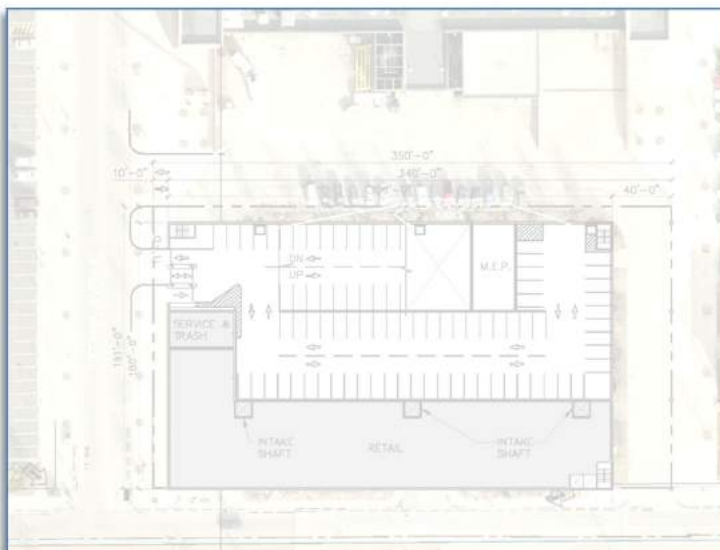
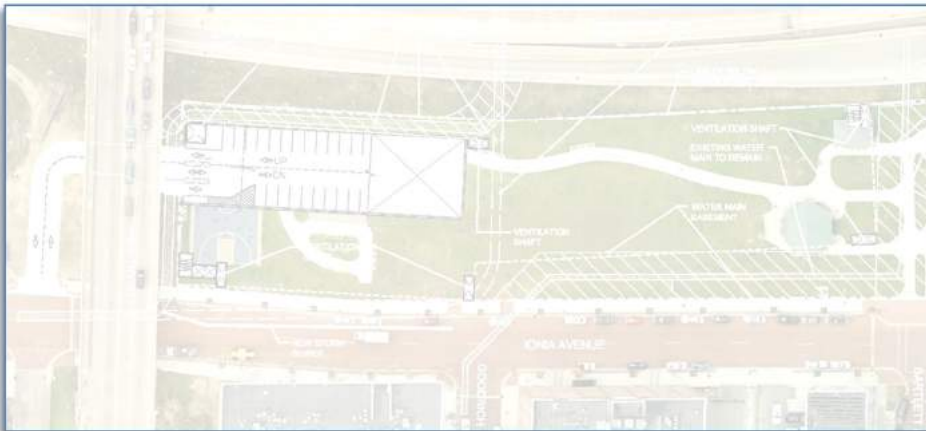
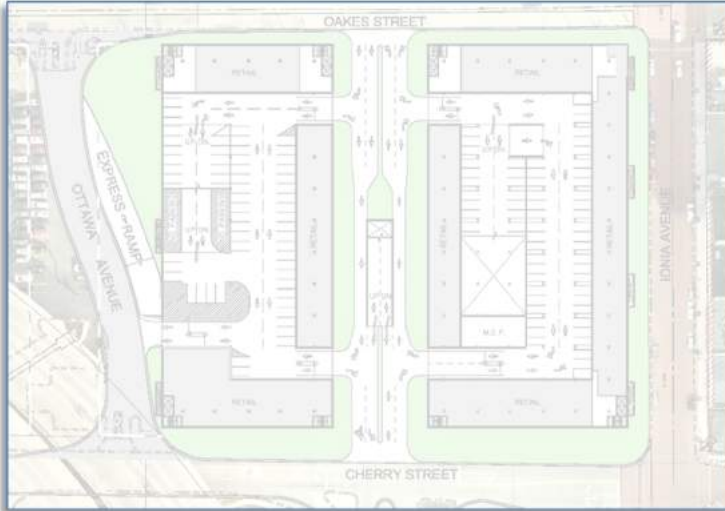


Arena South Underground Parking Capacity/Feasibility Study



SUBMITTED BY:

Carl Walker, Inc.
5136 Lovers Lane, Suite 200
Kalamazoo, MI 49002

September 30, 2014

Table of Contents

1.0	INTRODUCTION / EXECUTIVE SUMMARY
1.1	Arena South Visioning Plan
1.2	Study Purpose & Goals
2.0	UNDERGROUND PARKING SITES
2.1	Current Parking & City Preferences
2.2	Area 2
2.3	Areas 4 & 5
2.4	Heartside Park
3.0	BUILDING CODE CONSIDERATIONS
3.1	Key Code Considerations
3.2	Impact on Underground Parking
3.3	Accommodating Code Requirements & Addressing Safety
4.0	GEOTECHNICAL CONSIDERATIONS
4.1	Available Information
4.2	Potential Impact on Parking Structure
4.3	Recommendations for Additional Investigation
5.0	UTILITY CONSIDERATIONS
5.1	Available Information
5.2	Potential Impact on Parking Structure
5.3	Recommendations for Additional Investigation
6.0	TRAFFIC CONSIDERATIONS
6.1	Available Information
6.2	Potential Impact on Traffic
6.3	Recommendations for Additional Investigation
7.0	KNOWN FUTURE DEVELOPMENTS

8.0 DESIGN CONSIDERATIONS / CONCEPT DEVELOPMENT

- 8.1 Geotechnical Considerations
- 8.2 Structural Considerations
- 8.3 Parking Structure Considerations
- 8.4 Underground Parking Structure Enhancements
- 8.5 Above Grade Development Considerations

9.0 PARKING STRUCTURE CONCEPTS

- 9.1 Area 2 Parking Structure Concept
- 9.2 Area 4 & Area 5 Parking Structure Concept
- 9.3 Heartside Park Parking Structure Concept
- 9.4 Additional Considerations

10.0 CONCEPTUAL CONSTRUCTION COST ESTIMATES

- 10.1 Primary Assumptions
- 10.2 Conceptual Cost Estimates

11.0 PROJECT SCHEDULE

- 11.1 Planning and Design
- 11.2 Construction

12.0 CONCEPT DRAWINGS

- 12.1 Area 2 Concept
- 12.2 Area 4 & 5 Concept
- 12.3 Heartside Concept

APPENDICES

Appendix A – Concept Drawings

Appendix B - Example Underground Parking Photographs

vehicular parking.” Therefore, the city commissioned this study to evaluate the feasibility of underground parking in potential development areas controlled by the city, including Area 2, Area 4, Area 5, and Heartside Park. This study has confirmed that underground parking is feasible at each of these sites.

1.2 Study Purpose & Objectives

When purchasing land for the development of Van Andel Arena, the Downtown Development

Authority also purchased adjacent sites for future development. While the sites were converted to temporary surface parking lots for a number of years, continued development in the Arena South District is creating the opportunity for higher and better uses.

Underground parking structures have become more common as land values in urban areas rise, and as communities encourage mixed-use developments that incorporate parking beneath the primary development use – office, residential, or retail. As stated in the project *Request for Proposal*:

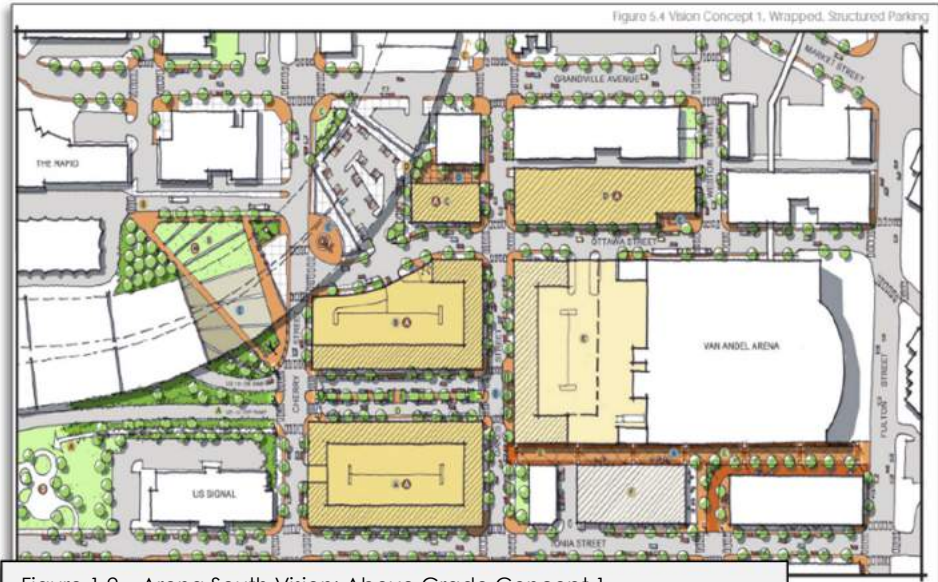


Figure 1.2 – Arena South Vision: Above Grade Concept 1



Figure 1.3 – Arena South Vision: Above Grade Concept 2

"The Downtown Development Authority (DDA), in cooperation with City's Parking and Planning Departments is requesting a study to determine the capacity, feasibility and costs associated with underground parking in the Arena South area. The focus of the study is Area 2, 4, 5, Heartside Park and the public right-of-way adjacent to these areas."

"For each area, Heartside Park and the contiguous right-of-ways, provide a report on findings of the data gathering, the number of underground spaces at each location and the cost per square foot or per space."

The primary purpose of this study is to evaluate the number of underground parking spaces that can be reasonably constructed in Area 2, Area 4, Area 5, and Heartside Park; and to provide a preliminary estimate of project related costs. Multiple variations of development on these sites have not been studied; however, above grade parking concepts based on the *Arena South Visioning Plan Concept 1* and *Concept 2* have been developed.

Arena South Visioning Plan Concept 1:

- Pedestrian emphasis on Cherry, Oakes, and Ionia Streets.
- Ottawa Street extension between Oakes and Cherry Streets.
- BR131 converted to a city boulevard with pedestrian emphasis and landscaped median.
- Separate Area 4 and Area 5 two-bay above grade parking structures with wrapped retail/residential construction.
- A two-bay Area 2 above grade parking structure with wrapped retail/residential.

Arena South Visioning Plan Concept 2:

- Pedestrian emphasis on Cherry, Oakes, and Ionia Streets.
- Ottawa Street extension between Oakes and Cherry Streets.
- Elimination of BR131.
- A two-bay Area 4 above grade parking structure with wrapped retail/residential.
- Two separate multi-story mixed use buildings along Ionia Street.
- Pedestrian Plaza & Corridor
 - Large plaza between buildings.
 - Landscaped pedestrian corridor between Cherry Street and Fulton Street.
- A two-bay Area 2 above grade parking structure with wrapped retail/residential.

1.3 Parking Concepts and Preliminary Construction Costs

The concepts developed for this report are summarized in Section 9, and drawings are included in Section 12. The basis for these concepts and their projected construction costs are provided within this report.

The table provided in Figure 1.4 summarizes the anticipated parking capacity for each site, along with projected construction costs.

- A. The underground parking structure concepts at each site include three (3) levels below grade (lowest level at approximately 38 ft. below grade).
 - a. An additional underground level has also been included for each site (Level P4 – approximately 49 ft. below grade).
- B. Residential/commercial development is anticipated to be above, and supported by the underground parking structure.
 - a. The underground parking concepts are based on short-span construction (Figure 8.1), providing the most flexibility for above grade development. This also provides a conservative estimate of parking capacity.
 - b. We recommend that long span construction (~60 ft.), or semi long span construction (~45 + 15 ft.) be utilized in the design. This framing will increase parking capacity and improve user comfort.
 - c. Floor-to-floor heights are based on long-span construction.
- C. The above grade parking structure concepts at Area 2, Area 4, and Area 5 include five (5) levels, wrapped with residential/commercial construction.
 - a. Wrapped residential is assumed to be 45 ft. to 60 ft. wide.
 - b. There are numerous development and associated parking options available, and the parking capacity identified is intended to provide an order of magnitude of available parking.
- D. If the site is to include both above grade and below grade parking, structural framing will require coordination to provide an efficient, balanced design. The construction costs shown consider the above grade and below grade structures separately.
- E. Traditional underground parking structures can be intimidating. To promote a sense of safety and security, design features may include enhancements such as open stairways, glass-backed elevators, high ceiling heights, structural bracing in lieu of shear walls, stained ceilings, and daylighting provisions (Refer to Section 8.4).

Arena South Underground Parking Feasibility - Conceptual Cost Summary									
February 6, 2014									
Arena South Construction Cost Summary DRAFT		AREA 2		Area 4 & 5			Heartside Park		
Three (3) Level Underground	No. of Parking Levels	Underground Parking Structure	Above Grade Parking Structure (Wrapped)	Underground Parking Structure	Above Grade Parking (Vision Concept 1)	Above Grade Parking (Vision Concept 2)	North Underground Parking Structure	South Underground Parking Structure	
	No. of Spaces	Three (3) - P1, P2, P3	5 - L1, L2, L3, L4, L5	Three (3) - P1, P2, P3	Five (5) - L1 thru L5	5 - L1, L2, L3, L4, L5	Three (3) - P1, P2, P3	5 - L1, L2, L3, L4, L5	
	Street Level "Cap" Parking Levels		NA	\$11,277,000	NA	NA	\$2,223,000	\$7,004,000	
	Construction Cost Total	\$3,176,000	\$9,950,000	\$52,273,000	\$20,750,000	\$10,600,000	\$11,702,000	\$21,246,000	
	Soft Costs (25%)	\$21,099,000	\$9,950,000	\$63,550,000	\$20,750,000	\$10,600,000	\$13,925,000	\$28,250,000	
Four (4) Level Underground	Estimated Project Budget Cost per Space	\$6,068,750	\$2,488,000	\$15,887,500	\$5,188,000	\$2,650,000	\$3,481,000	\$7,063,000	
		\$30,343,750	\$12,438,000	\$79,437,500	\$25,938,000	\$13,250,000	\$17,406,000	\$35,313,000	
		\$58,100	\$28,900	\$68,900	\$30,100	\$29,100	\$56,100	\$86,400	
	No. of Parking Levels	Four (4) - P1, P2, P3, P4		Four (4) - P1, P2, P3, P4			Four (4) - P1, P2, P3, P4	Four (4) - P1, P2, P3, P4	
	Street Level "Cap" Parking Levels	694		1569			409	710	
Construction Costs	Construction Cost Total	\$3,176,000		\$11,277,000			\$2,223,000	\$7,004,000	
	Soft Costs (25%)	\$30,524,000		\$76,573,000			\$17,022,000	\$30,811,000	
		\$33,700,000		\$87,850,000			\$19,245,000	\$37,815,000	
		\$8,425,000		\$21,963,000			\$4,811,000	\$9,454,000	
	Estimated Project Budget Cost per Space	\$42,125,000		\$109,813,000			\$24,056,000	\$47,269,000	
		\$60,700		\$70,000			\$58,800	\$66,600	

Figure 1.4 – Parking Capacities and Conceptual Cost Summary.

Construction Costs

25% Soft Costs Included (AE fees/Testing/10% Contingency)

Utilities Included

Ottawa Extension Excluded

Foundations for Development Excluded

Underground Concept Includes "Cap" Costs

Above Grade and Below Grade Considered Separately

1.4 Potential Economic Impact

Although the costs to build an underground parking structure are substantial, the potential economic benefits must be considered when evaluating these types of projects. Removing parking from the street level will dramatically improve the pedestrian experience. Furthermore, moving parking underground will help to maximize the available development area, which can provide significant benefits to the City of Grand Rapids and other public entities, such as the Grand Rapids Public Schools.

As an example, the three (3) level underground parking structure below Areas 4 & 5 accommodates approximately 1,153 parking spaces. Built above ground, this structure would require a floor area of approximately 380,000 sf. If this space were utilized for commercial purposes, the economic impact could be substantial.

To highlight some of the potential economic impacts, DDA staff considered a 380,000 sf, 300 to 350 unit residential development built in the Arena South area. The potential impacts include the creation of 1,100 new jobs, and the ability to generate \$4 to \$5 million in tax revenue annually. If the projections are carried out over a 40 year period, the significance of the benefits is even more impactful as shown in Figure 1.5.

Potential Economic Impacts: 380,000 sf Residential Development	
Development Size (Square Footage)	380,000
New Construction Activity (@\$200/s.f.)	\$76,000,000
Leasable Square Footage (80% - 90% of development)	300,000 - 350,000
Jobs (1 job/450 s.f. of retail: 1 job / 300 s.f. of office space)	650 - 1,100 jobs
Multi-Family Housing Units (1 unit/1,000 s.f.)	300 - 350 units
New Residents (1.5 people /unit)	450 - 525 residents
Annual Consumer Spending Impact (\$24,000/resident)	\$10,800,000 - \$12,600,000
40 Year Consumer Spending Impact (1ith 2% annual increase)	\$650,000,000 - \$761,000,000
Annual Tax Generation (Property & Income)	\$4,000,000 - \$5,000,000
40 Year Tax Generation (with 2% annual increase)	\$242,000,000 - \$302,000,000
TOTAL POTENTIAL ECONOMIC IMPACT (Consumer Spending + Tax Generation)	\$892 Million - \$1.63 Billion

Figure 1.5 – Potential Economic Impacts (prepared by DDA Staff)

2.0 UNDERGROUND PARKING SITES

Four (4) Arena South sites have been reviewed for underground parking: Area 2, Area 4, Area 5, and Heartside Park (Figure 2.1).

2.1 Current Parking & City Preferences

- A. The existing parking Areas 2, 4, and 5 are managed by the City's Parking Services Department.
- B. Access gates in the parking lots are down (engaged) 24 hours per day, 7 days a week.
- C. Parking lots are staffed for Arena events, with pay upon entry. During all other times the lots are not staffed, and pay-on-entry equipment is utilized.
- D. Parking Services preferences for parking in the area include:
 - a. A minimum of 1,500 new parking spaces (net add to the area).
 - b. Automated, pay-in-lane revenue collection. Staffed, pay-on-entry for event parking.
 - c. It is important to have sufficient ramping capacity, lane capacity, and roadway capacity to avoid vehicle back-up during entry and to empty the parking structures quickly.
 - d. Emphasis on security, including street facing stair towers for above grade construction.
 - e. Heartside Park parking would primarily accommodate residential and commercial development to the east of the park; and possibly overflow event parking.
 - f. Area 2, 4 and 5 parking would primarily accommodate downtown parking, Arena South residential and commercial development parking, and event parking.
 - g. Parking to be provided for monthly permit holders, transient parking (including evening entertainment), and event parking.

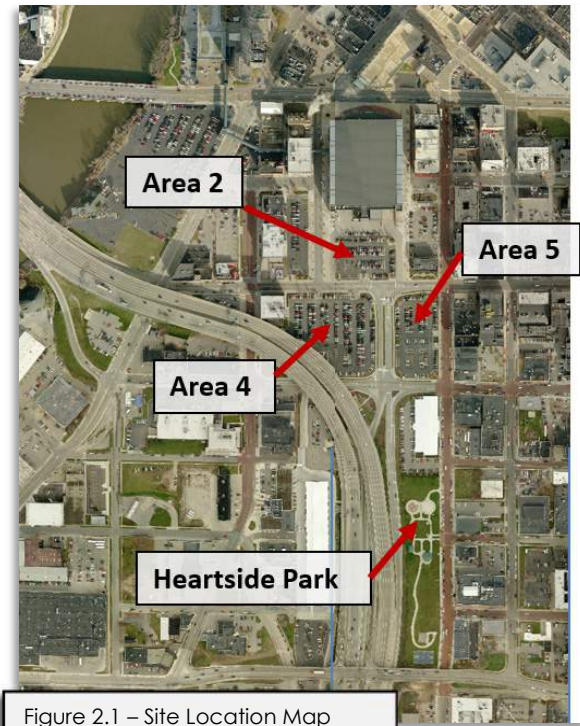


Figure 2.1 – Site Location Map

2.2 Area 2

- A. Area 2 is jointly owned by the City of Grand Rapids and Kent County, and managed by the Convention / Arena Authority (CAA).
- B. The CAA is currently evaluating an above grade parking structure in the Area 2 surface parking lot. Information regarding these plans was not available to our team.
- C. Site information, including a site survey was not available to our team. Property lines shown in Figure 2.2 are based on aerial photographs.
- D. Underground utilities do not impact the underground parking concepts (refer also to Section 5).
- E. The Figure 2.2.1 photograph is a view north, with Area 2 in the upper right, south of the Arena. Area 4 is in the foreground. Oakes Street is running east-west, north of Area 4.



Figure 2.2 – Area 2 Site Property Lines



Figure 2.2.1 – View North: Area 2 in upper right; Area 4 in foreground

- F. The Area 2 site dimensions (property line to property line) are approximately 350 ft. in the east-west direction by 191 ft. in the north-south direction.
- G. The Arena loading dock area is currently accessed from two (2) curb cuts at Oakes Street.
- H. The existing surface parking lot provides parking for approximately 146 cars. Vehicle access is from Oakes Street.
- I. The north-south pedestrian corridor along the east side of the Arena, between Fulton and Oakes Streets, is an important Arena South feature and is to be maintained; and perhaps enhanced (Refer to Vision Plan Concepts).
- J. An east-west pedestrian route is provided from Ottawa Street to the north-south pedestrian corridor running along the east side of the Arena.
- K. A residential/Office development is currently being planned for the Area 1 surface lot, located across Ottawa Street.

2.3 Areas 4 & 5

- A. Area 4 and Area 5 property lines are based on survey information provided by the City. Property lines shown below in Figure 2.3.



Figure 2.3 – Areas 4 & 5 Site Property Lines

B. The Figure 2.3.1 photograph is a view east, with Area 4 in the foreground and Area 5 at the top of the photograph. BR131 separates Areas 4 and 5.

C. This study has assumed the Ottawa Street extension between Oakes and Cherry Streets; and the elimination of the MDOT right-of-way for BR131 (vacated BR131).

a. The underground parking extends below the vacated BR131 (there are no utilities below the existing roadway).

b. Area 4 and Area 5 sites have been studied separately for above grade parking.

D. The Ottawa Extension assumes a 66 ft. ROW; and is based on a previous FTCH/City of Grand Rapids study (Figure 2.4).

E. The combined Area 4/5 assumes the connection of the south and north property lines across the MDOT ROW (BR131). Figure 2.5.

F. Underground utilities do not significantly impact the underground parking concepts for Areas 4 and 5 (refer also to Section 5).



Figure 2.3.1 – View East: Area 4 in foreground; Area 5 at top of photo, east of BR131



Figure 2.4 – FTCH/CITY Ottawa Street Extension Plan

G. The Area 4 area west of and below the Ottawa extension has not been considered for underground parking.

H. The existing Area 4 surface parking lot provides parking for approximately 422 cars. Vehicle access is from Oakes Street.

I. The existing Area 5 surface parking lot provides parking for approximately 163 cars. Vehicle access is from Ionia.



Figure 2.5 – Combined Areas 4 & 5 Site Property

2.4 Heartside Park

A. Property lines are based on the legal descriptions provided by the City (Figure 2.6). A property survey is not available.

B. The parking Lot to the north is privately owned.

C. The Figure 2.6.1 photograph is a view southeast, with the north end of Heartside Park shown in the upper right of the photograph. US131 exit ramp is shown in the foreground.

D. Only below grade parking has been considered for this site; with a park at street level.

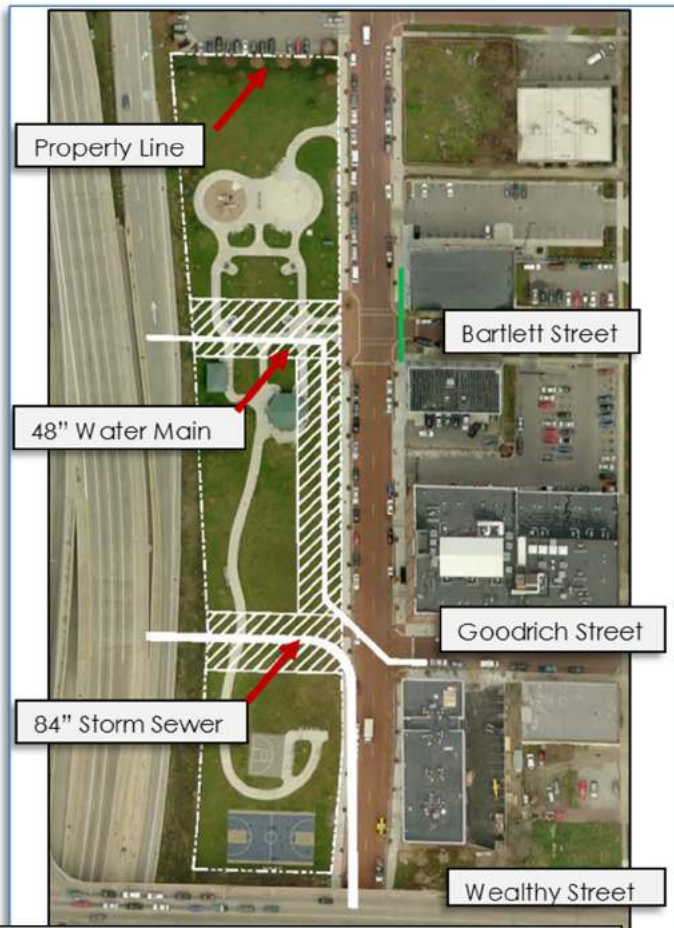


Figure 2.6 – Heartside Park Site Property Lines

- E. Underground utilities significantly impact the underground parking concepts (refer to Section 5 and Figure 2.6).
- a. Site is limited by existing utilities and utility easements.
 - b. 60 ft. easements at Bartlett Street and Goodrich Street; and a 44 ft. easement between Goodrich and Bartlett.
 - c. 48 inch water main crosses property thru Bartlett easement.
 - d. 84 inch storm sewer crosses property thru Goodrich easement.



Figure 2.6.1 – View Southeast: Heartside Park in the upper right corner; US131 in the foreground.

3.0 BUILDING CODE CONSIDERATIONS

Building code life safety requirements, structural requirements, and personal safety requirements often conflict when designing underground parking structures. Personal safety requires an open design, with minimal visual obstructions. In above grade structures, this is often accomplished with open stairs (with exterior glass enclosures), glass backed elevators, long-span construction, and open framing to resist lateral loads (wind and seismic).

3.1 Key Code Considerations

Above grade parking structures can often be code classified as “open structures”. This code classification generally eliminates the need for mechanical ventilation and fire sprinkler systems; and eliminates the code requirement for fire rated, enclosed stair and elevator cores. Most underground parking structures cannot be classified as “open”, and require fire rated elevator and stair cores, mechanical ventilation, and fire sprinkler systems.

3.2 Impact on Underground Parking

Fire rated elevator and stair cores are typically accomplished with solid masonry or concrete enclosures. Furthermore, mechanical ventilation and fire sprinkler systems are typically required in underground parking structure.

These requirements will increase construction cost.

Perhaps more importantly, the code requirements for underground parking can significantly reduce pedestrian line-of-sight within the parking areas, and eliminate the opportunity to observe conditions in stairs/elevators prior to entering; dramatically increasing user apprehension.

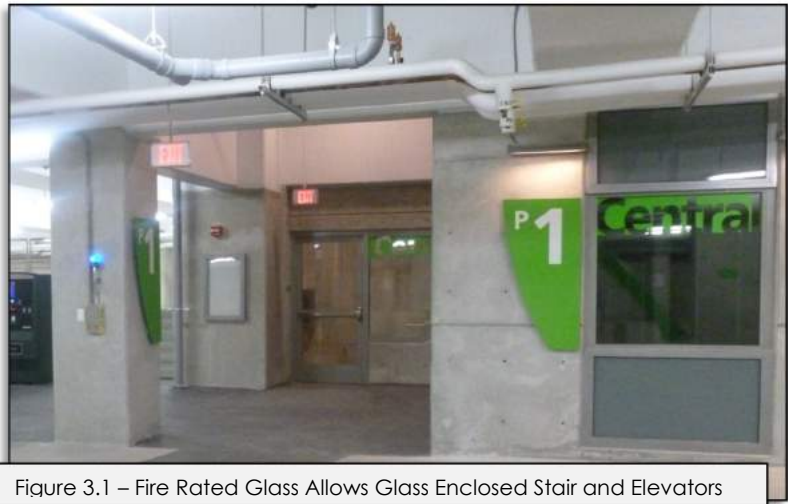


Figure 3.1 – Fire Rated Glass Allows Glass Enclosed Stair and Elevators

3.3 Accommodating Code Requirements & Addressing Safety

Underground public parking facilities require greater attention to safety. Traditional underground parking structures can be intimidating. Enclosed stair towers, enclosed elevators, structural elements reducing visibility, artificial lighting, and the lack of visual landmarks to guide pedestrians to their destinations can often make the parking experience uncomfortable. Furthermore, accommodating non-traditional parking structure uses such as buildings, plaza/parks, or roadways constructed above and supported on the structure may limit design flexibility.

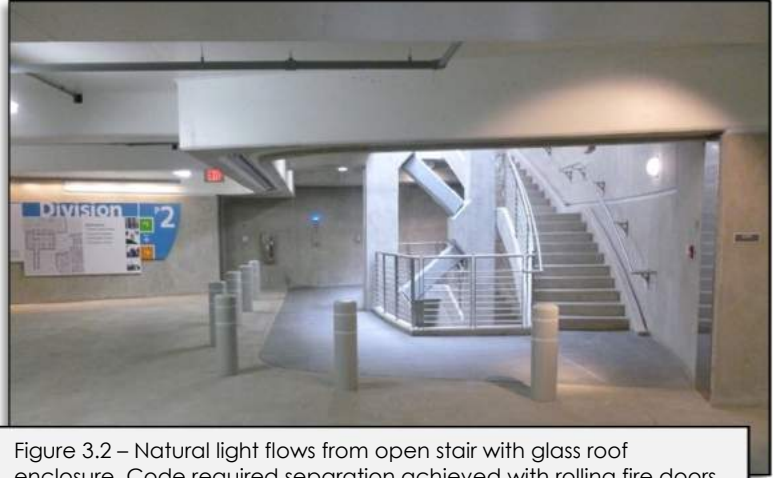


Figure 3.2 – Natural light flows from open stair with glass roof enclosure. Code required separation achieved with rolling fire doors.

To promote a sense of safety and security, while meeting life safety code requirements, key design features should include the use of fire rated glass for glass backed elevators and glass enclosed stairs. Section 8.4 provides a summary of additional enhancements recommended for consideration.

4.0 GEOTECHNICAL CONSIDERATIONS

4.1 Available Information

- A. MTC assembled geotechnical data from previous downtown geotechnical studies. Data sources included:

- Van Andel Arena (V0255)
- WMU – Cherry Street (99081)
- Commerce / Cherry Parking Ramp (061228)
- Ionia Avenue Reconstruction (031053)
- S-Curve (Z0697)
- Urban Market (111030)
- Gus Lot 7 (V0406)
- Charley's Crab (071273)

- B. MTC has summarized the underground conditions below each site based on available data. This preliminary information has been used to help assess the impact of subsurface conditions on the construction of underground parking; including the potential depth of construction, requirements for foundation/wall design, impact of ground water, and cost of construction.

 Materials Testing Consultants, INC. MATERIALS Engineers, Independent TESTING Laboratories, Geotechnical & Environmental CONSULTANTS — Since 1968			
Corporate Office 663 Plymouth Ave. NE • Grand Rapids, MI 49505 • (616) 456-5469 • FAX (616) 456-5784 Southeast Michigan 4721 Runway Blvd. • Ann Arbor, MI 48106 • (800) 968-6378 • (734) 619-6868 www.mtc-test.com			
Grand Rapids Arena South Underground Parking Study December 11, 2013 Geotechnical Considerations			
Site	Groundwater	Excavation/TERS	Foundations
Area 2	12 to 15 ft below street level.	Maintain ingress/egress to VanAndel Arena. Commercial building on the east side. Commercial building planned for west side.	Medium dense sand, highly weathered shale. Spread footing bearing pressure 4 to 6 ksf+/-.
	Wet coarse sand with occasional gravel to 40 ft deep.	City utilities on west and south sides.	
	Large volumes of groundwater control needed during and after construction.	Cobble and boulder obstructions.	100 to 200 ton micropiles. Also provides protection from solution activity.
	Footing and floor underdrains, pressure relief valves.	3 rows of wales/tie-backs, tie-backs 40 to 50 ft in length.	
Area 4/5	8 to 11 ft below street level.	Relatively open space on south, west and north sides. Commercial property to the east.	Very stiff to hard clay, weathered shale, medium dense sand. Spread footing bearing pressure 4 to 8 ksf+/-.
	More clay, less groundwater volume expected on south side of the site.	City utilities Ionia, Oakes and future Ottawa extension.	
		Protect S-Curve pier footings, coordinate plans with MDOT.	
		3 rows of wales/tie-backs, tie-backs 40 to 50 ft in length.	100 to 200 ton micropiles. Also provides protection from solution activity.
Heartside	8 to 16 ft below street level.	TERS required along US-131 off ramp.	Medium dense sand, highly weathered shale. Spread footing bearing pressure 4 to 6 ksf+/-.
	Peat thickness of 10 to 16 ft south of Bartlett.	Peat presents capacity problems for first possibly second row of tie-backs.	
	Likely water bearing sand immediately below peat.	Large diameter storm and sanitary sewer present in Goodrich and Bartlett alignments also utilities along Ionia.	
	Lowest expected volumes of groundwater compared to other two sites.	Tie-backs in MDOT ROW, coordination needed.	100 to 200 ton micropiles. Also provides protection from solution activity.
	Possible contaminates in groundwater.	Possible contaminates in peat.	

Figure 4.1 – MTC Geotechnical Conditions Summary

- C. Parking structure depth assumptions (3 level below grade structure is base assumption):
- a. Level B1 – 15 ft. floor-to-floor
 - b. Level B2 – 11'-4" floor-to-floor (26 ft.)
 - c. Level B3 – 11'-4" floor-to-floor (38 ft.)
 - d. Level B4 – 11'-4" floor-to-floor (49 ft.)
- D. Below grade conditions are summarized in Figure 4.1. Primary conditions are as follows:
- a. Area 2
 - 1) Ground Water – 12 to 15 ft. below street level
 - 2) Urban Fill – 9 to 13 ft. below street level
 - 3) Bedrock – 35 to 50 ft. below street level
 - 4) Cobblestone and boulder obstructions to be anticipated.
 - 5) Spread Footing Bearing Capacity at Bedrock: 8 to 10 ksf
 - 6) Micropile Capacity: 100 to 200 Tons
 - b. Area 4 & 5
 - 1) Ground Water – 8 to 11 ft. below street level
 - 2) Urban Fill – ~10 ft. below street level
 - 3) Bedrock – ~45 ft. below street level
 - 4) Cobblestone and boulder obstructions to be anticipated.
 - 5) Spread Footing Bearing Capacity at Bedrock: 8 to 12 ksf
 - 6) Micropile Capacity: 100 to 200 Tons
 - c. Heartside
 - 1) Ground Water – 8 to 16 ft. below street level
 - 2) Urban Fill – 3 to 12 ft. below street level
 - 3) Peat – 10 to 16 ft. below street level (highly compressible, low strength)
 - 4) Bedrock – 50 to 60 ft. below street level
 - 5) Cobblestone and boulder obstructions to be anticipated.
 - 6) Spread Footing Bearing Capacity at Bedrock: 8 to 10 ksf
 - 7) Micropile Capacity: 100 to 200 Tons
- E. The weathered shale bedrock is relatively soft and can generally be excavated with standard equipment.

4.2 Potential Impact on Parking Structure

- A. Due to below grade water conditions, water cut-off walls are recommended for more than 1 to 2 below grade parking levels.
 - a. A slurry diaphragm wall or secant auger cast wall system socketed into bedrock would likely be recommended.
 - b. This wall system can be designed for temporary or permanent soil retention.
- B. It is anticipated that a permanent dewatering system is not desirable, and a "Bath Tub" design would be recommended to provide permanent water protection.
 - a. Hydrostatic loads could be resisted with MAT foundation; potentially anchored to the bedrock with rock anchors. A waterproofing membrane would be installed below this slab.
 - b. A waterproofing membrane system would likely be recommended at the backside of the exterior wall system. If the excavation wall system is designed as the permanent earth retention system, then a drainage system would be required.
- C. Temporary tie-backs below adjacent properties will likely provide the most economical earth retention system.
- D. The City will require further investigation to confirm that below grade construction does not create water "back-flow" problems in other areas. MTC believes that this is not a problem, and could be confirmed with further investigation.

4.3 Recommendations for Additional Investigation

- A. Soils at the Heartside site include low strength peat. The impact on the earth retention system tie-backs will require additional evaluation.
- B. A preliminary geotechnical investigation consisting of two test borings drilled 10 ft. minimum into bedrock should be completed at the selected site to further define the geotechnical properties/considerations during schematic design supplemented by a final geotechnical investigation during the design phase of the parking structure.
- C. Investigation to confirm that below grade construction will not create water "back-flow" in other areas.

5.0 UTILITY CONSIDERATIONS

5.1 Available Information

- A. The existing public and private utilities in the Arena Area were identified and evaluated with previous studies. Proposed utility upgrades required to provide service to Areas 2, 4, and 5, also have been identified.
- B. Available information includes:
 - a. Proposed Arena Area Utility and Road Improvements Report – August 2006 (FTC&H)
 - b. Historical record drawings for street and parking improvements.
 - c. City sewer and water atlas maps.
 - d. Current topographic surveys of Areas 4 & 5, Oakes Street & Ionia Avenue

5.2 Potential Impact on Parking Structure

- A. Area 2
 - a. No public or private utilities cross the site.
 - b. All public and private utilities are available to the site except for sanitary sewer and steam.
 - c. Required Improvements: Sanitary sewer must be extended south on Ottawa Avenue from Weston to Oakes Street to serve the site. The City of Grand Rapids intends to complete this work with the planned Ottawa Avenue extension project.
- B. Area 4
 - a. A 20" transmission water main, 30" storm sewer, and city duct bank (twelve, 4" conduits) cross the site from north to south between Cherry and Oakes Streets. The water main and duct bank are within the proposed Ottawa Avenue extension right-of-way and do not conflict with proposed development. The existing 30" storm sewer requires relocation to the Ottawa Avenue extension right-of-way prior to development.
 - b. All public and private utilities are available to the site except for sanitary sewer and steam.
 - c. Required Improvements: Sanitary sewer must be extended south on Ottawa

Avenue from Weston to Oakes Street to serve the site. The City of Grand Rapids intends to complete this work with the plans Ottawa Avenue extension project.

C. Area 5

- a. No public or private utilities cross the site.
- b. All public and private utilities are available either from Ionia Avenue or Oakes Street.
- c. No utility upgrades are required to serve the site.

D. BR-131

- a. A City duct bank (four, 4" conduits) exists under the west sidewalk. There are no other utilities in BR-131.
- b. Required Improvements: The wiring in the conduits will require relocation to the duct bank in the proposed Ottawa Avenue extension right-of-way prior to abandonment of the duct bank. The cost for this work is minimal.

E. Heartside

- a. A 48" transmission water main, 84" storm sewer, and several small sanitary sewers cross the site from east to west in vacated Goodrich and Bartlett Street right-of-ways. The transmission water main and 84" storm sewer significantly limit the use of site for underground parking. See Figure 2.6.
- b. Both the 48" transmission water main and 84" storm sewer can be relocated but at considerable expense. Relocation of the 84" storm sewer is the more feasible of the two and has been assumed for the alternative evaluation presented in this report. See Figure 9.10.
- c. All public and private utilities are available to the site except for steam.
- d. Required Improvements: Relocate 84" sanitary sewer south from vacated Goodrich Street right-of-way to just north of Wealthy Street and abandon 12" sanitary sewer in vacated Goodrich Street.

5.3 Recommendations for Additional Investigation

- A. No additional investigation is required at this point.

6.0 TRAFFIC CONSIDERATIONS

6.1 Available Information

- A. The City of Grand Rapids Traffic Safety Department provided the following information:
- Average Daily Traffic (ADT) on the following roads:
 - Market Avenue
 - US-131 BR
 - Division Avenue
 - Fulton Street
 - Oakes Street
 - Cherry Street
 - Ionia Avenue
 - Synchro network with AM Peak, Mid-Day Peak, and PM Peak Hour counts at the following intersections:
 - Market Avenue / Oakes Street
 - Market Avenue / Cherry Street
 - US-131 BR / Oakes Street
 - US-131 BR / Cherry Street
 - Division Avenue / Oakes Street
 - Division Avenue / Cherry Street
 - Fulton Street / Ionia Avenue
 - Crash data at the following intersections:
 - US-131 BR / Oakes Street
 - US-131 BR / Cherry Street
 - Parsons Brinckerhoff Michigan Special Event Analysis

Intersection	AM Peak Hour		Mid-Day Peak Hour		PM Peak Hour	
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Market Avenue / Oakes Street	8.9	A	15.1	B	25.1	C
Market Avenue / Cherry Street	46.2	D	19.1	B	60.4	E
US-131 BR / Oakes Street	11.5	B	10.2	B	25.8	C
US-131 BR / Cherry Street	15.7	B	13.5	B	12.2	B
Division Avenue / Oakes Street	8.3	A	7.2	A	7.4	A
Division Avenue / Cherry Street	20.5	C	21.5	C	25.3	C
Fulton Street / Ionia Avenue	21.4	C	4.6	A	9.8	A

Figure 6.1 – Existing Level of Service at Signalized Intersections

- B. The table provided in Figure 6.1 summarizes the existing Level of Service (LOS) at the signalized intersections in the area of the Van Andel Arena given the Synchro models provided.
- All intersections identified operate with a decent LOS; the only exception is Market Ave/Cherry Street intersection during the PM peak period.
 - The two intersections within the study limits (Cherry Street/US-131 & Oakes Street/US-131) that have been previously reviewed for crashes were found to have no correctable crash patterns.

6.2 Traffic Considerations

- A. Cherry Street, Oakes Street, and Ionia Streets are to be pedestrian friendly. Vehicle entry/exit lane quantity, width, and location must consider pedestrians along street sidewalk.
- B. Anticipated maximum additional parking at the sites has been estimated: over 850 spaces at Area 2 Site; over 1,600 additional spaces at Areas 4/5 Site; and over 850 below grade spaces at the Heartside site.

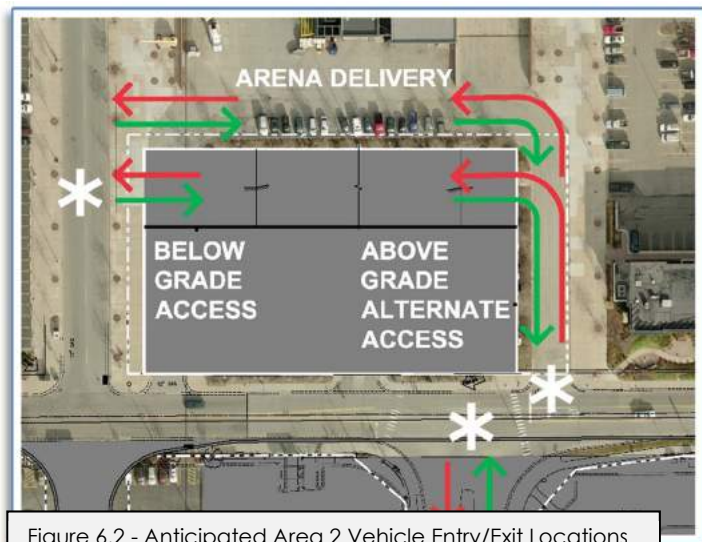


Figure 6.2 - Anticipated Area 2 Vehicle Entry/Exit Locations

- C. Potential Vehicle Access
- Area 2 (Figure 6.2)
 - The underground parking access is shown from Ottawa Street; the existing west arena service drive from Oakes may be eliminated.
 - Above grade parking access would be from

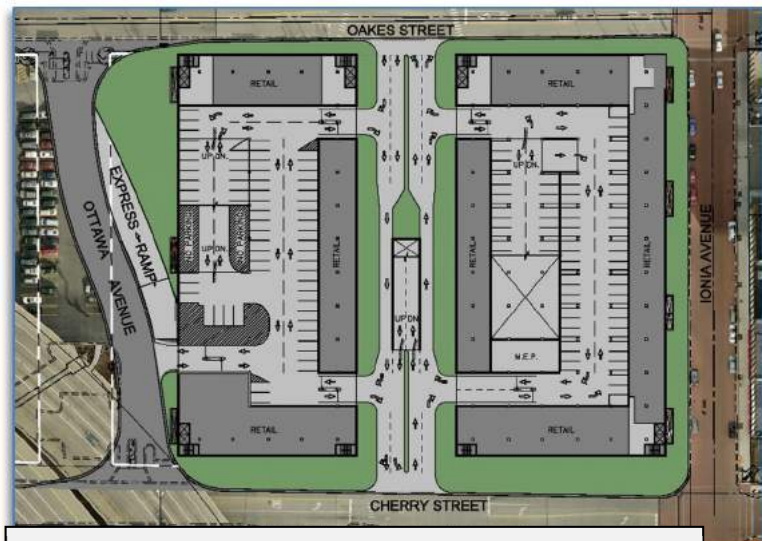


Figure 6.3 - Anticipated Area 4 & 5 Vehicle Entry/Exit Locations (Vision Concept 1)

Ottawa, and/or potentially Oakes at the existing east arena service drive.

- 3) The City prefers to avoid parking access from Oakes; however, the total parking count (below and above grade) will impact this decision.
- b. Area 4 & 5 (Figure 6.3)
 - 1) Parking access is shown from Cherry Street, Oakes Street, and the Ottawa Street extension.
- c. Heartside (Figure 6.4)
 - 1) Parking access to the South and North Garages is shown from Ionia Avenue.
 - 2) Parking access to the South Garage is shown the existing Downtown Market surface parking area.

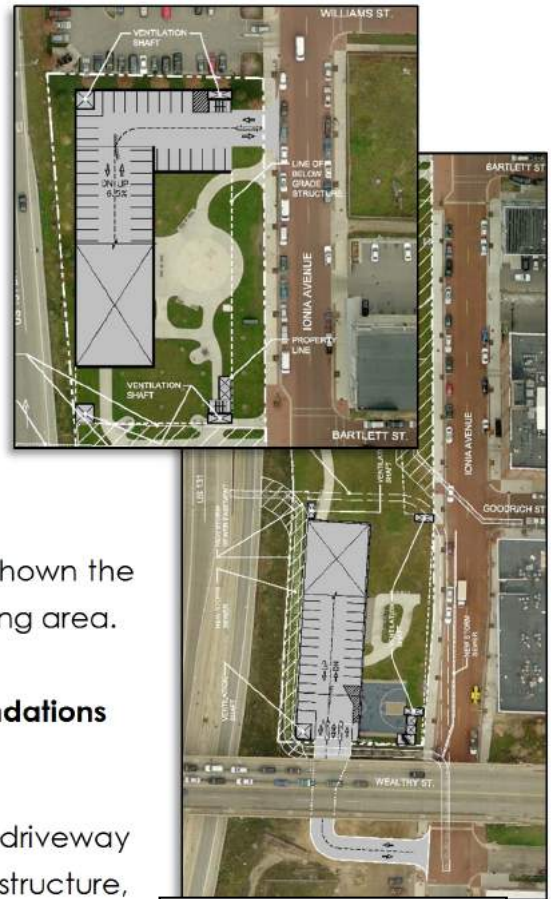


Figure 6.4 - Anticipated Heartside Vehicle Entry/Exit

6.3 Traffic Impact Discussion and Initial Recommendations

- A. Area 2
 - a. The parking structure's ideal access driveway location is at the northwest corner of the structure, accessing Ottawa Avenue. If a driveway is considered onto Oakes Street, then it should be reviewed with respect to drawings on the south side of Oakes. Interlocking lefts and offset driveways should be avoided.
 - b. During regular weekday activities, it is anticipated the structure would experience minimal on-street vehicular queuing.
 - c. As well, given the location of the access point on Ottawa Avenue (minor street) in comparison to Oakes Street (major street), the primary road network should operate comparable to current conditions.
 - d. Large events would necessitate special intersection control and circulation changes, which are considered similar to measures implemented for past events in the area.
 - e. The introduction of an additional 500+ above grade parking spaces may require consideration of an additional Oakes Street entry/exit.

B. Area 4 & 5

- a. The parking structure uses the connector between Oakes Street and Cherry Street (former BR131) for primary access points. The connector provides excellent access opportunity. Given the potential for a peak of ingress volumes, special attention should be given to providing smooth inbound operations to minimize ingress queues.
- b. Depending on the results of the future structure's traffic study, this connector can be configured for various layouts to meet anticipated traffic capacity demand. The connector's boulevard section provides for efficient right-in/right-out operations at each driveway. It also provides for right turn bays to accommodate on-street queuing.
- c. It is important to have efficient and effective operations at the intersections at Oakes Street and Cherry Street and therefore it is anticipated that both intersections would be signalized.
- d. During regular weekday activities, it is anticipated the structure would experience minimal on-street vehicular queuing.
- e. As well, given the location of the access points on the connector, the adjacent road network should operate comparable to current conditions.
- f. Large events would necessitate special intersection control and circulation changes.

C. Heartside Site – South

- a. The primary access point to the south structure situates the driveway near the Wealthy Street SW intersection. The access point would need to coordinate with the Downtown Market site, which would need to be reconfigured to accommodate the ramp access.
- b. Since the Wealthy Street SW extension is one-way to the east, the impacts from the offset configuration of the driveways are reduced.
- c. Adjacent Ionia Avenue on-street parking would require removal.
- d. During regular weekday activities, it is anticipated the structure would experience minimal on-street vehicular queuing.
- e. As well, the primary road network should operate comparable to current conditions. Large events would necessitate special intersection control and circulation changes.

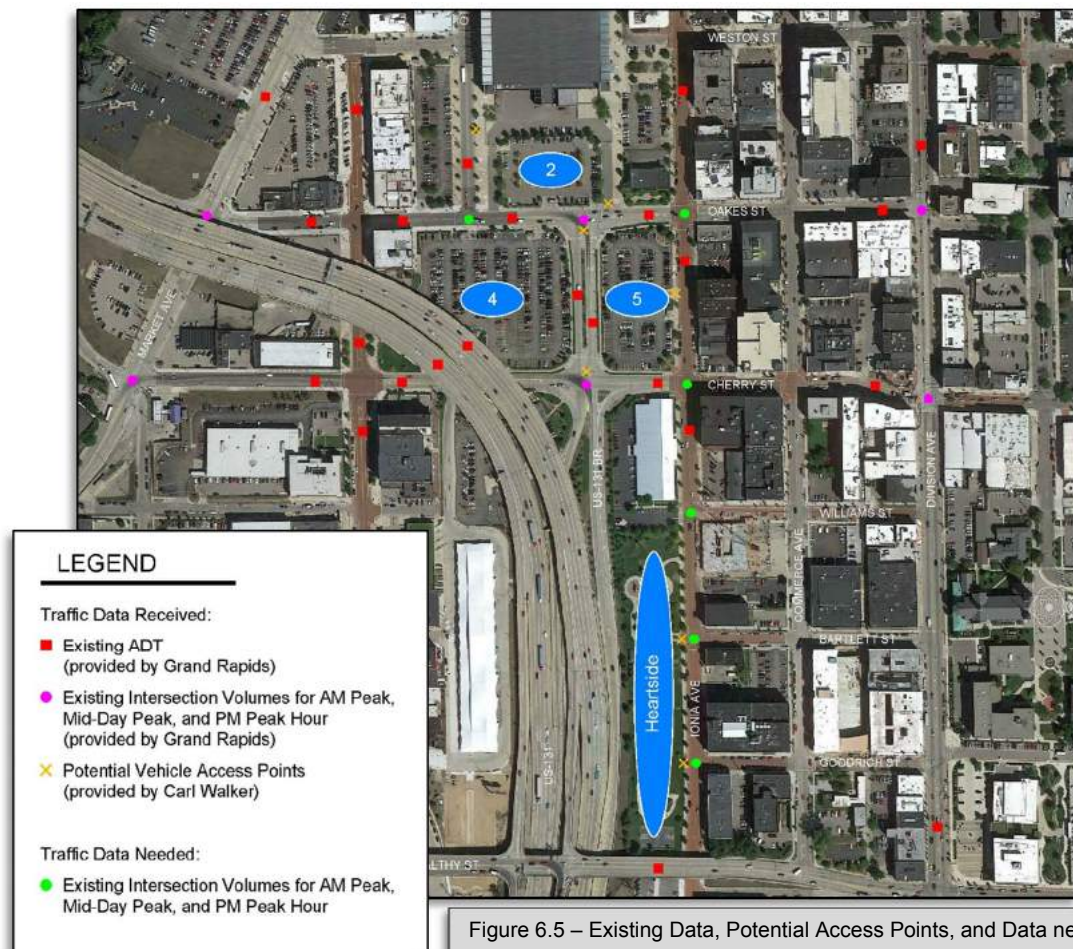
D. Heartside Site – North

- a. The primary access point to the north structure situates the driveway south of the

- Williams Street intersection. This is not an ideal location for an access point given the intersection offset with Williams Street. A more desirable location would share access with the parcel to the north.
- b. Adjacent on-street parking would require removal.
 - c. During regular weekday activities, it is anticipated the structure would experience minimal on-street vehicular queuing, though queuing does have the potential to impact the Williams Street intersection.
 - d. Large events would necessitate special intersection control and circulation changes.

6.4 Recommendations for Additional Investigation

- A. AM Peak, PM Peak, and Non-Peak Hour counts at the following intersections (see Figure 6.5):
 - a. Ottawa Avenue / Oakes Street
 - b. Ionia Avenue / Oakes Street
 - c. Ionia Avenue / Cherry Street



- d. Ionia Avenue / Williams Street
- e. Ionia Avenue / Bartlett Street
- f. Ionia Avenue / Goodrich Street

- B. Clarify characteristics and use of each parking structure option.
- C. Develop Trip Generation Scenarios and Demand Models for selected parking structure option(s).
- D. Create trip destination map of ingress and egress vehicles during AM Peak, Mid-Day Peak, PM Peak Hours, and Special Events.

7.0 KNOWN FUTURE DEVELOPMENTS

The City identified three (3) potential Arena South developments in existing City parking areas as follows:

- A. Area 1 – A residential/Commercial development is in the planning process. This development would displace 100 City parking spaces.
- B. Area 2 – The Convention / Arena Authority (CAA) is currently evaluating an above grade parking structure in the Area 2 surface parking lot.
- C. Area 5 – The City has had discussions with a developer regarding Area 5.

8.0 CONCEPT DESIGN CONSIDERATIONS

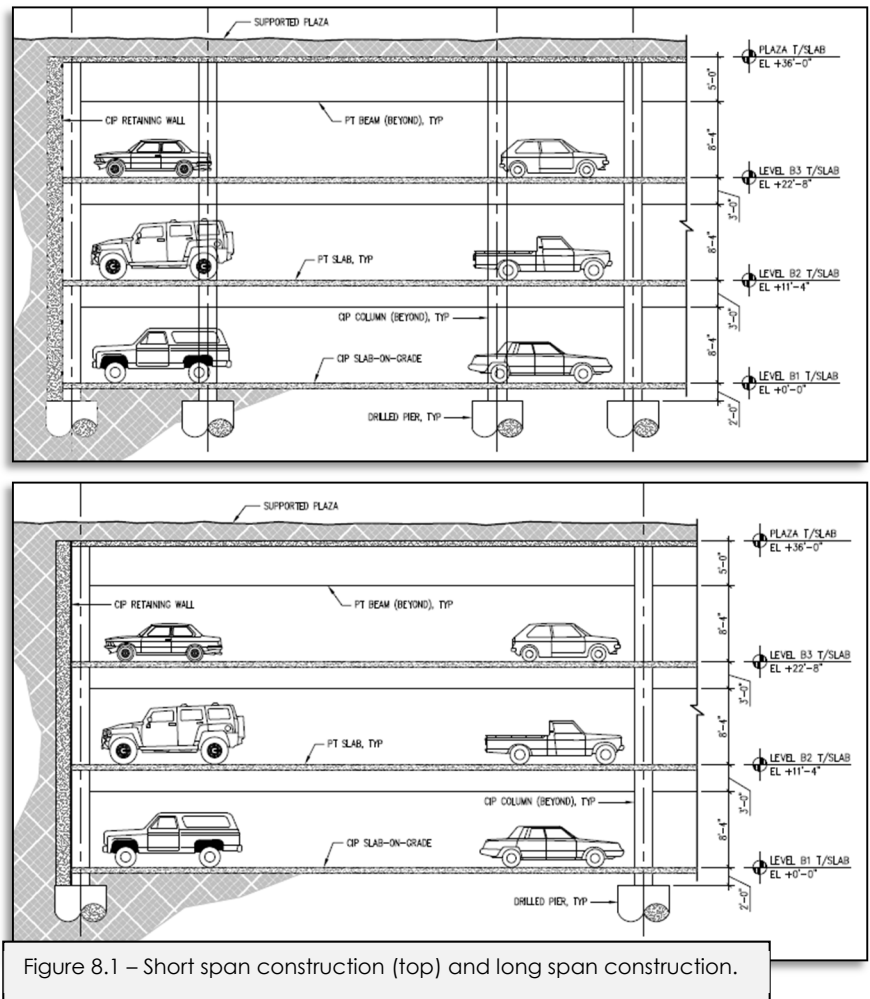
8.1 Geotechnical Considerations

- A. Three (3) levels of below grade parking is the basis for the conceptual options considered. The estimated cost for a fourth underground level has also been provided.
- B. A temporary earth retention system will be utilized, consisting of a slurry wall or a secant auger cast wall system socketed into bedrock. Temporary tie-backs below adjacent property is anticipated.
- C. A “Bath Tub” design is anticipated, designed to resist hydrostatic loading. A waterproofing membrane system is anticipated.

8.2 Structural Considerations

- A. Cast-in-place post-tensioned concrete slab and beam construction is anticipated. The column spacing shown in the concept drawings is based on cast-in-place concrete construction.
- B. The earth retention system will likely be temporary; lateral wall loads will be transferred to the structural system thru the slab.
- C. A pressure slab to resist hydrostatic loads is anticipated.
- D. The structural frame is to be designed to reduce structural restraint and associated concrete cracking, with detailing to reduce volume change restraint often associated with early deterioration of parking structures
- E. Residential/commercial development is anticipated to be above, and supported by the underground parking structure.

- a. Short span parking structure construction (Figure 8.1) is shown in the parking concepts to provide maximum flexibility for above grade development. This also provides a conservative estimate of parking capacity.
- b. We recommend that long span construction (~60 ft.), or semi long span construction (~45 + 15 ft.) be utilized in the design.
- c. Floor-to-floor heights are based on long-span construction.



- F. If the site is to include both above grade and below grade parking, structural framing will require coordination to provide an efficient, balanced design.

8.3 Parking Structure Considerations

- A. User Comfort Factors – A successful project will balance user comfort, parking efficiency and cost; and will provide efficient circulation, comfortable parking geometry, and well-defined vehicle and circulation routes. The User Comfort Factors (UCF) approach is applicable to a number of design considerations such as trail blazing, vehicular circulation, site dimensions, parking geometrics, flow capacity, and entry/exit design. Acceptable user comfort factors for parking, which are defined below, range from 1 to 4. Generally, users with low familiarity and high turnover, such as transients/visitors, should be accorded a higher UCF. Users

with high familiarity and low turnover, such as monthlies/employees, are more tolerant of lower user comfort.

UCF 1 - Poor; less than 50% of patrons will be satisfied

UCF 2 - Acceptable; 50% of patrons will be satisfied

UCF 3 - Good; 75% of patrons will be satisfied

UCF 4 - Excellent; 90% of patrons will be satisfied

A UCF 3 is the basis for the design concepts.

B. Parking Levels Below Grade

- a. Each below grade concept is based on three (3) levels of parking, and does not include street level parking.

8.4 Underground Parking Structure Enhancements

- A. Traditional underground parking structures can be intimidating. Enclosed stair towers, enclosed elevators, structural elements reducing visibility, artificial lighting, and the lack of visual landmarks to guide pedestrians to their destinations can often make the parking experience uncomfortable. Furthermore, accommodating non-traditional parking structure uses such as buildings, plaza/parks, or roadways constructed above and supported on the structure may limit design flexibility.

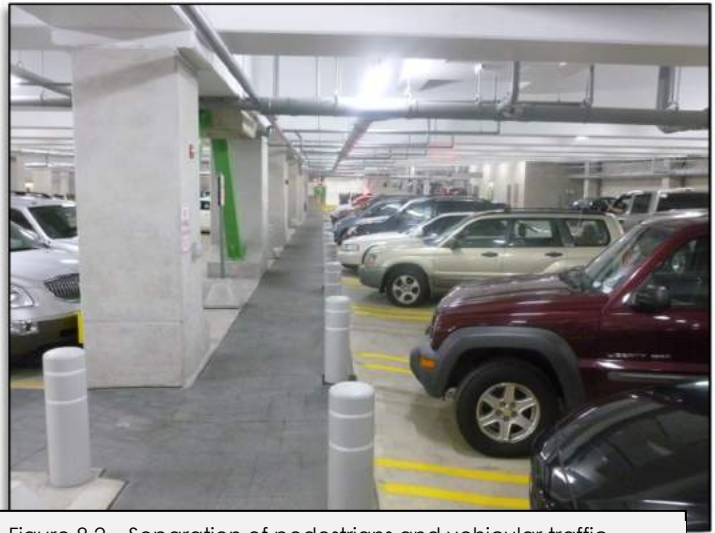


Figure 8.2 – Separation of pedestrians and vehicular traffic

- B. To promote a sense of safety and security, added design that will make the underground parking facility as comfortable and user friendly as reasonably possible may include:

- a. Open Stairways – Open stairs with glass enclosures promote personal safety and allows natural light to reach the lowest level of the structure. To meet design openness objectives, fire separation curtains can be utilized for egress stairs, and fully open non-egress stairs can be added to welcome visitors

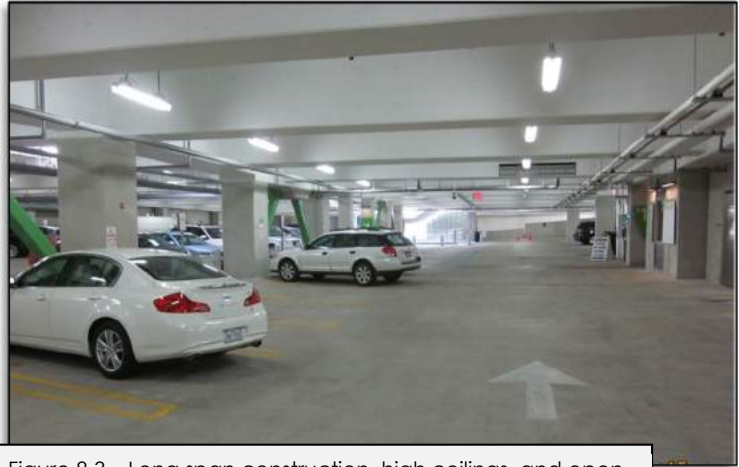


Figure 8.3 – Long span construction, high ceilings, and open bracing improve visibility

- and to project natural light to the lowest floor of the parking structure.
- b. Glass Backed Elevators – To accommodate glass backed elevators, fire rated glass enclosures can be installed at the elevator exterior wall.
- c. Structural Bracing – Structural bracing can be utilized in lieu of concrete shear walls to promote openness and to maximize visibility (Figure 8.4).
- d. High Ceiling Heights & Long-Span Construction – High ceiling height and long-span construction provide a sense of openness and improved visibility (Figure 8.3).

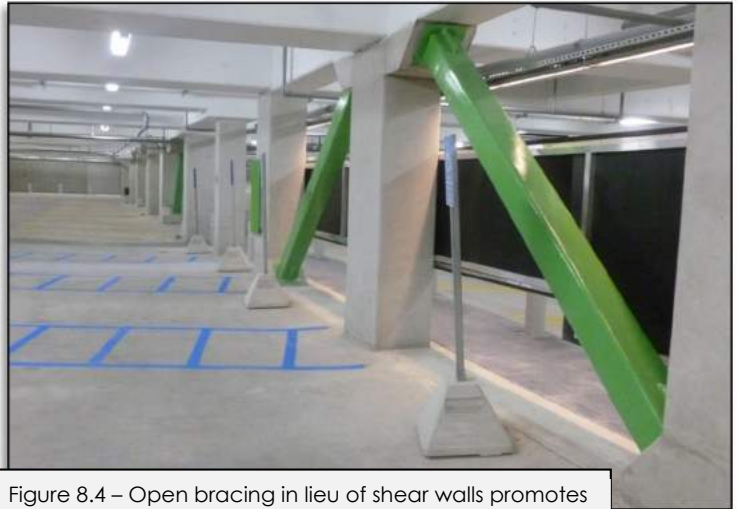


Figure 8.4 – Open bracing in lieu of shear walls promotes openness and visibility

- e. Lighting - Bright, uniform white lighting should be provided, supplemented by natural light where possible. White stained ceilings will also enhance lighting.
- f. Architectural Features - Architectural features can be used to create interest and complement parking and safety goals.

- g. Signage & Themed Wayfinding – Vehicle and pedestrian wayfinding is an important aspect of a safe and efficient parking facility. In an underground garage, a well-executed wayfinding plan will identify the user's location, prior to arriving at the surface.
- h. Cell Phone Repeaters – With the ability to call for assistance from remote locations, cellular telephones provide a sense of connection and security. Cellular repeaters installed at lower level locations will allow uninterrupted cellular service.
- i. Reduced Ambient Noise – Ambient noise, typically from mechanical ventilation units, can be disorienting. Designing the system to reduce ambient noise will improve the user's sense of security.
- j. Emergency Call Stations and Security Cameras – Emergency telephones and cameras are an effective means of security, but only if the system is well managed.
- k. Human Presence – As parking revenue control systems become more automated, 24 hour on-site staffing is becoming less common. The sense of security offered by the presence of on-site cashiers, maintenance staff, or security staff is difficult to replace with cameras and call stations.



Figure 8.5 – Glass stair roof provides protection, while allowing natural light to reach lower parking levels.

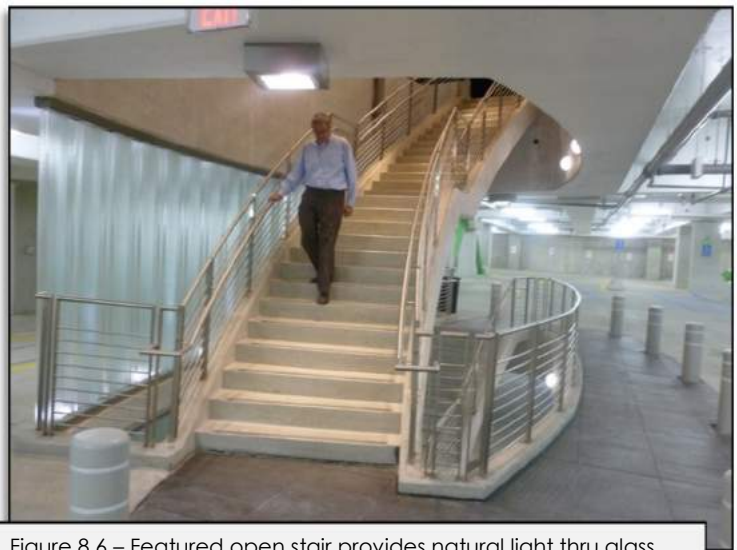


Figure 8.6 – Featured open stair provides natural light thru glass roof enclosure. Snow melt system protects pedestrians.

8.5 Above Grade Development Considerations

- A. Potential development concepts are unknown. The above grade parking concepts, including wrapped residential development, are based on the Vision Study concepts.
- B. Residential/commercial development should front Oakes, Cherry, and Ionia.
- C. Above grade parking capacity is based on five (5) levels of above grade construction. There are numerous development and associated parking options available, and the parking capacity identified is intended to provide an order of magnitude of available parking.

9.0 PARKING STRUCTURE CONCEPTS

9.1 Area 2 Parking Structure Concept

A. Below Grade Parking Structure

a. Three (3) below Grade Levels

- 1) Lowest Level at approximately 38 ft. below street level.
- 2) Approximately 522 Parking Spaces (net add of 376 spaces)

b. Four (4) below Grade Levels

- 1) Lowest Level at approximately 49 ft. below street level.
- 2) Approximately 694 Parking Spaces

c. Footprint extends below entire site, with 10 ft. setbacks where possible to assist with construction.

d. Short span below grade construction is shown to provide maximum above grade building flexibility.

Final design, coordinated with above grade construction, will likely reduce the number of columns, increasing parking count.

e. Vehicular access from Ottawa Street.

f. User Comfort & Parking Geometrics

- 1) Parking spaces are sized to be 9 ft. wide.
- 2) Maximum floor slope is 6 to 6.5%.



Figure 9.1 – Area 2 Street Level below grade parking access.

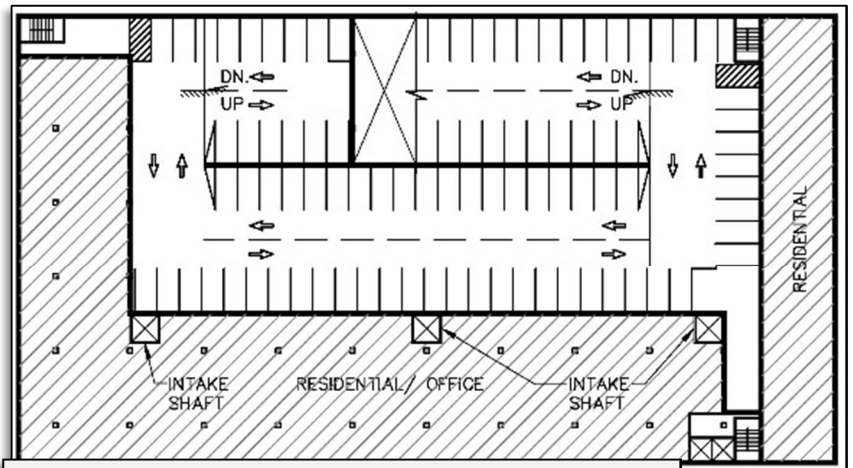


Figure 9.2 – Area 2 Above Grade Parking & Residential Wrap

3) User Comfort Factor (UCF) of 3 (refer to Section 8.3)

B. Above Grade Parking Structure:
Wrapped with Residential

a. Team assumed above grade parking wrapped with residential to assist in assessing potential parking capacity. Without specific programming, above grade parking concepts are based on the *Arena South Visioning Plan Concept 1 and Concept 2*.

b. 45 to 60 ft. wrap at west, south and east sides.

c. Five (5) Levels above grade shown; extends above below grade limits

d. Approximately 431 parking spaces; a net add of 285 spaces.

e. Loading dock access is maintained to the east from Oakes, below above grade residential. West access is relocated to Ottawa.

a. Vehicular access from Ottawa Street; or

potentially from Ionia based on total parking capacity.

b. User Comfort & Parking Geometrics

1) Parking spaces are sized to be 9 ft. wide.

2) Maximum floor slope is 6 to 6.5%.

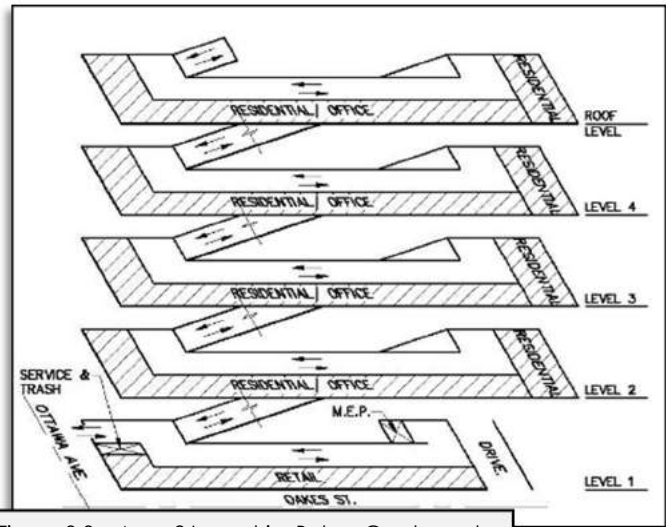


Figure 9.3 – Area 2 Isometric: Below Grade and Above Grade Parking.

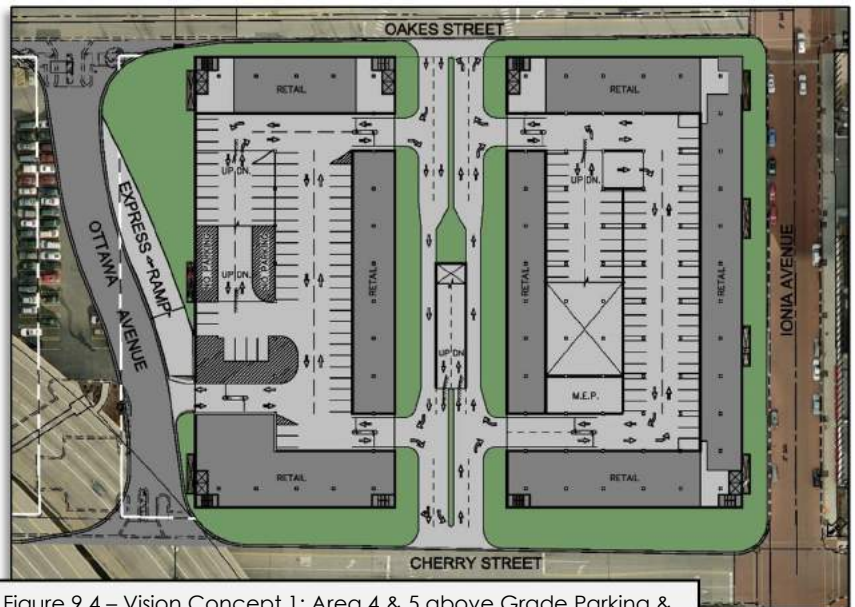


Figure 9.4 – Vision Concept 1: Area 4 & 5 above Grade Parking & Street Level below grade parking access.

3) User Comfort Factor (UCF) of 3 (refer to Section 8.3)

9.2 Area 4 & Area 5 Parking Structure Concept

A. The Ottawa Street extension is anticipated; however, separate sites 4 and 5 have been studied for above grade parking.

a. Figure 9.4 shows the street level configuration based on Vision Concept 1.

b. Figure 9.5 shows the street level configuration based on Vision Concept 2.



Figure 9.5 – Vision Concept 2: Area 4 & 5 above Grade Parking & Street Level below grade parking access.

B. Below Grade Parking Structure

a. Underground parking extends below BR131 (no utilities below roadway)

b. Three (3) below Grade Levels.

1) Lowest Level at approximately 38 ft. below street level.

2) Approximately 1,153 Parking Spaces (net add of 676 spaces)

3) Maintain approximately 108 surface parking spaces west of Ottawa Street extension.

c. Four (4) below Grade Levels.

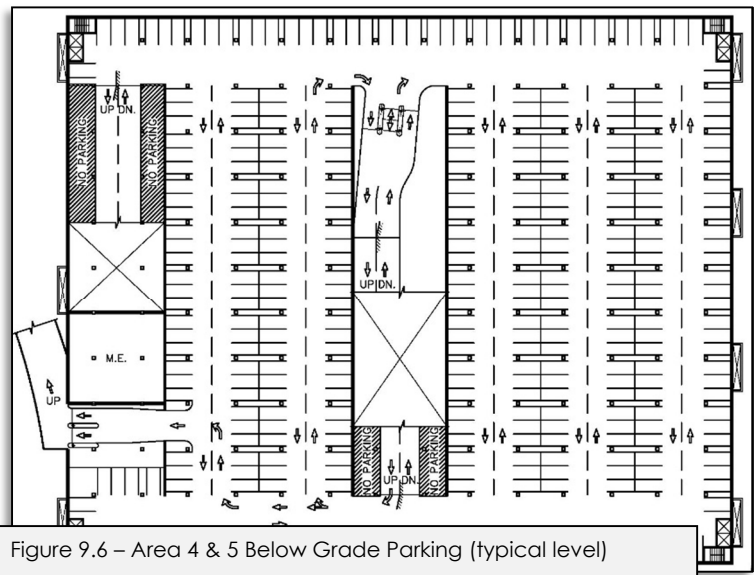


Figure 9.6 – Area 4 & 5 Below Grade Parking (typical level)

- 1) Lowest Level at approximately 49 ft. below street level.
 - 2) Approximately 1,569 Parking Spaces
 - 3) Maintain approximately 108 surface parking spaces west of Ottawa Street extension.
- d. Footprint extends below entire site east of Ottawa extension, with 10 ft. setbacks where possible to assist with construction.
 - e. Interior Speed Ramp design for faster loading/unloading.
 - f. Short span below grade construction is shown to provide maximum above grade building flexibility. Final design, coordinated with above grade construction, will likely reduce the number of columns, increasing parking count.
 - g. Vision Concept 1 parking access is shown from Cherry Street, Oakes Street, and the Ottawa Street extension.
 - 1) Express ramp to Ottawa is shown for alternate underground parking exiting.
 - h. Vision Concept 2 parking access is shown from the Ottawa extension for above grade parking; and from Cherry Street for underground parking.
 - 1) Express ramp to Ottawa is shown for alternate underground parking exiting.
 - i. User Comfort & Parking Geometrics
 - 1) Parking spaces are sized to be 9 ft. wide.
 - 2) Maximum floor slope is 6 to 6.5%; speed ramp slope up to 12.5%.
 - 3) User Comfort Factor (UCF) of 3 (refer to Section 8.3)
- C. Vision Concept 1: Area 4 & 5 Above Grade Parking Structure: Wrapped with Residential
- a. Team assumed above grade parking wrapped with residential to assist in assessing potential parking capacity. Without specific programming, above grade parking concepts are based on the *Arena South Visioning Plan Concepts 1 and 2*.
 - b. 45 to 60 ft. wrap
 - c. Five (5) Levels above grade shown

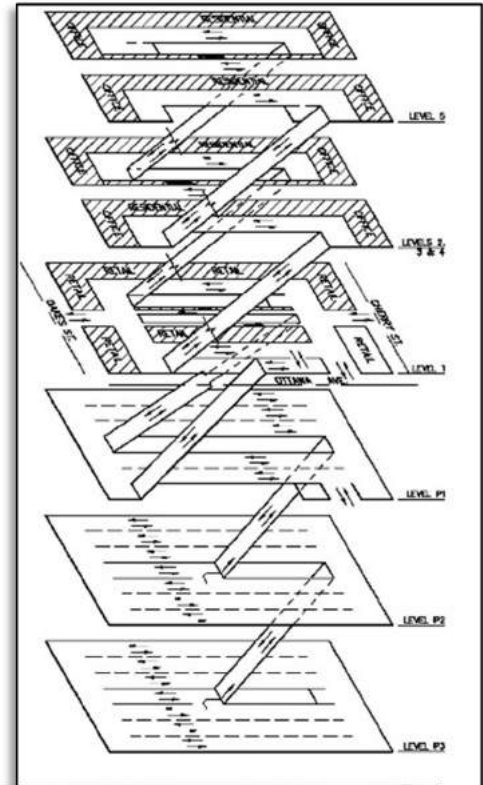


Figure 9.7 – Area 4 & 5 Isometric: Below Grade and Above Grade Parking.

- d. Approximately 863 parking spaces; net add of approximately 386 spaces.
 - e. User Comfort & Parking Geometrics
 - 1) Parking spaces are sized to be 9 ft. wide.
 - 2) Maximum floor slope is 6 to 6.5%.
 - 3) User Comfort Factor (UCF) of 3 (refer to Section 8.3)
- D. Vision Concept 2: Area 4 above Grade parking structure wrapped with residential construction; Area 5 multi-story mixed use above Grade development (no parking).
- a. Team assumed above grade parking wrapped with residential to assist in assessing potential parking capacity. Without specific programming, above grade parking concepts are based on the *Arena South Visioning Plan Concepts 1 and 2*.
 - b. 45 to 60 ft. wrap at Area 4 above grade structure.
 - c. Five (5) Levels above grade shown
 - d. Approximately 455 parking spaces; net loss of approximately 20 spaces.
 - e. User Comfort & Parking Geometrics
 - 1) Parking spaces are sized to be 9 ft. wide.
 - 2) Maximum floor slope is 6 to 6.5%.
 - 3) User Comfort Factor (UCF) of 3 (refer to Section 8.3)

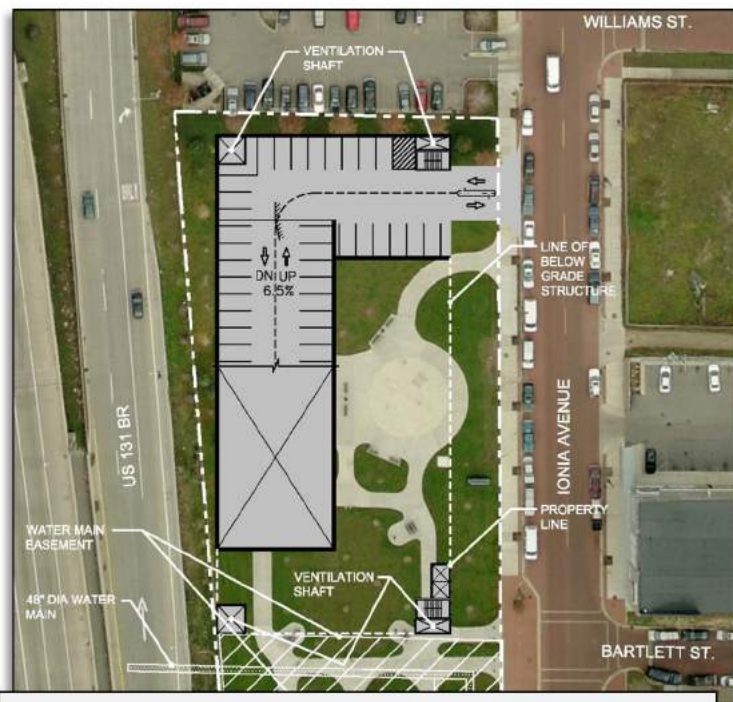


Figure 9.8 – Heartside North Street Level and Below Grade Parking Access

9.3 Heartside Park Parking Structure Concept

A. Below Grade Parking Structure

- a. Below grade parking only will be considered for this site; with a park at street level. Three (3) below Grade Levels.
- b. Lowest Level at approximately 40 ft. below street level.
- c. Underground utility easements significantly impact the underground parking concepts (refer also to Section 5).

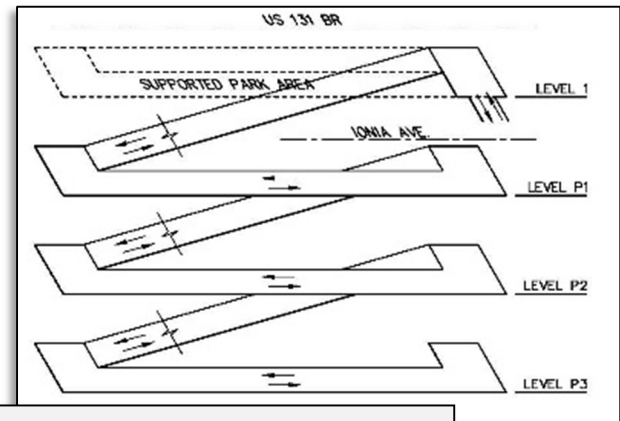


Figure 9.9 – Heartside North Isometric

- 1) 60 ft. easements at Bartlett and Goodrich; and 44 ft. easement between Goodrich and Bartlett.
- 2) 48 inch water main crosses property thru Bartlett easement.

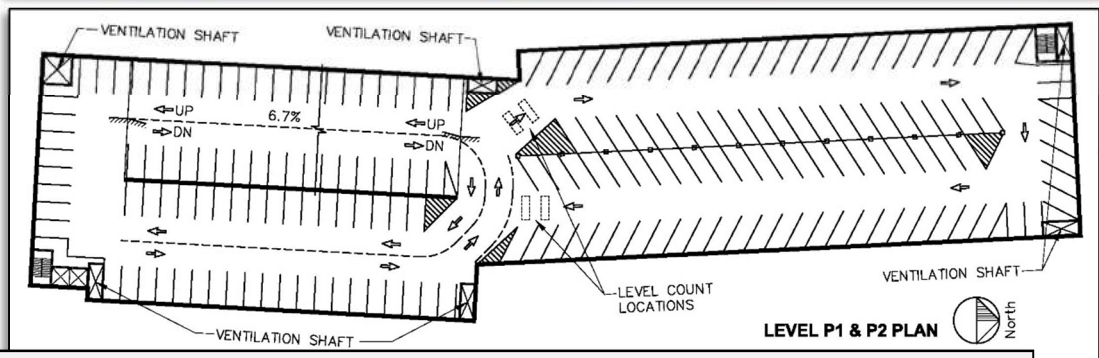
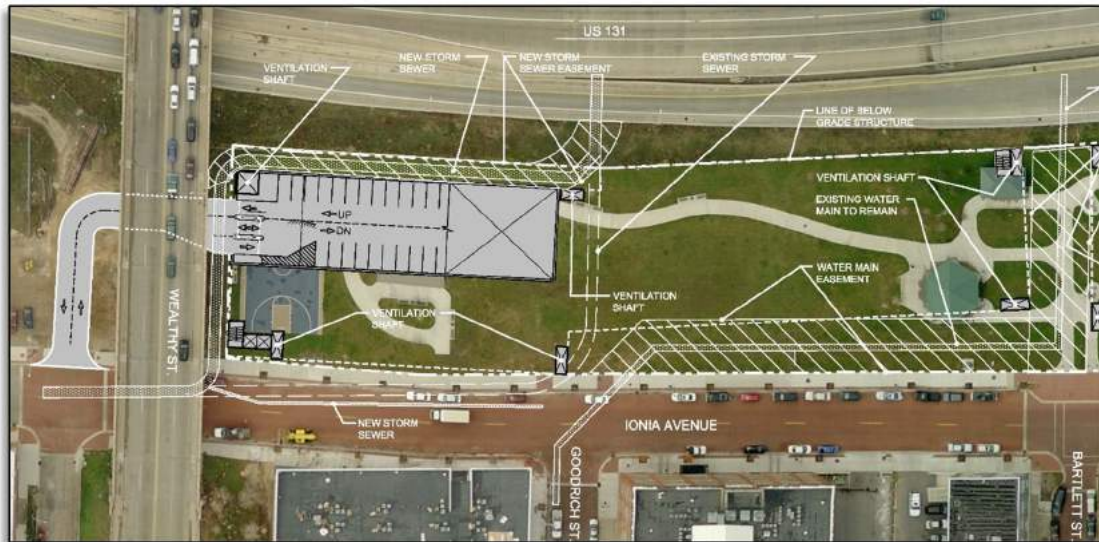


Figure 9.10 – Heartside South Street level, Below Grade Parking Access, and Below Grade

- 3) 84 inch storm sewer crosses property thru Goodrich easement.
- d. Relocation of the 84 inch storm sewer creates two (2) separate underground sites: North and South.
- e. North Structure
 - 1) Three (3) levels - 310 parking spaces
 - 2) Four (4) levels – 409 parking spaces
 - 3) Vehicle access from Ionia Avenue
- f. South Structure
 - 1) Three (3) levels - 532 parking spaces
 - 2) Four (4) levels – 710 parking spaces
 - 3) Vehicle access from Downtown Market surface parking lot
- g. Short span below grade construction is shown to provide maximum above grade building flexibility. Final design, coordinated with above grade construction, will likely reduce the number of columns, increasing parking count.
- h. User Comfort & Parking Geometrics
 - 1) Parking spaces are sized to be 9 ft. wide.
 - 2) Maximum floor slope is 6 to 6.5%.
 - 3) User Comfort Factor (UCF) of 3 (refer to Section 8.3)

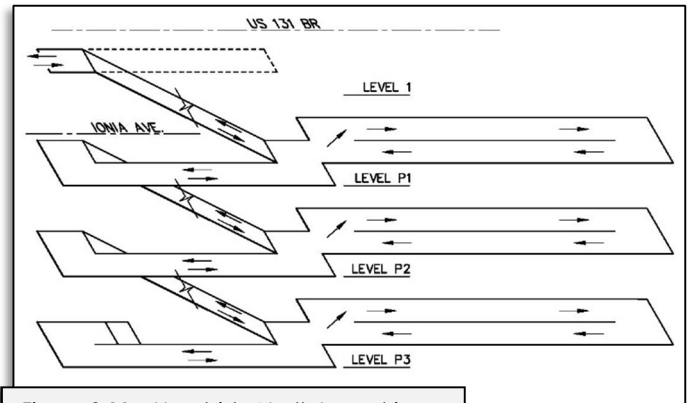


Figure 9.11 – Heartside North Isometric.

C. Street Level Park & Vehicle Access

- a. Park area anticipates waterproofing, drainage, and landscaping.
- b. North Structure vehicle access from the north parking lot would help to minimize ramping area / increase park area.
- c. Entry/exit speed ramps (no parking) with up to 12.5% slope will minimize ramping area / increase parking area. However, parking capacity will also be reduced.

9.4 Additional Considerations

A. Area 2 Parking

a. Alternative pedestrian access to Arena & Downtown

- 1) A below grade connection and/or a pedestrian bridge from Area 2 development would provide



Figure 9.12 – Express entry or exit ramps can expedite vehicle flow, reducing wait times.

convenient access to the Arena and the downtown skywalk system.

b. Alternative below grade access from Area 4/5 underground parking.

B. Areas 4 & 5 Parking

a. Additional vehicle entry and exiting

- 1) A vehicle tunnel below Cherry Street to access the garage from the 131 exit ramp would help to improve street traffic; and reduce the pedestrian/vehicle conflict along Cherry Street.
- 2) Vehicle entry and exit speed ramps within the Cherry, Ionia, or Oakes ROW, similar to the Ottawa exit ramp, could help to improve entering and exiting time; and reduce pedestrian/vehicle conflict.

b. Alternative pedestrian access to Arena & Downtown

- 1) Below grade access or a pedestrian bridge across Oakes connecting to Area 2 parking/development would provide convenient access to the Arena and the downtown skywalk system.

c. Alternative vehicle connection to Area 2

- 1) A vehicle tunnel below Oakes (or parking extension below Oakes) would allow coordination of entry/exiting; likely reducing street level interference with pedestrian traffic.

10.0 CONCEPTUAL CONSTRUCTION COST ESTIMATE

10.1 Conceptual Cost Estimate Summary

- A. The concepts developed for this report are summarized in Section 9, and drawings are included in Section 12. The basis for these concepts and their projected constructions cost are provided within this report.
- B. The table provided in Figure 10.1 summarizes the anticipated parking capacity for each site, along with projected construction costs.

10.2 Cost Assumptions

- A. Construction cost for a traditional above grade, stand-alone parking structure in Grand Rapids will be approximately \$50 to \$60 per sf, depending on architectural features, structural system, user comfort considerations, durability/service life, site conditions, and economic climate. Underground parking costs will also vary based on these considerations; however, a significant cost increase should be expected to address the following:
 - a. Temporary Earth Retention
 - b. Temporary and/or permanent dewatering
 - c. Large lateral loads from earth pressure and adjacent building surcharge
 - d. Accommodation of buildings, roadways, plazas/parks supported by the parking structure
 - e. User Comfort such as glass in elevators and stairs, increased lighting, and open framing/bracing
 - f. Mechanical ventilation
 - g. Fire protection sprinkler system
 - h. Pumps for storm and sanitary discharge
 - i. Reduced parking efficiency when accommodating alternative above grade uses.

Construction Cost Summary DRAFT		AREA 2		Area 4 & 5			Heartside Park	
		Underground Parking Structure	Above Grade Parking Structure (Wrapped)	Underground Parking Structure	Above Grade Parking (Vision Concept 1)	Above Grade Parking (Vision Concept 2)	North Underground Parking Structure	South Underground Parking Structure
Three (3) Level Underground	No. of Parking Levels	Three (3) - P1, P2, P3	5 - L1, L2, L3, L4, L5	Three (3) - P1, P2, P3	Five (5) - L1 thru L5	5 - L1, L2, L3, L4, L5	Three (3) - P1, P2, P3	5 - L1, L2, L3, L4, L5
	No. of Spaces	522	431	1153	863	455	310	532
	Street Level "Cap"							
	Parking Levels	\$3,176,000	NA	\$11,277,000	NA	NA	\$2,223,000	\$7,004,000
	Construction Cost Total	\$21,099,000	\$9,950,000	\$52,273,000	\$20,750,000	\$10,600,000	\$11,702,000	\$21,246,000
	Soft Costs (25%)	\$24,275,000	\$9,950,000	\$63,550,000	\$20,750,000	\$10,600,000	\$13,925,000	\$28,250,000
Four (4) Level Underground	Estimated Project Budget	\$6,068,750	\$2,488,000	\$15,887,500	\$5,188,000	\$2,650,000	\$3,481,000	\$7,063,000
	Cost per Space	\$30,343,750	\$12,438,000	\$79,437,500	\$25,938,000	\$13,250,000	\$17,406,000	\$35,313,000
		\$58,100	\$28,900	\$68,900	\$30,100	\$29,100	\$56,100	\$66,400
	No. of Parking Levels	Four (4) - P1, P2, P3, P4		Four (4) - P1, P2, P3, P4			Four (4) - P1, P2, P3, P4	Four (4) - P1, P2, P3, P4
	No. of Spaces	694		1569			409	710
	Street Level "Cap"							
Four (4) Level Underground	Parking Levels	\$3,176,000		\$11,277,000			\$2,223,000	\$7,004,000
	Construction Cost Total	\$30,524,000		\$76,573,000			\$17,022,000	\$30,811,000
	Soft Costs (25%)	\$33,700,000		\$87,850,000			\$19,245,000	\$37,815,000
	Estimated Project Budget	\$8,425,000		\$21,963,000			\$4,811,000	\$9,454,000
	Cost per Space	\$42,125,000		\$109,813,000			\$24,056,000	\$47,269,000
		\$60,700		\$70,000			\$58,800	\$66,600

Figure 10.1 - Parking Capacities and Conceptual Cost Summary.

Construction Costs

25% Soft Costs Included (AE fees/Testing/10% Contingency)

Utilities Included

Ottawa Extension Excluded

Foundations for Development Excluded

Underground Concept Includes "Cap" Costs

Above Grade and Below Grade Considered Separately

- B. Underground construction will require temporary excavation support. Tie-back anchorages are effective, and will typically extend 40' to 50' beyond the soldier piles. The tie-backs will typically run below City streets, and be de-tensioned following construction. For Area 2, the east tie-backs would extend below the Rockford property, and alternative bracing may be required.
- C. For each site, the underground and above ground parking structure concepts should be considered separately.
- D. Ottawa Street extension costs are not included.
- E. Soft costs are based on 25% of Construction Costs, and includes 10% Consultant Cost Contingency.
- F. Construction Cost estimates include the Street Level "cap"; but does not include added construction cost to support an above grade building.
- G. The base underground parking concept is three (3) levels below grade (lowest parking level at approximately 38 ft. below grade). For each site, additional parking and construction cost is provided for a fourth level (Level P4 – approximately 49 ft. below grade). The added below grade level provides a greater construction cost risk.

11.0 PROJECT SCHEDULE

11.1 Planning and Design

- A. We recommend budgeting 12 months for planning and design.

11.2 Construction

- A. The underground parking structure construction schedule will vary; however, we estimate the construction timeline to be approximately 24 months for the 3 level structure, and 24 to 30 months for the 4 level underground structure. This schedule is based on the Area 4 and Area 5 site; the construction duration will be less for the other, smaller sites.
- B. The above grade structure construction schedule will vary; however, we estimate the construction timeline to be approximately 12 to 14 months.

12 CONCEPT DRAWINGS (Appendix B)

12.1 Area 2 Concept

- A. Site 2 – Level 1 – Underground Parking Sheet 1 of 2
- B. Site 2 – Levels P1, P2 & P3 – Underground Parking: Sheet 2 of 2
- C. Site 2 – Level 2 – Above Grade Garage: Sheet 1 of 2
- D. Site 2 – Levels 2, 3, 4 & Roof – Above Grade: Sheet 2 of 2

12.2 Areas 4 & 5 Concept

- A. Site 4 & 5 – Level 1: Sheet 1 of 6
- B. Site 4 & 5 - Level 1: Sheet 1 Alt.
- C. Site 4 & 5 – Level P1: Sheet 2 of 6
- D. Site 4 & 5 – Level P1: Sheet 2 of 6
- E. Site 4 & 5 – Level P2: Sheet 3 of 6
- F. Site 4 & 5 – Level P3: Sheet 4 of 6
- G. Site 4 & 5 – Levels 2, 3 & 4: Sheet 5 of 6
- H. Site 4 & 5 – Level 5: Sheet 6 of 6

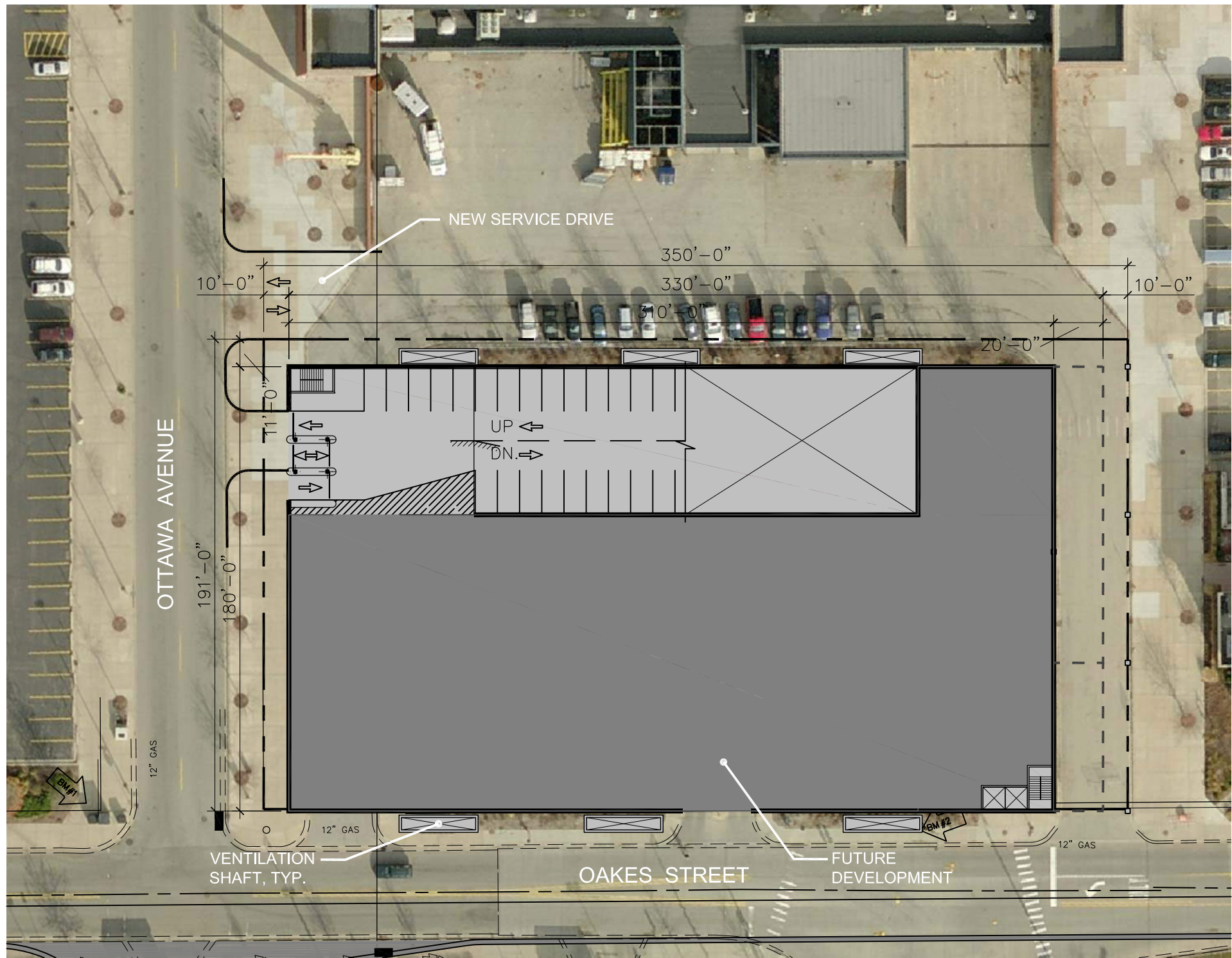
12.3 Heartside Concept

- A. Heartside Site – North – Level 1 Plan: Sheet 1 of 2
- B. Heartside Site – North – Levels P1, P2 & P3 Plans: Sheet 2 of 2
- C. Heartside Site – South – Level 1 Plan: Sheet 1 of 2
- D. Heartside Site – South – Levels P1, P2 & P3 Plans: Sheet 2 of 2

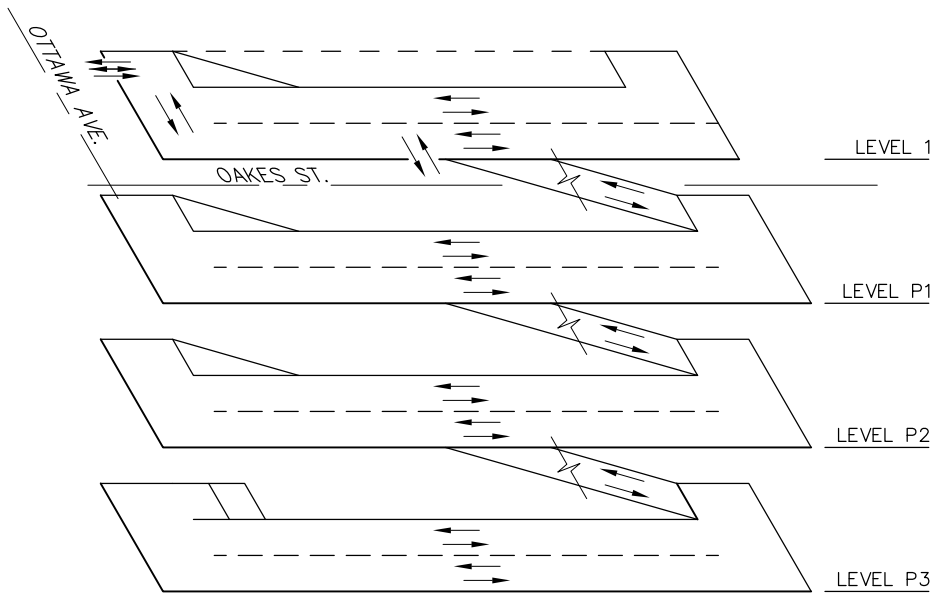
P:\NPS\N-2013\N1-2013-060 Arena South Underground Parking Study\Report\Final Report September 30 2014\Arena South Study Report FINAL 09-30-14.docx

APPENDIX A – CONCEPT DRAWINGS

- Area 2 Concept
- Area 4 & 5 Concept
- Heartside Concept



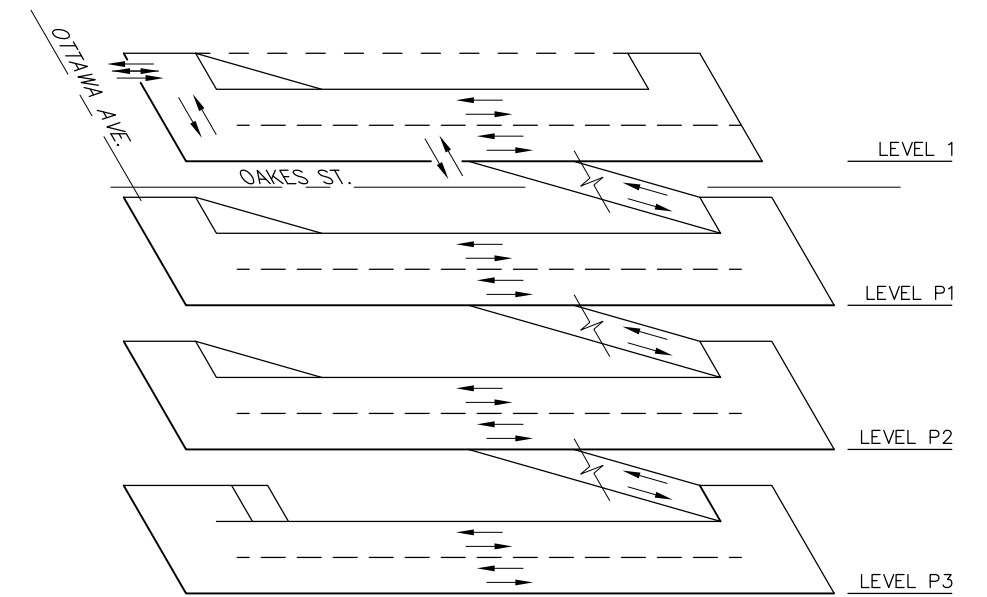
LEVEL 1



SITE 2 - UNDERGROUND GARAGE
NO SCALE N1-2013-060 SITE-2-UNDERGROUND-ISO

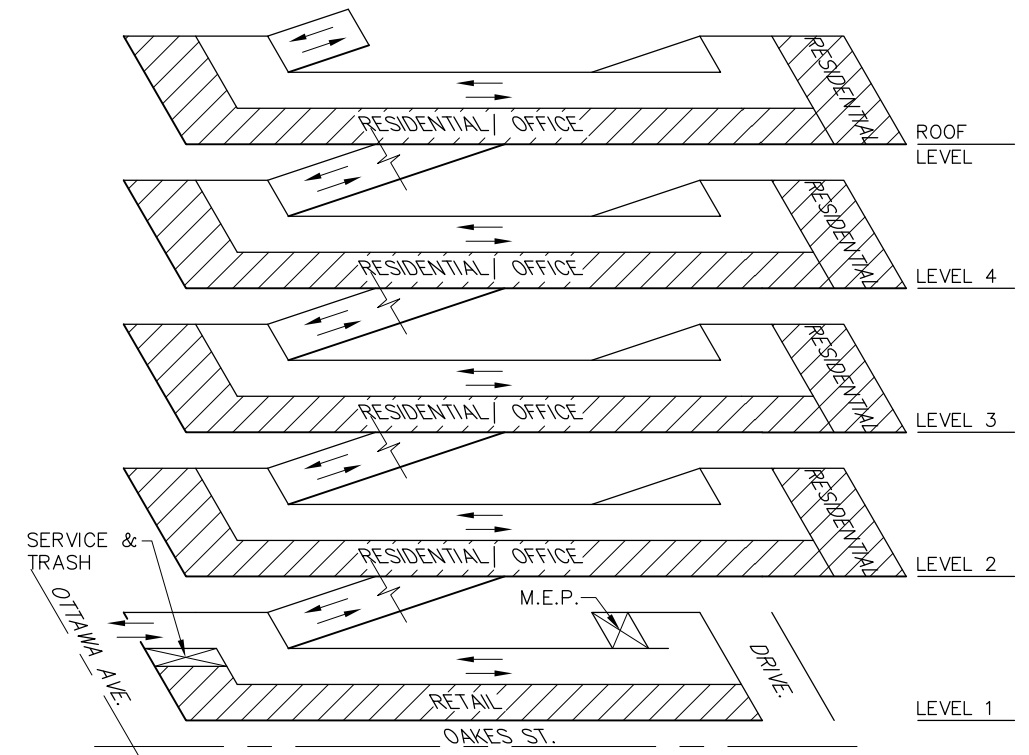
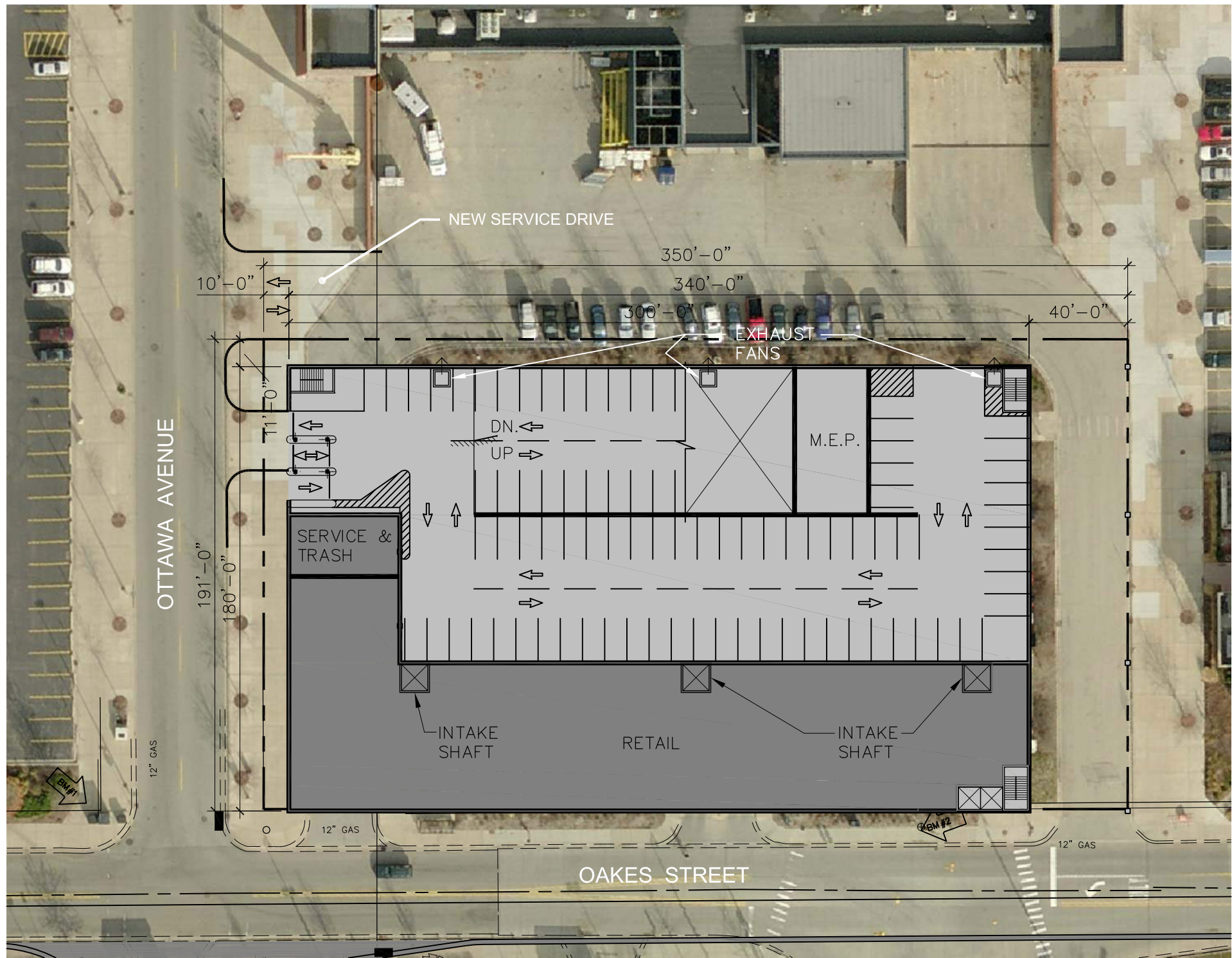
PARKING SPACES		BUILDING AREA (SQ. FT.)		
LEVEL	STANDARD SPACE	SUPPORTED GRADE	PARKING	TOTAL
L1	23	44,740	9,000	53,740
P1	180	—	59,400	59,400
P2	180	—	59,400	59,400
P3	166	—	57,340	57,340
SUBTOTAL	549	44,740	185,140	229,880
5% CONTINGENCY	27	—	—	—
TOTAL	522	44,740	185,140	229,880

N1-2013-060 SITE-2-UNDERGROUND-CTC



SITE 2 - UNDERGROUND GARAGE
NO SCALE N1-2013-060 SITE-2-UNDERGROUND-ISO

SHT. 2 of 2



**SITE 2 - ABOVE GRADE GARAGE
W/ COMMERCIAL/ RESIDENTIAL**
NO SCALE N1-2013-060 SITE-2-ABOVE GRADE-ISO

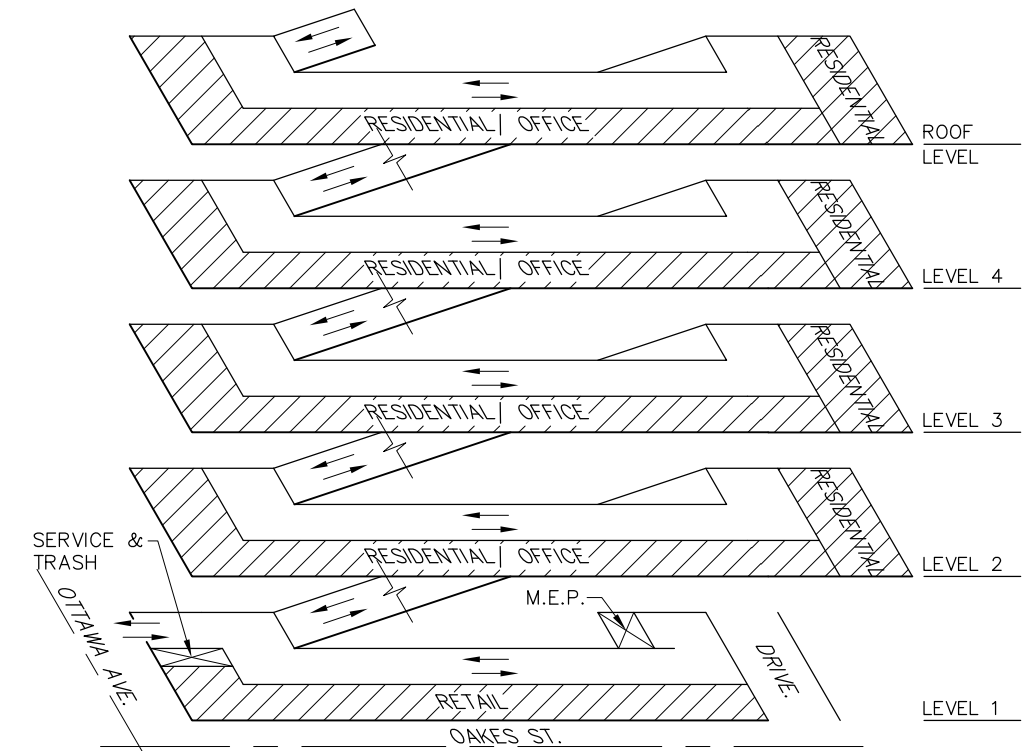
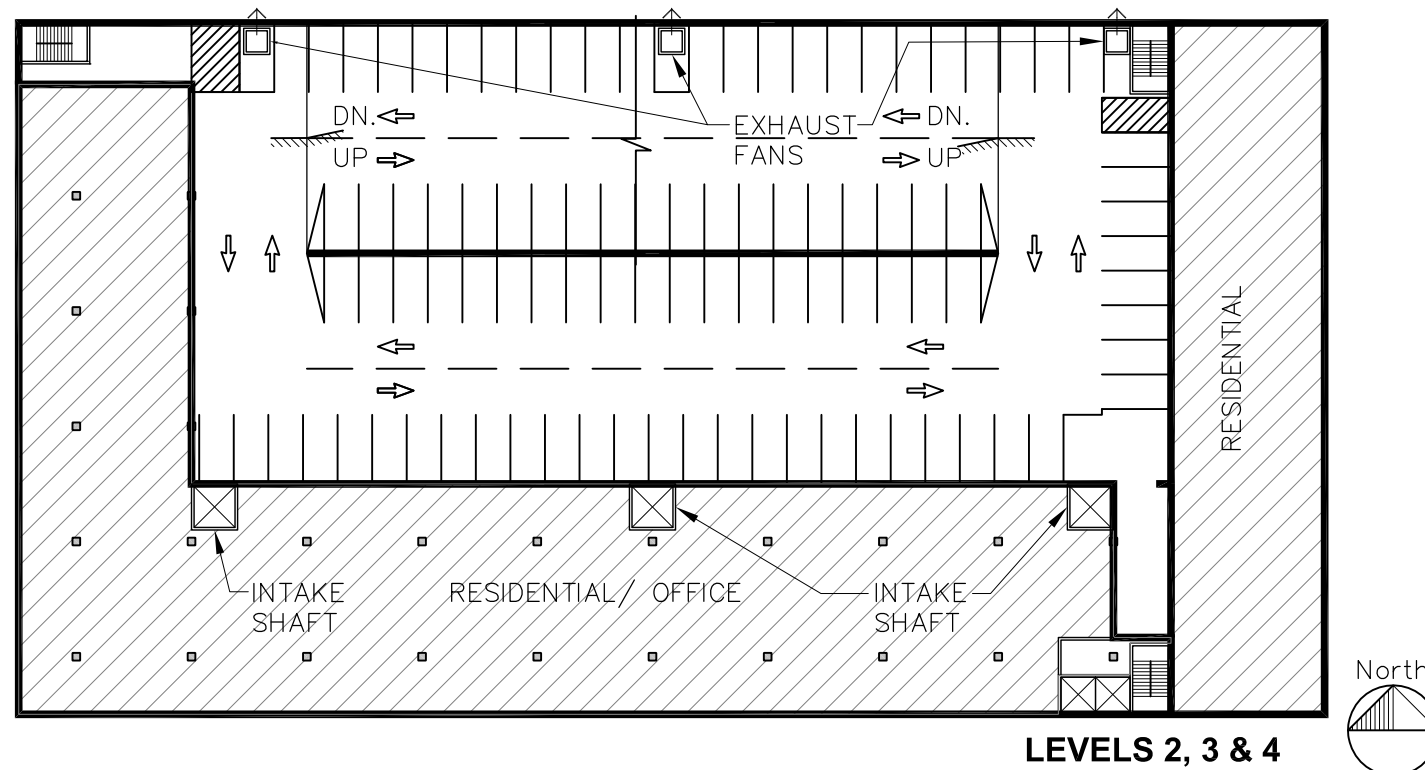
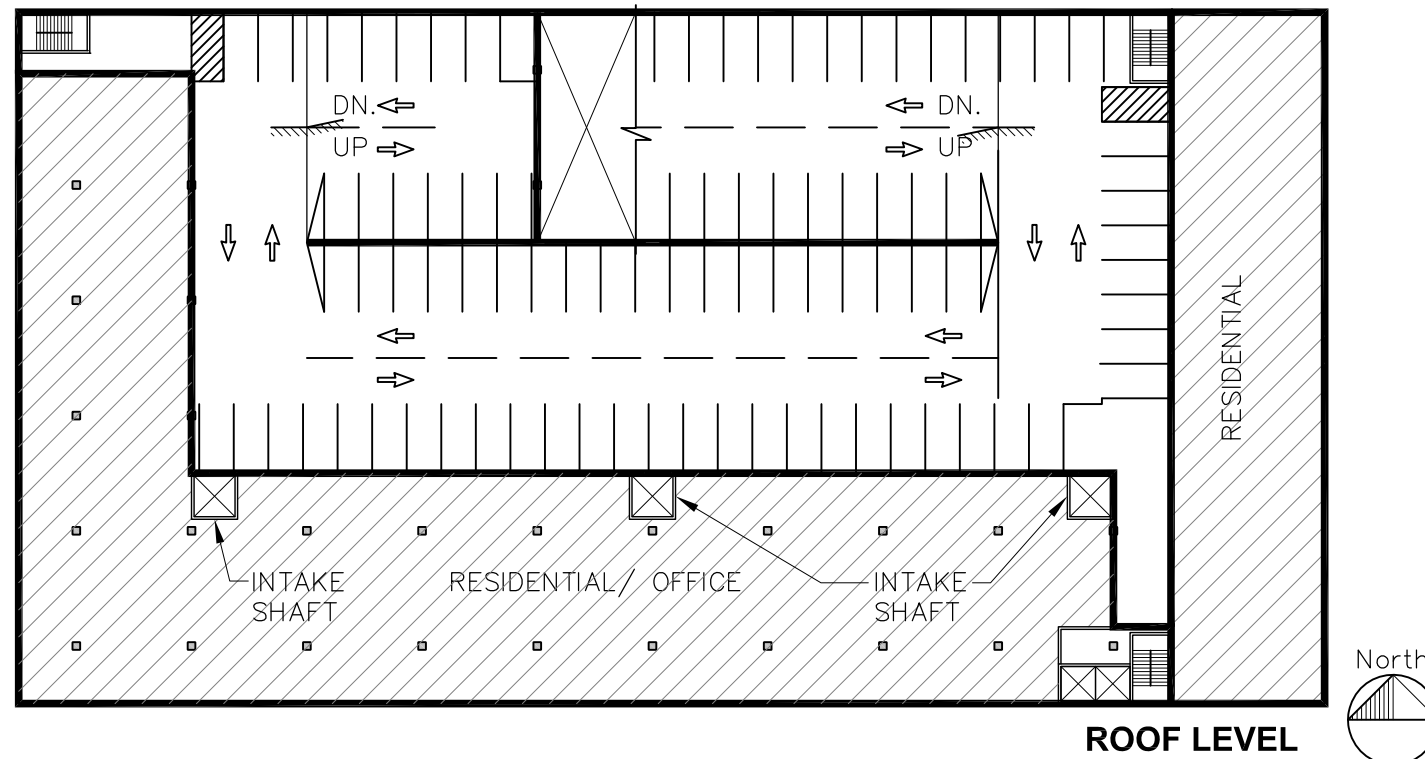
PARKING SPACES		BUILDING AREA (SQ. FT.)		
LEVEL	STANDARD SPACE	RETAIL, RESIDENTIAL & OFFICE	PARKING	TOTAL
ROOF	89	27,480	30,465	57,945
L4	94	27,480	32,005	59,485
L3	94	27,480	32,005	59,485
L2	94	27,480	32,005	59,485
L1	83	20,700	28,840	49,540
TOTAL	454	130,620	155,320	285,940

N1-2013-060 SITE-2-ABOVE GRADE-CTC

LEVEL 1

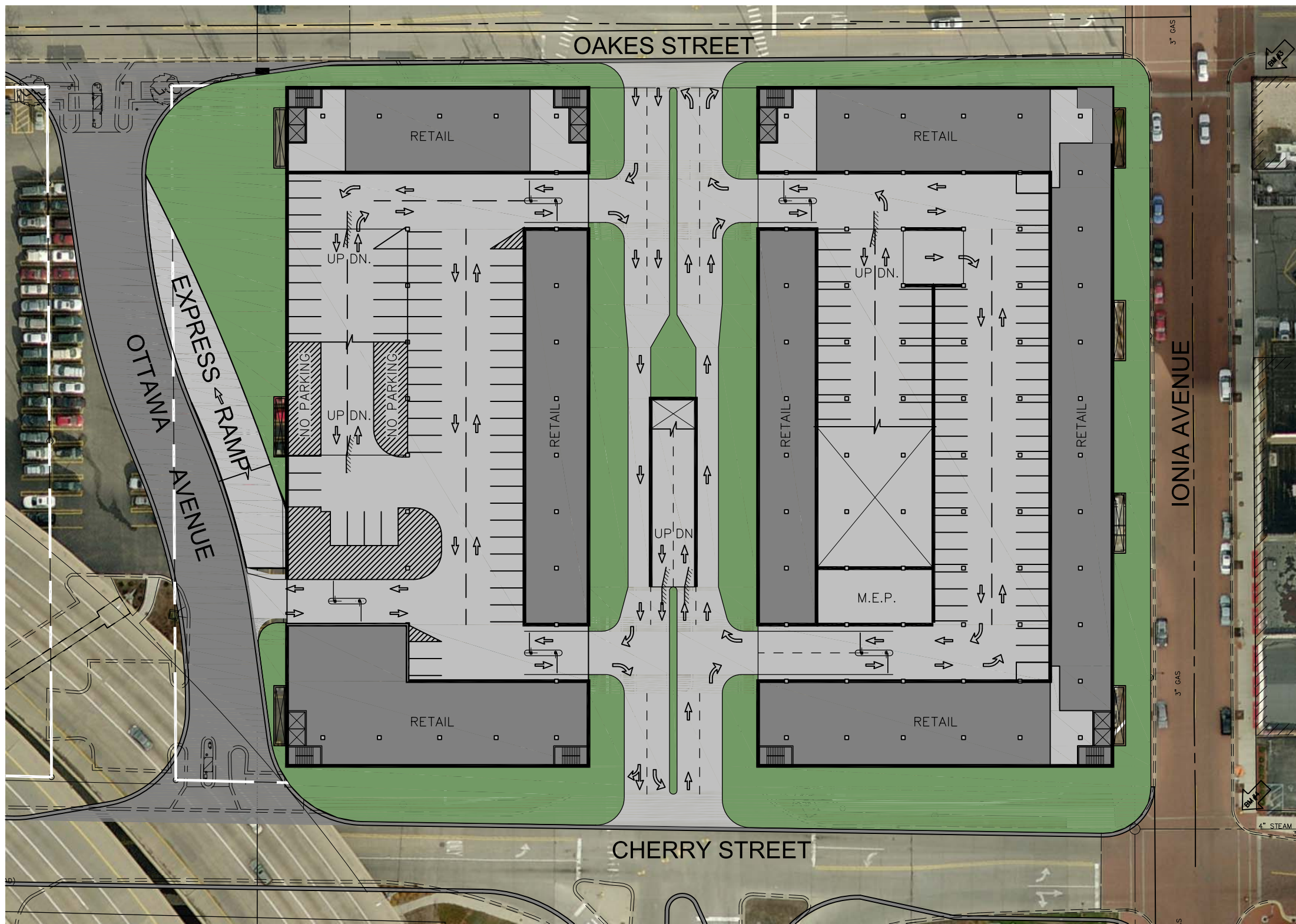


SHT. 1 of 2

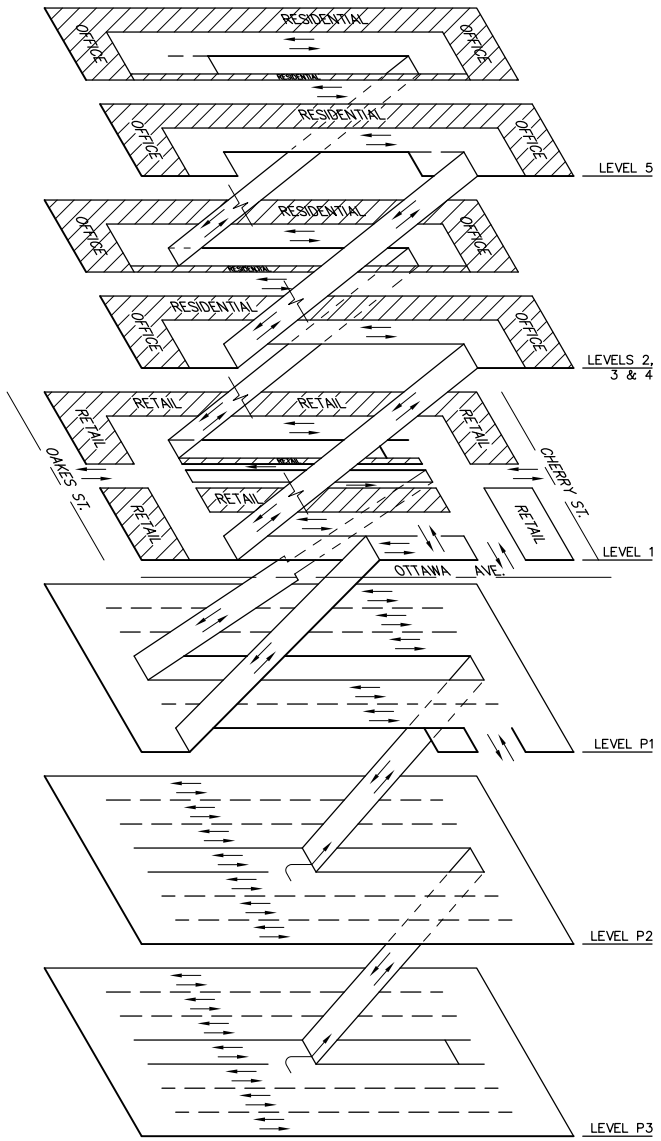


**SITE 2 - ABOVE GRADE GARAGE
W/ COMMERCIAL/ RESIDENTIAL**
NO SCALE N1-2013-060 SITE-2-ABOVE GRADE-ISO

SHT. 2 of 2



LEVEL 1



AREA 4-5 PARKING STRUCTURE

NO SCALE N1-2013-060 SITE-4-5-ISO



ABOVE GRADE GARAGE AND DEVELOPMENT

LEVEL	PARKING SPACES		BUILDING AREA (SQ. FT.)	
	STANDARD SPACE	RETAIL, RESIDENTIAL & OFFICE	PARKING	TOTAL
L5	182	57,780	61,830	119,610
L4	202	57,780	67,500	125,280
L3	202	57,780	67,500	125,280
L2	202	57,780	67,500	125,280
L1	120	56,560	64,600	121,160
SUBTOTAL	908	287,680	328,930	616,610
5% CONTINGENCY	45	-	-	-
TOTAL	863	287,680	328,930	616,610

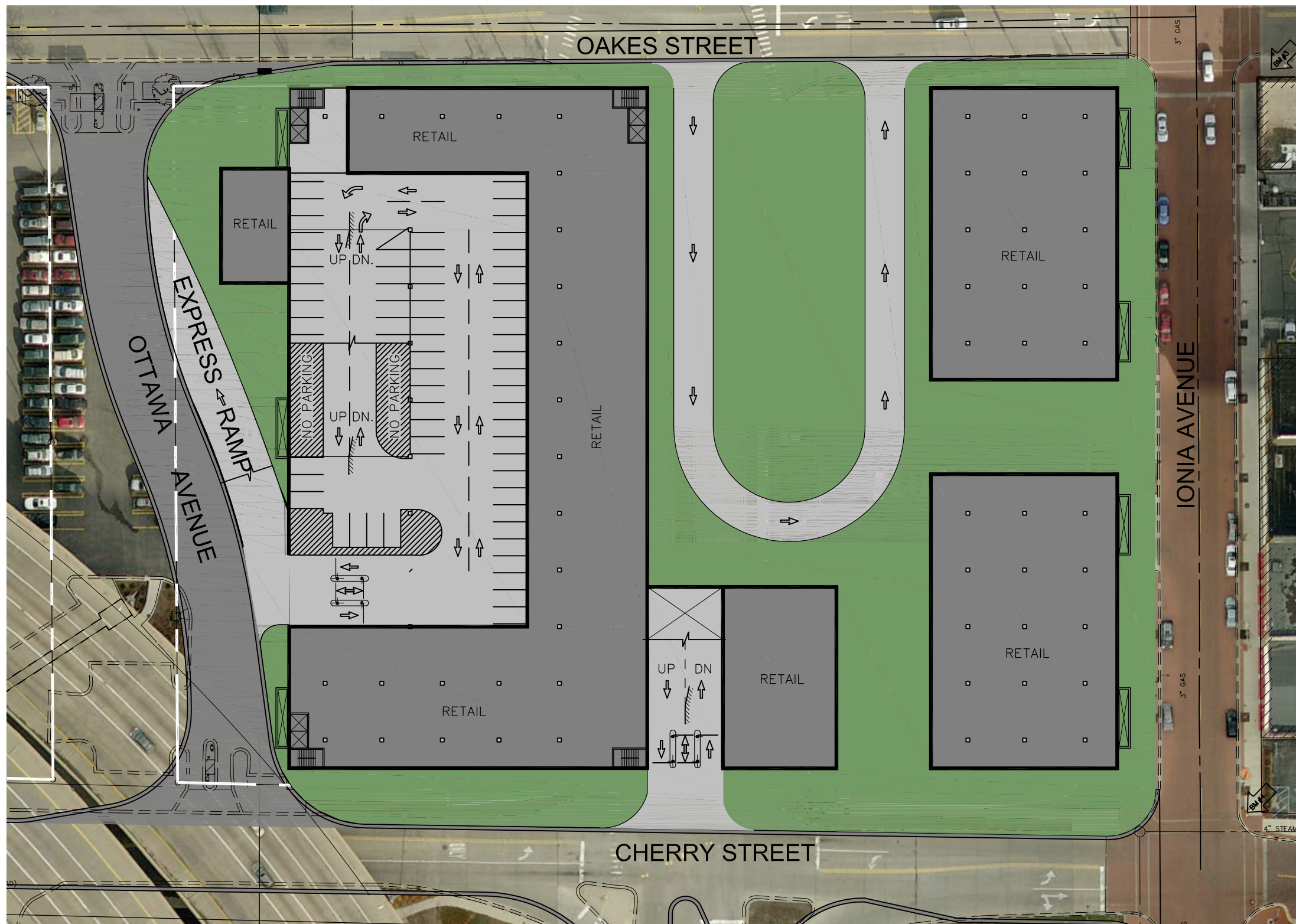
N1-2013-060 SITE-4-5-CTC

UNDERGROUND GARAGE AND DEVELOPMENT

LEVEL	PARKING SPACES		BUILDING AREA (SQ. FT.)	
	STANDARD SPACE	DEVELOPMENT AND SUPPORTED GRADE	PARKING	TOTAL
L1	-	156,550	-	156,550
P1	354	-	153,130	153,130
P2	430	-	153,130	153,130
P3	430	-	148,100	148,100
SUBTOTAL	1,214	156,550	454,360	610,910
5% CONTINGENCY	61	-	-	-
TOTAL	1,153	156,550	454,360	610,910

N1-2013-060 SITE-4-5-CTC

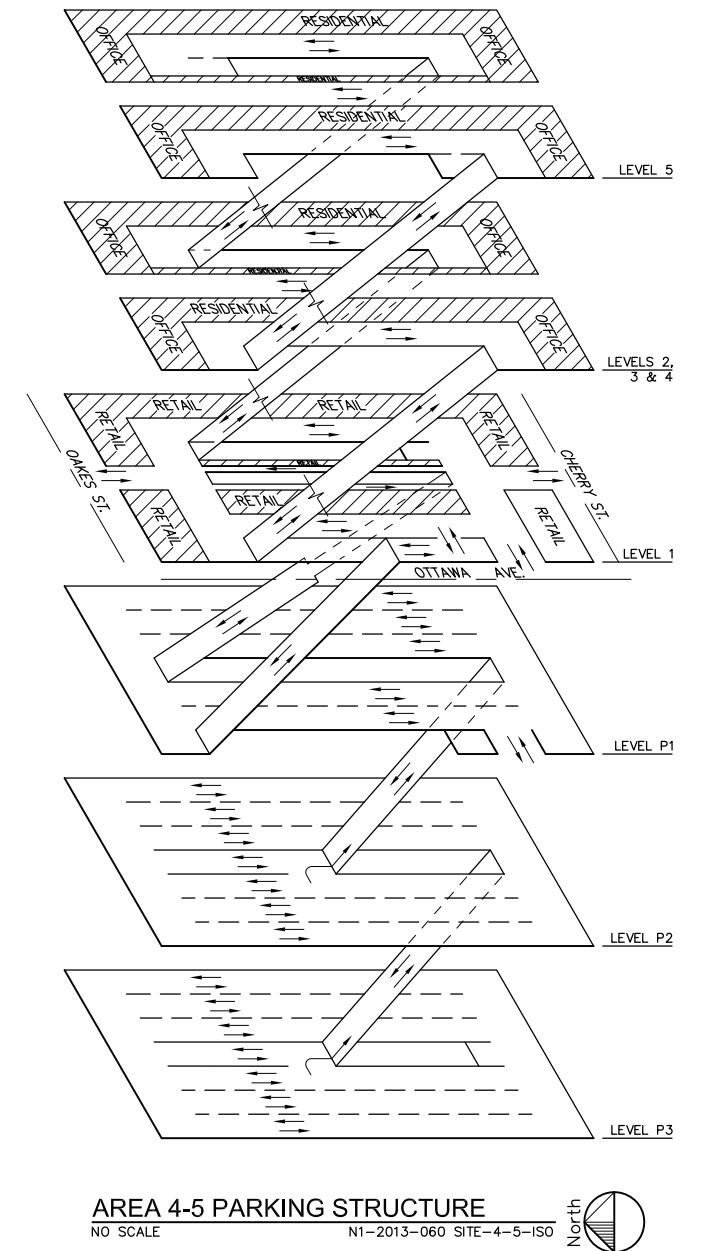
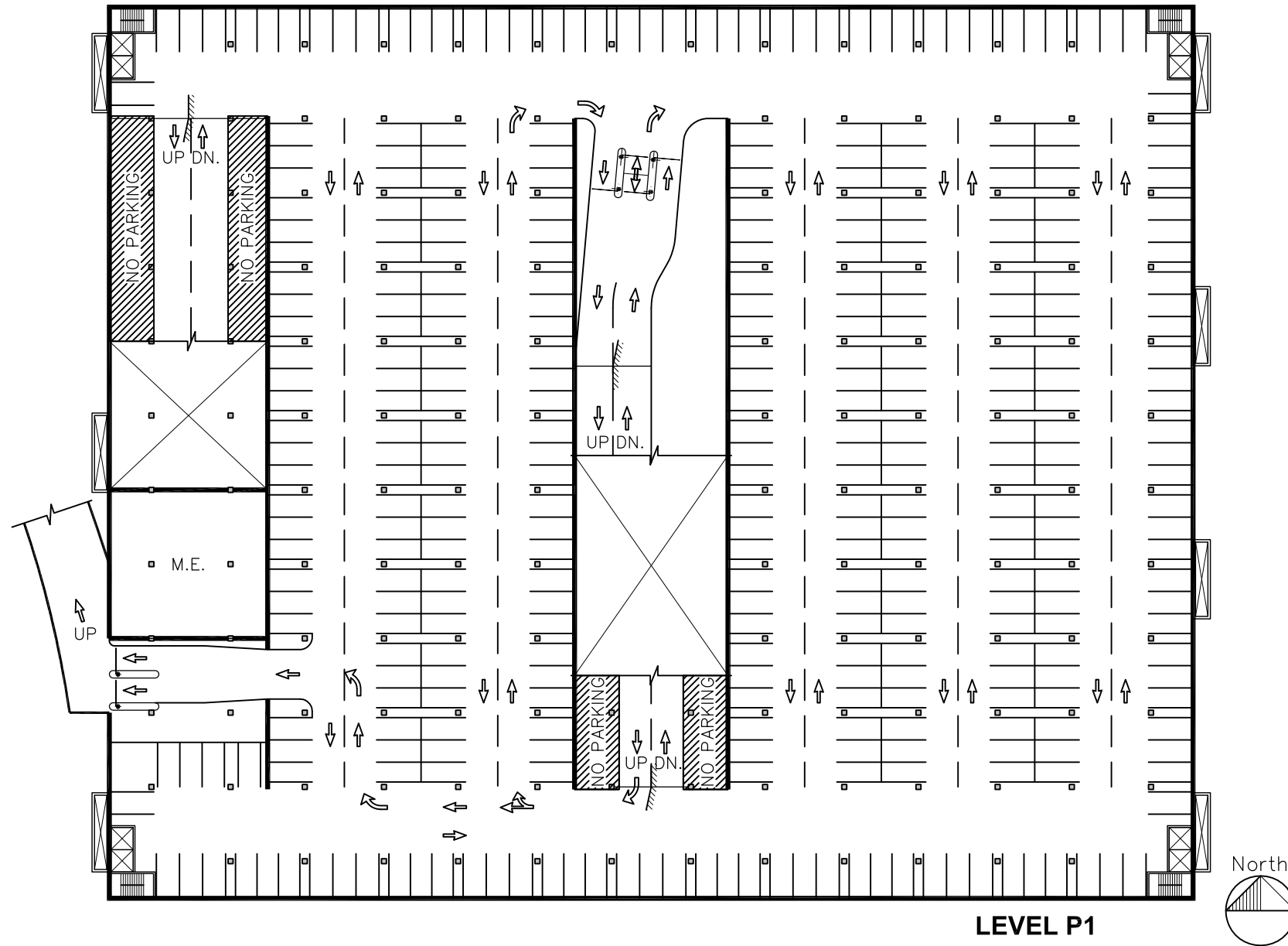
SHT. 1 of 6



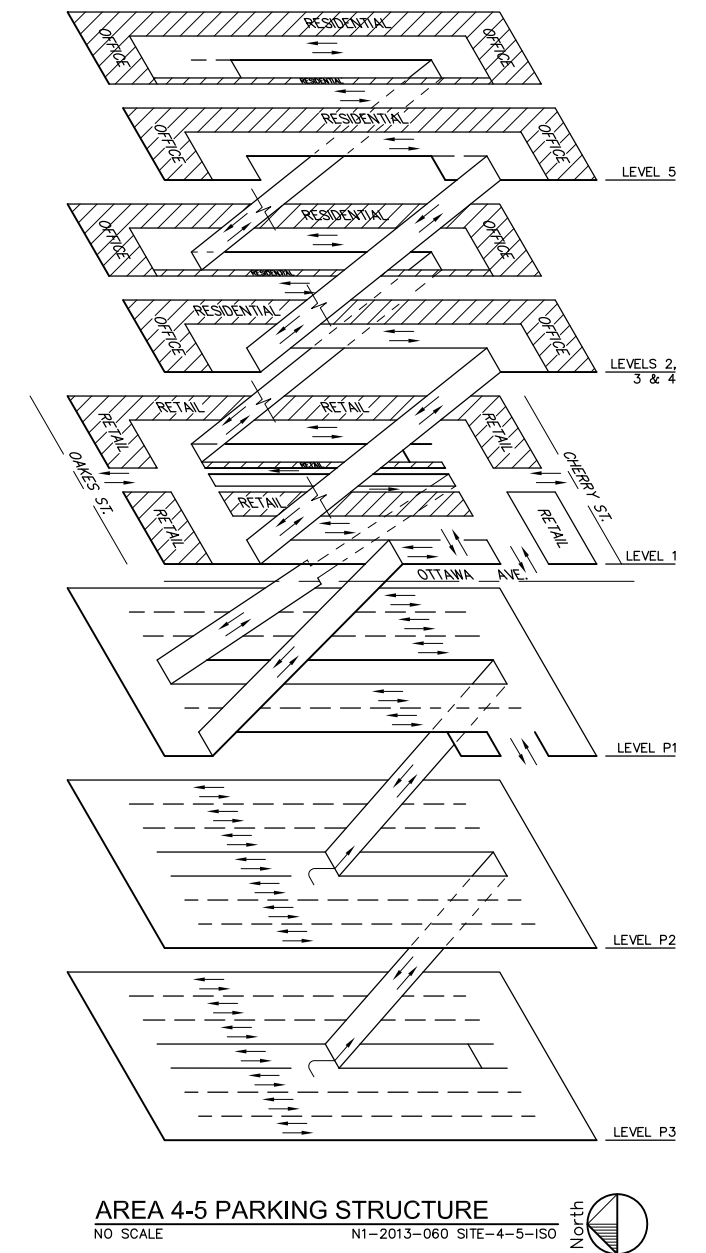
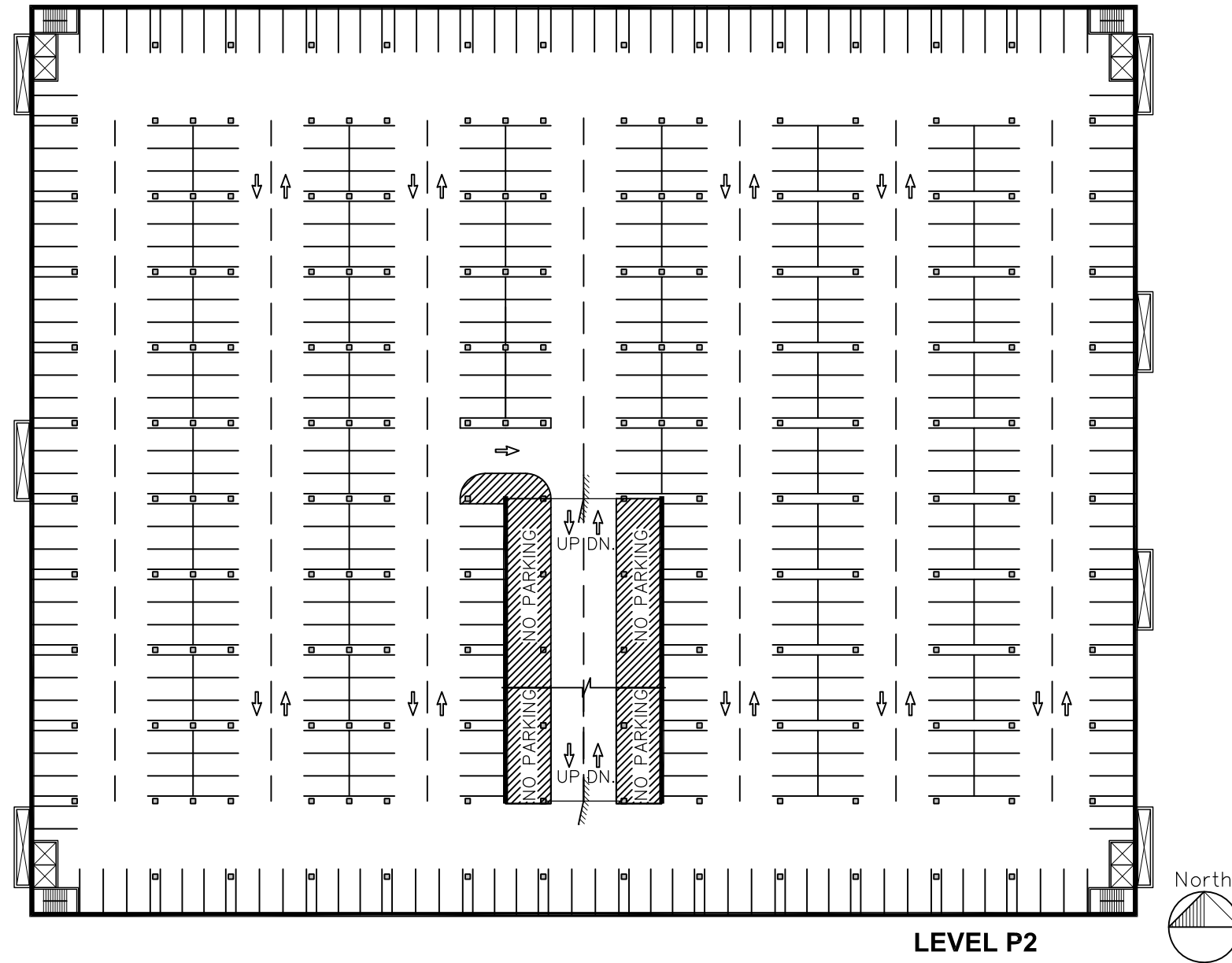
LEVEL 1



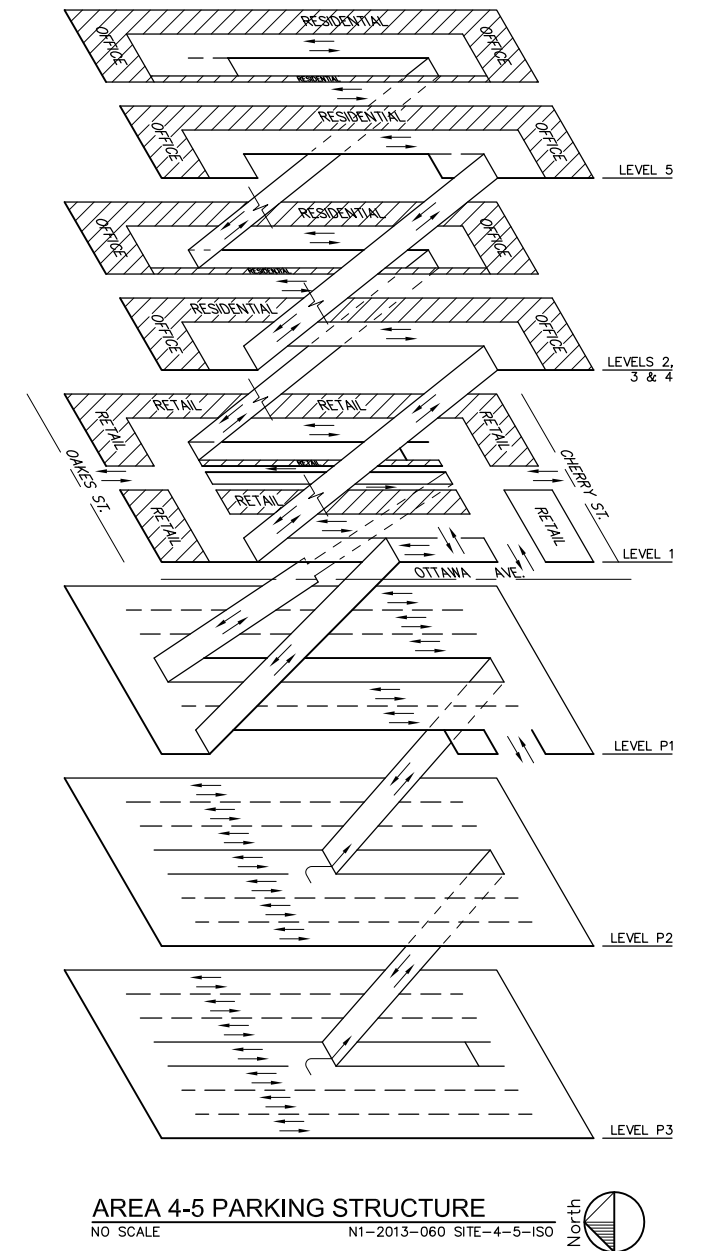
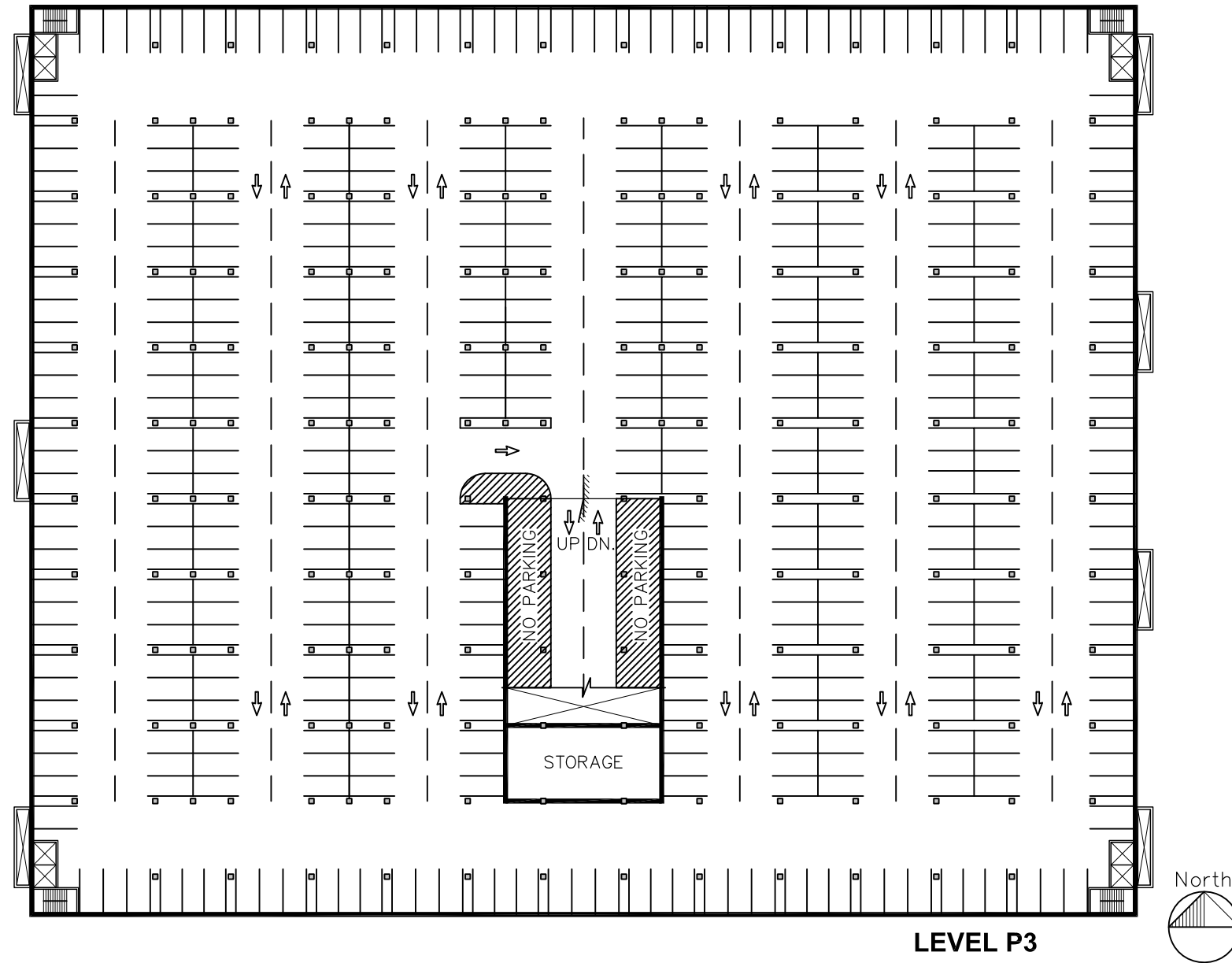
SHT. 1 ALT.



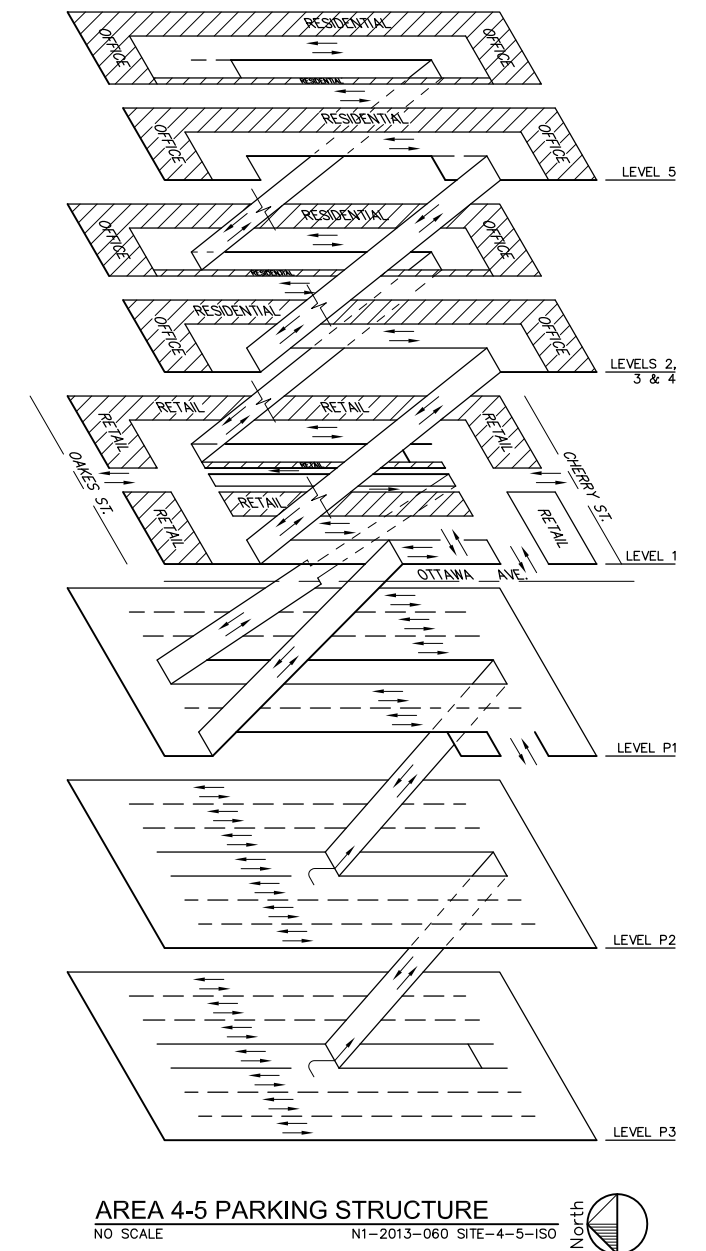
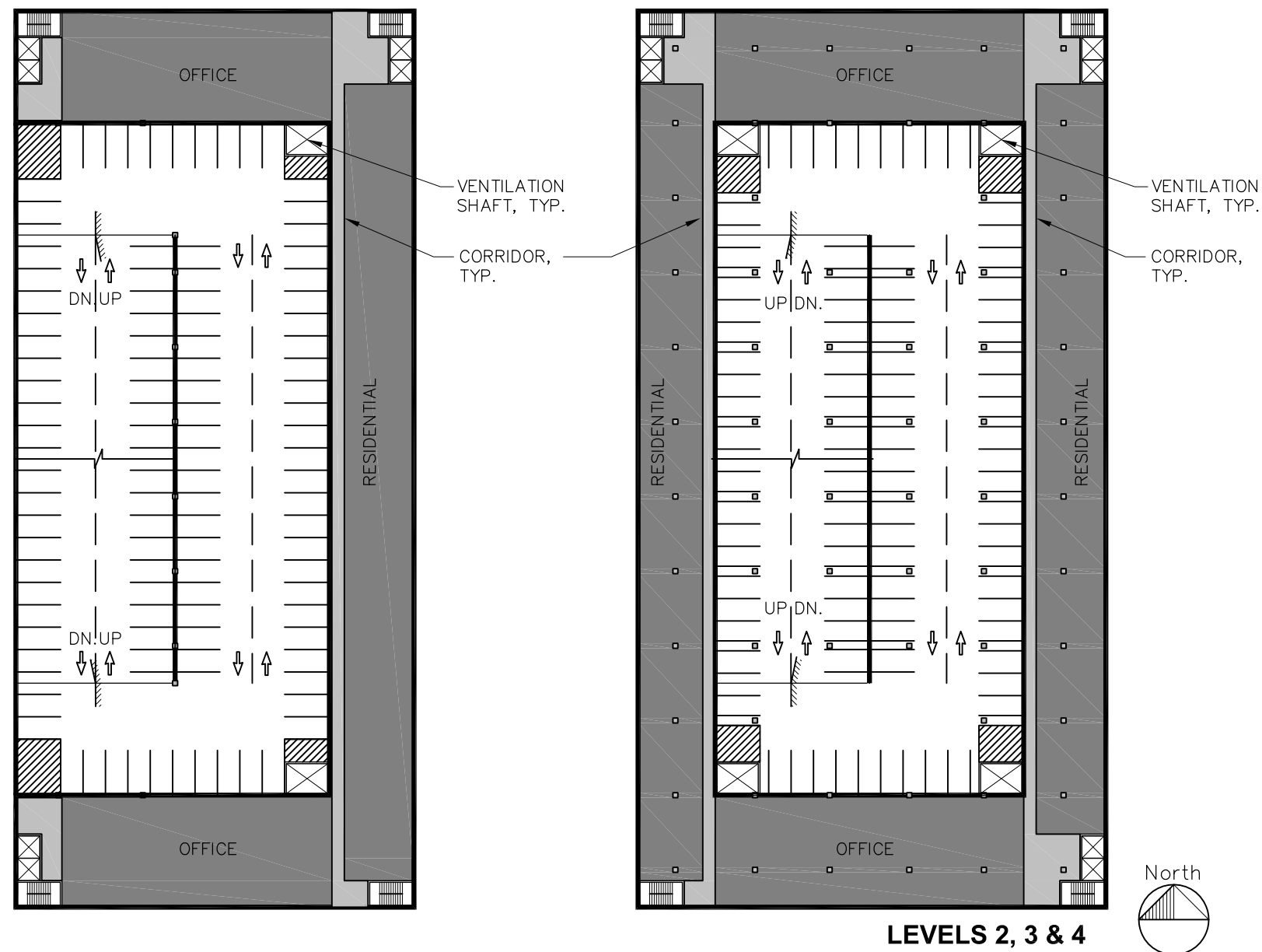
SHT. 2 of 6

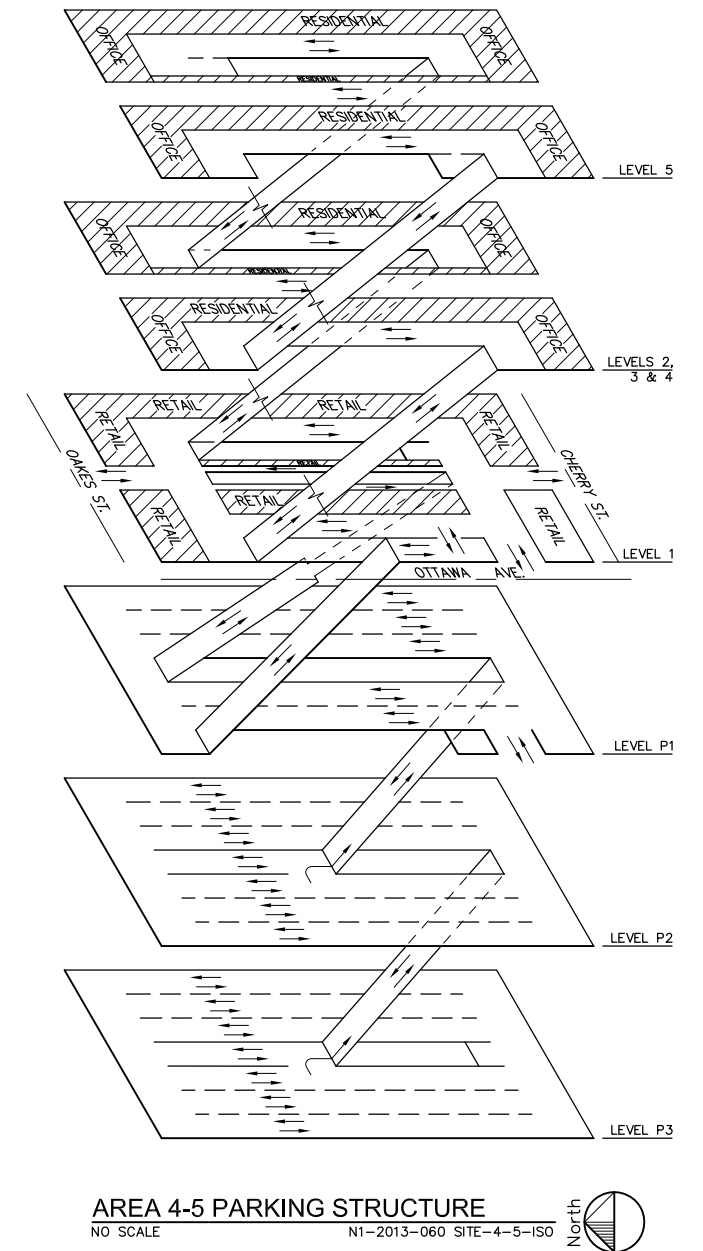
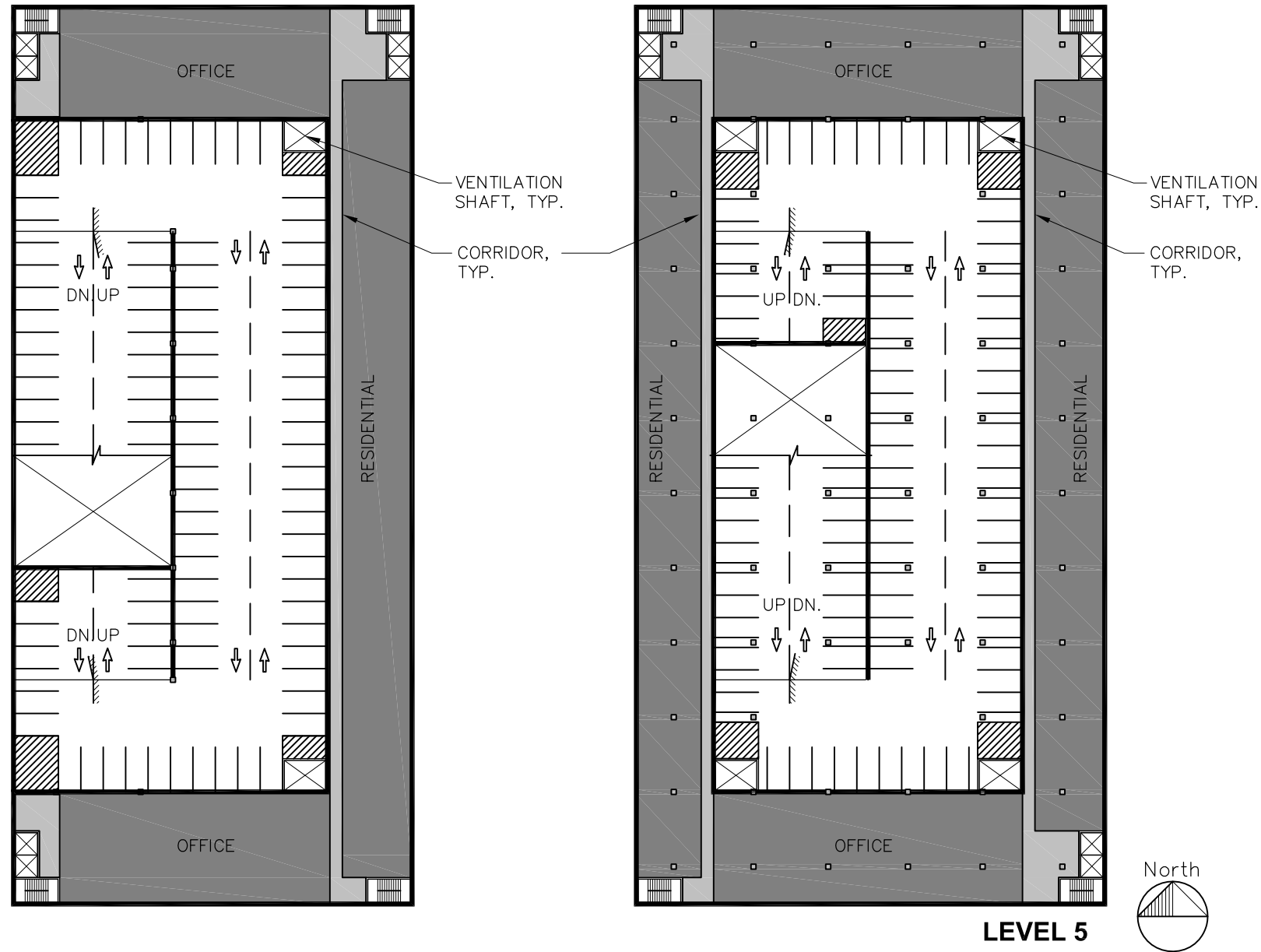


SHT. 3 of 6



SHT. 4 of 6

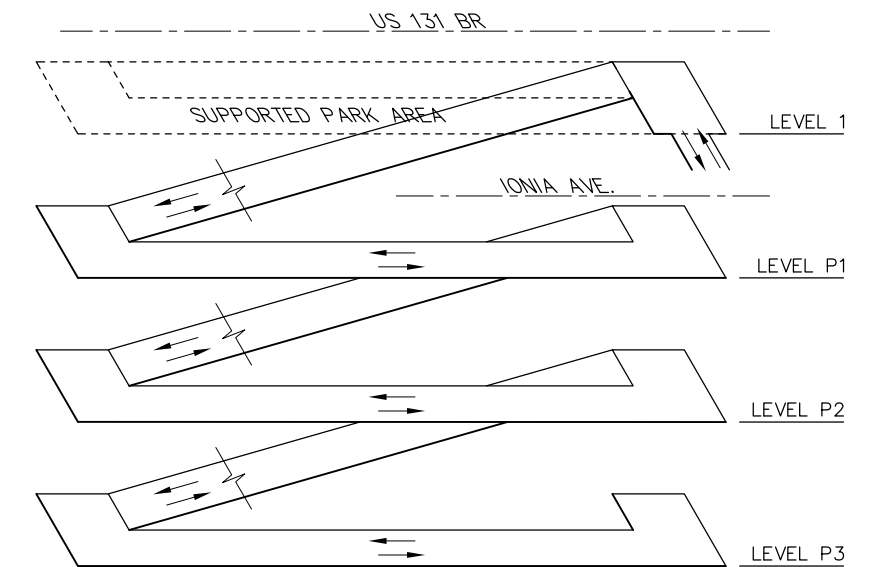




SHT. 6 of 6



LEVEL 1 PLAN



HEARTSIDE SITE PARKING STRUCTURE

NO SCALE

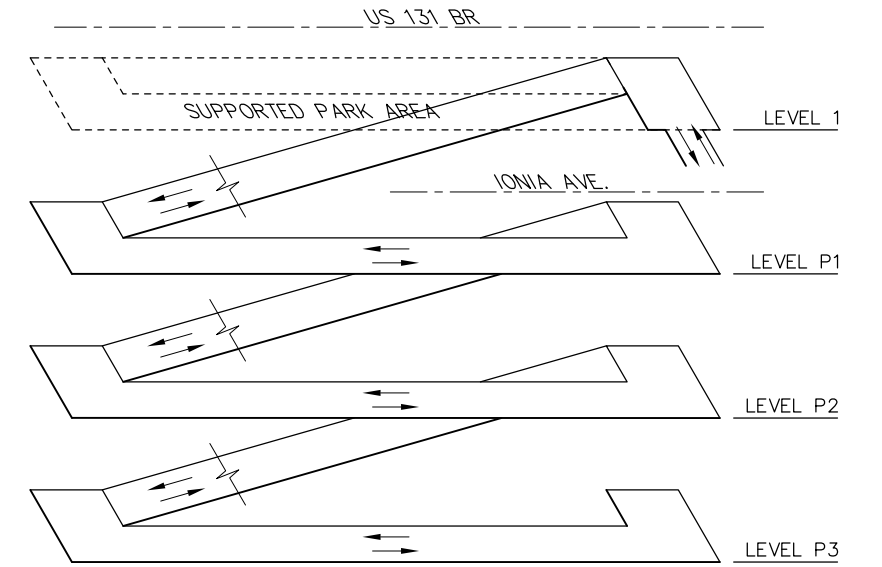
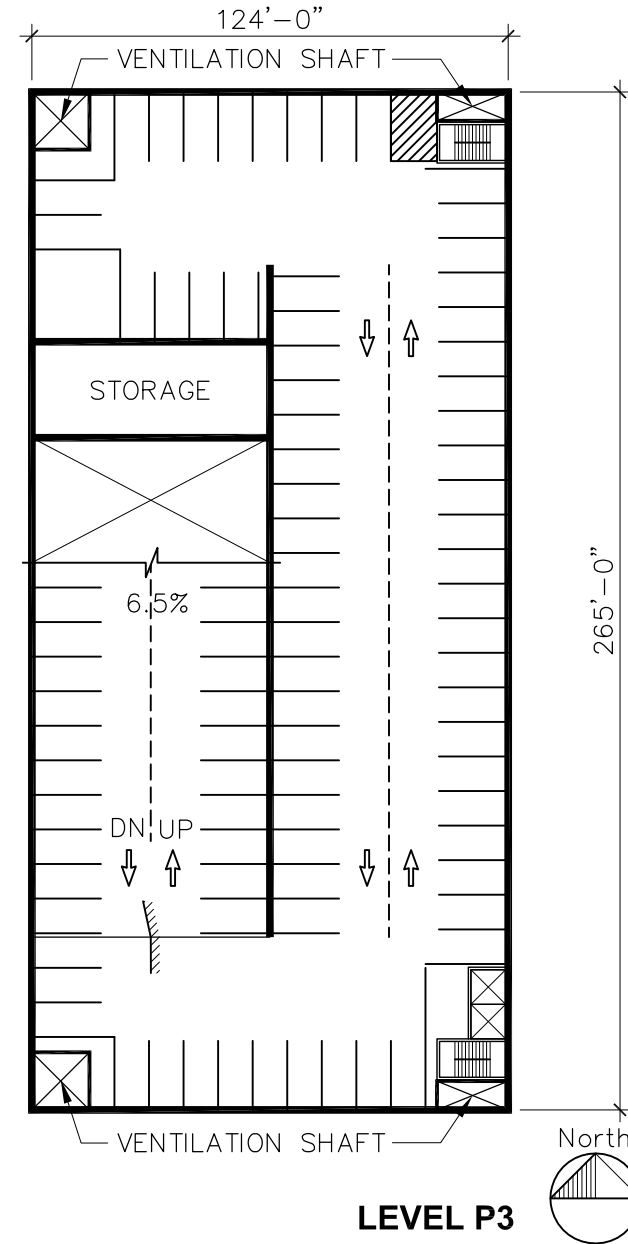
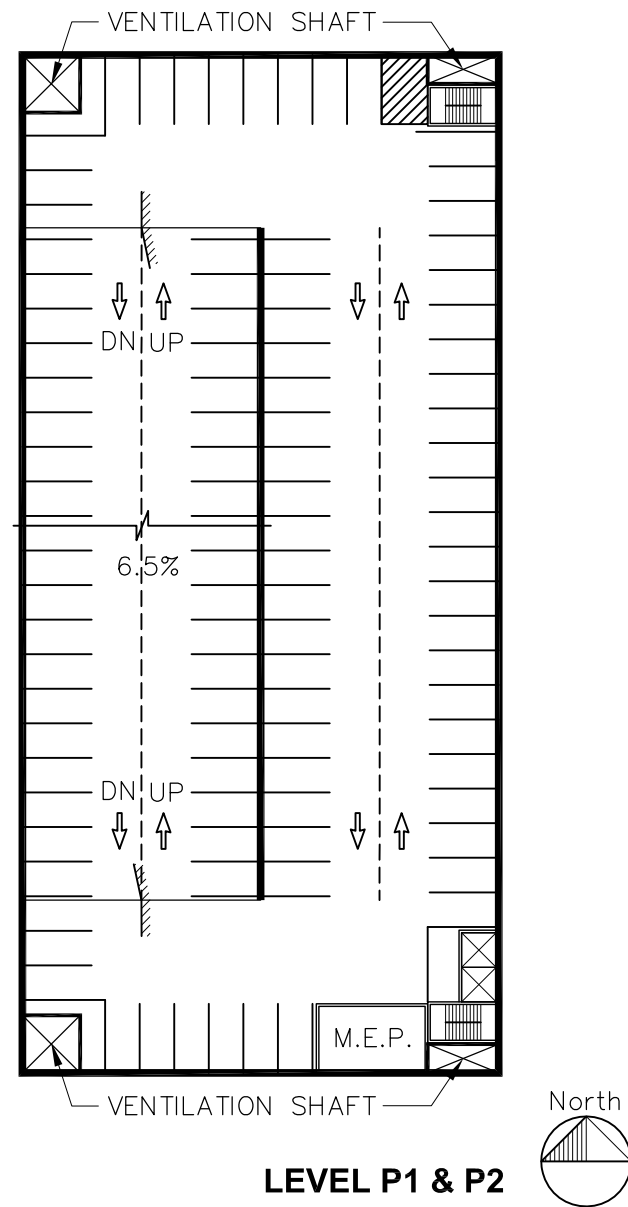
N1-2013-060 HEARTSIDE SITE-ISO



PARKING SPACES (9'-0" WIDE)		BUILDING AREA (SQ. FT.)		
LEVEL	STANDARD SPACE	SUPPORTED PARK AREA	PARKING	TOTAL
L1	33	14,590	11,691	26,281
P1	100	—	32,860	32,860
P2	103	—	32,860	32,860
P3	90	—	30,841	30,841
SUBTOTAL	326	14,590	108,252	122,842
5% CONTINGENCY	16	—	—	—
TOTAL	310	14,590	108,252	122,842

N1-2013-060 HEARTSIDE SITE-N-CTC

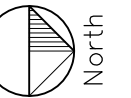
SHT. 1 of 2



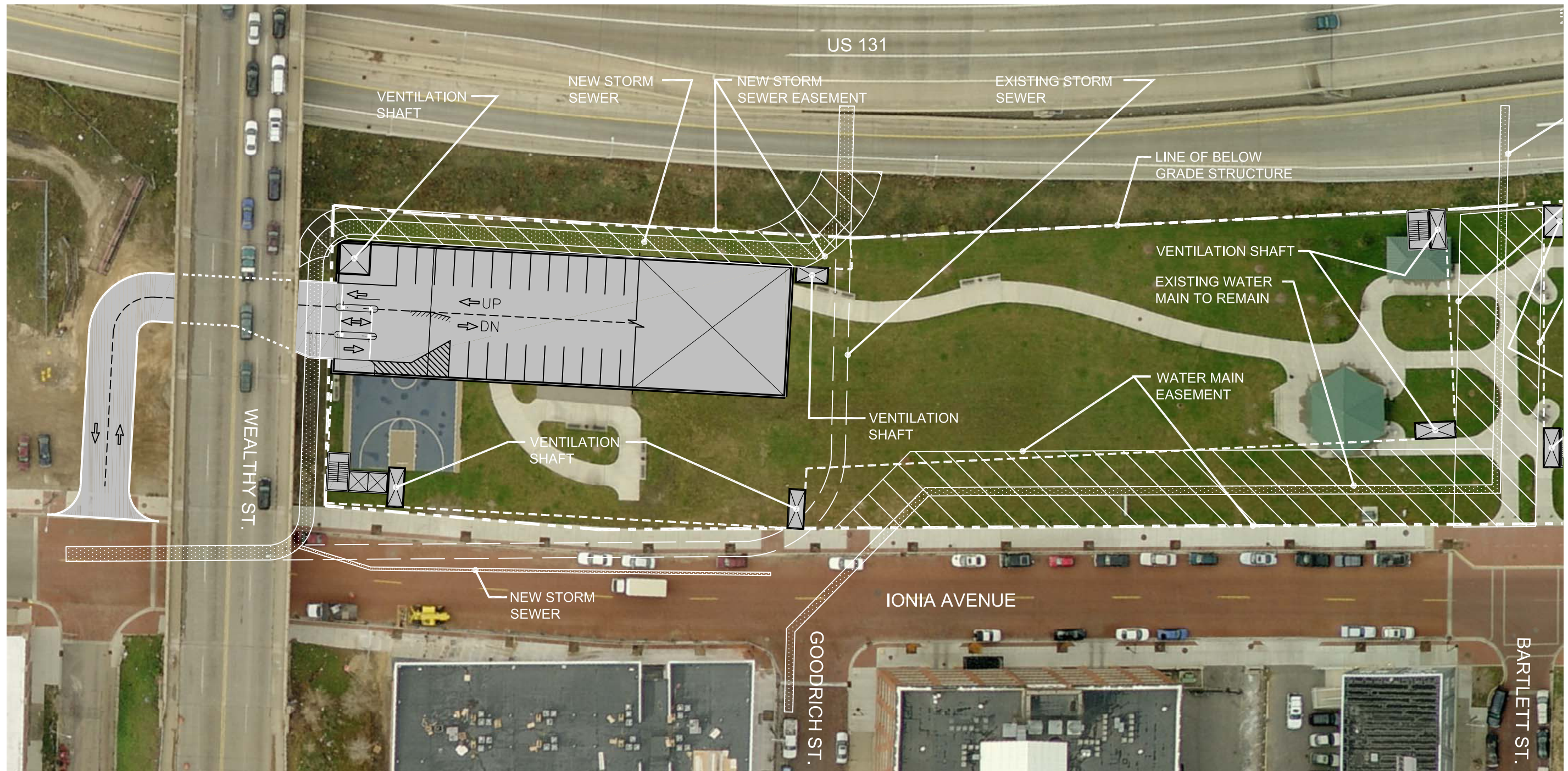
HEARTSIDE SITE PARKING STRUCTURE

NO SCALE

N1-2013-060 HEARTSIDE SITE-ISO



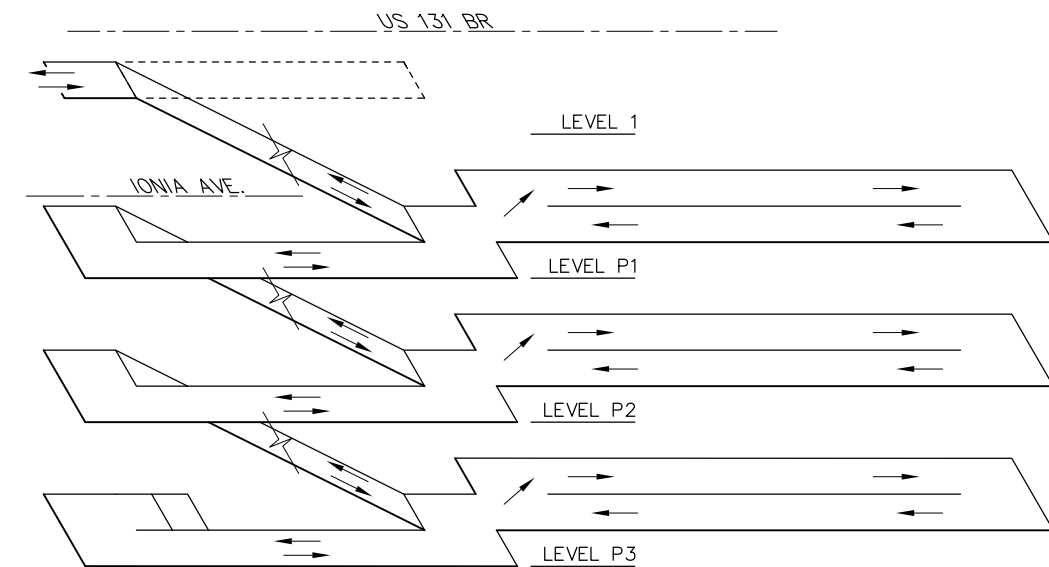
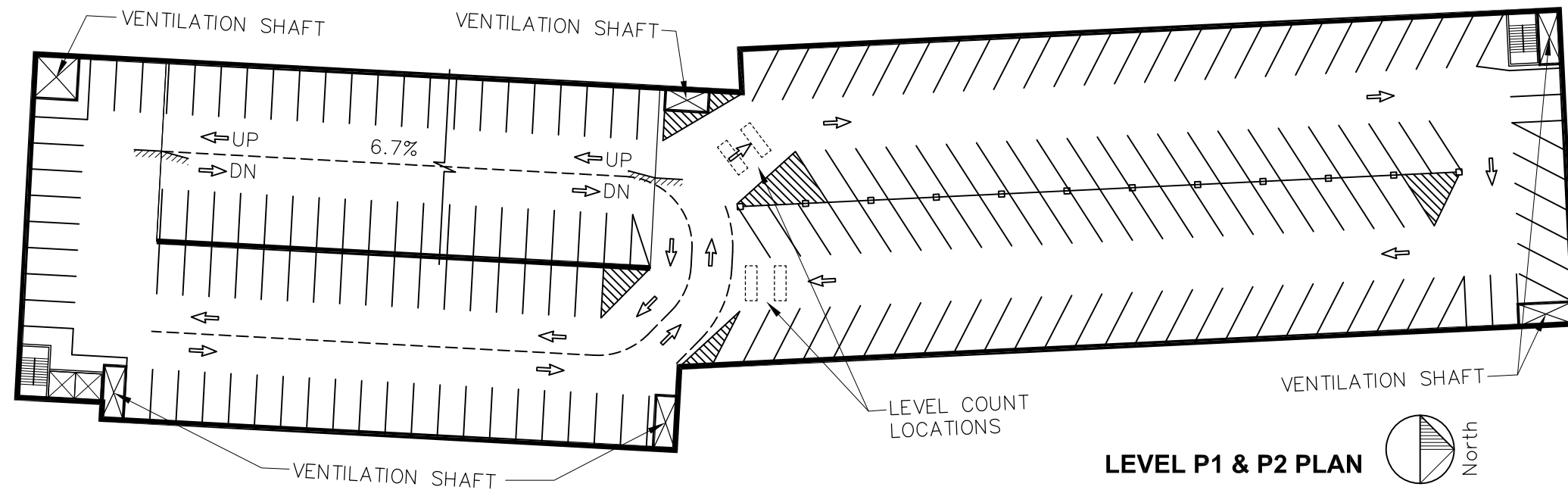
SHT. 2 of 2



LEVEL 1 PLAN



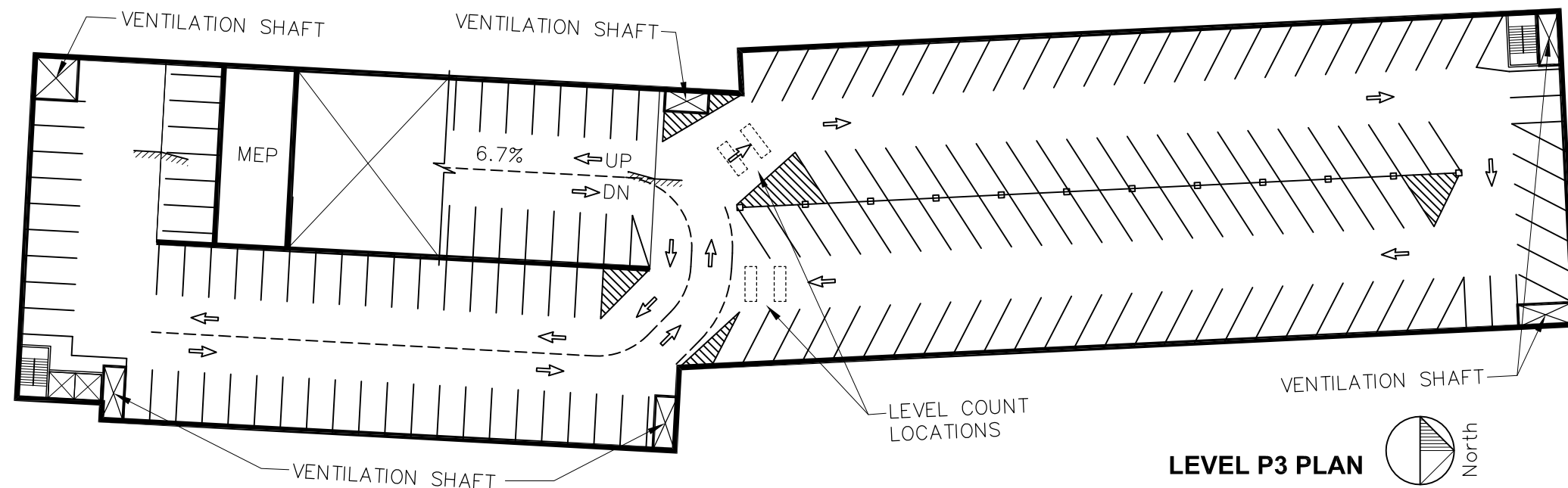
SHT. 1 of 2



HEARTSIDE SITE PARKING STRUCTURE

NO SCALE

N1-2013-060 HEARTSIDE SITE-ISO-SOUTH



PARKING SPACES (9'-0" WIDE)		BUILDING AREA (SQ. FT.)		
LEVEL	STANDARD SPACE	SUPPORTED PARK AREA	PARKING	TOTAL
L1	23	45,900	14,250	60,150
P1	185	—	60,464	60,464
P2	185	—	60,464	60,464
P3	167	—	57,213	57,213
SUBTOTAL	560	45,900	192,391	238,291
5% CONTINGENCY	28	—	—	—
TOTAL	532	45,900	192,391	238,291

N1-2013-060 HEARTSIDE SITE-S-CTC

SHT. 2 of 2

APPENDIX B – EXAMPLE UNDERGROUND PARKING PHOTOGRAPHS

- Library Lane Parking Structure – Ann Arbor
- Kansas City Performing Arts – Kansas City
- Miller Canfield Parking Structure – Kalamazoo
- Michigan Street Parking Structure – Grand Rapids
- University of Iowa Parking Structure – Iowa City



Arena South Underground Parking

Ann Arbor Library Lane

Public Roadways & Future Buildings

750 Cars, 4 Levels Below Grade





Arena South Underground Parking

Ann Arbor Library Lane

Public Roadways & Future Buildings

750 Cars, 4 Levels Below Grade





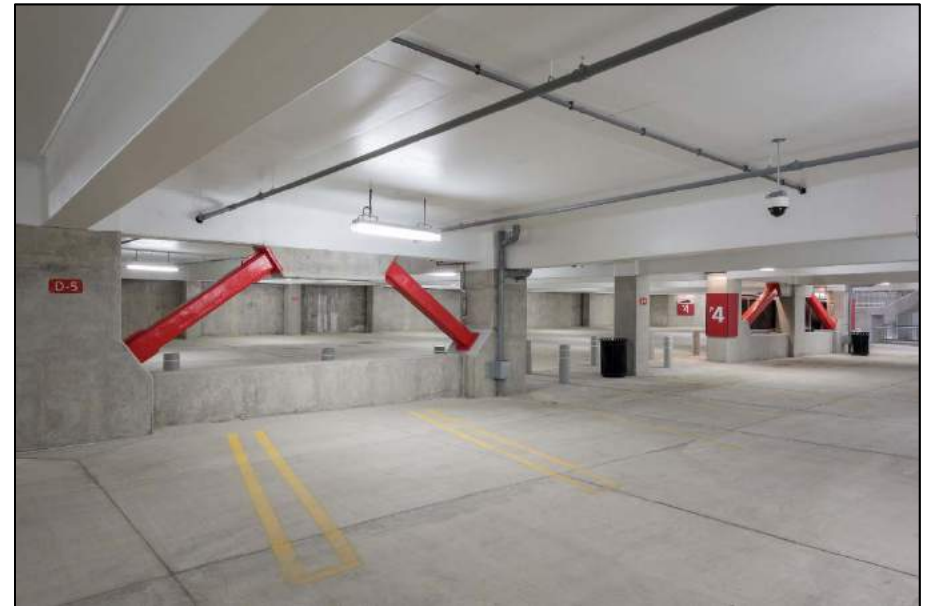
CITY OF
GRAND
RAPIDS

Arena South Underground Parking

Ann Arbor Library Lane

Public Roadways & Future Buildings

750 Cars, 4 Levels Below Grade



Carl Walker



Arena South Underground Parking

Ann Arbor Library Lane

Public Roadways & Future Buildings

750 Cars, 4 Levels Below Grade





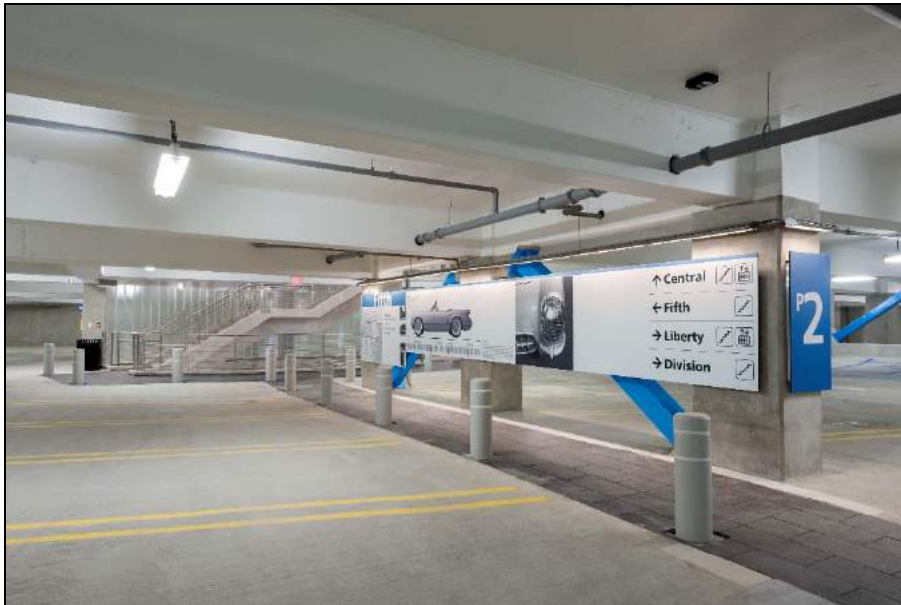
CITY OF
GRAND
RAPIDS

Arena South Underground Parking

Ann Arbor Library Lane

Public Roadways & Future Buildings

750 Cars, 4 Levels Below Grade



Carl Walker



Arena South Underground Parking

Kansas City Performing Arts

Public Park above Parking Garage
1,000 Cars, Below Grade

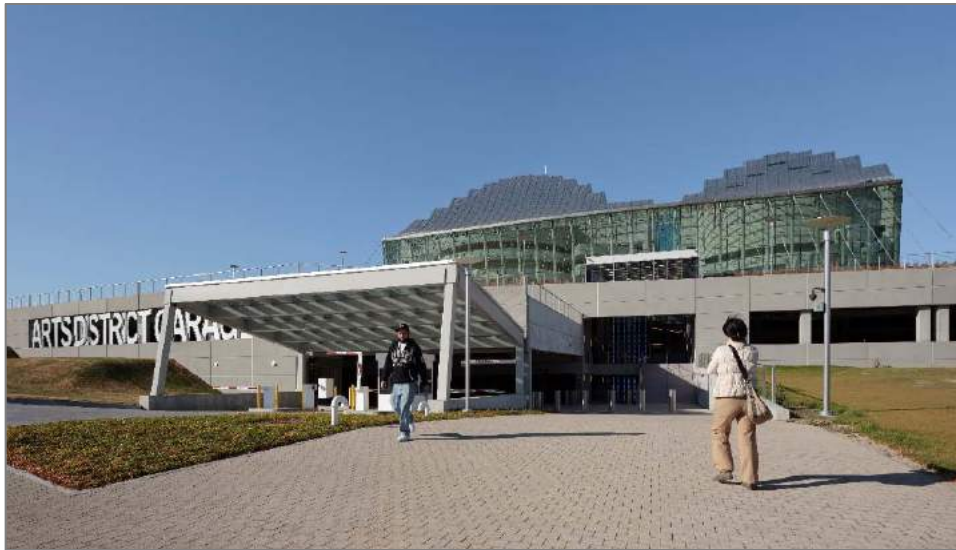




Arena South Underground Parking

Kansas City Performing Arts

Public Park above Parking Garage
1,000 Cars, Below Grade



Carl Walker

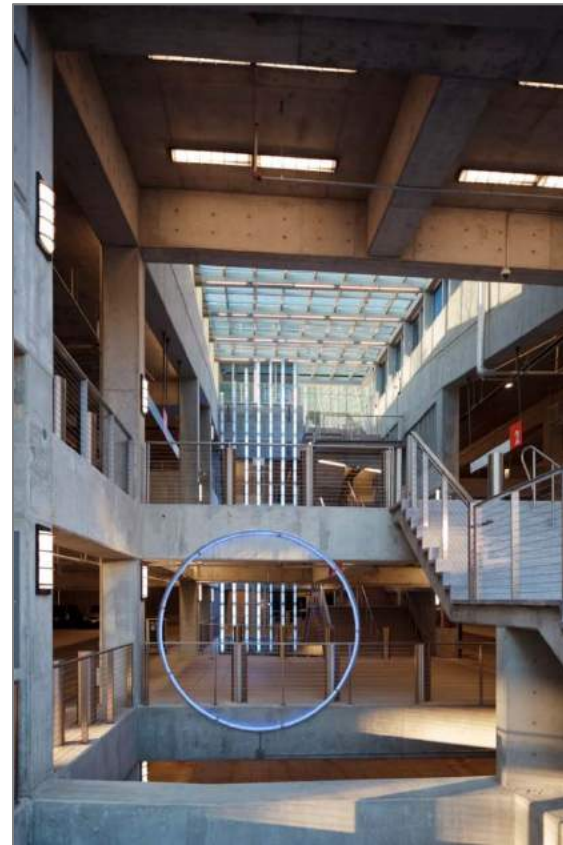


Arena South Underground Parking



Kansas City Performing Arts

Public Park above Parking Garage
1,000 Cars, Below Grade





CITY OF
GRAND
RAPIDS

Arena South Underground Parking

Miller Canfield Building Development

Buildings above Parking Garage
150 Cars, 3 Levels Below Grade



Carl Walker



CITY OF
GRAND
RAPIDS

Arena South Underground Parking

Miller Canfield Building Development

Buildings above Parking Garage
150 Cars, 3 Levels Below Grade



Carl Walker



Arena South Underground Parking

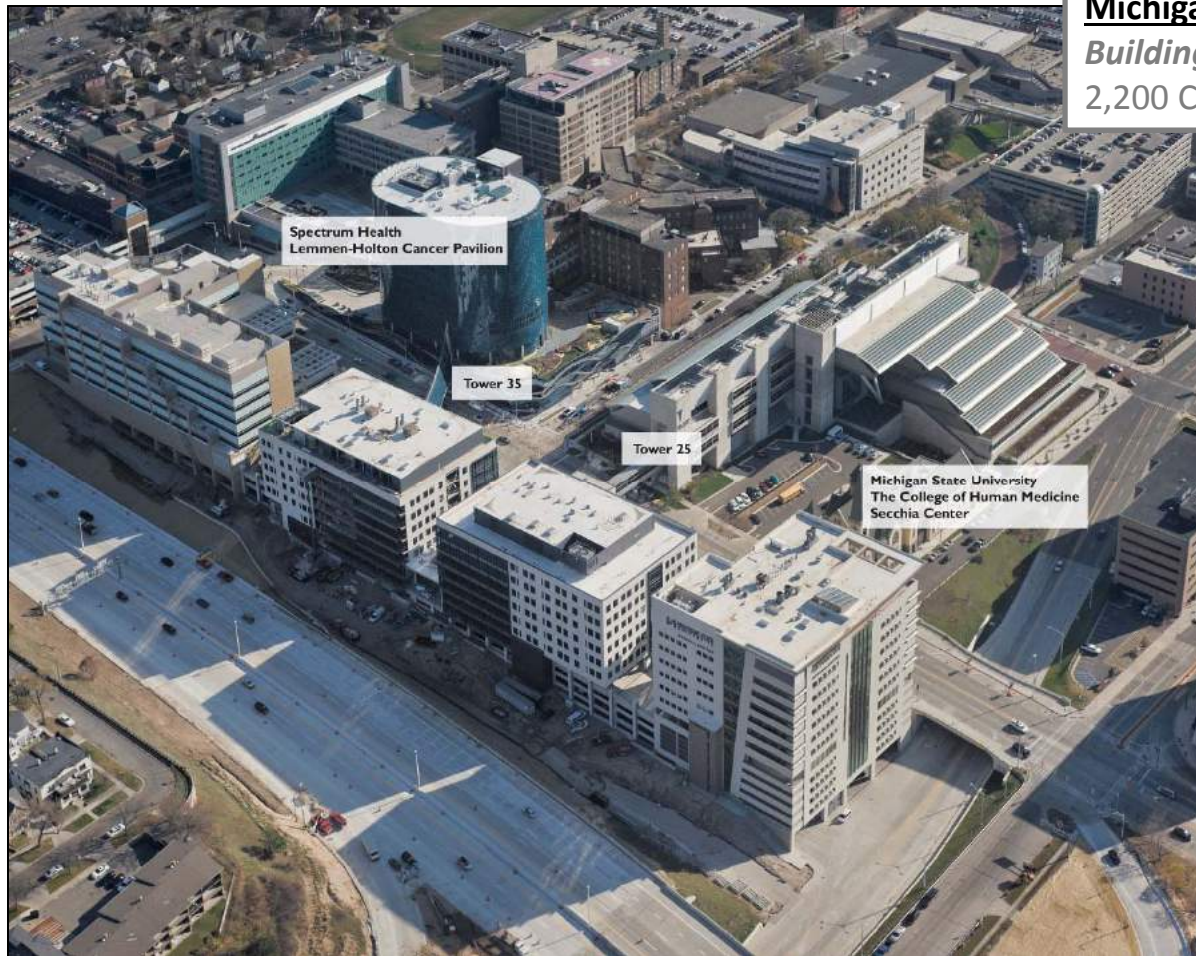
Miller Canfield Building Development

Buildings above Parking Garage
150 Cars, 3 Levels Below Grade





Arena South Underground Parking



Michigan Street Development

Buildings above Parking Garage
2,200 Cars, 6 Levels Below Grade



Arena South Underground Parking

Michigan Street Development

Buildings above Parking Garage
2,200 Cars, 6 Levels Below Grade





Arena South Underground Parking

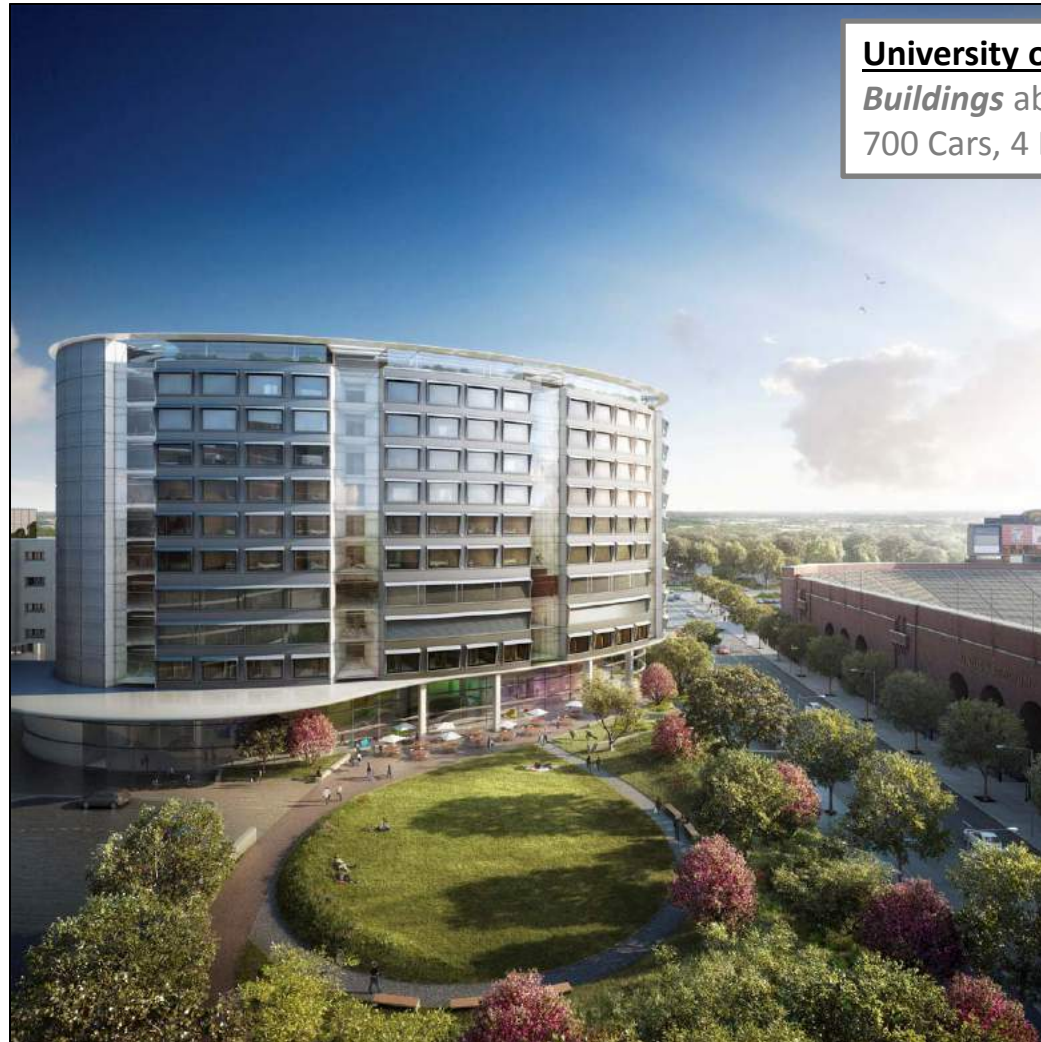
Michigan Street Development

Buildings above Parking Garage
2,200 Cars, 6 Levels Below Grade





Arena South Underground Parking



University of Iowa Health Clinic
Buildings above Parking Garage
700 Cars, 4 Levels Below Grade



CITY OF
GRAND
RAPIDS

Arena South Underground Parking

University of Iowa Health Clinic

Buildings above Parking Garage
700 Cars, 4 Levels Below Grade



Carl Walker