

# **VISUAL INSPECTION REPORT**

**LEO ROY PARKING GARAGE**

**100 MARKET STREET**

**LOWELL, MA 01852**



## **GROUP #1**

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University of  
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## Table of Deficiencies

<b>BEAM</b>				
DEFECT DESCRIPTION	SEVERITY	PRIORITY	PHOTO #	FLOOR
Efflorescence and leaching	Minor	3	1	1 <sup>st</sup> , 2 <sup>nd</sup> , 3 <sup>rd</sup> and 4 <sup>th</sup>
Scaling and exposed rebar	Severe	2	7	1 <sup>st</sup>
Deterioration of steel beam	Severe	2	17	4 <sup>th</sup>
Rust bleeding, leaking joint	Severe	2	13	1 <sup>st</sup> , 2 <sup>nd</sup> and 3 <sup>rd</sup>
<b>CEILING</b>				
DEFECT DESCRIPTION	SEVERITY	PRIORITY	PHOTO #	FLOOR
Spalling and exposed rebar	Severe	1	3	1 <sup>st</sup> , 2 <sup>nd</sup> , 3 <sup>rd</sup> and 4 <sup>th</sup>
Spall with exposed rebar and Electrical cable	Severe	1	4	1 <sup>st</sup>
Spall with exposed rebar	Minor	2	12	1 <sup>st</sup> , 2 <sup>nd</sup> , 3 <sup>rd</sup> and 4 <sup>th</sup>
Spall with exposed rebar	Severe	1	15	3 <sup>rd</sup>
<b>COLUMN</b>				
DEFECT DESCRIPTION	SEVERITY	PRIORITY	PHOTO #	FLOOR
Crack and spalling	Critical	1	8	1 <sup>st</sup>
Spalling with exposed rebar	Critical	1	9	1 <sup>st</sup>
Crack/separation	Severe	1	14	2 <sup>nd</sup>
Cracking and spalling	Minor	2	19	4 <sup>th</sup>
Deterioration	Minor	2	5	1 <sup>st</sup>
Cracking of concrete	Minor	2	6	1 <sup>st</sup>
<b>DRAINAGE</b>				
DEFECT DESCRIPTION	SEVERITY	PRIORITY	PHOTO #	FLOOR
Leaking drain pipe	Minor	2	5	1 <sup>st</sup> , 2 <sup>nd</sup> and 3 <sup>rd</sup>
Leaking drain pipe	Minor	2	19	4 <sup>th</sup>
Clogged Drainage	Minor	2	10	1 <sup>st</sup> , 2 <sup>nd</sup> , 3 <sup>rd</sup> , 4 <sup>th</sup> and 5 <sup>th</sup>
<b>FLOOR</b>				
DEFECT DESCRIPTION	SEVERITY	PRIORITY	PHOTO #	FLOOR
Standing puddle	Minor	3	11	2 <sup>nd</sup>
Full width by 1" cracking	Severe	2	16	4 <sup>th</sup>
Melting snow	Minor	3	20	5 <sup>th</sup>
<b>WALL</b>				
DEFECT DESCRIPTION	SEVERITY	PRIORITY	PHOTO #	FLOOR
42 inch by ½" sealed crack	Minor	3	2	4 <sup>th</sup>
Incomplete connection	Minor	3	18	4 <sup>th</sup>

## DEFICIENCY REPORTING GUIDE

### CATEGORIES OF DEFICIENCIES:

- Minor - Deficiencies which are minor in nature, generally do not impact the structural integrity and could easily be repaired. Examples include but not limited to: Spalling concrete, Minor pot holes, Minor corrosion of steel, Minor scouring, Clogged drainage, etc.
- Severe - Deficiencies which are more extensive in nature and need more planning and effort to repair. Examples include but not limited to: Moderate to major deterioration in concrete, Exposed and corroded rebar, etc.
- Critical - A deficiency in structural element that poses an unsafe condition due to the failure or imminent failure of the element which will affect the structural integrity.

### URGENCY OF REPAIR:

- 1 = ASAP- Action/Repair should be initiated upon receipt of the inspection report
- 2 = Prioritize- Shall be prioritized and repairs made when possible/funds become available
- 3 = Monitor-Pay close attention on the next scheduled visual inspection

## REMARKS

### PROPERTY INFORMATION

The Leo Roy parking garage is located at 100 Market Street Lowell, MA. It is a 5-story reinforced concrete structure which was constructed approximately 30 years ago. According to its plans, it has an area of 3.862 Acres per floor. The building is constructed of post-tensioned and reinforced concrete. All inside beams, which extend from East to West, and all roof decks are post-tensioned concrete. Spandrel beams, columns and all inside beams, which are extended from North to South, are cast- in place reinforced concrete.

### FIRST FLOOR

#### BEAM

There is excessive amounts of leakage through the roof deck which causes efflorescence stain on the side surface of the beam. There are also minor longitudinal cracks on the lower side surface of the beam. **See Photo # 1.** This is typical problem on all four floors. The cross beam (column line G) between the entrance and up ramp shows a severe scaling with heavily corroded and exposed rebars at the bottom side of the beam. **See Photo #7.** The middle span (beam-10) shows excessive rust bleeding on the side surface due to the failure of the expansion joint sealant. **See typical Photo # 13.** This is a typical problem on the first four floors.

#### CEILING

There is severe spalling with heavily corroded and exposed rebars between beam- 7 and beam-8. **See Photo #3.** This is a typical problem on the first four floors. There is also 10"× 10" severe spalling, with heavily corroded exposed rebars, and exposed electric cable between column R-8 and R-9. It also shows a saturated concrete surface on the ceiling which can be an indicator of first stage of concrete deterioration. **See Photo #4 and #12.** This is typical problem on the first four floors.

#### COLUMN

There are minor vertical cracks and minor efflorescence stains on the surface of column R-7 and G-3 due to the water leakage of the adjacent drain pipe. It also shows moderate rust bleeding on its surface. **See Photo #5 and #6.** Column E-10 shows an extensive ½" by full beam height diagonal crack right at the beam support. **See Photo #8.** There is also a spalling surface area with severely corroded and exposed joint rebars at the beam support of column E-10. This was flagged as a critical issue and should be repaired as soon as possible before conditions deteriorate further. **See Photo # 9**

## DRAINAGE

The existing drainage at the bottom of the up ramp is partially clogged by concrete thus limiting its full functionality. This problem can cause puddle of water. This is typical of all drains throughout the structure. **See Photo # 10.** There is large area of heavy leakage through the joint around the drainage pipe and the slab decks. The joints also show moderate to extensive rust. **See photo #5, #6 and #19.**

## WALL

The exterior concrete masonry block wall located on the east side of the entrance facing north shows moderate diagonal 42 × 1/2" sealed cracks. This is not a structural wall and it was flagged as a minor defect. **See Photo #2.**

## SECOND FLOOR

### BEAM

It is typical as first floor.

### CEILING

The ceiling adjacent to column K-10 shows a 12" × 15" deep spalling surface area with heavily corroded and exposed rebars on the ceiling. **See Photo 12.** . There is extensive rust bleeding through the expansion joint of the deck to the side face of the middle span beam. There is also part of the expansion joint sealant, or the water proof membrane, hanging out on the side of the middle span beam. **See Photo #13.** This is a typical problem on 3rd and 4th floor. For additional remarks see ceiling remarks of first floor.

### COLUMN

Column E-10 shows an extensive 1" width by half beam height diagonal crack on the beam support. **See Photo # 14.**

### DRAINAGE

It is typical as first floor.

### FLOOR

At the bottom of the down ramp, which is the expansion joint of the floor deck, there is heavy ponding of water; this puddle can cause water leakage and consequently may lead to corrosion of rebars and also deterioration of concrete. **See Photo # 11.** This is a typical problem on 3<sup>rd</sup> and 4<sup>th</sup> floor.

### THIRD FLOOR

#### BEAM

It is typical as first floor.

#### CEILING

The ceiling between column K-5 and K-6 shows 18"×10" deep spalling with heavily corroded and exposed rebars. It also shows a saturated concrete surface on the ceiling which can be an indicator of concrete deterioration. **See Photo #15.** For additional remarks see ceiling remarks of first floor.

#### DRAINAGE

It is typical as first and second floor

#### FLOOR

It is typical as second floor.

### FOURTH FLOOR

#### BEAM

There is a severe deterioration on the steel beam support of the pedestrian bridge. There is also a wide gap between the connection of the steel beam support and the brick wall. **See Photo #17.** For additional remarks see beam remarks of first floor.

#### CEILING

This is typical as 1<sup>st</sup> floor.

#### COLUMN

Column G-10 shows an extensive crack right on the beam support and a wet surface due to the extensive leakage from the drainage pipe adjacent to it. **See Photo #19.**

#### FLOOR

There are severe cracks at the connection of the pedestrian bridge to the parking garage. Cracking in the concrete surface of the bridge should be monitored and/or repaired. **See photo #16.** For additional remarks see floor slab remarks of second floor.

**FIFTH FLOOR****FLOOR**

The floor slab shows some minor scaling and uneven patching. There is also a pile of snow which can cause deterioration of the reinforced concrete. The stockpiling of snow other than on the first floor should be avoided. This melting snow, often containing deicing salt, can lead to progressive chloride infiltration into the concrete surface as well as possible overload of the structure's capacity. Clogged drainage further magnifies this problem as melt water cannot drain. Snow stockpiles were also observed on other floors. **See Photo # 20.**

**CONCLUSION**

This inspection report is based on visual observation of accessible areas of the property. No dismantling of building components was conducted. The conditions observed in the parking structure include from moderate to excessive spalled concrete, corroded and exposed rebars, and corroded drain pipes on all 5-stories. Further detailed inspection will be conducted for the defected structural components which are observed in this visual inspection and a report will be ready in May 2013.

**REFERENCES:**

ACI 362.2-00 (2000), Guide for Structural Maintenance of Parking Structures, ACI Committee 362, Farmington Hills, MI.

## PHOTO LOG

- Photo 1:** Efflorescence and leaching at cross beam K on 1<sup>st</sup> floor, typical
- Photo 2:** 42 inch by ½" sealed crack in concrete masonry block adjacent to 1<sup>st</sup> floor entrance
- Photo 3:** Failed patch with spalling and exposed rebar, full width of structure between beams 7 and 8 on first floor, typical all floors.
- Photo 4:** 10" x 10" spall with exposed rebar and electrical cable in ceiling on 1<sup>st</sup> floor between columns R-8 and R-9.
- Photo 5:** Deterioration of column R-7 adjacent to leaking drain pipe on 1<sup>st</sup> floor.
- Photo 6:** Cracking of concrete adjacent to leaking drain pipe at column G-3 on 1<sup>st</sup> floor
- Photo 7:** Severe scaling with exposed reinforcement in cross beam (column line G) between entrance and up ramp on 1<sup>st</sup> floor.
- Photo 8:** ½" by full beam height crack with spalling of beam support at column E-10, 1<sup>st</sup> floor.
- Photo 9:** Spalling with exposed rebar at beam support at column E-10, 1<sup>st</sup> floor.
- Photo 10:** Clogged drain at bottom of 1<sup>st</sup> floor up ramp. Typical all drains on all floors.
- Photo 11:** Standing puddle at bottom of down ramp on 2<sup>nd</sup> floor
- Photo 12:** 12"x15" spall with exposed rebar on 2<sup>nd</sup> floor adjacent to column K-10, typical on floors 1-4
- Photo 13:** Failure of expansion joint and leaking at beam 10 on 2<sup>nd</sup> floor, typical all floors.
- Photo 14:** Half beam height x 1" W crack at beam support at column E-10, 2<sup>nd</sup> floor.
- Photo 15:** 18" W x ~10' L spall with exposed rebar in ceiling between columns K-5 and K-6, 3<sup>rd</sup> floor.
- Photo 16:** Full width by 1" cracking in 4<sup>th</sup> floor pedestrian foot bridge
- Photo 17:** Deterioration of steel beam support connection on 4<sup>th</sup> floor pedestrian bridge
- Photo 18:** Incomplete connection of brick facing to concrete masonry blocks at 4<sup>th</sup> floor pedestrian bridge.
- Photo 19:** Cracking and spalling at beam support adjacent to leaking drain at column G-10, 4<sup>th</sup> floor.
- Photo 20:** Melting snow stockpile on roof deck

PHOTOS



Photo 1: Efflorescence and leaching at cross beam K on 1<sup>st</sup> floor, typical



Photo 2: 42 inch by 1/2" sealed crack in concrete masonry block adjacent to 1<sup>st</sup> floor entrance

PHOTOS



**Photo 3: Failed patch with spalling and exposed rebar, full width of structure between beams 7 and 8 on first floor, typical all floors.**



**Photo 4: 10" x 10" spall with exposed rebar and electrical cable in ceiling on 1<sup>st</sup> floor between columns R-8 and R-9.**

PHOTOS



**Photo 5: Deterioration of column R-7 adjacent to leaking drain pipe on 1<sup>st</sup> floor.**



**Photo 6: Cracking of concrete adjacent to leaking drain pipe at column G-3 on 1<sup>st</sup> floor**

PHOTOS



**Photo 7: Severe scaling with exposed reinforcement in cross beam (column line G) between entrance and up ramp on 1<sup>st</sup> floor.**



**Photo 8: ½" by full beam height crack with spalling of beam support at column E-10, 1<sup>st</sup> floor.**

PHOTOS



Photo 9: Spalling with exposed rebar at beam support at column E-10, 1<sup>st</sup> floor.



Photo 10: Clogged drain at bottom of 1<sup>st</sup> floor up ramp. Typical all drains on all floors.

PHOTOS

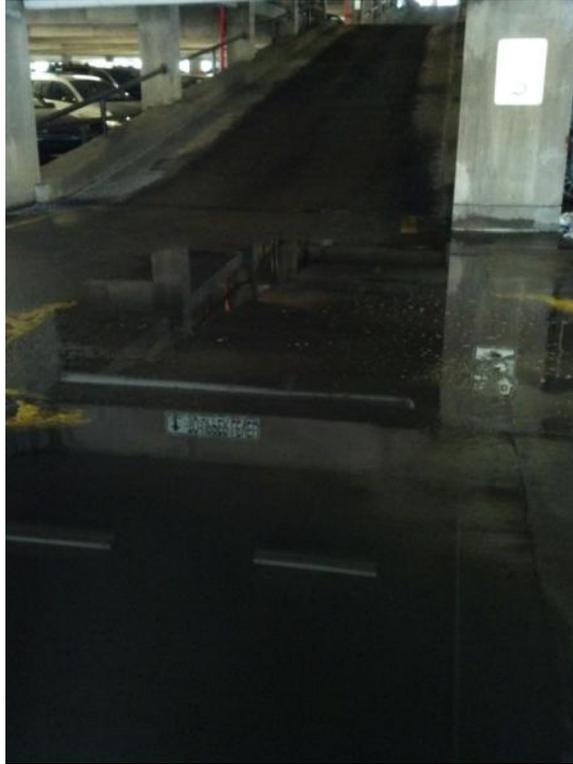


Photo 11: Standing puddle at bottom of down ramp on 2<sup>nd</sup> floor



Photo 12: 12"x15" spall with exposed rebar on 2<sup>nd</sup> floor adjacent to column K-10, typical on floors 1-4

PHOTOS



Photo 13: Failure of expansion joint and leaking at beam 10 on 2<sup>nd</sup> floor, typical all floors.



Photo 14: Half beam height x 1" W crack at beam support at column E-10, 2<sup>nd</sup> floor.

PHOTOS



Photo 15: 18" W x ~10' L spall with exposed rebar in ceiling between columns K-5 and K-6, 3<sup>rd</sup> floor.



Photo 16: Full width by 1" cracking in 4<sup>th</sup> floor pedestrian foot bridge

PHOTOS



Photo 17: Deterioration of steel beam support connection on 4<sup>th</sup> floor pedestrian bridge



Photo 18: Incomplete connection of brick facing to concrete masonry blocks at 4<sup>th</sup> floor pedestrian bridge.

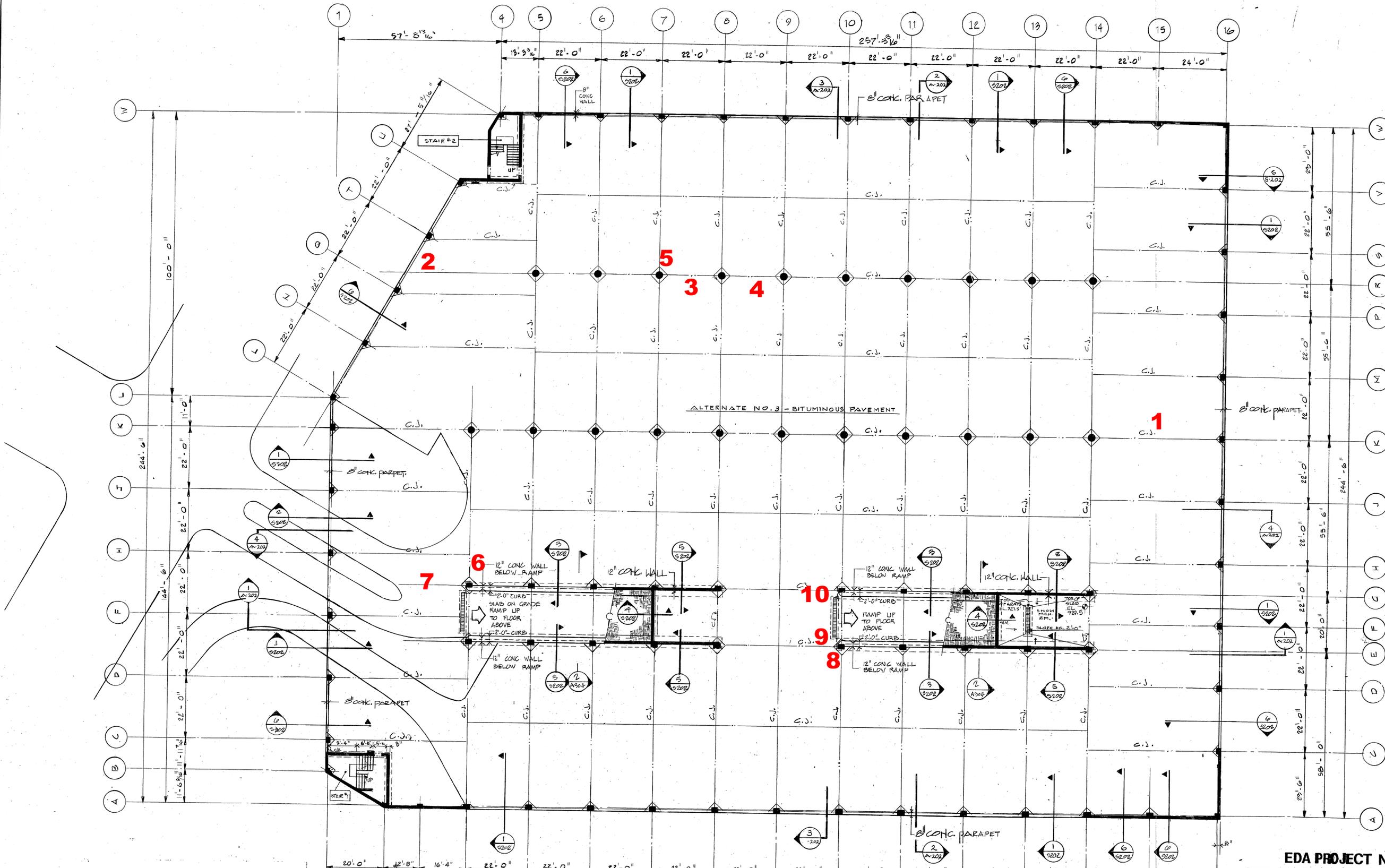
PHOTOS



Photo 19: Cracking and spalling at beam support adjacent to leaking drain at column G-10, 4<sup>th</sup> floor.



Photo 20: Melting snow stockpile on roof deck



**NOTES:**

1. See drawing S201 for foundation notes and typical details.
2. See drawing S202 for typical strip footings, details, and reinf. schedule.
3. Slab on grade to be 4" minimum with 6 x 6, 6/6 w.w.m. (ALTERNATE-BITUMINOUS PAVEMENT)
4. See drawing A-302 for stair details and reinforcement.
5. Finished floor elevation at building perimeter is 929.5, slope to drains as shown.
6. C.J. DENOTES CONTROL JT. SEE S201

NOTE- FOUNDATIONS BY P.D.N. CONTRACTOR - SEE DWG. S405 FOR COLUMN LOADS.



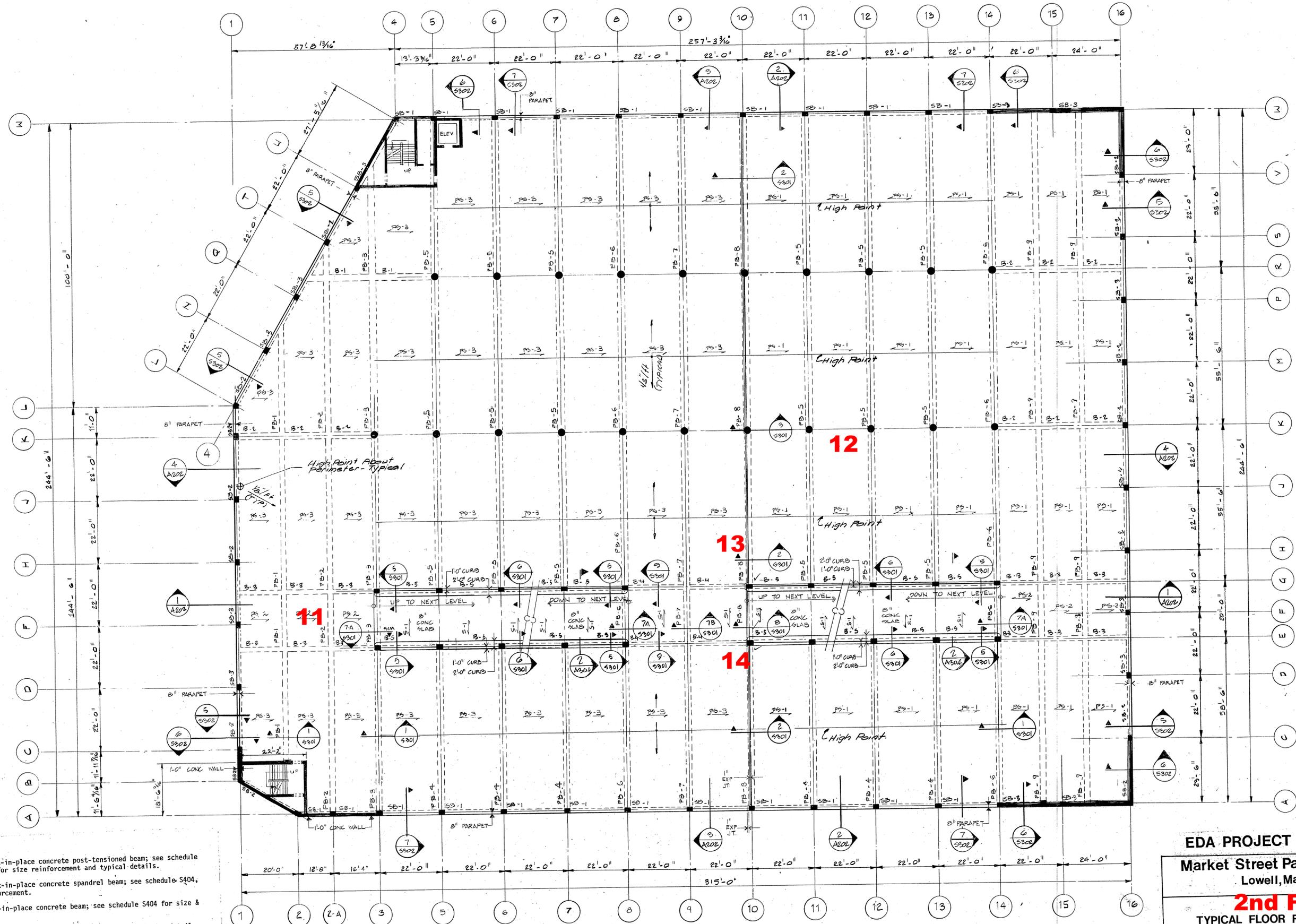
**EDA PROJECT No. 01-51-20414**

**Market Street Parking Structure  
Lowell, Massachusetts**

**FOUNDATION & GROUND LEVEL PLAN**

<b>ROBERT D. GOODOAK &amp; ASSOC.</b>			SCALE 1/4" = 1'-0"
ARCHITECTS	PLANNERS	ENGINEERS	JOB NO. 5129
17 HALL ST.	MEDFORD	MASS.	DRWG. NO. S101
DRAWN RW	CHECKED JOK	DATE OCT. 1977	





- NOTES:**
- PB-N indicates cast-in-place concrete post-tensioned beam; see schedule S401, S402, S403, for size reinforcement and typical details.
  - SB-N indicates cast-in-place concrete spandrel beam; see schedule S404, for size and reinforcement.
  - B-N indicates cast-in-place concrete beam; see schedule S404 for size & reinforcement.
  - PS indicates post-tensioned floor slab; see details /S403 for details.
  - See drawing S301 for typical concrete notes & details.
  - See schedule drawing S405 for column sizes and reinforcements and details.
  - See drawing A302 for typical stair details & reinforcement.
  - Finished floor elevation at building perimeter is ; slope to drains as shown.

TYPICAL FLOOR FRAMING PLAN

EDA PROJECT No. 01-51-20414

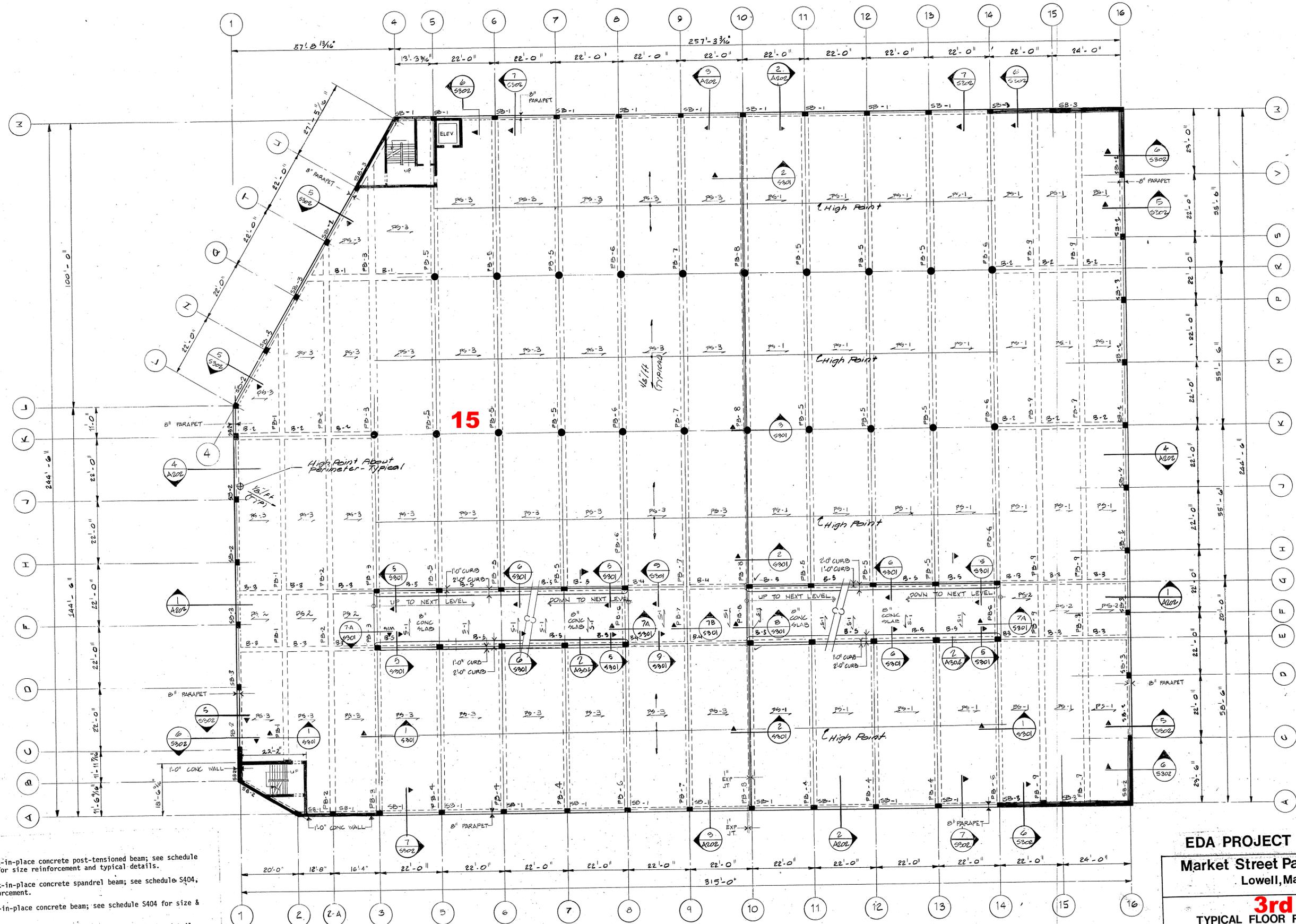
Market Street Parking Structure  
Lowell, Massachusetts

**2nd Floor**  
TYPICAL FLOOR FRAMING PLAN

ROBERT D. GOODOAK & ASSOC.  
ARCHITECTS PLANNERS ENGINEERS  
17 HALL ST. MEDFORD MASS.

SCALE  
1/8" = 1'-0"  
JOB NO.  
5129  
DRWG. NO.  
**S102**

DRAWN RW CHECKED JOK DATE OCT. 1977



15

- NOTES:**
- PB-N indicates cast-in-place concrete post-tensioned beam; see schedule S401, S402, S403, for size reinforcement and typical details.
  - SB-N indicates cast-in-place concrete spandrel beam; see schedule S404, for size and reinforcement.
  - B-N indicates cast-in-place concrete beam; see schedule S404 for size & reinforcement.
  - PS indicates post-tensioned floor slab; see details /S403 for details.
  - See drawing S301 for typical concrete notes & details.
  - See schedule drawing S405 for column sizes and reinforcements and details.
  - See drawing A302 for typical stair details & reinforcement.
  - Finished floor elevation at building perimeter is ; slope to drains as shown.



TYPICAL FLOOR FRAMING PLAN

EDA PROJECT No. 01-51-20414

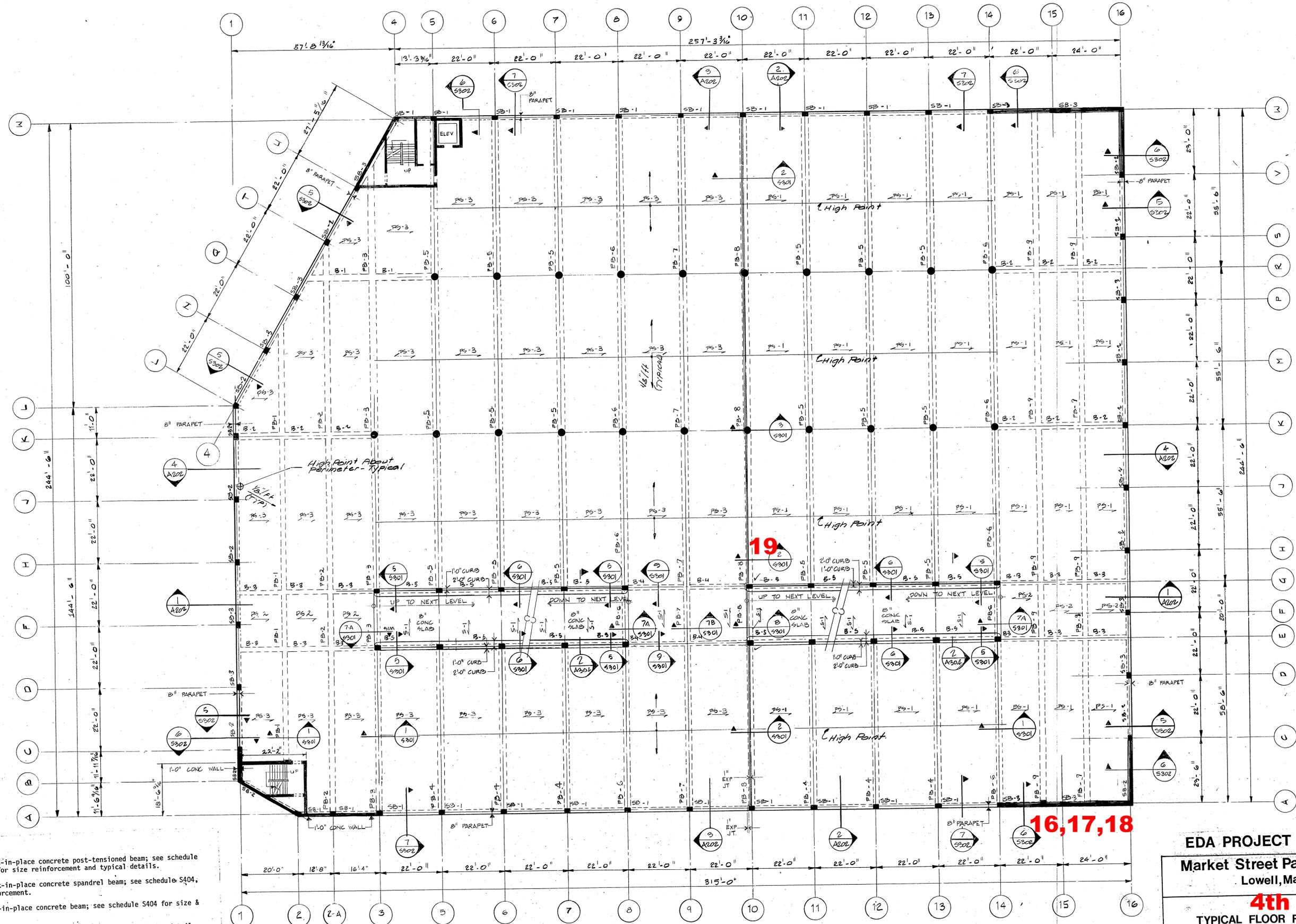
Market Street Parking Structure  
Lowell, Massachusetts

**3rd Floor**  
TYPICAL FLOOR FRAMING PLAN

ROBERT D. GOODAK & ASSOC.  
ARCHITECTS PLANNERS ENGINEERS  
17 HALL ST. MEDFORD MASS.

SCALE  
1/8" = 1'-0"  
JOB NO.  
5129  
DRWG. NO.  
**S102**

DRAWN RW CHECKED JOK DATE OCT. 1977



19

16,17,18

TYPICAL FLOOR FRAMING PLAN

- NOTES:
- PB-N indicates cast-in-place concrete post-tensioned beam; see schedule S401, S402, S403, for size reinforcement and typical details.
  - SB-N indicates cast-in-place concrete spandrel beam; see schedule S404, for size and reinforcement.
  - B-N indicates cast-in-place concrete beam; see schedule S404 for size & reinforcement.
  - PS indicates post-tensioned floor slab; see details /S403 for details.
  - See drawing S301 for typical concrete notes & details.
  - See schedule drawing S405 for column sizes and reinforcements and details.
  - See drawing A302 for typical stair details & reinforcement.
  - Finished floor elevation at building perimeter is ; slope to drains as shown.

EDA PROJECT No. 01-51-20414

Market Street Parking Structure  
Lowell, Massachusetts

**4th Floor**  
TYPICAL FLOOR FRAMING PLAN

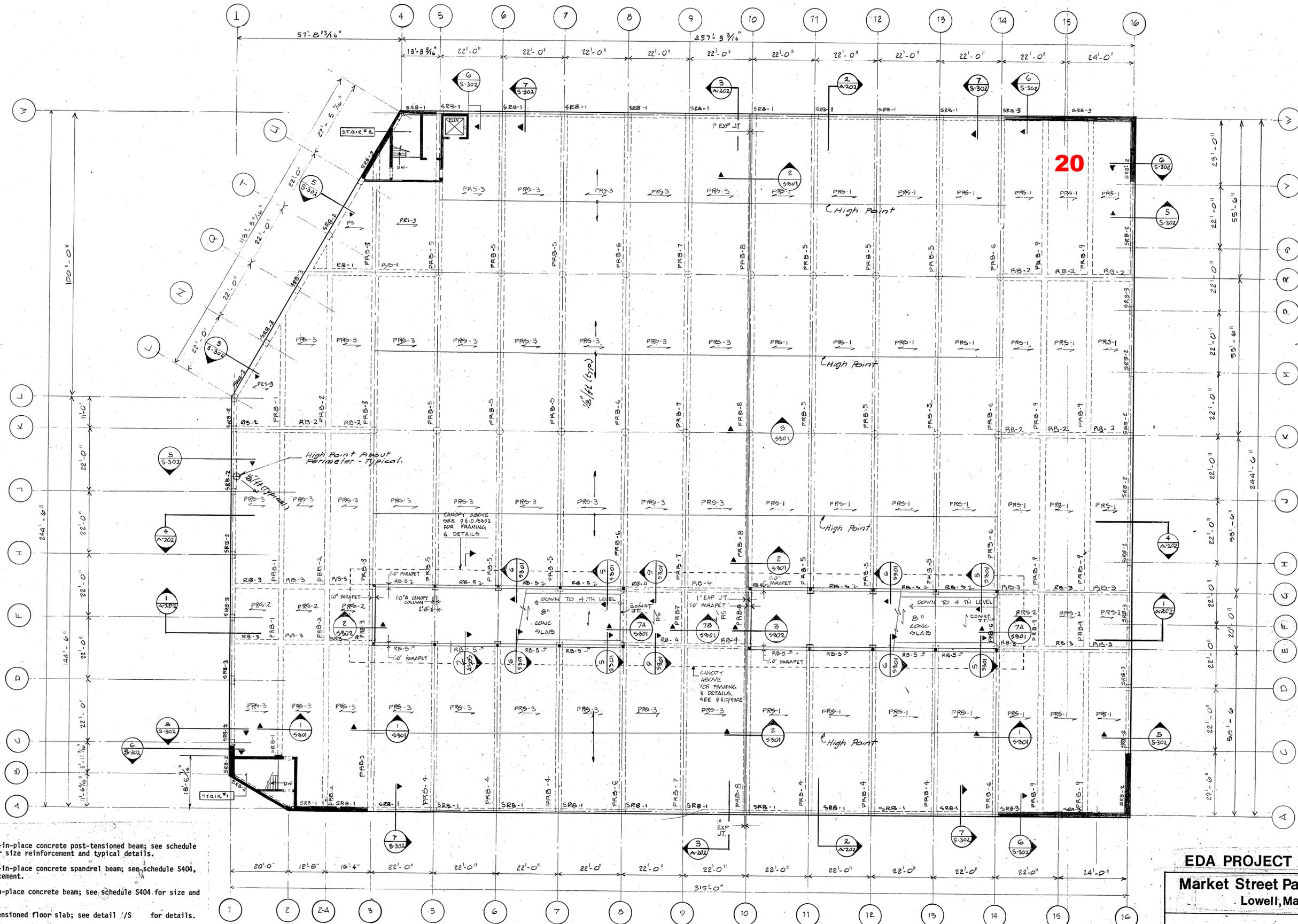
ROBERT D. GOODOK & ASSOC.  
ARCHITECTS PLANNERS ENGINEERS

17 HALL ST. MEDFORD MASS.

DRAWN RW CHECKED JOK DATE OCT. 1977

SCALE 1/8" = 1'-0"  
JOB NO. 5129  
DRWG. NO. S102





- NOTES:**
1. PRB-N indicates cast-in-place concrete post-tensioned beam; see schedule S401, S402, S404, for size reinforcement and typical details.
  2. SRB-N indicates cast-in-place concrete spandrel beam; see schedule S404, for size and reinforcement.
  3. PRS indicates cast-in-place concrete beam; see schedule S404 for size and reinforcement.
  4. PRS indicates post-tensioned floor slab; see detail //S for details.
  5. See drawing S301 for typical concrete notes and details.
  6. See schedule drawing S405 for column sizes and reinforcements and details.
  7. See drawing A302 for typical stair details and reinforcement.
  8. Finished floor elevation at building perimeter is ; slope to drains as shown.

# 5<sup>TH</sup> LEVEL PLAN

SCALE: 1/16" = 1'-0"

**EDA PROJECT No. 01-51-20414**

**Market Street Parking Structure**  
Lowell, Massachusetts

**5th LEVEL FRAMING PLAN**

<b>ROBERT D. GOODOAK &amp; ASSOC.</b>		SCALE 1/16" = 1'-0"
ARCHITECTS	PLANNERS	JOB NO. 5729
17 HALL ST.	MEDFORD MASS.	DRWG. NO. S103
DRAWN RW	CHECKED JOK	DATE DEC 1977