Arena South Underground Parking Capacity/Feasibility Study

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1.0 INTRODUCTION / EXECUTIVE SUMMARY

1.1 Arena South Visioning Plan

Arena South is bordered by Fulton Street to the north, Commerce Avenue to the east, Wealthy Street to the south, and Market Street to the west. Construction of Van Andel Arena in 1996 has created a positive development environment, and the Arena South Vision Plan was created to provide an “instrument to guide future development in Arena South” and is meant to communicate the “guiding principles of development that participants in the planning process expect.”

Based upon guiding principles developed by the Arena South visioning team of city staff and a variety of community stakeholders, two Vision Concept Plans were prepared representing the culmination of ideas which addressed issues such as road alignment, vehicular circulation, pedestrian access, and walk-ability.

Land use planning and potential building uses were also examined, resulting in a series of massing studies for a variety of potential mixed-use developments. To take full advantage of available street frontage within these buildings for placement of retail and commercial uses, each of the Vision Concept Plans include options for both wrapped and underground structured parking, which is the primary focus of this study. The Visioning Plan acknowledges that convenient parking is an important component for successful development; however, it also recognizes the need to maximize the “leasable square footage...contributing to property and income tax base, while still accommodating
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:
“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).
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<td><strong>AREA 2</strong></td>
<td>No. of Parking Levels</td>
<td>Three (3) - P1, P2, P3</td>
<td>5 - L1, L2, L3, L4, L5</td>
<td>Three (3) - P1, P2, P3</td>
<td>Five (5) - L1 thru L5</td>
<td>5 - L1, L2, L3, L4, L5</td>
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<td><strong>AREA 4 &amp; 5</strong></td>
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<td>Four (4) - P1, P2, P3</td>
<td>Four (4) - P1, P2, P3</td>
<td>Four (4) - P1, P2, P3</td>
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**Construction Costs**
- 25% Soft Costs Included
- Insurance
- 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.

<table>
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<th>Potential Economic Impacts: 380,000 sf Residential Development</th>
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<tr>
<td>Development Size (Square Footage)</td>
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<tr>
<td>New Construction Activity (@$200/s.f.)</td>
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<td>Leasable Square Footage (80% - 90% of development)</td>
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<tr>
<td>Jobs (1 job/450 s.f. of retail: 1 job / 300 s.f. of office space)</td>
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<tr>
<td>Multi-Family Housing Units (1 unit/1,000 s.f.)</td>
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<tr>
<td>New Residents (1.5 people/unit)</td>
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<td>Annual Consumer Spending Impact ($24,000/resident)</td>
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<td>40 Year Consumer Spending Impact (11th 2% annual increase)</td>
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<tr>
<td>Annual Tax Generation (Property &amp; Income)</td>
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<tr>
<td>40 Year Tax Generation (with 2% annual increase)</td>
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<tr>
<td>TOTAL POTENTIAL ECONOMIC IMPACT (Consumer Spending + Tax Generation)</td>
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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).
   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.
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.
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.
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).
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.

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.
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.
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.

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:

a. Van Andel Arena (V0255)
b. WMU – Cherry Street (99081)
c. Commerce / Cherry Parking Ramp (061228)
d. Ionia Avenue Reconstruction (031053)
e. S-Curve (Z0697)
f. Urban Market (111030)
g. Gus Lot 7 (V0406)
h. 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.

![Figure 4.1 – MTC Geotechnical Conditions Summary](image-url)
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:

   a. Average Daily Traffic (ADT) on the following roads:
      1) Market Avenue
      2) US-131 BR
      3) Division Avenue
      4) Fulton Street
      5) Oakes Street
      6) Cherry Street
      7) Ionia Avenue

   b. Synchro network with AM Peak, Mid-Day Peak, and PM Peak Hour counts at the following intersections:
      1) Market Avenue / Oakes Street
      2) Market Avenue / Cherry Street
      3) US-131 BR / Oakes Street
      4) US-131 BR / Cherry Street
      5) Division Avenue / Oakes Street
      6) Division Avenue / Cherry Street
      7) Fulton Street / Ionia Avenue

   c. Crash data at the following intersections:
      1) US-131 BR / Oakes Street
      2) US-131 BR / Cherry Street

   d. Parsons Brinckerhoff Michigan Special Event Analysis

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<tr>
<th>Intersection</th>
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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.

a. All intersections identified operate with a decent LOS; the only exception is Market Ave/Cherry Street intersection during the PM peak period.

b. 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.

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

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.

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 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).

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.
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%.
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
   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%.
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.

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.
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
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)
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).

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 9.9 – Heartside North Isometric

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)

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 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

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<th>Area 4 &amp; 5 (Above Grade Parking Structure)</th>
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#### 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
APPENDIX A – CONCEPT DRAWINGS

- Area 2 Concept
- Area 4 & 5 Concept
- Heartside Concept
Site 2 - Level 1 - Underground Garage

Arena South
Underground Parking
City of Grand Rapids, MI

01-08-2014 1"=50
Heartside Site - North - Level P1, P2 & P3 Plans | Arena South
Underground Parking
City of Grand Rapids, MI
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

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Ann Arbor Library Lane
Public Roadways & Future Buildings
750 Cars, 4 Levels Below Grade
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
Arena South Underground Parking

Miller Canfield Building Development
Buildings above Parking Garage
150 Cars, 3 Levels Below Grade
Arena South Underground Parking

Miller Canfield Building Development
Buildings above Parking Garage
150 Cars, 3 Levels Below Grade
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
Arena South Underground Parking

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