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Memorandum

To	Scott Musselman, Damfino Development LLC	Page 1
CC	Dave Hendershott, Paradigm Design; Michael Bellovich, Sand Products Corp.	
Subject	Executive Summary - The Docks PUD Traffic Impact Study: Build-Out Analysis Muskegon, Michigan	
From	Ray Schneider, AICP	
Date	May 22, 2019	

INTRODUCTION

AECOM previously conducted a traffic impact study for Paradigm Design for The Docks Planned Unit Development (PUD). An Executive Summary dated October 5, 2018 was submitted to Paradigm Design, Damfino Development LLC, and the City of Muskegon. The study encompassed an analysis of traffic conditions for a 299-unit residential development, including the analysis of four intersections.

Recently, an updated development site plan was received from Paradigm Design (dated 02/15/19) for The Docks PUD.

The updated site plan for The Docks PUD includes the following changes:

- A reduction in the number of residential units from 299 to 239 units.
- The addition of a sit-down restaurant with 81 seats.
- Changing the community center/clubhouse to a resident only clubhouse.
- Reduction of the number of residential access points to the development from three to one.

On April 10, 2019 Paradigm Design provided turning movement counts at the Lakeshore Drive/Beach Street intersection to AECOM, collected by the City of Muskegon on a summer Saturday, August 11, 2018. The August Saturday turning movement counts were used to update the traffic impact study analysis for the development. In addition, a roundabout is planned at the Lakeshore Drive/Beach Street intersection in the fall of 2020 and is included in the future analyses of this updated traffic impact study.

PEAK-HOUR TURNING MOVEMENT COUNTS

The City has requested that the portion of the August 2018 peak-hour turning movement counts taken on Lakeshore Drive between Beach Street and Waterworks Road be applied to Lakeshore Drive/Waterworks Road intersection to determine Lakeshore Drive through peak-hour volumes at Waterworks Road. The left-turn and right-turn related counts collected by AECOM for the previous study were used at the Lakeshore Drive/Waterworks Road intersection, as it is unlikely that these side street turning movement volumes would vary appreciably compared to a summer Saturday afternoon peak-hour.

Based on the land use changes for the proposed development listed in the Introduction section above, an update to the traffic study was completed for the future (2025) no-build and future (2025) build-out analyses, at the following three intersections:

1. Lakeshore Drive/Beach Street
2. Lakeshore Drive/Waterworks Road
3. Waterworks Road/Wilcox Avenue/Plum Avenue

A site location map is shown in **Figure 1**. The updated site plan is depicted in **Figure 2**.

TRAFFIC ANALYSIS SCENARIOS

Two (2) analysis periods were completed as part of the study as follows:

- Future Year (2025) No-Build Conditions
- Future Year (2025) Build-Out Conditions

As in the October 5, 2018 traffic study, an annual traffic growth rate of 1.0% was used to estimate growth at the three intersections. This growth rate was used to determine the future year (2025) no-build background traffic volumes. A capacity analysis was performed to determine a baseline scenario (future year (2025) no-build) of how the intersections would operate without The Docks PUD. For future year (2025) build-out conditions, a capacity analysis was performed to determine the impacts the site would have on the roadways and intersections within the study area.

FUTURE YEAR (2025) CONDITIONS

Future Year (2025) No-Build Conditions

The future year (2025) no-build peak-hour capacity analyses reveal that all study area intersections operate at acceptable levels of service, with all intersection movements at the three intersections operating at LOS D or better during the summer Saturday afternoon peak-hour. Future Year (2025) No-Build peak-hour volumes and movement-by-movement LOS values are depicted in **Figure 3**.

Future Year (2025) Build-Out Trip Generation

Traffic generated by the proposed Damfino Development PUD site, based on the updated site plan, was used to measure the impact of the development on the study area intersections for future year (2025) build-out conditions. The proposed The Docks PUD site is projected to generate 197 new trips (121 entering trips, 76 exiting trips) in the future year (2025) build-out summer Saturday afternoon peak-hour, as shown in **Table 1**.

Future Year (2025) Build-Out Trip Distribution/Traffic Assignment

Trip distribution and traffic assignment of the development site traffic was based on existing travel patterns in the study-area, surrounding land uses, access routes, the site driveway location. The trip distribution percentages were applied to the trips in Table 1 to assign the proposed site trips to the adjacent roadway network and the proposed site access point.

Table 1

**The Docks Traffic Impact Study
 Future (2025) Build-Out Trip Generation**

Land Use	Size	Unit of Measure	Summer Saturday Afternoon Peak-Hour Trips		
			Enter	Exit	Total
Single Family Detached Housing	142	units	70	41	111
Multi-family Housing (Low-Rise) ⁽¹⁾	67	units	24	14	38
Condominiums ⁽²⁾	30	units	9	6	15
Restaurant (High-Turnover Sit Down)	81	seats	23	20	43
	<i>Less: 25% internal trips</i>		<u>-5</u>	<u>-5</u>	<u>-10</u>
	Net Restaurant Trips		18	15	33
Total Trip Generation – The Docks			121	76	197

Source: Housing peak-hour trip generation based on peak-hour trip rate used in the October 5, 2018 traffic study.

⁽¹⁾Townhouses

⁽²⁾Condominiums

⁽³⁾Assumes a 25% reduction in restaurant-related trips due to internal trips (residents, and patrons arriving by boat).

The following trip distribution percentages were applied to the trips in Table 1 to assign the proposed site trips to the adjacent roadway network.

Traffic Distribution

- 50% to/from the east via Lakeshore Drive
- 35% to/from the south via Beach Street
- 15% to/from the north via Beach Street

Future Year (2025) build-out conditions trip distribution and traffic assignment is depicted in **Figure 4**.

Future Year (2025) Build-Out Conditions

For the future year (2025) build-out analysis it was assumed that the Waterworks Road approach to Lakeshore Drive remains as a shared left-turn/right-turn lane. The future year (2025) build-out peak-hour capacity analyses reveal that for the three study area intersections, all but one intersection movement operates at LOS of D or better during the summer Saturday peak-hour at the three study area intersections. The Waterworks Road approach to Lakeshore Drive operates at LOS E under a shared left-turn/right-turn lane operation for the summer Saturday afternoon peak-hour.

It is important to note that the LOS E for the Waterworks Road shared left-turn/right-turn lane approach to Lakeshore Drive is based on a peak-peak condition: a summer Saturday afternoon that also included a special event at the Pier Marquette beach. Even though the Waterworks Road approach LOS is E (without a separate left-turn lane), the associated average delay per vehicle is 35.2 seconds for the approach, not to be considered an excessive amount of delay considering this is for a summer peak-peak condition.

While LOS D or better is preferred for all movements of an intersection, other factors need to be evaluated to determine if intersection traffic operations are acceptable. Two other measures commonly evaluated are

95th percentile queue length and volume-to-capacity ratio (V/C). The 95th percentile queue represents the queue length wherein any one queue has only a five percent probability of exceeding this value during the peak hour, herein a near maximal queue. The 95th percentile queue for the Waterworks Road approach is only 72 feet (about three vehicles) under a single shared left-turn/right-turn lane arrangement. A V/C ratio greater than 1.00 is an over capacity condition. The V/C ratio for the Waterworks Road approach is only 0.54 with the share lane, well below capacity.

Some motorists who may not want to wait to make the left-turn movement from Waterworks Road may choose to instead enter the right-turn lane to proceed westbound on Lakeshore Drive to the roundabout at Lakeshore Drive/Beach Street and use the roundabout to turn around and proceed back onto eastbound Lakeshore Drive. This would result in reduced delay and queuing for the Waterworks Road left-turn movement but would not necessarily result in changing LOS from E to D for the Waterworks Road approach to Lakeshore Drive.

For the Waterworks Road/Lakeshore Drive intersection, an analysis was run with separate left-turn and right-turn lanes on the Waterworks Road approach to Lakeshore Drive under build-out conditions. With the separate turn lanes, the LOS for the Waterworks Road the average approach delay improves from LOS E to D, (average delay of left-turn and right-turn delays). However, while the right-turn lane movement improves from LOS E to C with the separate right-turn lane, the LOS remains at E with a separate left-turn lane. While the left-turn lane movement LOS does not improve compared to the shared lane arrangement, the 95th percentile queue and V/C ratio are reduced from three vehicles to two vehicles and from 0.54 to 0.37, respectively. Below is a comparison of traffic capacity and operations with and without separate turn lanes:

Waterworks Road Approach to Lakeshore Drive – Future (2025) Build-Out Analysis

Waterworks Road Movement	Peak-Hour Volume	LOS	Delay (sec)	95 th % Queue (vehicles)	V/C Ratio
Shared Left-Turn/Right-Turn lane	93	E	35.2	3	0.54
Left-Turn Only lane	45	E	37.2	2	0.37
Right-Turn Only lane	48	C	15.7	1	0.17
Average of Left-Turn Only & Right-Turn Only	47.5	D	26.0	1.5	0.27

Based on the above future (2025) build-out findings, constructing separate left-turn and right-turn lanes on the Waterworks Road approach to Lakeshore Drive is not recommended as separate turn lanes would not improve LOS and would only marginally reduce the 95th percentile queue and V/C ratio.

Future year (2025) build-out peak-hour volumes and movement-by-movement LOS values for the summer Saturday afternoon peak-hour condition, with maintaining the existing shared left-turn/right-turn lane configuration on Waterworks Road at Lakeshore Drive, are depicted in **Figure 5**.

CONCLUSION

The current site plan for the proposed The Docks PUD generates less traffic than the preliminary PUD (down from 268 trips to 197 trips).

Based on the analyses performed in this study, the proposed The Docks development is not anticipated to result in any unacceptable traffic operations under summer Saturday Future Year (2025) Build-Out conditions. No mitigation measures are recommended at any of the three intersections in the study area under build-out conditions.