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*Sixteenth Land Holdings Inc.*  
*4134 16TH Avenue Lands*  
*City of Markham*

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Development Phasing Report

Based Upon

Monitoring Programs

And

Strategic Interim 16<sup>th</sup> Avenue Intersection Improvements

April, 2018

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Based Upon  
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## **1. Introduction**

The Sixteenth Land Holdings Inc. project team has been continually refining the two subdivision plans. Poulos & Chung Limited (PC), the Project Transportation / Traffic Engineers have not only been providing specific input to the internal transportation system, including Active Transportation, but also has been conducting further analyses of the arterial boundary road operations.

In response to these analyses, Sixteenth Land Holdings Inc. has opened a dialogue with York Region indicating a willingness to pursue:

- Establishing a traffic flow monitoring and data gathering program. Such a program would:
  - Permit adjustments to intersection signal timings to maximize service and traffic flow performance;
  - Provide a continual update to the characteristics and behaviour of the background traffic flows;
  - Provide updated travel demand and modal choice characteristics for not only the subject lands but other developments within Markham;
- Accelerate design and construction of feasible 16<sup>th</sup> Avenue intersection improvements as part of the 4134 16<sup>th</sup> Avenue Lands development phasing. Sixteenth Land Holdings Inc. believes that such intersection improvements can provide intersection operational relief in the interim years prior to the construction of the internal collector road (Street “A”) bridge crossing and the ultimate 16<sup>th</sup> Avenue improvement plan. These analyses indicate that if key intersection lanes could be improved then:

- Operational benefits could be secured for numerous intersection turning movements and through vehicle movements. In particular this benefits existing through and turning traffic flows. In turn;
- Such intersection benefits also assist to better accommodate the phased development traffic flows of the subject lands.

It is understood by all concerned parties that once 16<sup>th</sup> Avenue is improved in accordance to the recommendations of the Environmental Assessment Study that significant operation benefits are secured for total traffic flows well into the future. Currently York Region is finalizing the 16<sup>th</sup> Avenue Environmental Assessment Study and will bring forth the construction timeline for improvements between Woodbine Avenue and York / Durham Line.

Sixteenth Land Holdings Inc. recognizes that the development of the subject lands will proceed in stages. Each stage will require further operational / implementation studies including the continual update of Transportation / Traffic / Mobility data. This further work must be cognizant of changing travel demand characteristics as well as anticipated transportation system improvements and additions.

This report provides a analysis to examine the strategic opportunities that are available. It permits a sequencing of development and identifies the foundation for conducting further assessments going forward. These further assessments using continually updated information can assess further development phasing relative to total travel demands and the condition of the transportation system.

This report:

- Identifies potential 16<sup>th</sup> Avenue intersection improvements that can strategically be undertaken immediately;
- Analyzes horizon years 2021, 2024 incorporating;
  - Continued growth in existing background traffic;
  - Incorporating 4134 16<sup>th</sup> Avenue Lands development phasing;
- Rationalizes an acceptable 4134 16<sup>th</sup> Avenue Lands development potential that can be accommodated incorporating the currently identified strategic improvements.

The analysis contained in this report builds upon the detailed information contained in the two previous reports submitted by PC. These reports are:

- Transportation Assessment 4134 16<sup>th</sup> Avenue Internal Roadway Network Options, Preferred Roadway Network, Official Plan Amendment, October 2016;
- Traffic Impact Assessment 4134 16<sup>th</sup> Avenue West Side Plan of Subdivision, East Side Plan of Subdivision, October 2016.

The following sections document the investigation and analysis undertaken.

It is noted that the analysis presented is for the typical weekday roadway peak hours. In all cases assessment evaluation and critical decision making is based upon peak hour peak direction of travel.

## 2. 4134 16<sup>th</sup> Avenue Lands Development Phasing

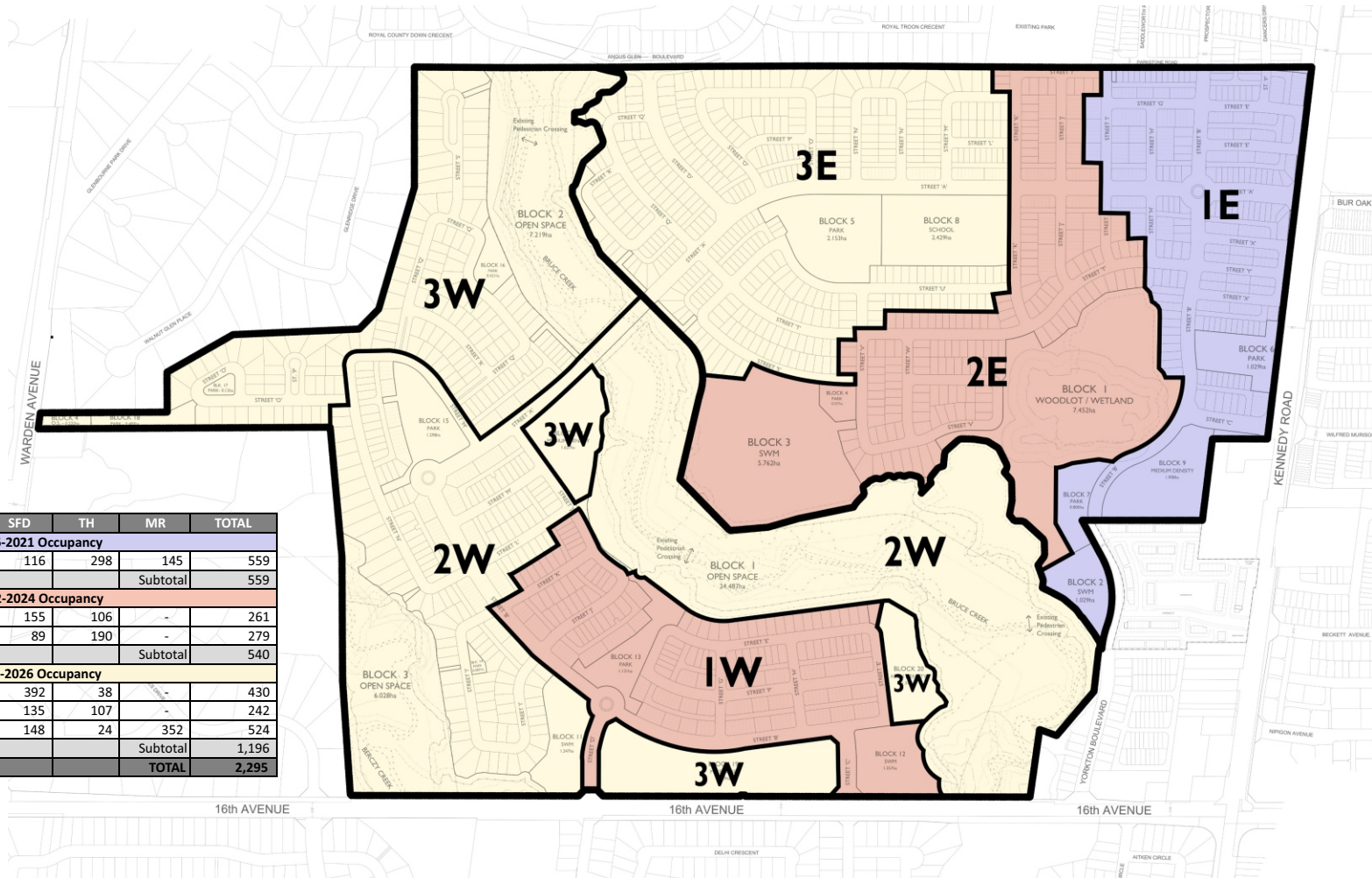
The 4134 16<sup>th</sup> Avenue Lands development phasing areas are shown in Figure 1.

Table 1 presents the initial phasing / collector road connection strategy. It is noted that further transportation analysis is necessary to verify development phasing and road network requirements beyond 2024.

**Table 1**  
**Initial Development Phasing Strategy**

<b>Horizon Year</b>	<b>Available Collector Road Connections</b>
2021	Street A to Kennedy Road Street C to Kennedy Road Street B to Yorkton Boulevard and Prospectors Drive Street F to Dancers Drive
2024	Streets C and D to 16 <sup>th</sup> Avenue  Further analysis is required to confirm the timing to introduce the collector road (Street “A”) crossing of the Bruce valley. It is likely that the crossing would be desirable in the latter stages of Phase 2.
Beyond 2024	Street D to Angus Glen Boulevard

PHASE	SFD	TH	MR	TOTAL
<b>STAGE A: 2016-2021 Occupancy</b>				
1 East	116	298	145	559
			Subtotal	559
<b>STAGE B: 2022-2024 Occupancy</b>				
2 East	155	106	-	261
1 West	89	190	-	279
			Subtotal	540
<b>STAGE C: 2024-2026 Occupancy</b>				
3 East	392	38	-	430
2 West	135	107	-	242
3 West	148	24	352	524
			Subtotal	1,196
			<b>TOTAL</b>	<b>2,295</b>



PHASING PLAN

4134 16TH AVENUE, CITY OF MARKHAM, REGION OF YORK

April 6, 2018

mbtw wai

### 3. Examining 16<sup>th</sup> Avenue Intersection Improvement Opportunities

A range of intersection improvements was considered. This included maximizing the number of through lanes at the intersections to the inclusion of strategic lane additions / modifications.

A description and initial evaluation of these improvements is presented below.

#### *Maximization of Intersection Through Lanes*

At the 16<sup>th</sup> Avenue intersections with Warden Avenue and Kennedy Road the maximum intersection improvement considered was:

- The inclusion of 1 additional through lane of traffic in each direction of travel. This would involve; a widening before the intersection to permit 3 traffic lanes in each direction of travel and a widening to 3 traffic lanes in each direction of travel after the intersection with a taper back down to the existing 4 lanes before the next signalized intersection.

Such a maximum improvement would serve to improve the overall individual intersection operation and level of service performance. However, such extensive intersection modification should only be considered in a timeline which matches the planned York Region 16<sup>th</sup> Avenue corridor improvements. As the Region reaches Woodbine Avenue from the west, such intersection improvements can become very viable and beneficial. The portion of 16<sup>th</sup> Avenue which has been introduced to approximately Woodbine Avenue now has the ability to receive increased traffic flows.

#### *Strategic Introduction of Intersection Through Lanes*

The peak hour peak directional traffic flows have been examined in detail at each intersection. It is feasible to consider adding an additional through lane with a matching mirror merge lane beyond the intersection.

As an example in horizon year 2024 to assist PM peak hour traffic flows consideration can be given to adding a northbound through lane south of 16<sup>th</sup> Avenue with a mirror merge lane north of 16<sup>th</sup> Avenue at both the Warden Avenue and Kennedy Road intersections. Such a consideration is reasonable because north of 16<sup>th</sup> Avenue the existing northbound lanes have the capability of accommodating increased flows.

The eastbound and westbound directions of travel do not have that carrying capacity flexibility.

The strategic introduction of intersection through lanes has merit and should be further examined, especially when York Region defines the transportation system improvement time line for 16<sup>th</sup> Avenue and Kennedy Road. With this information further analyses can be conducted to analyze the continued development phasing.

#### *Immediate Strategic Intersection Improvements*

The ongoing analysis has identified several improvements that can be immediately introduced at the 16<sup>th</sup> Avenue and Kennedy Road intersection.

The strategic intersection improvements include:

- Increasing the length of the eastbound exclusive right turn lane;
- Increasing the length of the southbound exclusive right turn lane. (Extending southerly from Beckett Avenue);
- Extending the westbound exclusive right turn lane from Yorkton Boulevard easterly to Kennedy Road.

The analysis indicates that such lane modifications will assist existing background vehicle turning movements and reduce conflicts with eastbound and westbound through traffic flows. Such improvements not only benefit background traffic flows but also serve to provide better operating conditions for development traffic flows.

These strategic improvements are shown in Figure 2.

## **4. Evaluation of Existing Intersection Operations**

The 16<sup>th</sup> Avenue intersections with Warden Avenue and Kennedy Road have been analyzed and evaluated over several years by PC. These analyses have used the Synchro Software Program incorporating the default parameter setting of the program. The default settings are designed to provide a conservative analysis.

PC through monitoring efforts believes drivers utilizing 16<sup>th</sup> Avenue; Warden Avenue and Kennedy Road have learned to control and navigate their vehicles in an efficient manner.

This is evident by the analysis presented in Figure 3.

The Synchro Software program with default settings indicates that the intersections on average operate approximately 13% over capacity. In reality the observed vehicles have cleared the intersection in the peak hour examined, therefore the intersection could be close to or at capacity but not over capacity.

PC upon adjusting the saturation flow parameter can then allow the Synchro Software Program to replicate the observed operating condition.







### Sensitivity Analysis of Existing Saturation Flows

Intersections	Saturation Flow = 1950 vph		Saturation Flow = 2100 vph		Saturation Flow = 2200 vph	
	Base Saturation Flow		Base Saturation Flow increased by 8%		Base Saturation Flow increased by 13%	
	AM	PM	AM	PM	AM	PM
16th Ave. & Kennedy Rd.	E (57) 0.96 ebl- 0.88 wbt- 0.89 nbl- 0.98 sbt- 1.03 sbr- 0.97	D (53) 1.07 ebl- 0.99 ebt- 0.94 wbl- 1.18 nbt- 0.93	D (44) 0.88 all moves <1.0	D (44) 0.99 all moves <1.0 except wbl- 1.10	D (44) 0.84 all moves <1.0	D (44) 0.93 all moves <1.0 except wbl- 1.05
16th Ave. & Warden Ave.	E (56) 1.13 ebl- 0.88 wbl- 1.15 wbt- 0.91 nbl- 1.07 sbt- 1.03	E (62) 1.01 ebt- 1.12 nbt- 0.95 wbl- 0.99	D (46) 1.05 all moves <1.0 except wbl - 1.07	D (49) 0.94 all moves <1.0 except ebt- 1.03	D (43) 1.00 all moves <1.0 wbl - 1.02	D (44) 0.90 all moves <1.0

### Assessment

1. Examine the Existing Volume/Capacity Ratio versus Demand (Existing Intersection / individual Movement should be equal or less than 1.0).
2. Existing Saturation used in the initial Synchro Analysis is 1950 vehicles per hour per lane.
3. Sensitivity Analysis by increasing the saturation by 8% ( SAT = 2100 Vphpl to 13 % (2200 vphpl) results in the overall ratio below or at 1.0.

### Conclusion

**Based on the above assessment, it is found that an overall ratio of 1.13 represents a ratio that is reasonable to assess future horizon years.**

As noted in Figure 3 this parameter adjustment can be carried forward to evaluate future horizon year operating conditions. The inherent Synchro default analysis setting is overcome by recognizing that an intersection ratio of approximately 1.13 is acceptable and essentially replicating the existing operating conditions.

## 5. Analyzing 16<sup>th</sup> Avenue Intersections by Horizon Year

PC completed an extensive step wise analysis which is summarized in this section. The analyses completed examined existing road infrastructure, the inclusion of strategic intersection improvements and a range of phased development dwelling unit numbers.

The critical and governing components of this analysis included the following:

- The introduction of the collector road intersections:
  - On Kennedy Road (East Draft Plan);
  - 16<sup>th</sup> Avenue (West Draft Plan), and;
  - The strategic intersection improvements identified in Figure 2 are recommended to be in place prior to the occupancy of any dwelling unit;
- The sensitivity analysis conducted in horizon years 2021 and 2024 incorporated the following development dwelling unit numbers.
  - Horizon year 2021;
    - 500 dwelling units, and;
    - 800 dwelling units;
  - Horizon year 2024;
    - 800 dwelling units;
    - 900 dwelling units;
    - 1,000 dwelling units.
- The above bracketing of dwelling unit numbers was in effect derived from the step wise analysis undertaken. The step wise analysis was strongly influenced by the initial set of strategic intersection improvements (Figure 2) brought forward.

Although the 4134 16<sup>th</sup> Avenue Lands brought forth an initial development phasing strategy it is evident that travel demand factors, available roadway capacity and strategic intersection improvements provide a much more refined phasing plan.

## **6. Rationalizing the Most Effective Initial Development Phasing**

Respecting the performance of intersection operations led to this initial phasing plan.

Upon reviewing this analysis it can be concluded that the intersection operation methodology employed in combination with the strategic intersection improvements results in reasonable and acceptable operating conditions on 16th Avenue. The intersection levels of service and performance ratios are within the tolerances defined by the adjusted methodology.

The delta change between 2021 and 2041 is evident by comparing two rows. The row entitled “Year 2021 (Phase 1)” can be compared to the row entitled “Year 2024 (Phase 2). In these two rows the amount of subject land dwelling units has remained the same. The only difference is three year advancement to 2024. The implication of background traffic growth is evident in the 16<sup>th</sup> Avenue & Warden Avenue column.

The analysis demonstrates that a 1,000 dwelling unit total can be staged between now and 2021 / 2024.

This analysis has provided a framework and foundation for examining further development phases. The opportunity to include strategic and feasible intersection improvements has proven to be realistic and beneficial. Continuing with this approach incorporating updated data inputs can likely lead to further solution driven operational benefits for the arterial roads.

**Table 2 - Levels of Service Summary ( Only Peak Through Movement Presented )**

Development Staging	Number of Units Analyzed	16th Ave. & Kennedy Rd.		16th Ave. & Warden Ave.	
		AM	PM	AM	PM
Year 2021 (Phase 1)	Total : 500	E (77) 1.10 <i>sbt=1.03</i> <i>wbt-1.15</i>	E (80) 1.13  <i>ebt-1.10</i> <i>nbt-1.10</i>	E (80) 1.13 <i>sbt-1.03</i> <i>wbt-1.15</i>	E (72) 1.09  <i>ebt -1.09</i> <i>nbt-1.10</i>
Year 2021 (Phase 1)	Total : 800	E (78) 1.10 <i>sbt-1.05</i> <i>wbt-1.15</i>	E (82) 1.13  <i>ebt -1.10</i> <i>nbt-1.12</i>	F (86) 1.15 <i>sbt-1.05</i> <i>wbt-1.18</i>	E (78) 1.14  <i>ebt -1.12</i> <i>nbt-1.10</i>
Year 2024 (Phase 2)	Total : 800	F (81) 1.10 <i>sbt=1.05</i> <i>wbt-1.19</i>	F (86) 1.13  <i>ebt-1.15</i> <i>nbt-1.13</i>	F (97) 1.17 <i>sbt-1.09</i> <i>wbt-1.22</i>	F (88) 1.17  <i>ebt-1.16</i> <i>nbt- 1.16</i>
Year 2024 (Phase 2)	Total : 900	F (82) 1.11 <i>sbt=1.06</i> <i>wbt-1.19</i>	F (88) 1.14  <i>ebt-1.16</i> <i>nbt-1.14</i>	F (99) 1.17 <i>sbt-1.09</i> <i>wbt-1.23</i>	E (90) 1.17  <i>ebt-1.16</i> <i>nbt- 1.17</i>
Year 2024 (Phase 2)	Total : 1000	F (82) 1.11 <i>sbt=1.06</i> <i>wbt-1.19</i>	F (89) 1.15  <i>ebt-1.16</i> <i>nbt-1.14</i>	F (100) 1.17 <i>sbt-1.09</i> <i>wbt-1.24</i>	F (91) 1.21  <i>ebt-1.16</i> <i>nbt- 1.17</i>

## 7. Conclusions and Recommendations

This transportation analysis permits the following conclusions to be brought forward:

### *Intersection Operations Evaluation*

- The methodology brought forward to evaluate intersection performance is considered reasonable and can be applied towards the evaluation of intersection performance.

### *Roadway Network*

- The Region Of York is completing Environmental Assessment Studies to improve the 16<sup>th</sup> Avenue and Kennedy Road corridors;
- The timeline to implement these improvements will be known shortly but it is evident with their implementation that significant improved vehicle operations will be secured;
- In the interim years it is evident that strategic intersection improvements (along with monitoring and signal timing adjustments) can help to improve 16<sup>th</sup> Avenue vehicle operations. In addition;
- As the timing for 16<sup>th</sup> Avenue corridor improvements becomes known, it is evident that further intersection improvements (Warden Avenue and Kennedy Road) can be considered. There is a improvement synergy that can be secured by relating to the planned timelines for the planned EA road improvements;

### *Data Collection and Monitoring*

- It is evident that continued analysis will be dependent upon securing updated traffic flow information on the arterial roads. In addition;
  - Travel demands can be continually monitored to see the influence of expanded transit and active transportation up take not only on the adjacent corridors but throughout Markham;
  - Monitoring the pace of background traffic growth by reviewing the schedules of anticipated area development

The subject lands development phasing plans will be subject to further detailed traffic / transportation / mobility assessments. These assessments will incorporate the above considerations and permit an accurate definition of staged development with associated transportation improvements and travel demand up dates.

This transportation analysis permits the following recommendations to be brought forward. It is recommended that:

- That York Region and The Sixteenth Land Holdings Inc. group work together to secure the immediate strategic intersection improvements shown in Figure 2;
- The east and west draft plans must each secure direct collector road connections to the bounding arterial road. In the case of the East Draft Plan, this is Kennedy Road. In the case of the west draft plan this is 16<sup>th</sup> Avenue. In turn;
- The strategic intersection improvements shown in Figure 2 are recommended prior to occupancy of any dwelling units in either East or West Draft Plans;
- The analysis indicates that 1,000 dwelling units can be supported with reasonably acceptable intersection operating conditions. This can be secured prior to the construction of the internal collector road (Street “A”) bridge crossing and / or prior to the planned 16<sup>th</sup> Avenue improvements;
- The intersection of 16<sup>th</sup> Avenue and Warden Avenue continue to be evaluated to determine if the introduction of a northbound through lane is reasonable and beneficial;
- Additional phasing (dwelling units) may be considered, subject to further analysis incorporating updated monitoring information and potential infrastructure improvements;

The above are considered in the drafting of conditions to permit the draft plans to proceed.