00 AM	12:00 AM	7:00 AM	10:00 AM	11:00 AM
Volume	25	98	63	33	64	14	16	23	52	2	4	0	12	19	367
PM Peak	4:00 PM	12:00 PM	4:00 PM	2:00 PM	5:00 PM	4:00 PM	2:00 PM	1:00 PM	1:00 PM	12:00 PM	7:00 PM	12:00 PM	2:00 PM	3:00 PM	4:00 PM
Volume	33	138	65	37	62	15	12	33	61	4	3	0	14	16	431

Date:	Jul 12 2023														
	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7	Class 8	Class 9	Class 10	Class 11	Class 12	Class 13	Counted as Class 6	
Start Time	Bikes	Cars & Trailers	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 Classed	Total
12:00 AM	0	2	0	0	0	0	0	0	0	3	0	0	6	2	13
1:00 AM	0	1	1	1	1	0	0	0	0	0	0	0	4	2	10
2:00 AM	0	4	0	0	0	0	0	0	0	1	0	0	2	2	9
3:00 AM	0	26	5	0	3	0	0	0	0	0	0	0	2	2	38
4:00 AM	0	83	28	0	28	0	0	2	1	0	0	0	3	4	149
5:00 AM	0	86	22	4	35	0	0	0	2	1	0	0	4	6	160
6:00 AM	4	41	12	7	41	0	0	2	3	2	0	0	5	11	128
7:00 AM	1	13	7	9	30	2	0	3	2	3	0	0	9	11	90
8:00 AM	2	10	5	8	36	2	0	3	3	4	0	0	7	8	88
9:00 AM	0	9	10	5	32	1	0	3	4	4	0	0	8	12	88
10:00 AM	1	7	12	6	22	2	0	2	7	4	0	2	8	9	82
11:00 AM	0	12	12	5	35	0	1	4	7	7	0	0	15	15	113
12:00 PM	1	10	16	5	38	0	0	7	5	5	0	0	15	11	113
1:00 PM	1	12	3	6	31	2	1	3	5	9	0	0	10	10	93
2:00 PM	1	9	6	5	23	0	2	2	3	5	0	0	16	10	82
3:00 PM	0	38	20	3	45	1	0	10	2	5	0	0	8	5	137
4:00 PM	0	83	24	1	53	1	0	7	1	0	0	0	5	3	178
5:00 PM	0	60	16	1	30	4	0	1	1	2	0	0	2	4	121
6:00 PM	1	43	10	0	16	3	0	1	1	5	0	0	3	5	88
7:00 PM	1	12	4	2	14	0	0	1	0	0	0	0	2	3	39
8:00 PM	0	5	2	4	3	0	0	0	0	0	0	0	5	4	23
9:00 PM	0	2	1	1	4	0	0	0	0	1	0	0	5	4	18
10:00 PM	0	4	2	1	4	0	0	1	0	2	0	0	0	3	17
11:00 PM	0	2	1	0	3	0	0	3	0	0	0	0	4	4	17
Day Total	13	574	219	74	527	18	4	55	47	63	0	2	148	150	1894
Percent	0.69%	30.31%	11.56%	3.91%	27.82%	0.95%	0.21%	2.90%	2.48%	3.33%	0.00%	0.11%	7.81%	7.92%	
ADT	6312														
AM Peak	7:00 AM	11:00 AM	10:00 AM	10:00 AM	11:00 AM	11:00 AM	8:00 AM	9:00 AM	10:00 AM	5:00 AM	2:00 AM	12:00 AM	9:00 AM	9:00 AM	11:00 AM
Volume	26	94	55	35	57	13	15	33	62	1	4	0	13	20	380
PM Peak	1:00 PM	5:00 PM	1:00 PM	2:00 PM	12:00 PM	5:00 PM	1:00 PM	1:00 PM	2:00 PM	2:00 PM	11:00 PM	12:00 PM	1:00 PM	1:00 PM	4:00 PM
Volume	31	140	70	32	66	21	17	38	62	2	4	0	16	25	457

SUMMARY: ALL COUNTS															
Date:	Jul 6 2023 - Jul 12 2023														
	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7	Class 8	Class 9	Class 10	Class 11	Class 12	Class 13	Counted as Class 6	Total
	Bikes	Cars & Trailers	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 Classed	Total
Grand Total	65	3410	1314	368	2778	93	20	210	153	292	2	17	557	805	10084
Percent	0.64%	33.82%	13.03%	3.65%	27.55%	0.92%	0.20%	2.08%	1.52%	2.90%	0.02%	0.17%	5.52%	7.98%	
ADT	1440.571														
SUMMARY: WEEKDAY ONLY															
Date:	Jul 6 2023 - Jul 12 2023														
	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7	Class 8	Class 9	Class 10	Class 11	Class 12	Class 13	Counted as Class 6	Total
	Bikes	Cars & Trailers	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 Classed	Total
Grand Total	60	2747	1077	325	2470	89	17	198	150	253	2	16	532	649	8585
Percent	0.70%	32.00%	12.55%	3.79%	28.77%	1.04%	0.20%	2.31%	1.75%	2.95%	0.02%	0.19%	6.20%	7.56%	
ADT	1717														

Appendix B – Existing Tower Road ESAL Calculations

APPENDIX B - Tower Road Background Traffic ESAL

Part 1: Traffic Data

2023 Two-Way Avg. Weekday ADT
 Avg. ADT 1717 *QC Data collection 7/6/2023 - 7/12/2023*

2043 Two-Way Avg. Weekday ADT
 1715 *Assume 0% per year growth*

Pavement Type: Asphalt Concrete
 Year of Opening: 2023
 Structural Design Life: 20 years Typical for new roadways
 20-year expansion factor 1.00 2043 ADT/2023 ADT

Part 2: Annual Growth Rate

$R = [E^{(1/n)} - 1] * 100$

R = Annual Growth (%)
 E = Expansion Factor 1.00
 n = Number of Years 20

R = -0.01

Part 3: ESAL for year 2023

Vehicle Class	Percent of ADT	Number of Trucks*	Percent Total Trucks	ESAL Factor**	Directional Factor	Year 2023 ESAL's
1	0.70%	12		0		0
2	32.00%	549		0		0
3	12.55%	215		0		0
4	3.79%	65	6.91%	246	0.55	8,795
5	28.77%	494	52.55%	104	0.55	28,257
6	8.60%	148	15.74%	284	0.55	23,118
7	0.20%	3	0.32%	757	0.55	1,249
8	2.31%	40	4.26%	253	0.55	5,566
9	1.75%	30	3.19%	466	0.55	7,689
10	2.95%	51	5.43%	561	0.55	15,736
11	0.02%	0	0.00%	603	0.55	0
12	0.19%	3	0.32%	546	0.55	901
13	6.20%	106	11.28%	1037	0.55	60,457
Truck Count:		940	100%	Total ESAL:		151,767

*Bi-directional Truck Traffic

**ESAL factor per ODOT pavement design guide, 2019 Table 8

Part 4: ESAL for Design Life

Ex: 2023 ESAL's = 2013 ESAL's [1+(R/100)]

Year	ESAL's	Summation		
2023	151,767	151,767	Opening Year	151,767
2024	151,758	303,525		
2025	151,749	455,274		
2026	151,740	607,015		
2027	151,732	758,747		
2028	151,723	910,469		
2029	151,714	1,062,183		
2030	151,705	1,213,888		
2031	151,696	1,365,585		
2032	151,687	1,517,272		
2033	151,679	1,668,951		
2034	151,670	1,820,620		
2035	151,661	1,972,281		
2036	151,652	2,123,933		
2037	151,643	2,275,577		
2038	151,634	2,427,211		
2039	151,626	2,578,837		
2040	151,617	2,730,453		
2041	151,608	2,882,061		
2042	151,599	3,033,660		
2043	151,590	3,185,250		
2044	151,581	3,336,832		

Appendix C – Tower Road Construction Traffic Assumptions

Appendix D – Construction Traffic ESAL Calculations

APPENDIX D - Tower Road Construction Traffic ESAL

Part 1: Traffic Data

See Tower Road Construction Traffic Summary for Assumptions

Class 1-3	23600
Class 6	4200
Class 9	340

Vehicle totals are for the entire construction durations. ODOT ESAL factors convert ADT to annual ESAL. Need to reduce the total construction traffic volume to daily. Assume that construction traffic is spread evenly over the duration of construction, or 160 total days.

Assumed Daily traffic

Class 1-3	147.5
Class 6	26.25
Class 9	2.125

Part 2: Annual Growth Rate

$$R = [E^{(1/n)} - 1] * 100$$

R = Annual Growth (%)

E = Expansion Factor 1.00 CONSTRUCTION YEAR ONLY

n = Number of Years 20

$$R = 0.00$$

Part 3: ESAL for year 2023

Vehicle Class	Percent of ADT	Number of Trucks*	Percent Total Trucks	ESAL Factor**	Directional Factor	Year 2023 ESAL's
1	0.00%	0		0		0
2	0.00%	0		0		0
3	0.00%	148		0		0
4	0.00%	0	0.00%	246	0.55	0
5	0.00%	0	0.00%	104	0.55	0
6	0.00%	26	92.51%	284	0.55	4,100
7	0.00%	0	0.00%	757	0.55	0
8	0.00%	0	0.00%	253	0.55	0
9	0.00%	2	7.49%	466	0.55	545
10	0.00%	0	0.00%	561	0.55	0
11	0.00%	0	0.00%	603	0.55	0
12	0.00%	0	0.00%	546	0.55	0
13	0.00%	0	0.00%	1037	0.55	0

Truck Count: 28 100% Total ESAL: 4,645

*Bi-directional Truck Traffic

**ESAL factor per ODOT pavement design guide, 2019 Table 8

Part 4: ESAL for Design Life

Construction Year Annual ESALs	4,645	ADTT converted to Annual
Days per year	365	
Daily ESALs	12.7257192	
Days of Construction	160	(Phase 1 - 30 days, Phase 2 - 130 days)
Total Const. ESAL's	2,036	