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March 28, 2017

Mr. Joe Wetzel
Railroad, LLC
c/o The Young Group
800 West Broad Street, #333
Falls Church, VA 22046

Re: Railroad Cottages
Trip Generation Comparison
Tax Map 52-102-030, 031 and 032
City of Falls Church
Pennoni YNGG1701

Dear Mr. Wetzel:

As requested, please find a trip generation summary for your use with the City and stakeholders for the proposed conceptual development plan for the Railroad Cottages. The proposed conversion to allow 10 single family detached 'senior living' residential units generates similar roadway peak hour and weekday trips in relation to the 'by-right' site development scenario with 4 single family detached residential units. The calculations and comparisons are outlined below. We conclude that the proposed special exception with age-restricted housing (age 55 and over) is consistent with by-right development and that a VDOT Chapter 870 review is not required.

The 1.25 acre site is proposed for a CDP for development totaling 10 DU, with access to the termini of Railroad Avenue, south of the W & OD Trail and west of Route 7.

Trip Generation

The proposed site activities are summarized in **Table E1** below, based on trip equations from the Institute of Transportation Engineers (ITE) Trip Generation Manual (9th Edition). The effective trip rates are calculated by residential dwelling unit, to be conservative. Calculations do not include any Transportation Demand Management (TDM) reductions for the age-restricted uses. The Table shows the average rate for comparisons from the national database. The ITE Manual included several types of age-restricted housing. Detached residential units were used to reflect the cottages. Other types of senior housing uses include Senior Adult Housing (attached), Congregate Care Facilities and Continuing Care Retirement Communities. Generally, trip per unit go down as the residents' mobility decreases as the age increases. The ITE Manual notes:

- *Senior adult housing consists of detached independent living developments, including retirement communities, age-restricted housing and active adult communities. These developments may include amenities such as golf courses, swimming pools, 24-hour security,*

transportation and common recreational facilities. However, they generally lack centralized dining and on-site health facilities. Detached senior adult housing communities may or may not be gated. Residents in these communities are typically active (requiring little to no medical supervision). The percentage of retired residents varies by development.

- *Many factors affected the trip rates for detached senior adult housing. Factors such as the average age of residents, development of location and size, affluence of residents, employment status and vehicular access should be taken into consideration when conducting an analysis.*
- *The peak hour of the generator typically did not coincide with the peak hour of the adjacent street traffic. The A.M. peak hour of the generator typically ranged from 7:00 a.m. to 12:00 p.m. and the P.M. peak hour of the generator typically ranged from 1:00 p.m. to 6:00 p.m. The sites surveyed in the 1980s through the 2000s in California, Florida, New Hampshire, New Jersey, Pennsylvania and Canada.*

TABLE E1: PROPOSED TRIP GENERATION SUMMARY

	AM Peak Hour Trips	PM Peak Hour Trips	Weekday Daily Trips
Railroad Cottages[(1)]	2	3	37
TDM Trips[(1)]	-0	-0	-0
Pass-by Trips	-0	-0	-0
Internal Trips	-0	-0	-0
External Trips	2	3	37

(1) = ITE Trip Generation Manual (9th Edition) Land Use Code 251 rate for 10 DU. See **Table 1** for details.

The range of rates, in and out trips, and effective trip rates are attached in **Table 1** with the box for the average trips from ITE for Senior Housing and for signal family detached housing. However, since the site trip variable – dwelling unit-- is small for both proposed and by-right conditions, the application of the ITE trip equations is not appropriate. The ITE trip rate equations for land Use Code 251 are linear, so with only 1 DU, the AM trips are at 30 trips, which is not realistic.

The peak hour of the roadway during the 'rush hour' is typically the highest street volume counts, so the roadway peak hours were shown in the Tables. Off peak hours trips for senior housing – after 9 AM and before 4 PM -- are higher by 25 to 35 percent – in relation to the roadway peaks.

Trip Generation Change Summary

The proposed site activities are compared with the site "by-right" tabulations in **Table E2** below, based on single family detached average rates from the Institute of Transportation Engineers (ITE) Trip Generation Manual (9th Edition). The change in trips are shown to compare with the by-right uses, which show no increase in trips. Daily trips for single-family housing default to the VDOT 'default rate of 10 trips per DU.

TABLE E2: PROPOSED TRIP GENERATION COMPARISON

Scenario	Railroad Cottages	Weekday AM Peak (two-way Trips)	Weekday PM Peak (two-way Trips)	Weekday Daily (two-way Trips)
Proposed	10 SF DU Senior Housing	2	3	37
By-right	4 SF DU (ITE Code 210)	3	4	40
	Change from By-Right	-1	-1	-3
	Percentage Change	-33.3%	-25.0%	-7.5%

Trip Generation Sensitivity

The senior housing rates in ITE are based on 23 AM and 24 PM peak period studies. In past land use cases in Northern Virginia for senior housing, Pennoni has reviewed increased daily trips to account for flex-time traveling (i.e. households with workers who may commute part time or full time on the roads). To evaluate the sensitivity of the ITE data base, the average rates from ITE have been increased by 1 standard deviation (to reflect app. 88%) of the likelihood of higher trips. As shown in the bottom of Table 1, the effective trip rates with 1 standard deviation added are shown for the proposed 10 senior housing, as well as for the by-right detached housing, which recognizes multiple bedrooms and car ownership for facilities.

With the added trip sensitivity for senior housing, the proposed site activities are compared with the by-right tabulations , also with an increase in trips for multiple bed rooms and car ownership, in **Table E3** below, based on average rates and one standard deviation added from the Institute of Transportation Engineers (ITE) Trip Generation Manual (9th Edition).

TABLE E3: PROPOSED TRIP GENERATION SENSITIVITY WITH MAX TRIPS

Scenario	Railroad Cottages	Weekday AM Peak (two-way Trips)	Weekday PM Peak (two-way Trips)	Weekday Daily (two-way Trips)
Proposed CDP	10 DU Senior Housing (Ave + I.S.D.)	7	8	57
By-right	4 SF DU (ITE Code 210 + I.S.D.)	7	8	53
	Change from Approved	0	0	+4
	Percentage Change	0.0%	0.0%	+7.5%

Senior housing, with over 55 year age restriction for one member of the household and no year round school age children results no increase in peak hour trips than the single family detached homes. Daily trips for the senior housing with the increase in rates are 4 vehicles higher than the single-family detached trips with 4 DU assumed.

Other Data Sources

As part of land use entitlement applications in Northern Virginia, Pennoni had reviewed trip rates for active adult uses. In reviewing field traffic counts at Ashburn and Dumfries for the Dell Webb Four Seasons senior living communities, effective trip rates for the roadway peak hours for these sites compare to the ITE averages in the ITE Trip Generation Manual (2012). For a recent Fairfax County approval in the Fort Belvoir area, Pennoni used the trip rates as the average plus one standard deviation for the Daily trips to recognize a conservative approach for age-restricted housing for Daily activities. That rate at 5.7 trips per DU for Daily trips is shown in the sensitivity analysis in **Table E3**, and is 55 percent higher than the ITE data base rates.

In reviewing the on-line resources from ITE, the trip sources for senior housing in the ITE Journal have be incorporated into the rates used in the 9th Edition (from 2012). Note that one of the recent studies sources in 2011 includes a review of four senior housing sites in suburban Maryland, where the effective trip rates per dwelling units were 0.02 higher in the AM peak for dwelling units and equal in the PM peak at 0.27 trips per DU. Note that the PM average trip rate per DU for single family detached homes is 1.0 trips per DU, or 3.7 times higher than the Senior housing rate. The 2011 data is consistent with the data from Table E1. Therefore, the methodology per dwelling unit rate for this comparison is consistent with local and national trends.

Conclusions

The proposed use as senior housing single-family detached (SFD) residential uses at 10 lots generates peak period and Daily trips that are consistent with the by-right development of 4 single-family detached dwelling units, without age restrictions. The comparisons are based on the average data associated with the ITE Trip Generation Manual, review of trip generation sensitivity, local experience in Northern Virginia for other age-restricted land use entitlement applications, and a literature review.

If you should have any questions, please contact me directly at (703) 840-4830.

Sincerely,

PENNONI

Mr. Douglas R. Kennedy, P.E.
Associate Vice President

Enclosure: Table 1 Trip generation computations

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Table 1
Trip Generation

ITE Land Use [1,2] CODE	CODE	DENSITY	Var.		USE	AM PEAK HOUR IN	AM PEAK HOUR OUT	AM PEAK HOUR TOTAL	PM PEAK HOUR IN	PM PEAK HOUR OUT	PM PEAK HOUR TOTAL	DAILY (2-way)
Railroad Cottages Trip Generation												
251	251.100	10	DU		Senior Adult Housing Det.	1	1	2	2	1	3	37
251	251.180	10	DU	e	Senior Hous. Det @ 10 DU	11	21	32	5	3	8	61
251	251.200	10	DU		Senior Housing Det. (D+ 1 SD	1	2	3	2	1	3	57
251	251.220	10	DU	e	Senior Housing Det. (+ 1 SD)	2	5	7	5	3	8	57
		10	**DU**		**Use ave + 1 S.D.**	**2**	**5**	**7**	**5**	**3**	**8**	**57**
By Right												
210	210.171	4	DU	e	SF Res. @ 4 DU	3	10	13	3	1	4	54
210	210.190	4	DU		Single-Fam. Det. (VDOT)	1	2	3	3	1	4	40
210	210.200	4	DU		Single-Fam. Det. (+ 1 S.D.)	2	5	7	5	3	8	53
210	210.100	4	DU		Single-Fam. Det.	1	2	3	3	1	4	38
		4	**DU**		**Use ave + 1 S.D.**	**2**	**5**	**7**	**5**	**3**	**8**	**53**

Comparisons Proposed Vs. By-Right

Average Rate	Change	0	-1	-1	-1	0	-1	-3
	Percentage Change	0.0%	-50.0%	-33.3%	-33.3%	0.0%	-25.0%	-7.5%
Average Rate + 1 S.D.	Change	0	0	0	0	0	0	4
	Percentage Change	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	7.5%

Effective Trip Rates [3]			AM Peak Hour (2-way)	AM Peak Hour % Inbound	PM Peak Hour (2-way)	PM Peak Hour % Inbound	Daily Weekday (2-way)
251	Senior Adult Housing Det.	DU	0.20	50%	0.30	67%	3.70
251	Senior Hous. Det @ 10 DU	DU	3.20	34%	0.80	63%	6.10
251	Senior Housing Det. (D+ 1 SD)	DU	0.30	33%	0.30	67%	5.70
251	Senior Housing Det. (+ 1 SD)	DU	0.70	29%	0.80	63%	5.70
210	SF Res. @ 4 DU	DU	3.25	23%	1.00	75%	13.50
210	Single-Fam. Det. (VDOT)	DU	0.75	33%	1.00	75%	10.00
210	Single-Fam. Det. (+ 1 S.D.)	DU	1.75	29%	2.00	63%	13.25
210	Single-Fam. Det.	DU	0.75	33%	1.00	75%	9.50

(1)Trip Generation Manual (9th Edition), Institute of Transportation Engineers (ITE); 2012. Average trip rates used, unless noted with "e", then equations

(2) ITE Land Code shown as the first 3 digits. Decimal shown for internal use by Pennoni for lookup table for trip rate variable.

(3) Effective trip rates calculated by land use:

For average rates = (Density) x (ave. trip rate) = 2-way Trips ; x (inbound percentage) for Trips In

For ITE equations, "e" noted = (Density) x (trip equation) = 2-way Trips ; x (inbound percentage) for Trips In