

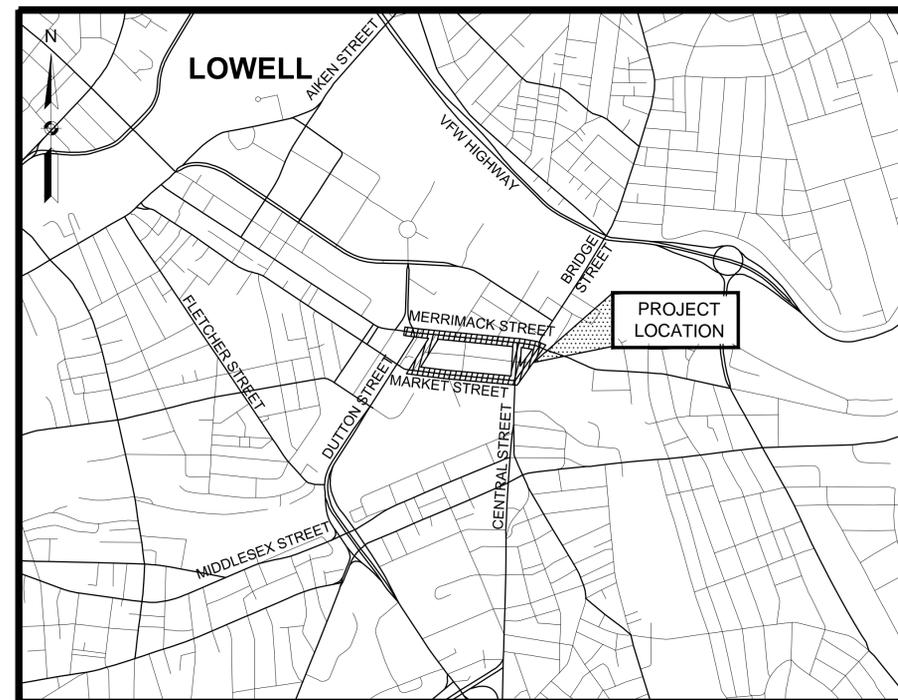
# TRANSPORTATION IMPROVEMENT PROJECT

LOWELL  
TWO-WAY CONVERSION  
TITLE SHEET & INDEX  
SHEET 1 OF 25

PLAN OF  
DOWNTOWN TWO-WAY CONVERSION  
IN THE CITY OF  
LOWELL  
MIDDLESEX COUNTY

THE MASSACHUSETTS HIGHWAY DEPARTMENT STANDARD SPECIFICATIONS FOR HIGHWAYS AND BRIDGES DATED 1988, AS AMENDED, THE SUPPLEMENTAL SPECIFICATIONS DATED JUNE 15, 2012, THE 2012 CONSTRUCTION STANDARD DETAILS, THE 1996 CONSTRUCTION AND TRAFFIC STANDARD DETAILS, (AS RELATED TO TRAFFIC STANDARD DETAILS ONLY), THE LATEST MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS WITH MASSACHUSETTS AMENDMENTS, THE 1990 STANDARD DRAWINGS FOR SIGNS AND SUPPORTS, THE 1968 STANDARD DRAWINGS FOR TRAFFIC SIGNALS AND HIGHWAY LIGHTING, AND THE LATEST EDITION OF THE AMERICAN STANDARD FOR NURSERY STOCK, WILL GOVERN.

SHEET NO.	DESCRIPTION
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3	KEY PLAN & CONSTRUCTION NOTES
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25	CONSTRUCTION DETAILS



SCALE 1" = 1000'

LENGTH OF PROJECT = 4,300.00 FEET = 0.814 MILES

NO.	DESCRIPTION	DATE
1	ISSUED FOR CONSTRUCTION	2/18/14

2-18-14

ENGINEER DATE

TEC, INC.

65 Glenn Street      169 Ocean Boulevard  
Lawrence, MA 01843      Hampton, NH 03842

Tel (978) 794-1792      Fax (978) 794-1793

www.TheEngineeringCorp.com

DESIGNED BY <b>KKR/SWG</b>	CHECKED BY <b>MCM</b>	DATE <b>JULY 18, 2013</b>
DRAWN BY <b>KKR/SWG</b>	APPROVED BY <b>KRD</b>	PROJECT NO. <b>T0462</b>

## GENERAL SYMBOLS

EXISTING	PROPOSED	DESCRIPTION
		CATCH BASIN
		GAS GATE
		WATER GATE
		HYDRANT
		LIGHT POLE
		CABLE MANHOLE
		DRAINAGE MANHOLE
		ELECTRIC MANHOLE
		SEWER MANHOLE
		TELEPHONE MANHOLE
		STONE BOUND
		DRILL HOLE
		GUY POLE OR GUY WIRE
		UTILITY POLE
		BUSH
		TREE
		PARKING METER
		PARKING METER SIGN
		OVERHEAD CABLE/WIRE
		CURBING
		UNDERGROUND DRAIN PIPE (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND ELECTRIC DUCT (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND GAS MAIN (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND SEWER MAIN (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND TELEPHONE DUCT (DOUBLE LINE 24 INCH AND OVER)
		UNDERGROUND WATER MAIN (DOUBLE LINE 24 INCH AND OVER)
		SAWCUT LINE
		LIMIT OF EDGE OF PAVEMENT OR COLD PLANE AND OVERLAY
		TOWN OR CITY LAYOUT
		PROPERTY LINE
		BRICK SIDEWALK
		COBBLESTONE
		CEMENT CONCRETE
		BUILDING
		RAILROAD TRACK
		WHEELCHAIR RAMP

## TRAFFIC SYMBOLS

EXISTING	PROPOSED	DESCRIPTION
		WIRE LOOP DETECTOR (6' x 6' TYP UNLESS OTHERWISE SPECIFIED)
		PEDESTRIAN PUSH BUTTON, SIGN AND SADDLE
		VEHICULAR SIGNAL HEAD
		PEDESTRIAN SIGNAL HEAD, (TYPE AS NOTED OR AS SPECIFIED)
		RAILROAD SIGNAL
		SIGNAL POST AND BASE (ALPHA-NUMERIC DESIGNATION NOTED)
		MAST ARM, SHAFT AND BASE (ARM LENGTH AS NOTED)
		SIGN AND POST
		TRAFFIC SIGNAL MOUNTED SIGN
		OPTICAL PRE-EMPTION CONFIRMATION STROBE
		OPTICAL PRE-EMPTION DETECTOR
		CONTROL CABINET, GROUND MOUNTED
		VIDEO DETECTION CAMERA
		PULL BOX 12"x12" (OR AS NOTED)
		TRAFFIC SIGNAL CONDUIT

## PAVEMENT MARKINGS SYMBOLS

EXISTING	PROPOSED	DESCRIPTION
		PAVEMENT ARROW - WHITE
		LEGEND "ONLY" - WHITE
		"SHARROW" - WHITE
		HANDICAPPED PARKING STALL - WHITE
		"SHARKS TOOTH" YIELD LINE - WHITE
		STOP LINE
		CROSSWALK
		SOLID WHITE LANE LINE
		SOLID WHITE EDGE LINE
		DOUBLE YELLOW CENTER LINE
		BROKEN WHITE LANE LINE - 2' LINE W/ 4' GAP

## GENERAL ABBREVIATIONS

ABBREVIATION	DESCRIPTION
AADT	ANNUAL AVERAGE DAILY TRAFFIC
ABAN	ABANDON
ADJ	ADJUST
APPROX.	APPROXIMATE
A.C.	ASPHALT CONCRETE
ACCM PIPE	ASPHALT COATED CORRUGATED METAL PIPE
BIT.	BITUMINOUS
BC	BOTTOM OF CURB
BD.	BOUND
BL	BASELINE
BLDG	BUILDING
BM	BENCHMARK
BO	BY OTHERS
BOS	BOTTOM OF SLOPE
BR.	BRIDGE
BSP	BARE STEEL PIPE
CB	CATCH BASIN
CBCI	CATCH BASIN WITH CURB INLET
CC	CEMENT CONCRETE
CCM	CEMENT CONCRETE MASONRY
CEM	CEMENT
CI	CURB INLET
CIP	CAST IRON PIPE
CLF	CHAIN LINK FENCE
CL	CENTERLINE
CMP	CORRUGATED METAL PIPE
CSP	CORRUGATED STEEL PIPE
CO.	COUNTY
CONC	CONCRETE
CONT	CONTINUOUS
CONST	CONSTRUCTION
CR GR	CROWN GRADE
DHV	DESIGN HOURLY VOLUME
DI	DROP INLET
DIA	DIAMETER
DIP	DUCTILE IRON PIPE
DW	STEADY DON'T WALK - PORTLAND ORANGE
DWY	DRIVEWAY
ELEV (or EL.)	ELEVATION
EMB	EMBANKMENT
EOP	EDGE OF PAVEMENT
EXIST (or EX)	EXISTING
EXC	EXCAVATION
F&C	FRAME AND COVER
F&G	FRAME AND GRATE
FDN.	FOUNDATION
FLDSTN	FIELDSTONE
FP	FLAG POLE
GAR	GARAGE
GBF	GRANITE BOUND FOUND
GC	GRANITE CURB
GCC	GRANITE CURB CORNER
GD	GROUND
GG	GAS GATE
GI	GUTTER INLET

## GENERAL ABBREVIATIONS (cont.)

ABBREVIATION	DESCRIPTION
GIP	GALVANIZED IRON PIPE
GRAN	GRANITE
GPL	GUY POLE
GRAV	GRAVEL
GRD	GUARD
HDW	HEADWALL
HMA	HOT MIX ASPHALT
HOR	HORIZONTAL
HYD	HYDRANT
INV	INVERT
IRR. CAB	IRRIGATION CABINET
JCT	JUNCTION
L	LENGTH OF CURVE
L&S	LOAM & SEED
LB	LEACH BASIN
LP	LIGHT POLE OR LOW PRESSURE
LSA	LANDSCAPED AREA
LT	LEFT
MAX	MAXIMUM
MB	MAILBOX
MH	MANHOLE
MHB	MASSACHUSETTS HIGHWAY BOUND
MIN	MINIMUM
NIC	NOT IN CONTRACT
NO.	NUMBER
PC	POINT OF CURVATURE
PCC	POINT OF COMPOUND CURVATURE
P.G.L.	PROFILE GRADE LINE
PI	POINT OF INTERSECTION
PL	PLASTIC
POC	POINT ON CURVE
POT	POINT ON TANGENT
PRC	POINT OF REVERSE CURVATURE
PROJ	PROJECT
PROP	PROPOSED
PSB	PLANTABLE SOIL BORROW
PT	POINT OF TANGENCY
PVC	POINT OF VERTICAL CURVATURE
PVI	POINT OF VERTICAL INTERSECTION
PVT	POINT OF VERTICAL TANGENCY
PVMT	PAVEMENT
PWW	PAVED WATER WAY
R	RADIUS OF CURVATURE
R&D	REMOVE AND DISPOSE
RCP	REINFORCED CONCRETE PIPE
RD	ROAD
RDWY	ROADWAY
REM	REMOVE
RET	RETAIN
RET WALL	RETAINING WALL
ROW	RIGHT OF WAY
RR	RAILROAD
R&R	REMOVE AND RESET
R&S	REMOVE AND STACK
RT	RIGHT

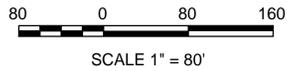
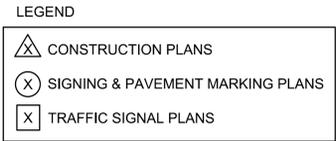
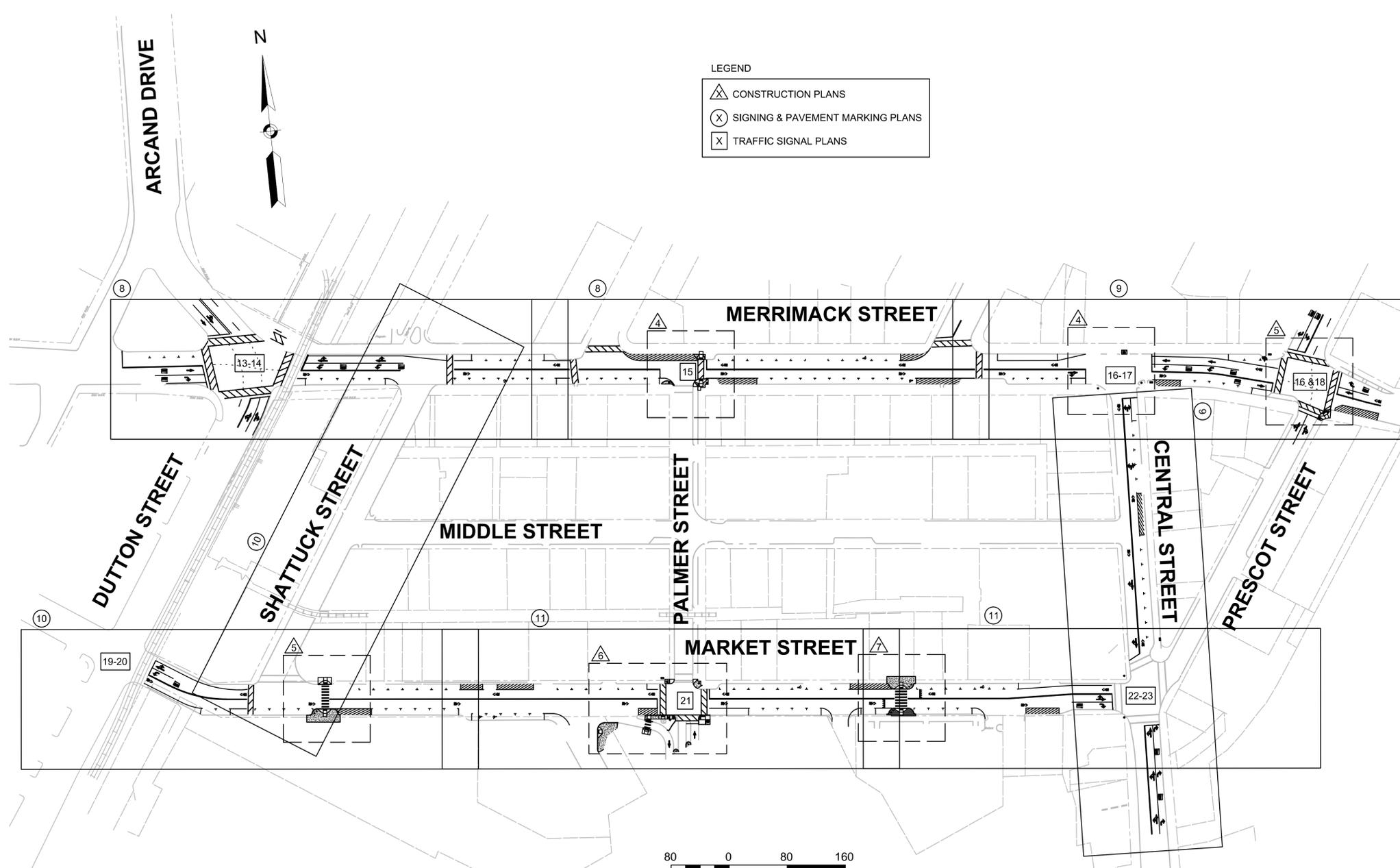
## GENERAL ABBREVIATIONS (cont.)

ABBREVIATION	DESCRIPTION
SB	STONE BOUND
SHLD	SHOULDER
SMH	SEWER MANHOLE
ST	STREET
STA	STATION
SSD	STOPPING SIGHT DISTANCE
SHLO	STATE HIGHWAY LAYOUT LINE
SW	SIDEWALK
T	TANGENT DISTANCE OF CURVE/TRUCK %
TAN	TANGENT
TEMP	TEMPORARY
TC	TOP OF CURB
TOS	TOP OF SLOPE
TYP	TYPICAL
UP	UTILITY POLE
VAR	VARIES
VERT	VERTICAL
VC	VERTICAL CURVE
WCR	WHEEL CHAIR RAMP
WG	WATER GATE
WIP	WROUGHT IRON PIPE
WM	WATER METER/WATER MAIN
X-SECT	CROSS SECTION

## TRAFFIC SIGNAL ABBREVIATIONS

ABBREVIATION	DESCRIPTION
CAB.	CABINET
DW	STEADY DON'T WALK
FDW	FLASHING DON'T WALK
FDN	FOUNDATION
FR	FLASHING CIRCULAR RED
FRL	FLASHING RED LEFT ARROW
FY	FLASHING CIRCULAR AMBER
FYL	FLASHING AMBER LEFT ARROW
FYR	FLASHING AMBER RIGHT ARROW
G	STEADY CIRCULAR GREEN
GL	STEADY GREEN LEFT ARROW
GR	STEADY GREEN RIGHT ARROW
MA	MAST ARM
OL	OVERLAP
PB	PULL BOX
PBN	PUSH BUTTON
PED	PEDESTRIAN
R	STEADY CIRCULAR RED
RL	STEADY RED LEFT ARROW
RR	STEADY RED RIGHT ARROW
SCH.	SCHEDULE
TS	TRAFFIC SIGNAL
W	STEADY WALK
Y	STEADY CIRCULAR AMBER
YL	STEADY AMBER LEFT ARROW

**LOWELL  
TWO-WAY CONVERSION  
KEY PLAN & CONSTRUCTION NOTES  
SHEET 3 OF 25**



**GENERAL NOTES:**

1. EXISTING CONDITIONS INFORMATION FROM ACTUAL ON-THE-GROUND INSTRUMENT SURVEY PERFORMED BY VANASSE HANGEN BRUSTLIN, INC. (PROVIDED BY THE CITY OF LOWELL) DATED MARCH 4, 2008 AND UPDATED BASED ON FIELD OBSERVATIONS BY TEC, INC. DURING SUMMER 2013.  
HORIZONTAL DATUM = NAD83 (MASSACHUSETTS STATE PLANE COORDINATES)  
VERTICAL DATUM = NGVD29
2. EXISTING VAULT INFORMATION FROM SURVEY AND INSPECTIONS PERFORMED BY VANASSE HANGEN BRUSTLIN, INC. DURING OCTOBER-DECEMBER, 2007 (PROVIDED BY THE CITY OF LOWELL).
3. ALL EXISTING STATE, COUNTY, AND CITY LOCATION LINES AND PRIVATE PROPERTY LINES HAVE BEEN ESTABLISHED FROM AVAILABLE INFORMATION AND THEIR EXACT LOCATION ARE NOT GUARANTEED.
4. THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES ARE SHOWN IN AN APPROXIMATE WAY ONLY AND HAVE NOT BEEN INDEPENDENTLY VERIFIED BY THE OWNER OR ITS REPRESENTATIVE. THE CONTRACTOR SHALL CONTACT VARIOUS CITY DEPARTMENTS AND DIGSAFE (1-800-DIGSAFE) A MINIMUM OF 72 HOURS PRIOR TO ANY CONSTRUCTION TO VERIFY THE LOCATION OF ALL EXISTING UTILITIES BEFORE COMMENCING WORK, AND SHALL BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT BE OCCASIONED BY THE CONTRACTOR'S FAILURE TO LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES.
5. WHERE AN EXISTING UTILITY IS FOUND TO CONFLICT WITH THE PROPOSED WORK, THE LOCATION, ELEVATION AND SIZE OF THE UTILITY SHALL BE ACCURATELY DETERMINED WITHOUT DELAY BY THE CONTRACTOR, AND THE INFORMATION FURNISHED TO THE ENGINEER FOR RESOLUTION OF THE CONFLICT.
6. ALL MUNICIPALLY OWNED UTILITY STRUCTURES (CATCH BASINS, DRAIN MANHOLES, SEWER MANHOLES, WATER GATES, ETC.) SHALL BE ADJUSTED BY THE CONTRACTOR TO FINISHED GRADE UNLESS DIRECTED OTHERWISE. CONTRACTOR SHALL COORDINATE WITH THE LOWELL DEPARTMENT OF PUBLIC WORKS TO ALLOW FOR THE REPLACEMENT OF EXISTING UTILITY STRUCTURES IN POOR CONDITION. THESE REPLACEMENT UTILITY STRUCTURES TO BE PROVIDED AND INSTALLED BY THE DPW.
7. ALL PRIVATELY OWNED UTILITY STRUCTURES (GAS GATES, ELECTRIC/TELEPHONE MANHOLES, ETC.) SHALL BE ADJUSTED TO FINISHED GRADE BY THE PRIVATE UTILITY COMPANY, UNLESS DIRECTED OTHERWISE. THE CONTRACTOR SHALL COORDINATE WITH PRIVATE UTILITY COMPANIES FOR THE ALTERATION AND ADJUSTMENT, AS NECESSARY, WITHOUT ADDITIONAL COMPENSATION.
8. CATCH BASIN FRAMES AND GRATES SHALL BE IN CONFORMANCE WITH CITY OF LOWELL STANDARDS.
9. AREAS OUTSIDE THE LIMITS OF PROPOSED WORK DISTURBED BY THE CONTRACTOR'S OPERATIONS SHALL BE RESTORED BY THE CONTRACTOR TO THEIR ORIGINAL CONDITION AT THE CONTRACTOR'S EXPENSE.
10. ALL DISTURBED AREAS OUTSIDE THE CURBLINE SHALL BE STABILIZED WITH 4" LOAM AND SEED, UNLESS OTHERWISE NOTED.
11. THE TERM "PROPOSED" (PROP) MEANS WORK TO BE CONSTRUCTED USING NEW MATERIALS OR, WHERE APPLICABLE, RE-USING EXISTING MATERIALS IDENTIFIED AS "REMOVE AND RESET" (R&R), AS APPROVED BY THE ENGINEER.
12. THE TERM "MEET EXIST" MEANS TO MEET BOTH THE EXISTING ALIGNMENT AND ELEVATION.
13. ALL EXISTING TREES WITHIN THE PROJECT LIMITS SHALL BE RETAINED. ALL PROVIDED DIMENSIONS REFER TO THE DIAMETER AT BREST HEIGHT.
14. AN UNOBSTRUCTED PATH OF TRAVEL WITH A MINIMUM WIDTH OF 3'-0" (EXCLUDING THE WIDTH OF CURB) SHALL BE MAINTAINED PAST ALL OBSTRUCTIONS (UTILITY POLES, SIGNS, MAILBOXES, ALONG DRIVEWAY OPENINGS, ETC.)
15. EXISTING TRAFFIC SIGNAL CONDUIT SHOWN IS BASED ON AVAILABLE RECORD PLANS AND THEIR LOCATION SHALL BE CONSIDERED APPROXIMATE. ALL EXISTING CONDUIT SHALL BE CONFIRMED IN THE FIELD BY THE CONTRACTOR PRIOR TO ANY CONSTRUCTION.
16. IF EXISTING CONDUIT SHOWN TO BE RETAINED AND UTILIZED FOR PROPOSED TRAFFIC SIGNAL CABLING IS FOUND TO BE DAMAGED OR CRUSHED, THE CONTRACTOR SHALL REPLACE THE CONDUIT UNDER ITEM 804.31 ONLY AS DIRECTED BY THE ENGINEER.
17. ELECTRONIC FILES TO BE PROVIDED BY THE ENGINEER AT THE REQUEST OF THE CONTRACTOR FOR LAYOUT PURPOSES.

**PAVEMENT NOTES**

**PROPOSED FULL DEPTH PAVEMENT (MARKET STREET GARAGE DRIVEWAY)**

- SURFACE: 2" HMA TOP COURSE OVER  
2" HMA INTERMEDIATE COURSE - BINDER MIX
- SUBBASE: 12" GRAVEL BORROW, TYPE b (2-6" LIFTS)

**PROPOSED FULL DEPTH PAVEMENT PATCH**

- SURFACE: 2" HMA TOP COURSE OVER  
2" HMA INTERMEDIATE COURSE - BINDER MIX
- SUBBASE: 12" GRAVEL BORROW, TYPE b (2-6" LIFTS)

**PAVEMENT NOTES**

**PROPOSED MILL & OVERLAY**

- SURFACE: 1 1/2" HMA TOP COURSE OVER  
VARIABLE DEPTH LEVELING COURSE OR  
VARIABLE DEPTH PAVEMENT MILLING  
TO MEET PROPOSED GRADES

**PROPOSED CEMENT CONCRETE SIDEWALK**

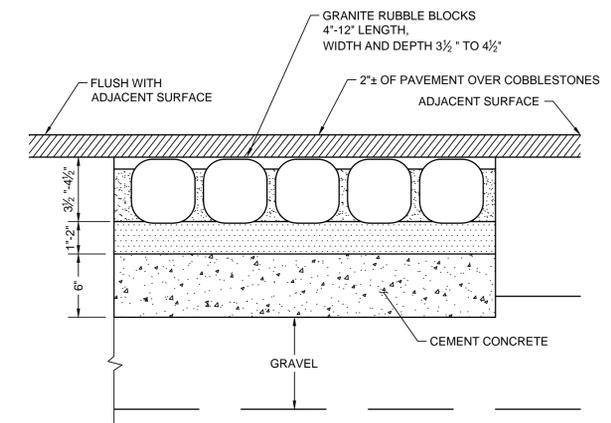
- SURFACE: 4" CEMENT CONCRETE  
(4000 PSI, 3/4", 610, AIR-ENTRAINED)
- BASE: 8" GRAVEL BORROW, TYPE b

**PROPOSED CEMENT CONCRETE WHEELCHAIR RAMP**

- SURFACE: 6" CEMENT CONCRETE  
(4000 PSI, 3/4", 610, AIR-ENTRAINED)
- BASE: 8" GRAVEL BORROW, TYPE b

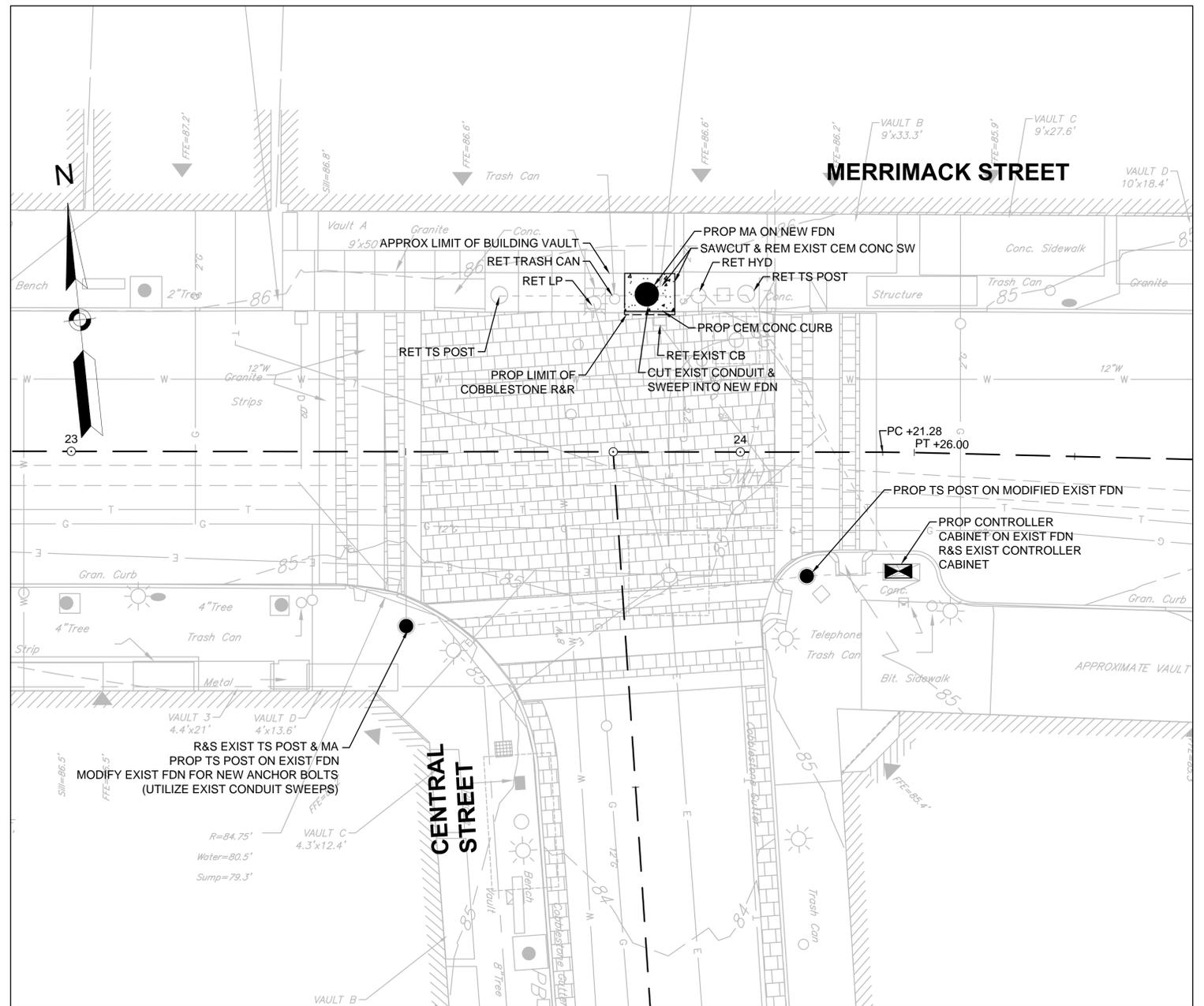
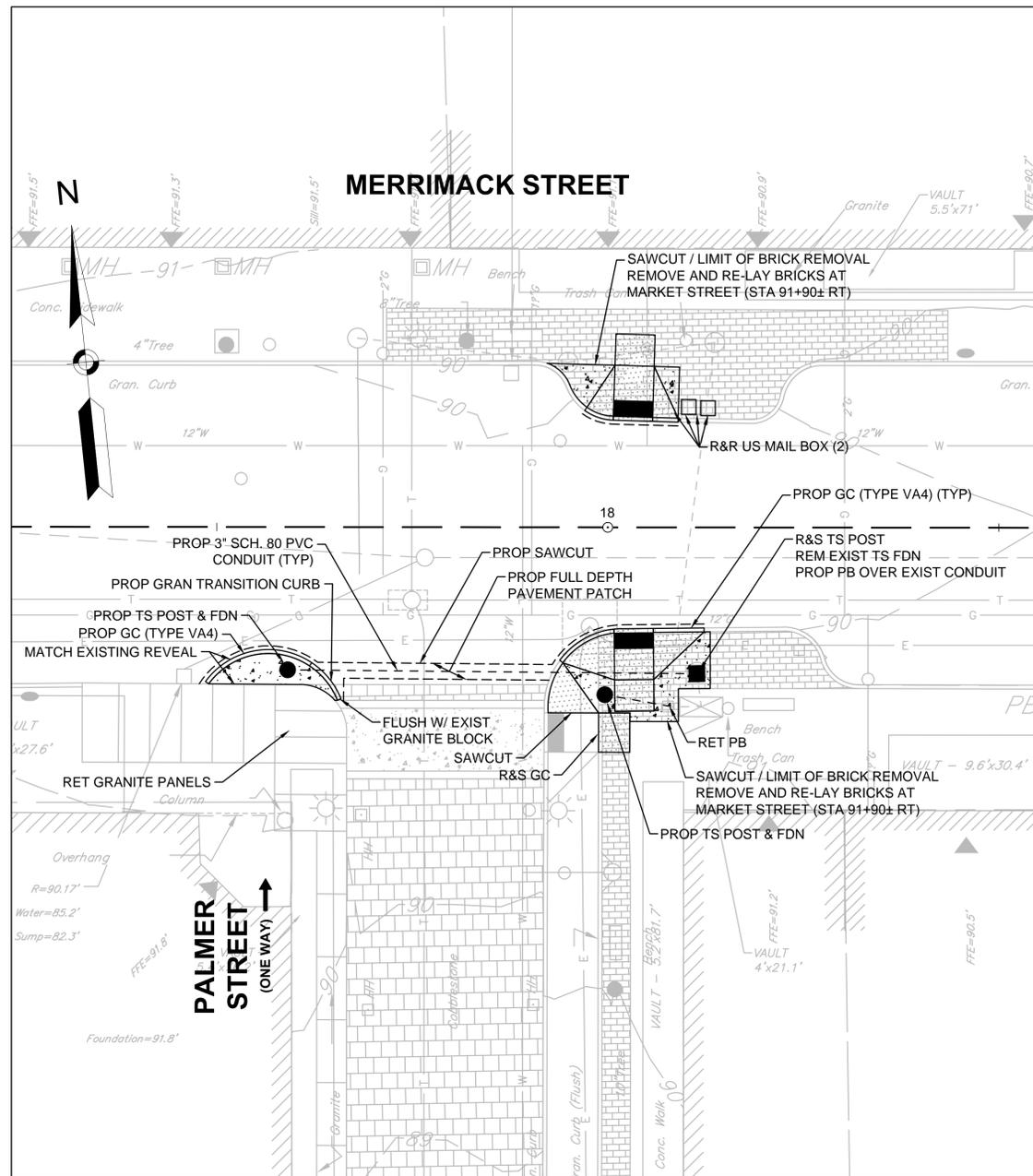
**GENERAL PAVEMENT NOTES:**

1. ANY EXISTING GRAVEL BASE DEEMED SUITABLE FOR REUSE BY THE RESIDENT ENGINEER SHALL REMAIN AND BE COMPACTED. ADD GRAVEL BORROW TYPE b AS REQUIRED.
2. ASPHALT EMULSION FOR TACK COAT SHALL BE APPLIED BETWEEN ALL ASPHALT SURFACES AND SAWCUT JOINTS BEFORE PAVING. HMA JOINT SEALANT SHALL BE APPLIED TO ALL COLD JOINTS (LONGITUDINAL AND TRANSVERSE) BEFORE PAVING SURFACE COURSE. ASPHALT EMULSION FOR TACK COAT SHALL BE APPLIED AT A RATE OF 0.05 GAL/SY, EXCEPT OVER MILLED AND CEMENT CONCRETE SURFACES, WHERE THE APPLICATION RATE SHALL BE 0.07 GAL/SY. ALL SURFACES SHALL BE CLEAN OF ALL ORGANICS, DEBRIS, AND SAND PRIOR TO PAVING.
3. EXISTING COBBLESTONES EXCAVATED WITHIN LIMITS OF PAVEMENT & CONCRETE EXCAVATION SHALL BE CONSIDERED INCIDENTAL TO ITEMS 127.01 AND 129.2 AND SHALL BE REMOVED & DISPOSED OF BY THE CONTRACTOR.

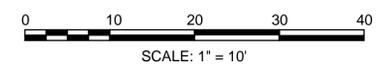


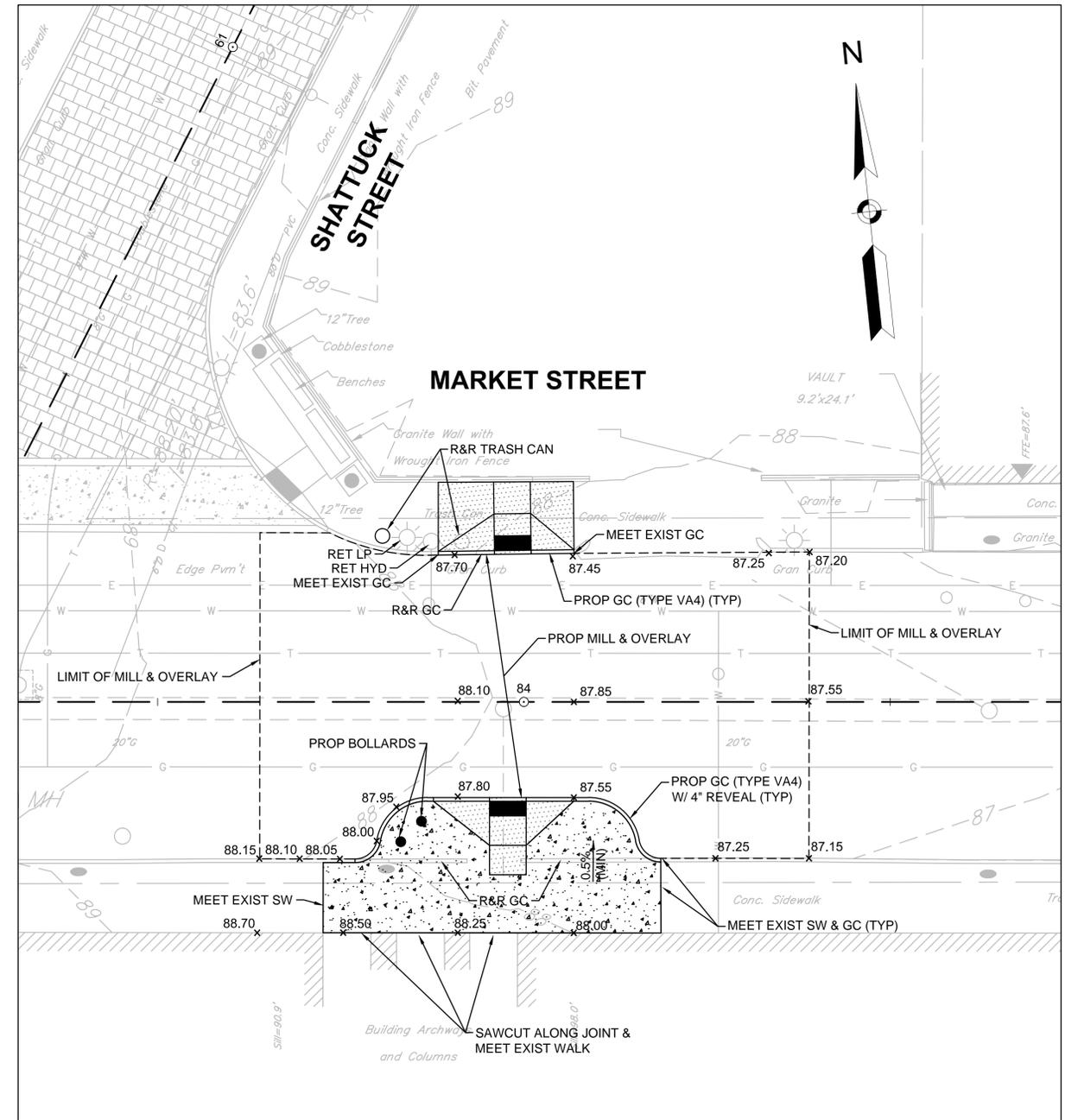
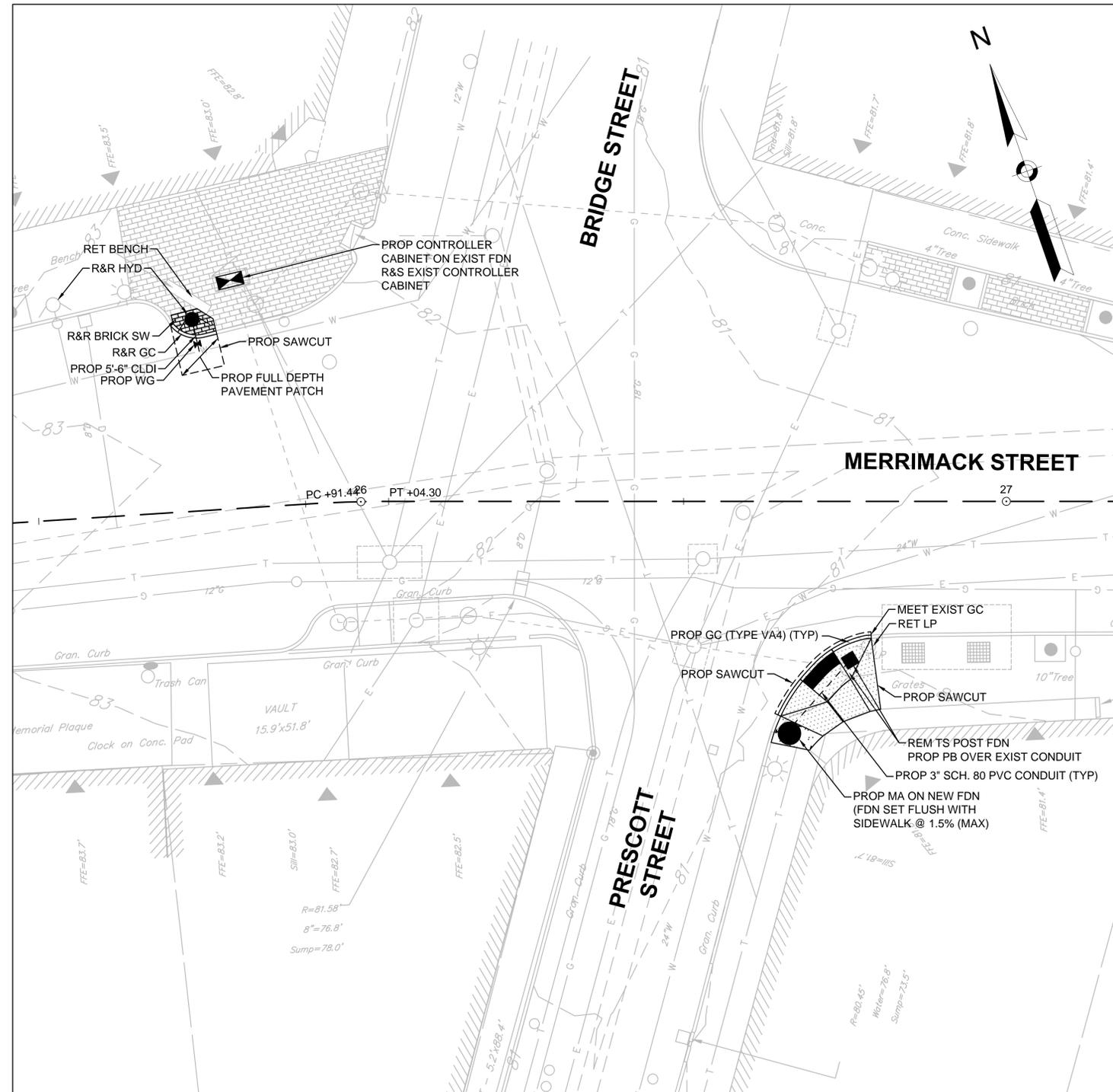
**EXISTING GRANITE COBBLESTONES/RUBBLE PAVEMENT  
(MARKET STREET, CENTRAL STREET & MERRIMACK STREET)**  
N.T.S.

**NOTE:** THIS DETAIL HAS BEEN SHOWN TO INDICATE THE TYPICAL SECTION OF EXISTING PAVEMENT STRUCTURE ALONG THE NOTED STREETS. SOME LOCATIONS ALONG NOTED STREETS MAY DIFFER FROM THIS DETAIL.

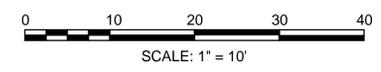


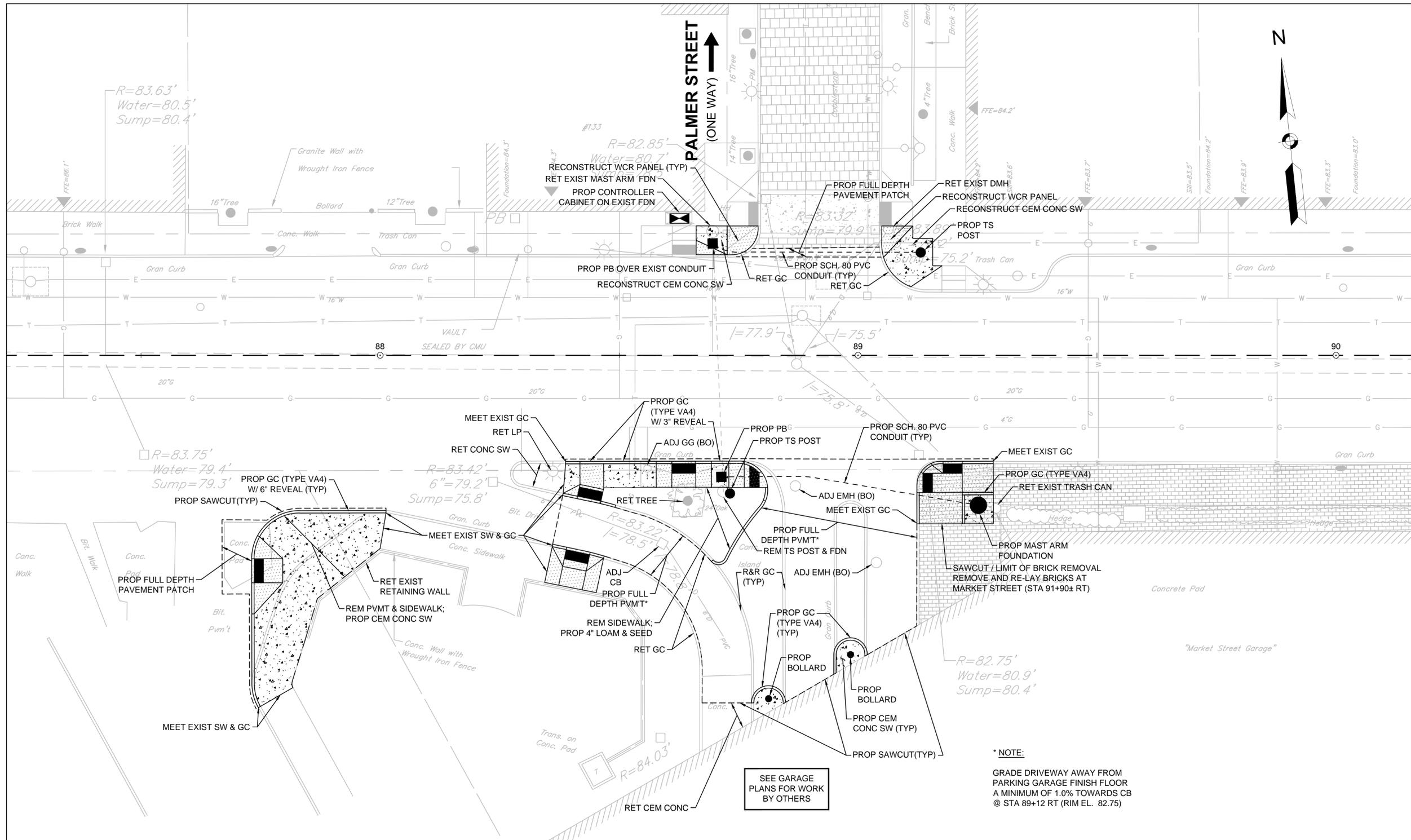
-  = PROPOSED CEMENT CONCRETE WHEELCHAIR RAMP (SEE DETAILS)
-  = PROPOSED CEMENT CONCRETE SIDEWALK (1.5% MAX SLOPE TO CURB)





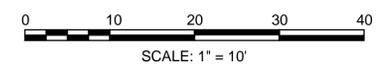
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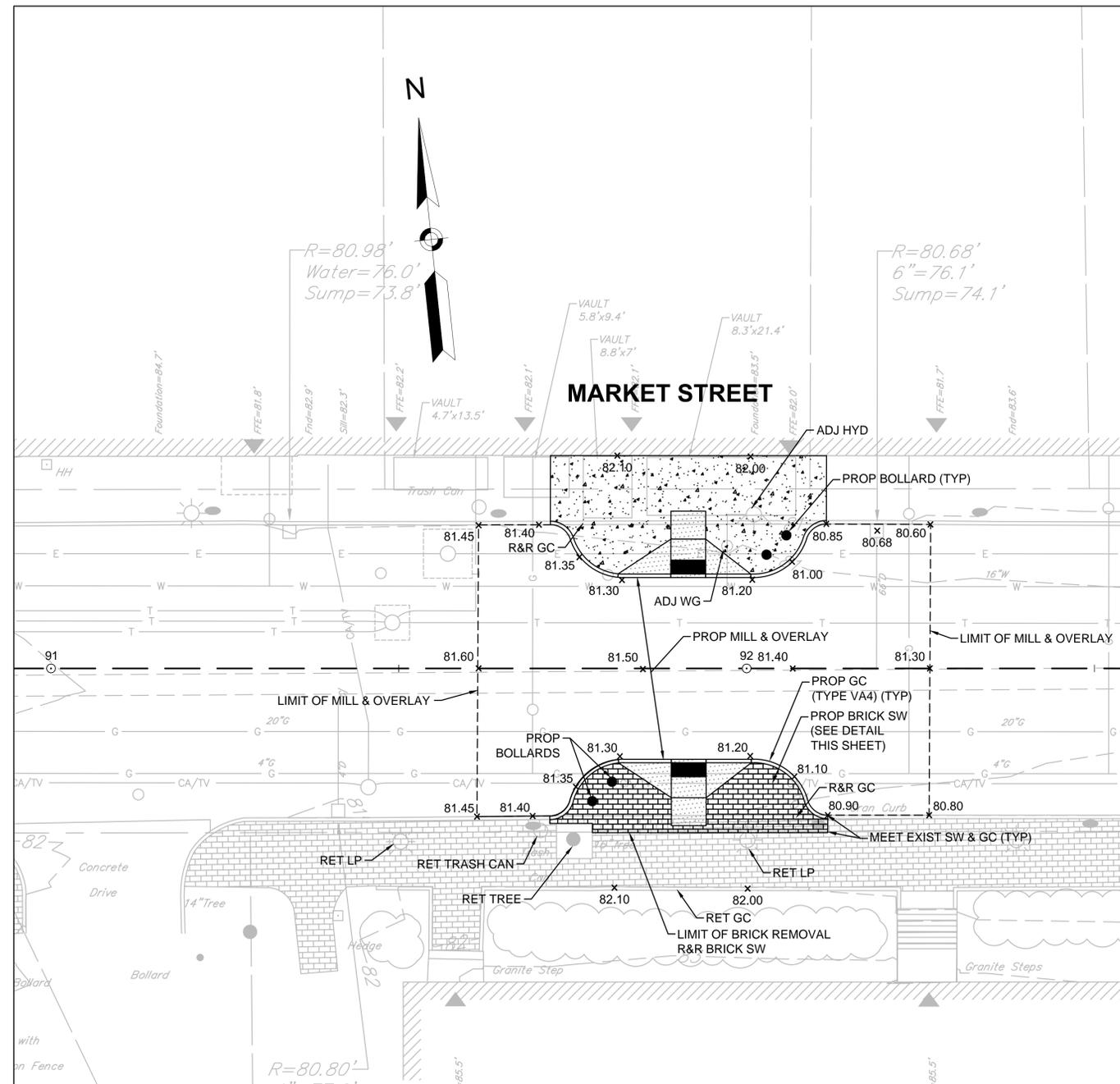




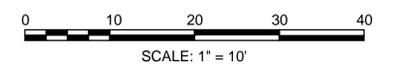
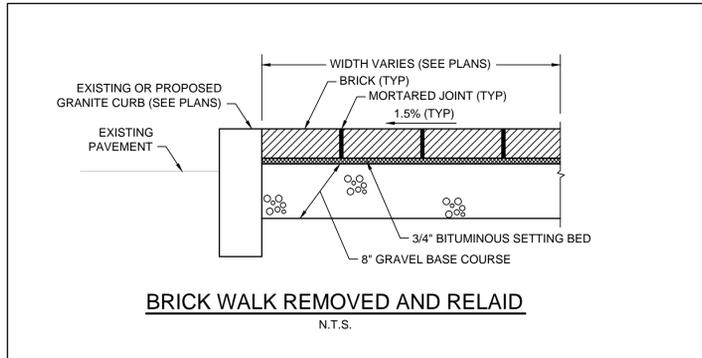
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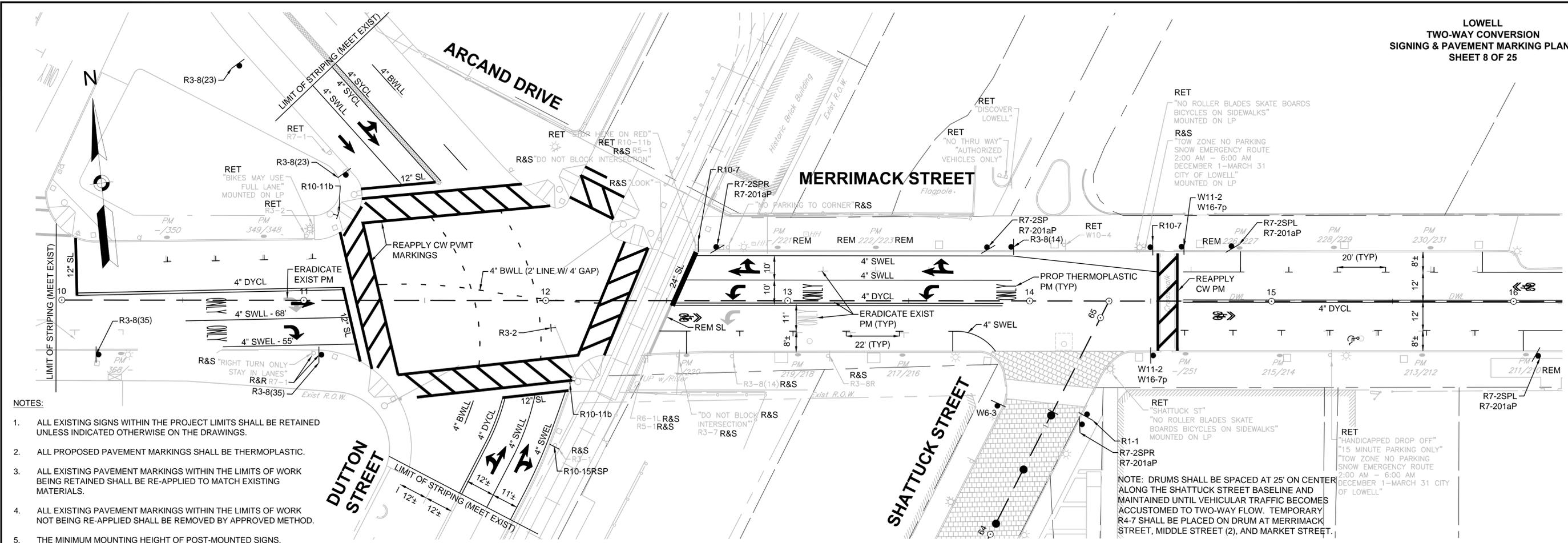
**\* NOTE:**  
GRADE DRIVEWAY AWAY FROM PARKING GARAGE FINISH FLOOR A MINIMUM OF 1.0% TOWARDS CB @ STA 89+12 RT (RIM EL. 82.75)



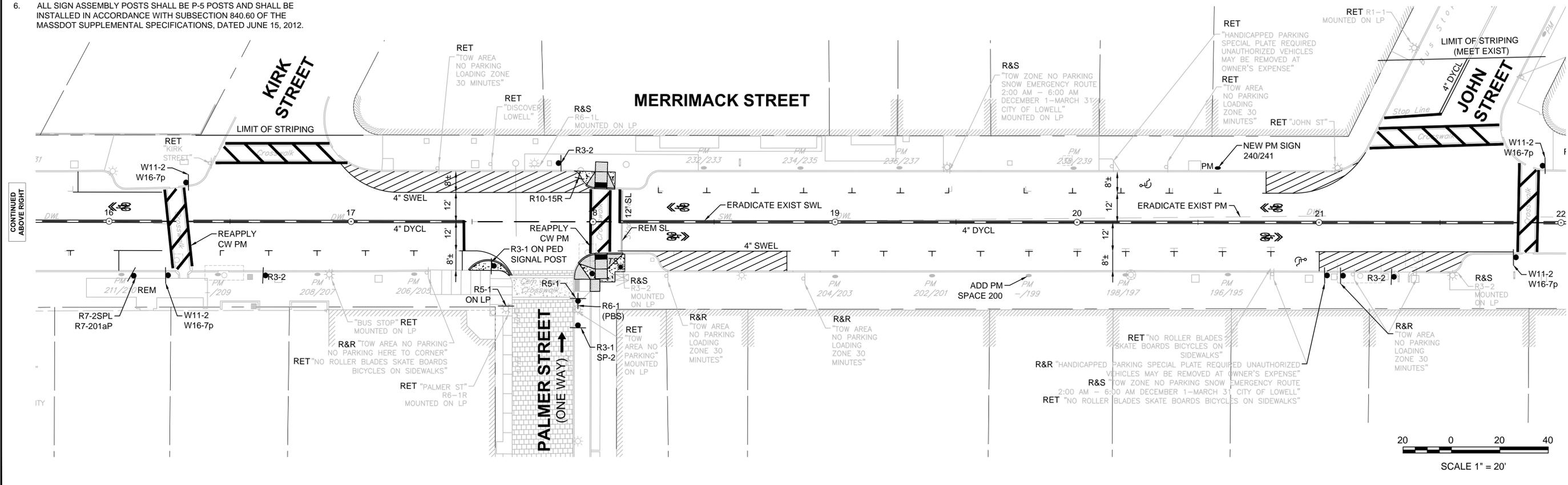


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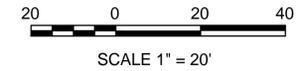
- NOTES:
1. ALL EXISTING SIGNS WITHIN THE PROJECT LIMITS SHALL BE RETAINED UNLESS INDICATED OTHERWISE ON THE DRAWINGS.
  2. ALL PROPOSED PAVEMENT MARKINGS SHALL BE THERMOPLASTIC.
  3. ALL EXISTING PAVEMENT MARKINGS WITHIN THE LIMITS OF WORK BEING RETAINED SHALL BE RE-APPLIED TO MATCH EXISTING MATERIALS.
  4. ALL EXISTING PAVEMENT MARKINGS WITHIN THE LIMITS OF WORK NOT BEING RE-APPLIED SHALL BE REMOVED BY APPROVED METHOD.
  5. THE MINIMUM MOUNTING HEIGHT OF POST-MOUNTED SIGNS, MEASURED VERTICALLY FROM THE BOTTOM OF THE SIGN TO THE TOP OF CURB OR SIDEWALK, OR THE ELEVATION OF THE NEAR EDGE OF TRAVEL WAY, SHALL BE 7 FEET UNLESS OTHERWISE SPECIFIED.
  6. ALL SIGN ASSEMBLY POSTS SHALL BE P-5 POSTS AND SHALL BE INSTALLED IN ACCORDANCE WITH SUBSECTION 840.60 OF THE MASSDOT SUPPLEMENTAL SPECIFICATIONS, DATED JUNE 15, 2012.

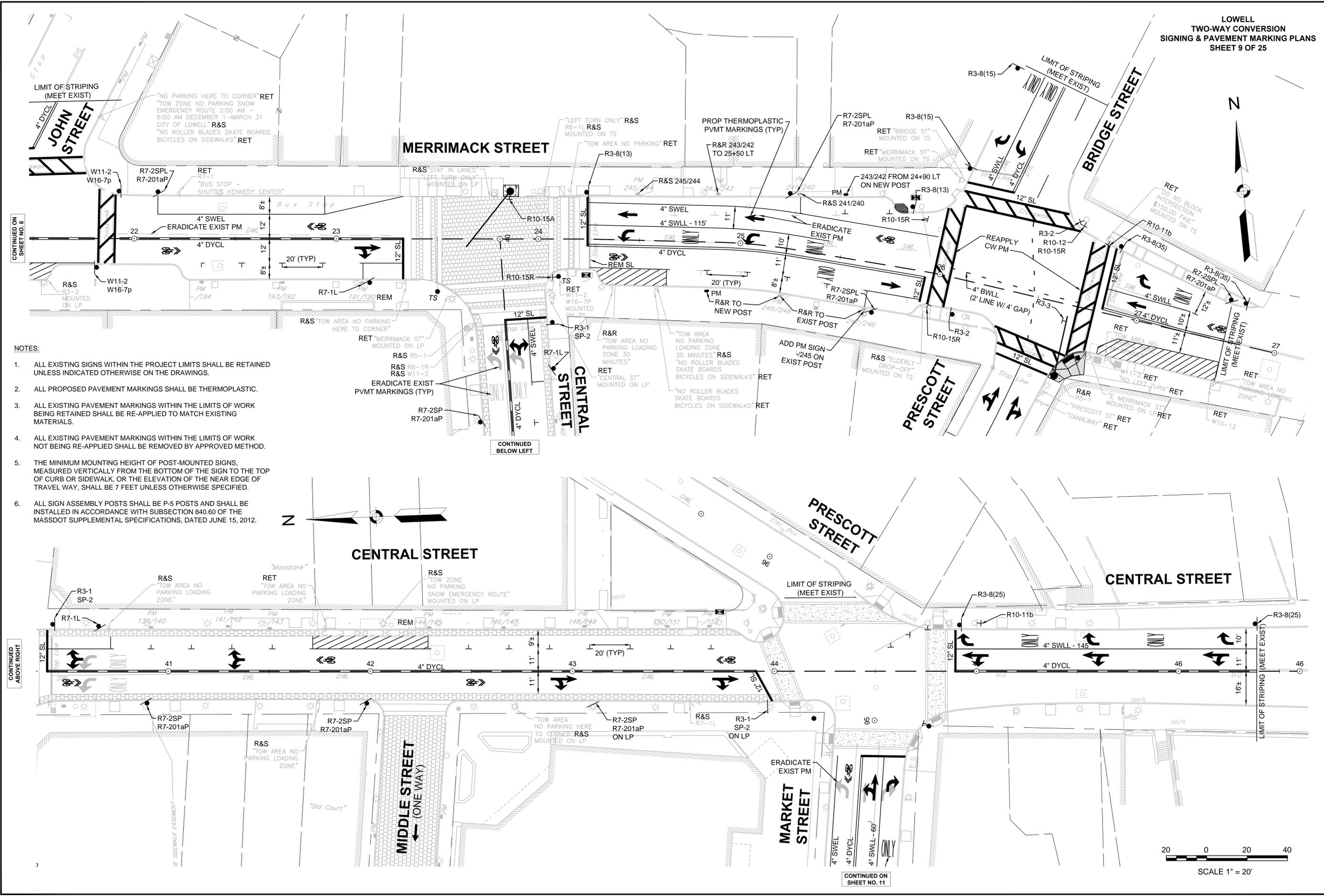


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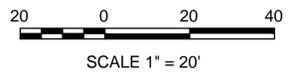
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- NOTES:
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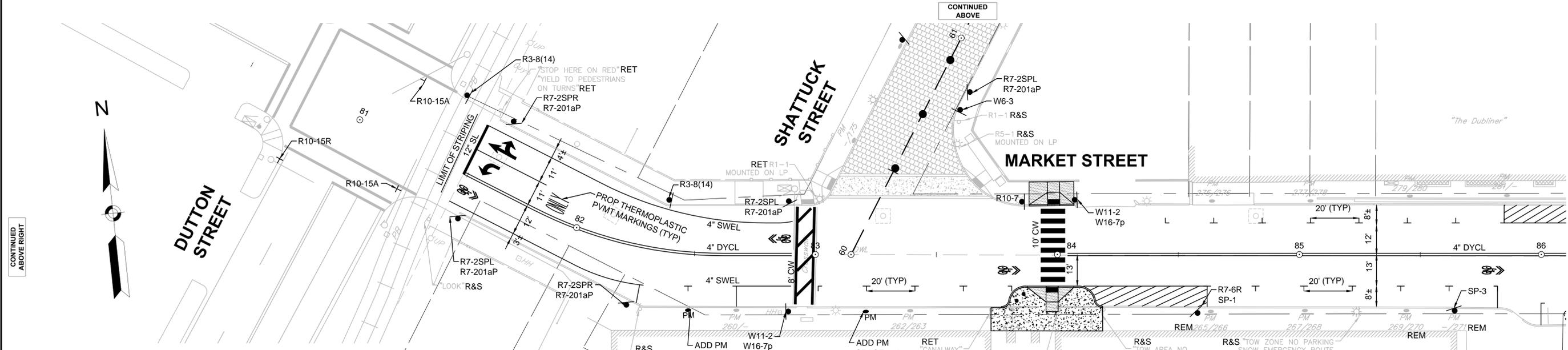
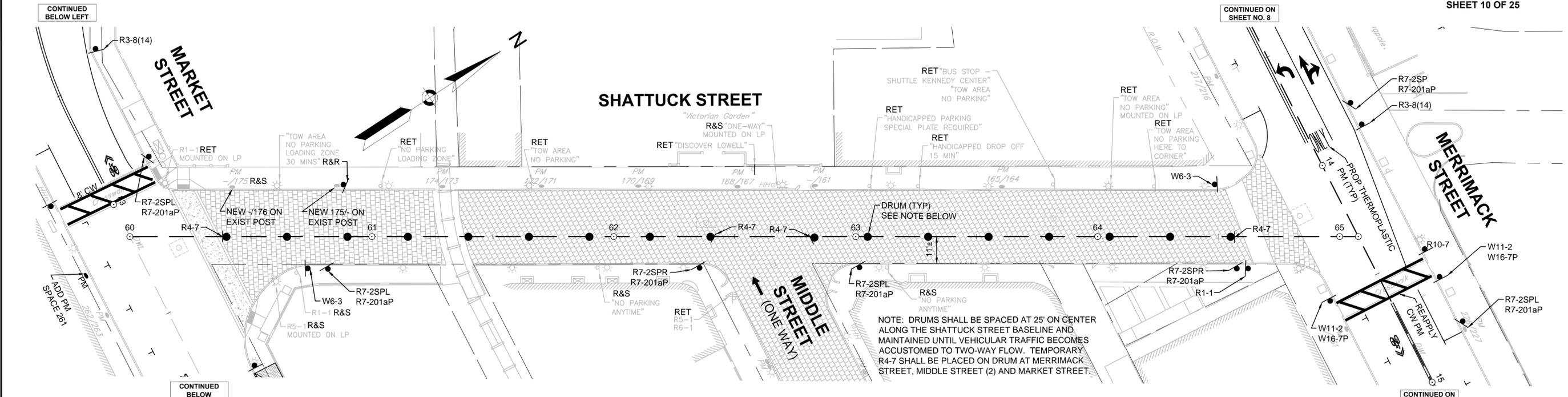


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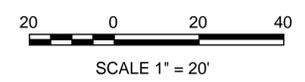
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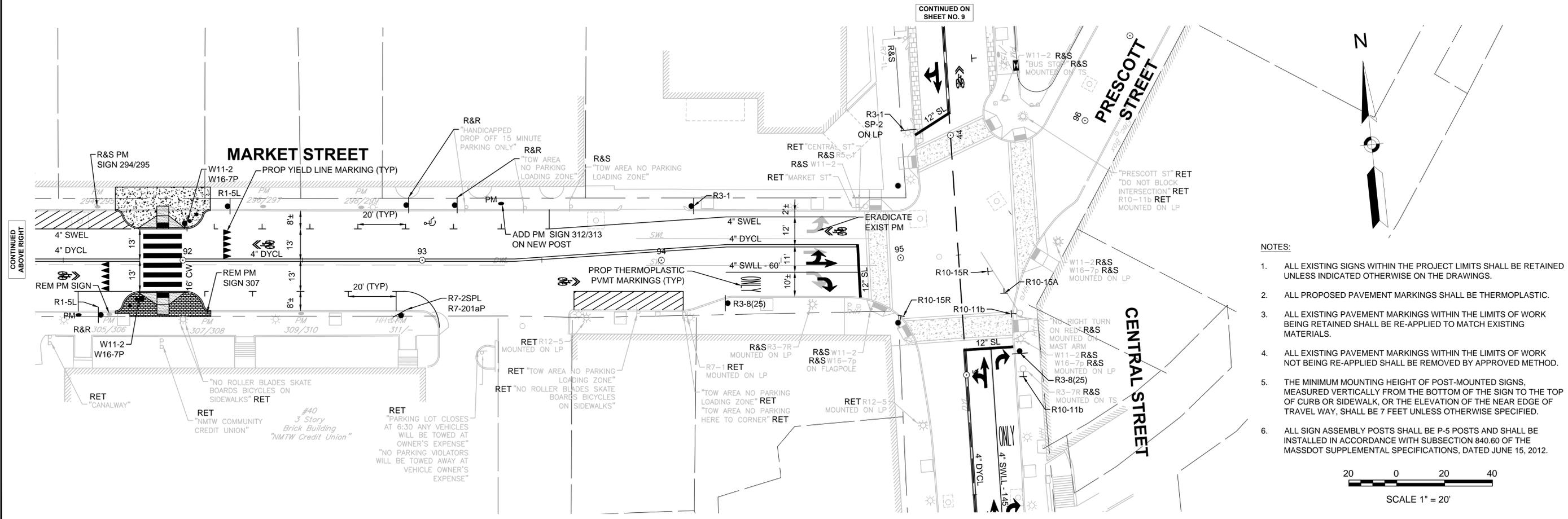
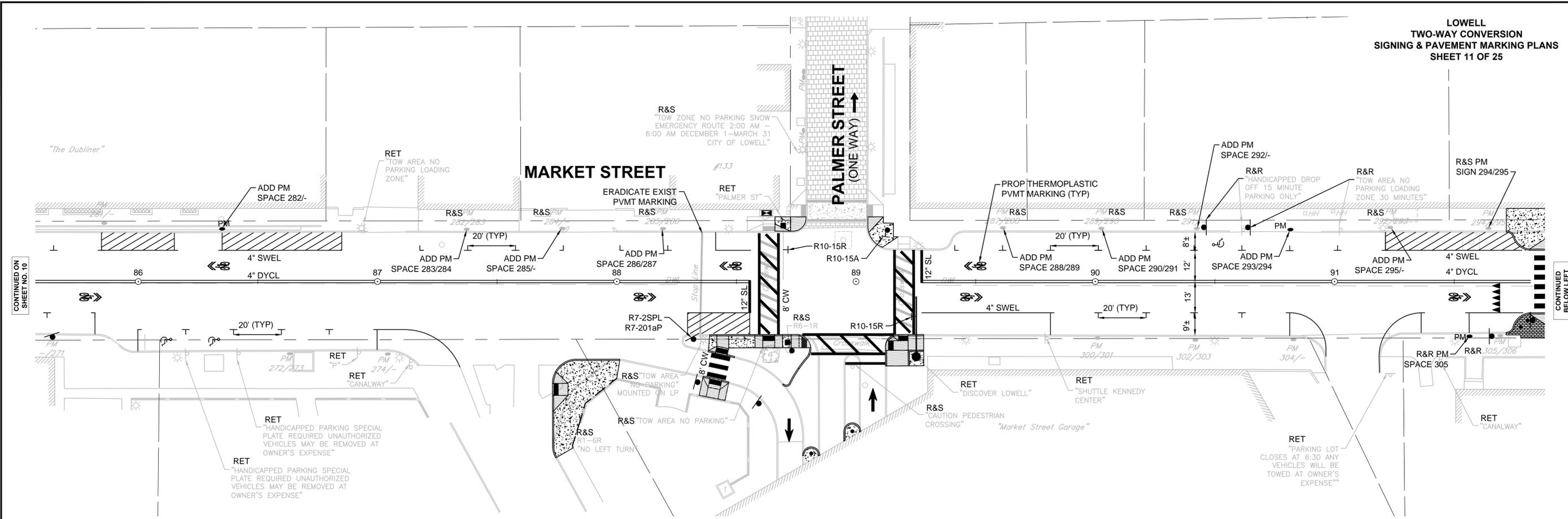
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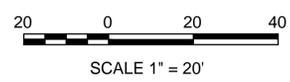


- NOTES:
1. ALL EXISTING SIGNS WITHIN THE PROJECT LIMITS SHALL BE RETAINED UNLESS INDICATED OTHERWISE ON THE DRAWINGS.
  2. ALL PROPOSED PAVEMENT MARKINGS SHALL BE THERMOPLASTIC.
  3. ALL EXISTING PAVEMENT MARKINGS WITHIN THE LIMITS OF WORK BEING RETAINED SHALL BE RE-APPLIED TO MATCH EXISTING MATERIALS.
  4. ALL EXISTING PAVEMENT MARKINGS WITHIN THE LIMITS OF WORK NOT BEING RE-APPLIED SHALL BE REMOVED BY APPROVED METHOD.
  5. THE MINIMUM MOUNTING HEIGHT OF POST-MOUNTED SIGNS, MEASURED VERTICALLY FROM THE BOTTOM OF THE SIGN TO THE TOP OF CURB OR SIDEWALK, OR THE ELEVATION OF THE NEAR EDGE OF TRAVEL WAY, SHALL BE 7 FEET UNLESS OTHERWISE SPECIFIED.
  6. ALL SIGN ASSEMBLY POSTS SHALL BE P-5 POSTS AND SHALL BE INSTALLED IN ACCORDANCE WITH SUBSECTION 840.60 OF THE MASSDOT SUPPLEMENTAL SPECIFICATIONS, DATED JUNE 15, 2012.





- NOTES:
1. ALL EXISTING SIGNS WITHIN THE PROJECT LIMITS SHALL BE RETAINED UNLESS INDICATED OTHERWISE ON THE DRAWINGS.
  2. ALL PROPOSED PAVEMENT MARKINGS SHALL BE THERMOPLASTIC.
  3. ALL EXISTING PAVEMENT MARKINGS WITHIN THE LIMITS OF WORK BEING RETAINED SHALL BE RE-APPLIED TO MATCH EXISTING MATERIALS.
  4. ALL EXISTING PAVEMENT MARKINGS WITHIN THE LIMITS OF WORK NOT BEING RE-APPLIED SHALL BE REMOVED BY APPROVED METHOD.
  5. THE MINIMUM MOUNTING HEIGHT OF POST-MOUNTED SIGNS, MEASURED VERTICALLY FROM THE BOTTOM OF THE SIGN TO THE TOP OF CURB OR SIDEWALK, OR THE ELEVATION OF THE NEAR EDGE OF TRAVEL WAY, SHALL BE 7 FEET UNLESS OTHERWISE SPECIFIED.
  6. ALL SIGN ASSEMBLY POSTS SHALL BE P-5 POSTS AND SHALL BE INSTALLED IN ACCORDANCE WITH SUBSECTION 840.60 OF THE MASSDOT SUPPLEMENTAL SPECIFICATIONS, DATED JUNE 15, 2012.



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TRAFFIC SIGN SUMMARY													
IDENTIFICATION NUMBER	SIZE OF SIGN (in)		LEGEND	TEXT DIMENSIONS (INCHES)			NUMBER OF SIGNS REQUIRED	COLOR			NUMBER OF P-5 POSTS REQUIRED	UNIT AREA (S.F.)	AREA IN SQUARE FEET
	WIDTH	HEIGHT		LETTER HEIGHT	VERTICAL SPACING	ARROW RTE. MKR.		BACK-GROUND	LEGEND	BORDER			
R1-1	30	30			①		1		①		1	6.25	6.25
R1-2	36	36					1				1	9.00	9.00
R1-5L	36	36					2				2	9.00	18.00
R3-1	24	24					4				2 (2 MTD. ON LIGHT POLE)	4.00	16.00
R3-2	24	24					7				5 (2 MTD. ON TS EQUIP)	4.00	28.00
R3-3	24	24					1				0 (1 MTD. ON TS EQUIP)	4.00	4.00
R3-8(13)	30	30					2				2	6.25	12.50
R3-8(14)	30	30					3				3	6.25	18.75
R-8(15)	30	30					2				2	6.25	12.50
R3-8(23)	30	30					2				2	6.25	12.50
R3-8(25)	30	30					3				3	6.25	18.75
R3-8(35)	30	30					4				4	6.25	25.00
R5-1	30	30					2				1 (1 MTD. ON LIGHT POLE)	6.25	12.50
R6-1 (PBS)	36	12					1				0 (1 MTD. W/ R5-1)	3.00	3.00
R7-1L	12	18					2				2	1.50	3.00
R7-2SP	12	18					4				3 (1 MTD. ON LIGHT POLE)	1.50	6.00

NOTES:

- ① SEE 2009 MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS FOR TEXT AND LEGEND DIMENSIONS.
- ② FLOURESCENT YELLOW-GREEN BACKGROUND W/ BLACK LEGEND & BORDER.

TRAFFIC SIGN SUMMARY													
IDENTIFICATION NUMBER	SIZE OF SIGN (in)		LEGEND	TEXT DIMENSIONS (INCHES)			NUMBER OF SIGNS REQUIRED	COLOR			NUMBER OF P-5 POSTS REQUIRED	UNIT AREA (S.F.)	AREA IN SQUARE FEET
	WIDTH	HEIGHT		LETTER HEIGHT	VERTICAL SPACING	ARROW RTE. MKR.		BACK-GROUND	LEGEND	BORDER			
R7-2SPL	12	18			①		12		①		12	1.50	18.00
R7-2SPR	12	18					5				5	1.50	7.50
R7-6R	12	18					1				1	1.50	1.50
R7-201aP	12	6					21				0 (21 MTD. W/ R7-2SP SERIES)	0.50	10.50
R10-3e	9	15					54				0 (ALL MTD. ON TS EQUIP)	0.94	50.63
R10-7	24	30					2				2	5.00	10.00
R10-11b	36	36					5				0 (5 MTD. ON TS EQUIP)	9.00	45.00
R10-12	30	36					1				0 (1 MTD. ON TS EQUIP)	7.50	7.50
R10-15A	30	30					5				0 (5 MTD. ON TS EQUIP)	6.25	31.25
R10-15R	30	30					11				0 (11 MTD. ON TS EQUIP)	6.25	68.75
R10-15RSP	30	30					1				0 (1 MTD. ON EXIST POST)	6.25	6.25
W6-3	36	36					2				2	9.00	18.00
W11-2	30	30			②		11		②		11	6.25	68.75
W16-7P	24	12					11				0 (10 MTD. W/ W11-2)	2.00	22.00
SP-1	12	18			①		1		①		0 (1 MTD. W/ R7-6R)	1.50	1.50
SP-2	6	12					3				0 (1 MTD. W/ R3-1)	0.50	1.50
SP-3	12	18					1				1	1.50	1.50



ITEM 816.01

MERRIMACK STREET AT ARCAND STREET / DUTTON STREET / WORTHEN STREET

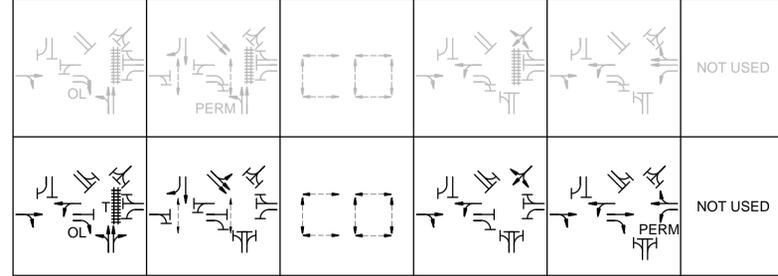
LIST OF MAJOR ITEMS REQUIRED

QUANTITY	DESCRIPTION
3	SIGNAL HEAD, 3-SECTION, 12" L.E.D. MODULES, LOUVERED BACKPLATES
1	SIGNAL HEAD, 4-SECTION, 12" L.E.D. MODULES, LOUVERED BACKPLATES
4	R&S SIGNAL HEAD
1	R&R SIGNAL HEAD
8	PEDESTRIAN SIGNAL HEAD, 16" L.E.D. MODULES, W/ COUNTDOWN INDICATOR & AUDIBLE WARNING DEVICES
14	PEDESTRIAN PUSH BUTTON (VIBRATORY) W/ R10-3e AND SIGN SADDLE
8	R&S PEDESTRIAN SIGNAL HEAD
14	R&S PEDESTRIAN PUSH BUTTON & SIGN SADDLE
4	WIRE LOOP DETECTOR (6' X 20')
1	ABANDON AND DISCONNECT ALL LOOPS ALONG MERRIMACK ST WB APPROACH TO DUTTON STREET
4	MAST ARM OR POST MOUNTED SIGNS (R10-15R, R3-2, R10-11b AS NOTED - UNDER ITEM 832.)
1	EMERGENCY VEHICLE PRE-EMPTION DETECTOR AND DETECTOR CABLING
1	CONTROLLER PROGRAMMING & FINE TUNING
1	INTERSECTION CABLING FOR NEW SIGNAL HEADS / LOOPS / PRE-EMPTION

PLUS NECESSARY CONDUIT, CABLE, LABOR, MISCELLANEOUS MATERIAL AND EQUIPMENT TO COMPLETE THE INSTALLATION AND PROVIDE AN OPERATING TRAFFIC CONTROL SIGNAL.

APPROACH		DIRECTION	HOUSING	EXISTING / PROPOSED SEQUENCE AND TIMING															FLASHING OPERATION
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
MINIMUM INTERVAL				10			10						4			10			
VEHICLE EXTENSION				3			3						0			3			
MAXIMUM 1				20			35						4			30			
MAXIMUM 2				35			30						4			35			
YELLOW CLEARANCE					3.0			3.0						3.0			3.0		
RED CLEARANCE						1.5			1.5						1.0			2.0	
WALK							7.0			7									
PEDESTRIAN CLEARANCE							21.0	3.0	1.5		24.0	1							
MERRIMACK STREET WEST		EB	O,P	G	Y	R	R	R	R	R	R	R	G	Y	R	G	Y	R	FY
MERRIMACK STREET WEST		WB	R,T,U	G	Y	R	R	R	R	R	R	R	G	Y	R	G	Y	R	FY
MERRIMACK STREET EAST		EB-T	H	R	R	R	R	R	R	R	R	R	R	R	R	G	Y	R	FR
MERRIMACK STREET EAST		EB-R	D	$\begin{matrix} R \\ \rightarrow \end{matrix}$	$\begin{matrix} R \\ \rightarrow \end{matrix}$	R	R	R	R	R	R	R	R	R	R	G	Y	R	FR
MERRIMACK STREET EAST		WB	A,G,K	R	R	R	R	R	R	R	R	R	R	R	R	G	Y	R	FR
DUTTON STREET		NB	J,N,L	G	Y	R	R	R	R	R	R	R	R	R	R	R	R	R	FY
ARCAND DRIVE		SB	B,E,M	R	R	R	G	Y	R	R	R	R	R	R	R	R	R	R	FY
WORTHEN STREET		SB	Q,S	R	R	R	G	Y	R	R	R	R	R	R	R	R	R	R	FR
COBBLESTONES		SWB	C,F	R	R	R	R	R	R	R	R	R	G	Y	R	R	R	R	FR
TROLLEY		ALL	T1-T4	G	Y	R	R	R	R	R	R	R	R	R	R	R	R	R	OUT
CONCURRENT PEDESTRIAN		Ø2 PED	P1,P8,P9,P14	DW	DW	DW	W/FDW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	OUT
PEDESTRIAN		ALL	P1-P14	DW	DW	DW	DW	DW	DW	W	FDW	DW	DW	DW	DW	DW	DW	DW	OUT
DETECTOR				NON-LOCK			NON-LOCK			NON-LOCK			NON-LOCK			NON-LOCK			
RECALL				OFF			SOFT			OFF			OFF			SOFT			
				Ø1			Ø2			Ø3			Ø4			Ø5			Ø6,Ø7,&Ø8

- NOTES:
- AUTOMATIC FLASHING OPERATION PER M.U.T.C.D. SECTIONS 4D.28 THRU 4D.31.
  - PEDESTRIAN PHASE UPON PUSH BUTTON ACTIVATION ONLY
  - MAXIMUM 1 = NORMAL OPERATION
  - MAXIMUM 2 = M-F 3PM TO 7PM
  - PERM = PERMISSIVE LEFT-TURN
  - OL = OVERLAP
  - T = TROLLEY



SEQUENCE & TIMING NOTES:

- IF THE ASSIGNED RIGHT OF WAY FOR ANY TRAFFIC MOVEMENT IS TO REMAIN IN EFFECT DURING THE NEXT CALLED PHASE, THE SIGNAL INDICATIONS FOR THAT TRAFFIC MOVEMENT WILL NOT CHANGE DURING THE CLEARANCE INTERVAL.
- THE RIGHT OF WAY MAY BE ASSIGNED TO ANY PHASE OR ANY COMBINATION OF NON-CONFLICTING PHASES.
- IF CALLS EXIST ON ALL PHASES, THE ASSIGNMENT OF RIGHT OF WAY SHALL BE IN ACCORDANCE WITH THE PREFERENTIAL PHASE SEQUENCE.
- IF THE ASSIGNED RIGHT-OF-WAY FOR ANY TRAFFIC MOVEMENT IS TO CHANGE DURING THE NEXT CALLED PHASE, THE SIGNAL INDICATION FOR THAT MOVEMENT WILL DISPLAY THE APPROPRIATE CLEARANCE INTERVALS.
- PEDESTRIAN PHASE WILL ONLY BE CALLED UPON PUSH BUTTON ACTIVATION. UPON PUSH BUTTON ACTIVATION.

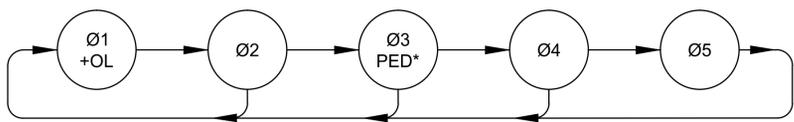
CONSTRUCTION NOTES:

- THE CONSTRUCTION SHALL CONFORM WITH MASSACHUSETTS DEPARTMENT OF TRANSPORTATION, HIGHWAY DIVISION SPECIFICATIONS UNLESS OTHERWISE NOTED.
- EACH LOOP GROUP SHALL BE SPLICED IN SINGLE PULL BOX AND WIRED TO SEPARATE CONTROLLER INPUT.
- ALL SIGNAL HEADS AND SIGNS SHALL BE RIGIDLY MOUNTED.
- CONTRACTOR SHALL FINE-TUNE THE TIMING AND COORDINATION PARAMETERS IN THE PRESENCE OF THE ENGINEER AND CITY OF LOWELL REPRESENTATIVES FOLLOWING INSTALLATION.

EXISTING / PROPOSED DETECTOR DATA						
DETECTOR NO.	NO. SECTION/ SIZE	NO. OF TURNS	OPERATIONS	DELAY/ EXT.	PHASE CALLED	LOOP CONNECTION
1	2-6'X20'	2-4-2	PRESENCE	0	Ø5	SERIES
2	2-6'X20'	2-4-2	PRESENCE	0	Ø5	SERIES
3	3-6'X6'	UNKNOWN	PRESENCE	5 SEC	Ø5	SERIES
4	3-6'X6'	UNKNOWN	PRESENCE	0	Ø5	SERIES
5	3-14'X6'	UNKNOWN	PRESENCE	0	Ø1,Ø4&Ø5	SERIES
6	2-6'X6' 1-6'X14'	UNKNOWN	PRESENCE	0	Ø1,Ø4&Ø5	SERIES
7	3-6'X6'	UNKNOWN	PRESENCE	0	Ø2	SERIES
8	2-6'X6' 1-6'X14'	UNKNOWN	PRESENCE	0	Ø2	SERIES
9	3-6'X6'	UNKNOWN	PRESENCE	0	Ø1	SERIES
10	3-6'X6'	UNKNOWN	PRESENCE	0	Ø1	SERIES
11	4-6'X6'	UNKNOWN	PRESENCE	0	Ø2	SERIES
12	3-6'X6'	UNKNOWN	PRESENCE	0	Ø2	SERIES
13	6'X14'	UNKNOWN	PRESENCE	0	Ø4	SERIES

NOTE: EXISTING LOOP DETECTORS SHOULD BE VERIFIED IN THE FIELD.

PROPOSED PHASE SEQUENCE



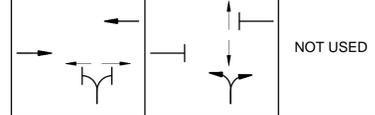
PREEMPTION PHASING & PRIORITY			
DETECTOR	PREEMPT PHASE ASSIGNMENT	MOVEMENT	VEHICLE PHASE ASSIGNMENT
D1	1		Ø2
D2	2		Ø1
D3	3		Ø5
D4	4		Ø2
D5	5		Ø5

- EMERGENCY VEHICLE PRE-EMPTION NOTES:
- EMERGENCY VEHICLE PRE-EMPTION SIGNALS SHALL BE OPTICALLY TRANSMITTED BY OPTICAL EMITTERS MOUNTED IN EMERGENCY VEHICLES AND RECEIVED BY OPTICAL DETECTORS LOCATED AT EACH INTERSECTION.
  - EMERGENCY VEHICLE PRE-EMPTION SIGNALS SHALL BE SERVICED ON A FIRST DETECTED FIRST SERVE BASIS.
  - IN RESPONSE TO A PRE-EMPTION SIGNAL RECEIVED AT AN INTERSECTION BY OPTICAL DETECTOR D1 (OR D2, D3, D4, D5) THE CONTROLLER SHALL HOLD OR ADVANCE TO AND HOLD IN EMERGENCY VEHICLE PRE-EMPTION PHASE #1 (OR #2, #3, #4, #5) GREEN FOR A MINIMUM OF FIFTEEN (15) SECONDS OR UNTIL PRE-EMPTION SIGNAL CEASES. THE CONTROLLER SHALL THEN TIME PRE-EMPTION PHASE CLEARANCE (3 SECONDS: YELLOW AND 2 SECONDS: ALL RED) AND SERVICE SUBSEQUENT EMERGENCY VEHICLE PRE-EMPTION PHASES AS NECESSARY.
  - NORMAL CLEARANCE SHALL BE PROVIDED ON PHASES THAT ARE TO BE TERMINATED BY PRE-EMPTION DEMAND.
  - CONFIRMATION STROBE SHALL BE ILLUMINATED WHENEVER ANY EMERGENCY VEHICLE PRE-EMPTION GREEN IS ON.

EXISTING / PROPOSED SIGNAL HEAD DATA											
T1-T4	U	A-C,E-F,K-M,O,T	G	D,H	J,N	D	H,J,N	P1-P3,P6,P8	P4-P5, P9-P14	P7	P4-P5,P9-P14
ALL 12" LENSES			ALL 12" LENSES W/ 5" LOUVERED BACKPLATES			ALL 12" LENSES W/ 5" LOUVERED BACKPLATES (FREE-SWINGING ON MAST ARM)				16" L.E.D. W/ COUNTDOWN INDICATORS	ALL 16" L.E.D. W/ COUNTDOWN INDICATORS

PROPOSED SEQUENCE AND TIMING									
APPROACH	DIRECTION	HOUSING	1	2	3	4	5	6	FLASHING OPERATION
MINIMUM INTERVAL			10			6			
VEHICLE EXTENSION			2			2			
MAXIMUM 1			50			20			
MAXIMUM 2			-			-			
YELLOW CLEARANCE				3.0			3.0		
RED CLEARANCE					1.0			1.0	
WALK			7.0			7.0			
PEDESTRIAN CLEARANCE			5.0	3.0	1.0	4.0	3.0	1.0	
MERRIMACK STREET	EB	F,G	G	Y	R	R	R	R	FY
MERRIMACK STREET	WB	B,C,E	G	Y	R	R	R	R	FY
PALMER STREET	NB	A,D	R	R	R	G	Y	R	FR
CONCURRENT PEDESTRIAN	Ø1 PED	P3-P4	W/FDW	DW	DW	DW	DW	DW	OUT
CONCURRENT PEDESTRIAN	Ø2 PED	P1-P2	DW	DW	DW	W/FDW	DW	DW	OUT
DETECTOR			NON-LOCK			NON-LOCK			
RECALL			SOFT			OFF			
			Ø1			Ø2			Ø3,Ø4,Ø5, Ø6,Ø7,Ø8

- NOTES:
- AUTOMATIC FLASHING OPERATION PER M.U.T.C.D. SECTIONS 4D.28 THRU 4D.31.
  - PEDESTRIAN CALL UPON PUSH BUTTON ACTIVATION ONLY
  - MAXIMUM 1 = NORMAL OPERATION  
MAXIMUM 2 = NOT USED
  - Ø2&Ø6 OPERATE IN DUAL ENTRY MODE

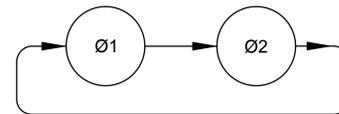


ITEM 816.02  
MERRIMACK STREET AT PALMER STREET  
LIST OF MAJOR ITEMS REQUIRED

QUANTITY	DESCRIPTION
1	8' TS POST, ORNAMENTAL, PAINTED BLACK, INCL. FOUNDATION
1	10' TS POST, ORNAMENTAL, PAINTED BLACK, INCL. FOUNDATION
1	R&S 8' TS POST
2	SIGNAL HEAD, 3-SECTION, 12" L.E.D. MODULES, LOUVERED BACKPLATES
2	R&R SIGNAL HEAD
2	PEDESTRIAN SIGNAL HEAD, 16" L.E.D. MODULES, W/ COUNTDOWN INDICATOR & AUDIBLE WARNING DEVICES
4	PEDESTRIAN PUSH BUTTON (VIBRATORY) W/ R10-3e AND SIGN SADDLE
1	R&R PEDESTRIAN SIGNAL HEAD
2	R&S PEDESTRIAN PUSH BUTTON & SIGN SADDLE
1	VIDEO DETECTION CAMERA W/ EXTENSION ARM (OMNI-DIRECTIONAL)
1	VIDEO DETECTION CHASSIS AND CABLING
1	VIDEO DETECTION PROCESSOR MODULE
3	EMERGENCY PRE-EMPTION DETECTORS AND DETECTOR CABLING
2	EMERGENCY PRE-EMPTION 2-CHANNEL PHASE SELECTORS
1	EMERGENCY PRE-EMPTION SYSTEM CHASSIS
1	EMERGENCY PRE-EMPTION STROBE (WHITE LENS)
1	12" X 12" PULL BOX (UNDER ITEM 811.31)
65 FEET	3" SCH. 80 PVC CONDUIT (UNDER ITEM 804.3)
1	MAST ARM OR POST MOUNTED SIGNS (R10-15R AS NOTED - UNDER ITEM 832.)
1	CONTROLLER/COORDINATION PROGRAMMING & FINE TUNING
1	INTERSECTION CABLING FOR NEW SIGNAL HEADS / PRE-EMPTION

PLUS NECESSARY CONDUIT, CABLE, LABOR, MISCELLANEOUS MATERIAL AND EQUIPMENT TO COMPLETE THE INSTALLATION AND PROVIDE AN OPERATING TRAFFIC CONTROL SIGNAL.

PROPOSED PHASE SEQUENCE



VIDEO DETECTOR DATA					
DETECTOR NO.	APPROX. SIZE	Ø CALLED	Ø EXTENDED	OPERATIONS	DELAY/ EXT.
1	±6'X50'	Ø1	Ø1	PRESENCE	0
2	±10'X50'	Ø2	Ø2	PRESENCE	0
3	±6'X50'	Ø1	Ø1	PRESENCE	0

NOTE: DELAY AND EXTENSION TIMINGS SHALL BE PROGRAMMED IN THE CONTROLLER ONLY.

CONSTRUCTION NOTES:

- PULL BOXES SHALL NOT BE LOCATED WITHIN WHEELCHAIR RAMPS.
- THE CONSTRUCTION SHALL CONFORM WITH MASSACHUSETTS DEPARTMENT OF TRANSPORTATION, HIGHWAY DIVISION SPECIFICATIONS UNLESS OTHERWISE NOTED.
- ALL MAST ARM FOUNDATIONS SHALL CONFORM WITH MASSACHUSETTS DEPARTMENT OF TRANSPORTATION, HIGHWAY DIVISION "MAST ARM & FOUNDATION DETAILS STANDARD DRAWINGS", DATED FEBRUARY 24, 2011
- EACH LOOP GROUP SHALL BE SPLICED IN SINGLE PULL BOX AND WIRED TO SEPARATE CONTROLLER INPUT.
- ALL SIGNAL HEADS AND SIGNS SHALL BE RIGIDLY MOUNTED.
- CONTRACTOR SHALL FINE-TUNE THE TIMING AND COORDINATION PARAMETERS IN THE PRESENCE OF THE ENGINEER AND CITY OF LOWELL REPRESENTATIVES FOLLOWING INSTALLATION.

SEQUENCE & TIMING NOTES:

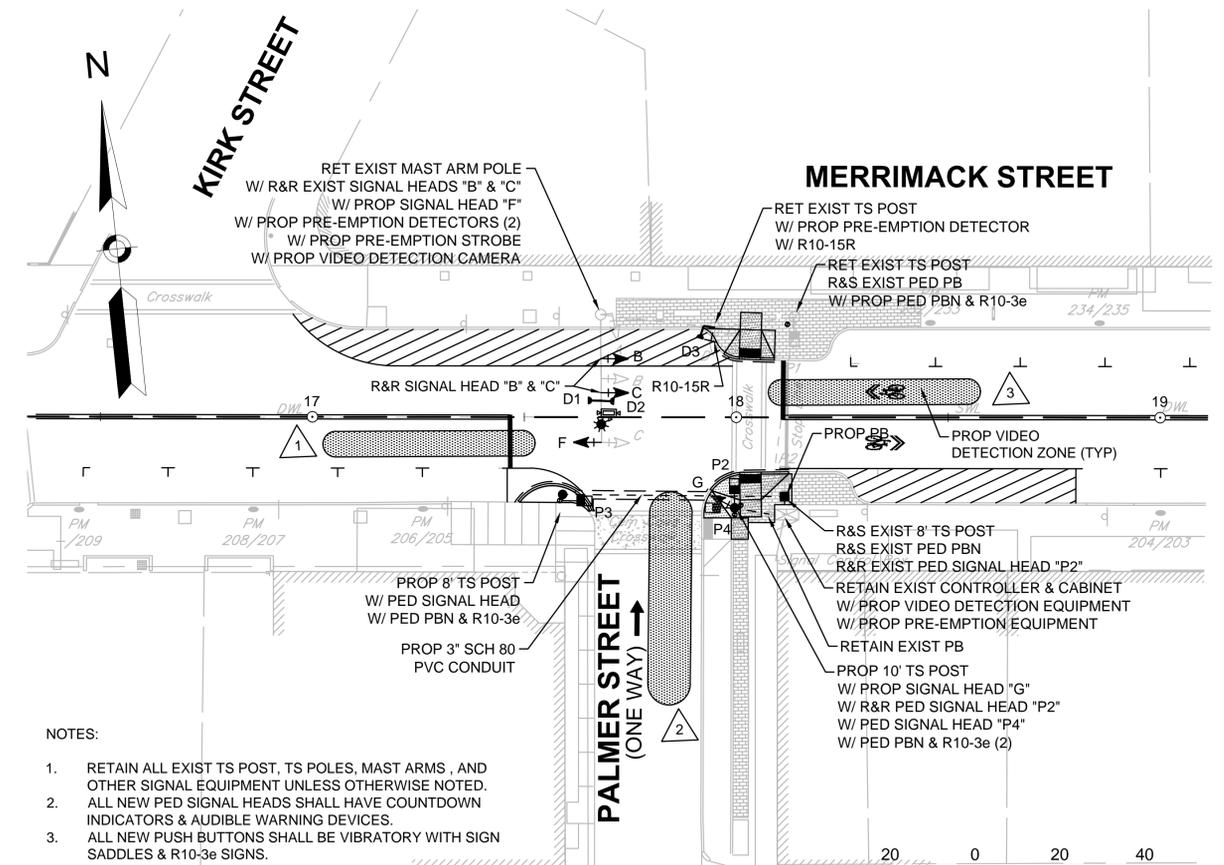
- IF THE ASSIGNED RIGHT OF WAY FOR ANY TRAFFIC MOVEMENT IS TO REMAIN IN EFFECT DURING THE NEXT CALLED PHASE, THE SIGNAL INDICATIONS FOR THAT TRAFFIC MOVEMENT WILL NOT CHANGE DURING THE CLEARANCE INTERVAL.
- THE RIGHT OF WAY MAY BE ASSIGNED TO ANY PHASE OR ANY COMBINATION OF NON-CONFLICTING PHASES.
- IF CALLS EXIST ON ALL PHASES, THE ASSIGNMENT OF RIGHT OF WAY SHALL BE IN ACCORDANCE WITH THE PREFERENTIAL PHASE SEQUENCE.
- IF THE ASSIGNED RIGHT-OF-WAY FOR ANY TRAFFIC MOVEMENT IS TO CHANGE DURING THE NEXT CALLED PHASE, THE SIGNAL INDICATION FOR THAT MOVEMENT WILL DISPLAY THE APPROPRIATE CLEARANCE INTERVALS.
- CONCURRENT PEDESTRIAN PHASE WILL ONLY BE CALLED UPON PUSH BUTTON ACTIVATION. UPON PUSH BUTTON ACTIVATION.

EXISTING / PROPOSED SIGNAL HEAD DATA					
A,D,E	B,C	F	G	P1-P2	P3-P4
	REMOVED & RESET 				
		FREE SWINGING	12" LENSES W/ 5" LOUVERED BACKPLATE		ALL 16" L.E.D. W/ COUNTDOWN INDICATORS

PREEMPTION PHASING & PRIORITY			
DETECTOR	PREEMPT PHASE ASSIGNMENT	MOVEMENT	VEHICLE PHASE ASSIGNMENT
D1	1	→	Ø1
D2	2	←	Ø1
D3	3	↕	Ø2

EMERGENCY VEHICLE PRE-EMPTION NOTES:

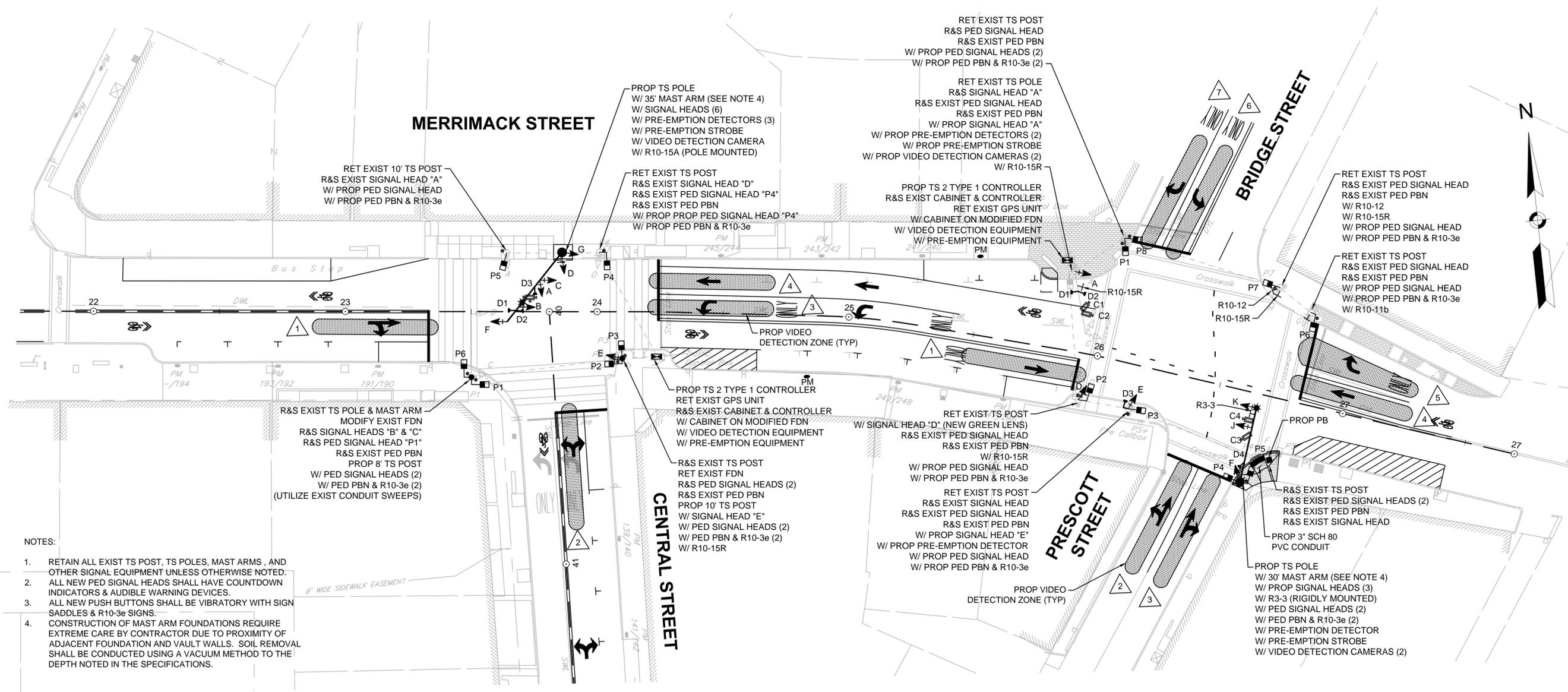
- EMERGENCY VEHICLE PRE-EMPTION SIGNALS SHALL BE OPTICALLY TRANSMITTED BY OPTICAL EMITTERS MOUNTED IN EMERGENCY VEHICLES AND RECEIVED BY OPTICAL DETECTORS LOCATED AT EACH INTERSECTION.
- EMERGENCY VEHICLE PRE-EMPTION SIGNALS SHALL BE SERVICED ON A FIRST DETECTED FIRST SERVE BASIS.
- IN RESPONSE TO A PRE-EMPTION SIGNAL RECEIVED AT AN INTERSECTION BY OPTICAL DETECTOR D1 (OR D2, D3) THE CONTROLLER SHALL HOLD OR ADVANCE TO AND HOLD IN EMERGENCY VEHICLE PRE-EMPTION PHASE #1 (OR #2, #3) GREEN FOR A MINIMUM OF TEN (10) SECONDS OR UNTIL PRE-EMPTION SIGNAL CEASES. THE CONTROLLER SHALL THEN TIME PRE-EMPTION PHASE CLEARANCE (3 SECONDS: YELLOW AND 1 SECOND: ALL RED) AND SERVICE SUBSEQUENT EMERGENCY VEHICLE PRE-EMPTION PHASES AS NECESSARY.
- NORMAL CLEARANCE SHALL BE PROVIDED ON PHASES THAT ARE TO BE TERMINATED BY PRE-EMPTION DEMAND.
- CONFIRMATION STROBE SHALL BE ILLUMINATED WHENEVER ANY EMERGENCY VEHICLE PRE-EMPTION GREEN IS ON.



NOTES:

- RETAIN ALL EXIST TS POST, TS POLES, MAST ARMS, AND OTHER SIGNAL EQUIPMENT UNLESS OTHERWISE NOTED.
- ALL NEW PED SIGNAL HEADS SHALL HAVE COUNTDOWN INDICATORS & AUDIBLE WARNING DEVICES.
- ALL NEW PUSH BUTTONS SHALL BE VIBRATORY WITH SIGN SADDLES & R10-3e SIGNS.

SCALE 1" = 20'  
SEE SHEET 12 FOR SIGN SUMMARY



NOTES:

1. RETAIN ALL EXIST TS POST, TS POLES, MAST ARMS, AND OTHER SIGNAL EQUIPMENT UNLESS OTHERWISE NOTED. ALL NEW PED SIGNAL HEADS SHALL HAVE COUNTDOWN INDICATORS & AUDIBLE WARNING DEVICES.
2. ALL NEW PUSH BUTTONS SHALL BE VIBRATORY WITH SIGN SADDLES & R10-3e SIGNS.
3. CONSTRUCTION OF MAST ARM FOUNDATIONS REQUIRE EXTREME CARE BY CONTRACTOR DUE TO PROXIMITY OF ADJACENT FOUNDATION AND VAULT WALLS. SOIL REMOVAL SHALL BE CONDUCTED USING A VACUUM METHOD TO THE DEPTH NOTED IN THE SPECIFICATIONS.



SCALE 1" = 20'

SEE SHEET 12 FOR SIGN SUMMARY

PROPOSED SEQUENCE AND TIMING															
APPROACH	DIRECTION	HOUSING	1	2	3	4	5	6	7	8	9	10	11	12	FLASHING OPERATION
MINIMUM INTERVAL			10			10			6			10			
VEHICLE EXTENSION			2			2			2			2			
MAXIMUM 1			20			50			40			50			
MAXIMUM 2			20			50			40			50			
YELLOW CLEARANCE				3.0			3.0			3.0				3.0	
RED CLEARANCE					1.0			1.0			1.0			1.0	
WALK						7.0			7.0						
PEDESTRIAN CLEARANCE						9.0	3.0	1.0	9.0	3.0	1.0				
MERRIMACK STREET	EB	E,F	R	R	R	G	Y	R	R	R	R	R	R	R	FY
MERRIMACK STREET	WB-L	B	←G- <sup>R</sup>	←Y- <sup>R</sup>	R	R	R	R	R	R	R	G	Y	R	FY
MERRIMACK STREET	WB-T	C,G	R	R	R	R	R	R	R	R	R	G	Y	R	FY
CENTRAL STREET	NB	A,D	R	R	R	R	R	R	G	Y	R	R	R	R	FR
CONCURRENT PEDESTRIAN	Ø2&Ø6 PED	P1-P2	DW	DW	DW	W/FDW	DW	DW	DW	DW	DW	DW	DW	DW	OUT
CONCURRENT PEDESTRIAN	Ø4 PED	P3-P6	DW	DW	DW	DW	DW	DW	W/FDW	DW	DW	DW	DW	DW	OUT
DETECTOR			NON-LOCK		NON-LOCK		NON-LOCK		NON-LOCK						
RECALL			OFF		SOFT		OFF		SOFT						
			Ø1		Ø2		Ø4		Ø6						Ø3,Ø5,Ø7,&Ø8
															NOT USED

- NOTES:
- AUTOMATIC FLASHING OPERATION PER M.U.T.C.D. SECTIONS 4D.28 THRU 4D.31.
  - PEDESTRIAN CALL UPON PUSH BUTTON ACTIVATION ONLY
  - MAXIMUM 1 = NORMAL OPERATION  
MAXIMUM 2 = DURING COORDINATION
  - Ø2&Ø6 TO OPERATE IN DUAL ENTRY MODE
  - PERM = PERMISSIVE LEFT-TURN

- SEQUENCE & TIMING NOTES:
- IF THE ASSIGNED RIGHT OF WAY FOR ANY TRAFFIC MOVEMENT IS TO REMAIN IN EFFECT DURING THE NEXT CALLED PHASE, THE SIGNAL INDICATIONS FOR THAT TRAFFIC MOVEMENT WILL NOT CHANGE DURING THE CLEARANCE INTERVAL.
  - THE RIGHT OF WAY MAY BE ASSIGNED TO ANY PHASE OR ANY COMBINATION OF NON-CONFLICTING PHASES.
  - IF CALLS EXIST ON ALL PHASES, THE ASSIGNMENT OF RIGHT OF WAY SHALL BE IN ACCORDANCE WITH THE PREFERENTIAL PHASE SEQUENCE.
  - IF THE ASSIGNED RIGHT-OF-WAY FOR ANY TRAFFIC MOVEMENT IS TO CHANGE DURING THE NEXT CALLED PHASE, THE SIGNAL INDICATION FOR THAT MOVEMENT WILL DISPLAY THE APPROPRIATE CLEARANCE INTERVALS.
  - CONCURRENT PEDESTRIAN PHASE WILL ONLY BE CALLED UPON PUSH BUTTON ACTIVATION. UPON PUSH BUTTON ACTIVATION.

PREEMPTION PHASING & PRIORITY			
DETECTOR	PREEMPT PHASE ASSIGNMENT	MOVEMENT	VEHICLE PHASE ASSIGNMENT
D1	1		Ø2
D2	2		Ø1&Ø6
D3	3		Ø4

- EMERGENCY VEHICLE PRE-EMPTION NOTES:
- EMERGENCY VEHICLE PRE-EMPTION SIGNALS SHALL BE OPTICALLY TRANSMITTED BY OPTICAL EMITTERS MOUNTED IN EMERGENCY VEHICLES AND RECEIVED BY OPTICAL DETECTORS LOCATED AT EACH INTERSECTION.
  - EMERGENCY VEHICLE PRE-EMPTION SIGNALS SHALL BE SERVICED ON A FIRST DETECTED FIRST SERVE BASIS.
  - IN RESPONSE TO A PRE-EMPTION SIGNAL RECEIVED AT AN INTERSECTION BY OPTICAL DETECTOR D1 (OR D2, D3) THE CONTROLLER SHALL HOLD OR ADVANCE TO AND HOLD IN EMERGENCY VEHICLE PRE-EMPTION PHASE #1 (OR #2, #3) GREEN FOR A MINIMUM OF TEN (10) SECONDS OR UNTIL PRE-EMPTION SIGNAL CEASES. THE CONTROLLER SHALL THEN TIME PRE-EMPTION PHASE CLEARANCE (3 SECONDS: YELLOW AND 1 SECOND: ALL RED) AND SERVICE SUBSEQUENT EMERGENCY VEHICLE PRE-EMPTION PHASES AS NECESSARY.
  - NORMAL CLEARANCE SHALL BE PROVIDED ON PHASES THAT ARE TO BE TERMINATED BY PRE-EMPTION DEMAND.
  - CONFIRMATION STROBE SHALL BE ILLUMINATED WHENEVER ANY EMERGENCY VEHICLE PRE-EMPTION GREEN IS ON.
  - PEDESTRIAN INDICATIONS SHALL REMAIN IN SOLID "DON'T WALK" DURING ACTIVE PRE-EMPTION INTERVAL.

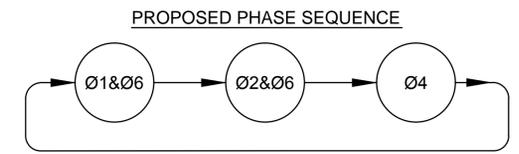
EXISTING / PROPOSED SIGNAL HEAD DATA			
A,B,C,D	A,C,D,E,F,G	B	P1-P6
REMOVED & STACK			
	ALL 12" LENSES W/ 5" LOUVERED BACKPLATES		ALL 16" L.E.D. W/ COUNTDOWN INDICATORS

ITEM 816.03  
MERRIMACK STREET AT CENTRAL STREET  
LIST OF MAJOR ITEMS REQUIRED

QUANTITY	DESCRIPTION
1	8Ø TS 2 TYPE 1 CONTROLLER IN A TYPE P BASE MOUNTED CABINET ON MODIFIED FDN, PAINTED BLACK
1	R&S EXIST CONTROLLER AND CABINET
1	TS POLE W/ 35' MAST ARM, TYPE 2, PAINTED BLACK, INCL. FDN.
1	R&S TS POLE W/ 25' MAST ARM, MODIFY EXIST FDN.
1	10' TS POST, ORNAMENTAL, PAINTED BLACK, ON EXIST FOUNDATION
1	8' TS POST, ORNAMENTAL, PAINTED BLACK, ON MODIFIED FOUNDATION
1	R&S 8' TS POST
6	SIGNAL HEAD, 3-SECTION, 12" L.E.D. MODULES, LOUVERED BACKPLATES
1	SIGNAL HEAD, 4-SECTION, 12" L.E.D. MODULES, LOUVERED BACKPLATES
4	R&S SIGNAL HEAD
6	PEDESTRIAN SIGNAL HEAD, 16" L.E.D. MODULES, W/ COUNTDOWN INDICATOR & AUDIBLE WARNING DEVICES
6	PEDESTRIAN PUSH BUTTON (VIBRATORY) W/ R10-3e AND SIGN SADDLE
4	R&S PEDESTRIAN SIGNAL HEAD
3	R&S PEDESTRIAN PUSH BUTTON & SIGN SADDLE
1	VIDEO DETECTION CAMERA W/ EXTENSION ARM (OMNI-DIRECTIONAL)
1	VIDEO DETECTION CHASSIS AND CABLING
1	VIDEO DETECTION PROCESSOR MODULE
3	EMERGENCY PRE-EMPTION DETECTORS AND DETECTOR CABLING
2	EMERGENCY PRE-EMPTION 2-CHANNEL PHASE SELECTORS
1	EMERGENCY PRE-EMPTION SYSTEM CHASSIS
1	EMERGENCY PRE-EMPTION STROBE (WHITE LENS)
1	MALFUNCTION MANAGEMENT UNIT (MMU)
1	SPARE B.I.U. (BUS INTERFACE UNITS)
2	MAST ARM OR POST MOUNTED SIGNS (R10-15R, R10-15A AS NOTED - UNDER ITEM 832.)
1	CONTROLLER/COORDINATION PROGRAMMING & FINE TUNING
1	INTERSECTION CABLING FOR NEW SIGNAL HEADS / PRE-EMPTION

PLUS NECESSARY CONDUIT, CABLE, LABOR, MISCELLANEOUS MATERIAL AND EQUIPMENT TO COMPLETE THE INSTALLATION AND PROVIDE AN OPERATING TRAFFIC CONTROL SIGNAL.

	MONDAY THRU FRIDAY	SATURDAY	SUNDAY
PLAN 1/1/1 70" CYCLE	0600-1000	-	-
PLAN 2/1/1 80" CYCLE	1500-1900	-	-
PLAN 3/1/1 80" CYCLE	-	1000-1500	1000-1500
FREE OPERATION	0000-0600 1000-1500 1900-2400	0000-1000 1500-2400	0000-1000 1500-2400
FLASH OPERATION	NO PROGRAMMED FLASH MODE CONFLICT FLASH ONLY		



- COORDINATION NOTES:
- OFFSET: BEGINNING OF Ø6 YELLOW.
  - Ø6 "CALL NOT ACTUATED" DURING COORDINATION.
  - SPLIT TIMES EQUAL GREEN PLUS CLEARANCES.
  - INHIBIT MAX TERMINATION SHALL BE IN EFFECT DURING COORDINATION.
  - CONTRACTOR AND VENDOR SHALL ADJUST SIGNAL TIMINGS AND COORDINATION IN THE FIELD AS NECESSARY AND UPON APPROVAL BY ENGINEER AND CITY OF LOWELL.

	1/1/1	2/1/1	3/1/1
CYCLE LENGTH	70 SEC	80 SEC	80 SEC
OFFSET	11	4	4
SPLIT Ø1	18	16	16
SPLIT Ø2	31	31	31
SPLIT Ø4	21	33	33
SPLIT Ø6	49	47	47
COORDINATED PHASE	Ø6	Ø6	Ø6

- CONSTRUCTION NOTES:
- PULL BOXES SHALL NOT BE LOCATED WITHIN WHEELCHAIR RAMPS.
  - THE CONSTRUCTION SHALL CONFORM WITH MASSACHUSETTS DEPARTMENT OF TRANSPORTATION, HIGHWAY DIVISION SPECIFICATIONS UNLESS OTHERWISE NOTED.
  - ALL NEW MAST ARM FOUNDATIONS SHALL CONFORM WITH MASSACHUSETTS DEPARTMENT OF TRANSPORTATION, HIGHWAY DIVISION "MAST ARM & FOUNDATION DETAILS STANDARD DRAWINGS", DATED FEBRUARY 24, 2011
  - EACH LOOP GROUP SHALL BE SPLICED IN SINGLE PULL BOX AND WIRED TO SEPARATE CONTROLLER INPUT.
  - ALL SIGNAL HEADS AND SIGNS SHALL BE RIGIDLY MOUNTED.
  - CONTRACTOR SHALL FINE-TUNE THE TIMING AND COORDINATION PARAMETERS IN THE PRESENCE OF THE ENGINEER AND CITY OF LOWELL REPRESENTATIVES FOLLOWING INSTALLATION.

VIDEO DETECTOR DATA					
DETECTOR NO.	APPROX. SIZE	Ø CALLED	Ø EXTENDED	OPERATIONS	DELAY/ EXT.
	±6'X50'	Ø2	Ø2	PRESENCE	0
	±6'X50'	Ø4	Ø4	PRESENCE	0
	±6'X50'	Ø1&Ø6	Ø1&Ø6	PRESENCE	0
	±6'X50'	Ø6	Ø6	PRESENCE	0

NOTE: DELAY AND EXTENSION TIMINGS SHALL BE PROGRAMMED IN THE CONTROLLER ONLY.

PROPOSED SEQUENCE AND TIMING																		
APPROACH	DIRECTION	HOUSING	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	FLASHING OPERATION
MINIMUM INTERVAL			10			6			10			10			10			
VEHICLE EXTENSION			2			2			2			2			2			
MAXIMUM 1			40			25			40			40			50			
MAXIMUM 2			40			25			40			40			50			
YELLOW CLEARANCE				3.0			3.0			3.0			3.0			3.0		
RED CLEARANCE					1.5			1.5			1.5			1.5			1.5	
WALK			7.0						7.0			7.0			7.0			
PEDESTRIAN CLEARANCE			7.0	3.0	1.5				14.0	3.0	1.5	14.0	3.0	1.5	12.0	3.0	1.5	
MERRIMACK STREET	EB	J,K	↑	Y	R	R	R	R	R	R	R	R	R	R	R	R	R	FR
MERRIMACK STREET	WB-T/R	A	R	R	R	←R	←Y	←R	R	R	R	R	G	Y	R	R	R	FR
MERRIMACK STREET	WB-T	C	R	R	R	R	R	R	R	R	R	R	G	Y	R	R	R	FR
PRESCOTT STREET	NB	G,H	R	R	R	R	R	R	G	Y	R	R	R	R	R	R	R	FR
BRIDGE STREET	SB-L	E,F	←R-	←R-	←R-	←G-	←Y-	←R-	←R-	←R-	←R-	←R-	←R-	←R-	←R-	←R-	←R-	FR
BRIDGE STREET	SB-R	B,D	R	R	R	R	R	R	R	R	R	R	R	R	G	Y	R	FR
CONCURRENT PEDESTRIAN	Ø2 PED	P3-P4	W/FDW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	OUT
CONCURRENT PEDESTRIAN	Ø4 PED	P5-P6	DW	DW	DW	DW	DW	DW	W/FDW	DW								
CONCURRENT PEDESTRIAN	Ø6 PED	P7-P8	DW	DW	DW	DW	DW	DW	DW	DW	DW	W/FDW	DW	DW	DW	DW	DW	
CONCURRENT PEDESTRIAN	Ø8 PED	P1-P2	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	W/FDW	DW	DW	
DETECTOR			NON-LOCK	NON-LOCK	NON-LOCK	NON-LOCK	NON-LOCK	NON-LOCK	NON-LOCK	NON-LOCK	NON-LOCK	NON-LOCK	NON-LOCK	NON-LOCK	NON-LOCK	NON-LOCK	NON-LOCK	
RECALL			SOFT	OFF	SOFT	SOFT	SOFT	SOFT	SOFT	SOFT	SOFT	SOFT	SOFT	SOFT	SOFT	SOFT	SOFT	
			Ø2	Ø3	Ø4	Ø6	Ø8	Ø1,Ø5,&Ø7										
								NOT USED										

- NOTES:
- AUTOMATIC FLASHING OPERATION PER M.U.T.C.D. SECTIONS 4D.28 THRU 4D.31.
  - PEDESTRIAN CALL UPON PUSH BUTTON ACTIVATION ONLY
  - MAXIMUM 1 = NORMAL OPERATION  
MAXIMUM 2 = DURING COORDINATION
  - PERM = PERMISSIVE LEFT-TURN
  - OL = OVERLAP
  - OVERLAP SHALL NOT BE ACTIVE DURING ANY PED INTERVAL.

SEQUENCE & TIMING NOTES:

- IF THE ASSIGNED RIGHT OF WAY FOR ANY TRAFFIC MOVEMENT IS TO REMAIN IN EFFECT DURING THE NEXT CALLED PHASE, THE SIGNAL INDICATIONS FOR THAT TRAFFIC MOVEMENT WILL NOT CHANGE DURING THE CLEARANCE INTERVAL.
- THE RIGHT OF WAY MAY BE ASSIGNED TO ANY PHASE OR ANY COMBINATION OF NON-CONFLICTING PHASES.
- IF CALLS EXIST ON ALL PHASES, THE ASSIGNMENT OF RIGHT OF WAY SHALL BE IN ACCORDANCE WITH THE PREFERENTIAL PHASE SEQUENCE.
- IF THE ASSIGNED RIGHT-OF-WAY FOR ANY TRAFFIC MOVEMENT IS TO CHANGE DURING THE NEXT CALLED PHASE, THE SIGNAL INDICATION FOR THAT MOVEMENT WILL DISPLAY THE APPROPRIATE CLEARANCE INTERVALS.
- CONCURRENT PEDESTRIAN PHASE WILL ONLY BE CALLED UPON PUSH BUTTON ACTIVATION. UPON PUSH BUTTON ACTIVATION.

PREEMPTION PHASING & PRIORITY			
DETECTOR	PREEMPT PHASE ASSIGNMENT	MOVEMENT	VEHICLE PHASE ASSIGNMENT
D1	1	→	Ø2
D2	2	←	Ø6
D3	3	↕	Ø3&Ø8
D4	4	↕	Ø4

- EMERGENCY VEHICLE PRE-EMPTION NOTES:
- EMERGENCY VEHICLE PRE-EMPTION SIGNALS SHALL BE OPTICALLY TRANSMITTED BY OPTICAL EMITTERS MOUNTED IN EMERGENCY VEHICLES AND RECEIVED BY OPTICAL DETECTORS LOCATED AT EACH INTERSECTION.
  - EMERGENCY VEHICLE PRE-EMPTION SIGNALS SHALL BE SERVICED ON A FIRST DETECTED FIRST SERVE BASIS.
  - IN RESPONSE TO A PRE-EMPTION SIGNAL RECEIVED AT AN INTERSECTION BY OPTICAL DETECTOR D1 (OR D2, D3, D4) THE CONTROLLER SHALL HOLD OR ADVANCE TO AND HOLD IN EMERGENCY VEHICLE PRE-EMPTION PHASE #1 (OR #2, #3, #4) GREEN FOR A MINIMUM OF TEN (10) SECONDS OR UNTIL PRE-EMPTION SIGNAL CEASES. THE CONTROLLER SHALL THEN TIME PRE-EMPTION PHASE CLEARANCE (3 SECONDS; YELLOW AND 1.5 SECONDS; ALL RED) AND SERVICE SUBSEQUENT EMERGENCY VEHICLE PRE-EMPTION PHASES AS NECESSARY.
  - NORMAL CLEARANCE SHALL BE PROVIDED ON PHASES THAT ARE TO BE TERMINATED BY PRE-EMPTION DEMAND.
  - CONFIRMATION STROBE SHALL BE ILLUMINATED WHENEVER ANY EMERGENCY VEHICLE PRE-EMPTION GREEN IS ON.

CONSTRUCTION NOTES:

- PULL BOXES SHALL NOT BE LOCATED WITHIN WHEELCHAIR RAMPS.
- THE CONSTRUCTION SHALL CONFORM WITH MASSACHUSETTS DEPARTMENT OF TRANSPORTATION, HIGHWAY DIVISION SPECIFICATIONS UNLESS OTHERWISE NOTED.
- ALL NEW MAST ARM FOUNDATIONS SHALL CONFORM WITH MASSACHUSETTS DEPARTMENT OF TRANSPORTATION, HIGHWAY DIVISION "MAST ARM & FOUNDATION DETAILS STANDARD DRAWINGS", DATED FEBRUARY 24, 2011
- ALL NEW SIGNAL HEADS AND SIGNS ON PROPOSED MAST ARMS SHALL BE RIGIDLY MOUNTED. R&R SIGNAL HEADS SHALL BE ATTACHED TO MAST ARMS SIMILAR TO EXISTING ATTACHMENT.
- CONTRACTOR SHALL FINE-TUNE THE TIMING AND COORDINATION PARAMETERS IN THE PRESENCE OF THE ENGINEER AND CITY OF LOWELL REPRESENTATIVES FOLLOWING INSTALLATION.
- PEDESTRIAN INDICATIONS SHALL REMAIN IN SOLID "DON'T WALK" DURING ACTIVE PRE-EMPTION INTERVAL.

ITEM 816.04  
MERRIMACK STREET AT PRESCOTT STREET / BRIDGE STREET  
LIST OF MAJOR ITEMS REQUIRED

QUANTITY	DESCRIPTION
1	8Ø TS 2 TYPE 1 CONTROLLER IN A TYPE P BASE MOUNTED CABINET ON MODIFIED FDN, PAINTED BLACK
1	R&S EXIST CONTROLLER AND CABINET
1	TS POLE W/ 30' MAST ARM, TYPE 2, SHOE BASE, PAINTED BLACK, INCL. FDN.
4	SIGNAL HEAD, 3-SECTION, 12" L.E.D. MODULES, LOUVERED BACKPLATES
1	SIGNAL HEAD, 4-SECTION, 12" L.E.D. MODULES, LOUVERED BACKPLATES
3	R&S SIGNAL HEAD
1	12" L.E.D. MODULE (GREEN BALL) W/ INTERVAL REWIRING
8	PEDESTRIAN SIGNAL HEAD, 16" L.E.D. MODULES, W/ COUNTDOWN INDICATOR & AUDIBLE WARNING DEVICES
8	PEDESTRIAN PUSH BUTTON (VIBRATORY) W/ R10-3e AND SIGN SADDLE
8	R&S PEDESTRIAN SIGNAL HEAD
7	R&S PEDESTRIAN PUSH BUTTON & SIGN SADDLE
4	VIDEO DETECTION CAMERA W/ EXTENSION ARM
1	VIDEO DETECTION CHASSIS AND CABLING
1	VIDEO DETECTION PROCESSOR MODULE
4	EMERGENCY PRE-EMPTION DETECTORS AND DETECTOR CABLING
2	EMERGENCY PRE-EMPTION 2-CHANNEL PHASE SELECTORS
1	EMERGENCY PRE-EMPTION SYSTEM CHASSIS
1	EMERGENCY PRE-EMPTION STROBE (WHITE LENS)
1	MALFUNCTION MANAGEMENT UNIT (MMU)
1	SPARE B.I.U. (BUS INTERFACE UNITS)
1	12" X 12" PULL BOX (UNDER ITEM 811.31)
20 FEET	3" SCH. 80 PVC CONDUIT (UNDER ITEM 804.3)
5	MAST ARM OR POST MOUNTED SIGNS (R10-15R, R10-12, R3-3 AS NOTED - UNDER ITEM 832.)
1	CONTROLLER/COORDINATION PROGRAMMING & FINE TUNING
1	INTERSECTION CABLING FOR NEW SIGNAL HEADS / PRE-EMPTION

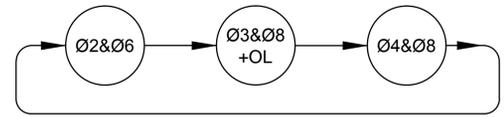
PLUS NECESSARY CONDUIT, CABLE, LABOR, MISCELLANEOUS MATERIAL AND EQUIPMENT TO COMPLETE THE INSTALLATION AND PROVIDE AN OPERATING TRAFFIC CONTROL SIGNAL.

	MONDAY THRU FRIDAY	SATURDAY	SUNDAY
PLAN 1/1/1 70" CYCLE	0600-1000	-	-
PLAN 2/1/1 80" CYCLE	1500-1900	-	-
PLAN 3/1/1 80" CYCLE	-	1000-1500	1000-1500
FREE OPERATION	0000-0600 1000-1500 1900-2400	0000-1000 1500-2400	0000-1000 1500-2400
FLASH OPERATION	NO PROGRAMMED FLASH MODE CONFLICT FLASH ONLY		

COORDINATION NOTES:

- OFFSET: BEGINNING OF Ø4&Ø8 YELLOW.
- Ø4&Ø8 "CALL NOT ACTUATED" DURING COORDINATION.
- SPLIT TIMES EQUAL GREEN PLUS CLEARANCES.
- INHIBIT MAX TERMINATION SHALL BE IN EFFECT DURING COORDINATION.
- CONTRACTOR AND VENDOR SHALL ADJUST SIGNAL TIMINGS AND COORDINATION IN THE FIELD AS NECESSARY AND UPON APPROVAL BY ENGINEER AND CITY OF LOWELL.

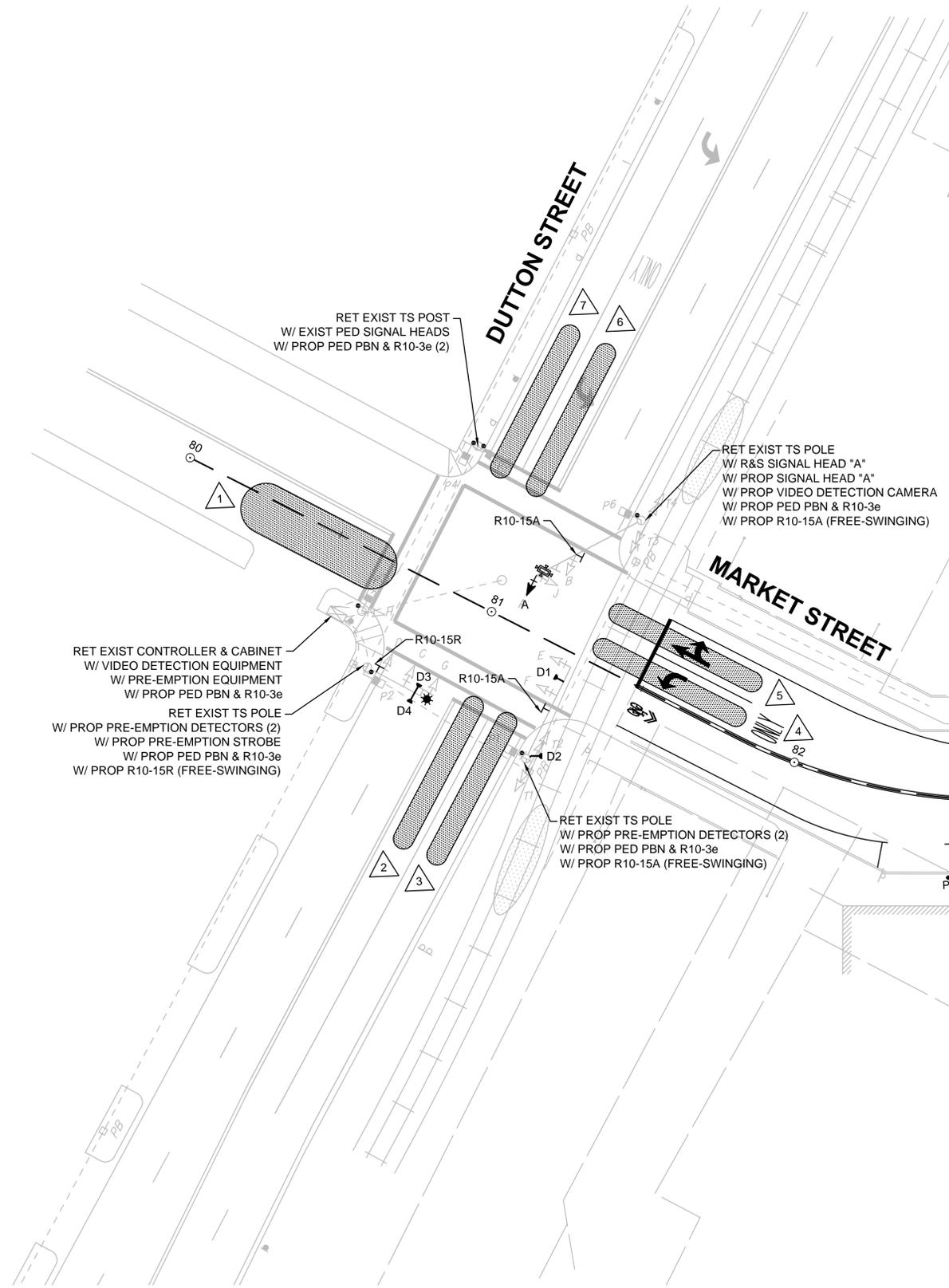
PROPOSED PHASE SEQUENCE



	1/1/1	2/1/1	3/1/1
CYCLE LENGTH	70 SEC	80 SEC	80 SEC
OFFSET	53	10	10
SPLIT Ø2	26	26	26
SPLIT Ø3	18	27	27
SPLIT Ø4	26	27	27
SPLIT Ø6	26	26	26
SPLIT Ø8	44	54	54
COORDINATED PHASE	Ø4 & Ø8	Ø4 & Ø8	Ø4 & Ø8

VIDEO DETECTOR DATA						
DETECTOR NO.	CAMERA NO.	APPROX. SIZE	Ø CALLED	Ø EXTENDED	OPERATIONS	DELAY/ EXT.
1	C4	±6'X50'	Ø2	Ø2	PRESENCE	0
2	C3	±6'X50'	Ø4	Ø4	PRESENCE	0
3	C3	±6'X50'	Ø4	Ø4	PRESENCE	0
4	C1	±6'X50'	Ø6	Ø6	PRESENCE	0
5	C1	±6'X50'	Ø6	Ø6	PRESENCE	0
6	C2	±6'X50'	Ø3	Ø3	PRESENCE	0
7	C2	±6'X50'	Ø8	Ø8	PRESENCE	0

NOTE: DELAY AND EXTENSION TIMINGS SHALL BE PROGRAMMED IN THE CONTROLLER ONLY.

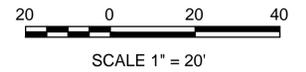


RET EXIST TS POST  
 W/ EXIST PED SIGNAL HEADS  
 W/ PROP PED PBN & R10-3e (2)

RET EXIST TS POLE  
 W/ R&S SIGNAL HEAD "A"  
 W/ PROP SIGNAL HEAD "A"  
 W/ PROP VIDEO DETECTION CAMERA  
 W/ PROP PED PBN & R10-3e  
 W/ PROP R10-15A (FREE-SWINGING)

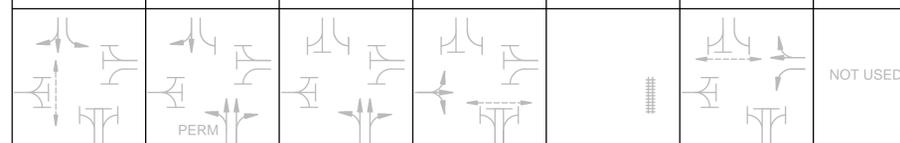
RET EXIST CONTROLLER & CABINET  
 W/ VIDEO DETECTION EQUIPMENT  
 W/ PRE-EMPTION EQUIPMENT  
 W/ PROP PED PBN & R10-3e  
 RET EXIST TS POLE  
 W/ PROP PRE-EMPTION DETECTORS (2)  
 W/ PROP PRE-EMPTION STROBE  
 W/ PROP PED PBN & R10-3e  
 W/ PROP R10-15R (FREE-SWINGING)

RET EXIST TS POLE  
 W/ PROP PRE-EMPTION DETECTORS (2)  
 W/ PROP PED PBN & R10-3e  
 W/ PROP R10-15A (FREE-SWINGING)



EXISTING/PROPOSED SEQUENCE AND TIMING																						
APPROACH	DIRECTION	HOUSING	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	FLASHING OPERATION	
MINIMUM INTERVAL			10			10			10			10			10			10				
VEHICLE EXTENSION			2			2			2			2			2			2				
MAXIMUM 1			13			19			10			25			10			25				
MAXIMUM 2			13			19			10			25			10			25				
YELLOW CLEARANCE				3.0			3.0			3.0			3.0			4.0			3.0			
RED CLEARANCE					2.0			2.0			2.0			2.0			2.0			2.0		
WALK			7.0									7						7				
PEDESTRIAN CLEARANCE			6.0	3.0	2.0							11.0	3.0	2.0				11.0	3.0	2.0		
MARKET STREET	EB	E,F	R	R	R	R	R	R	R	R	R	G	Y	R	R	R	R	R	R	R	R	FR
MARKET STREET	WB	H,J	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	R	G	Y	R	FR
DUTTON STREET	NB-L	A	R	R	R	G	Y	R	←G- <sup>G</sup>	←Y- <sup>Y</sup>	R	R	R	R	R	R	R	R	R	R	R	FY
DUTTON STREET	NB-T/R	B	R	R	R	G	Y	R	G	Y	R	R	R	R	R	R	R	R	R	R	R	FY
DUTTON STREET	SB-L	G	←G-	←Y-	←R-	←R-	←R-	←R-	←R-	←R-	←R-	←R-	←R-	←R-	←R-	←R-	←R-	←R-	←R-	←R-	←R-	FRA
DUTTON STREET	SB-T/R	C,D	G	Y	R	G	Y	R	R	R	R	R	R	R	R	R	R	R	R	R	R	FY
TROLLEY	ALL	T1-T4	R	R	R	R	R	R	R	R	R	R	R	R	R	G	Y	R	R	R	R	OUT
CONCURRENT PEDESTRIAN	Ø1 PED	P3-P4	W/FDW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	DW	OUT
CONCURRENT PEDESTRIAN	Ø4 PED	P1-P2	DW	DW	DW	W/FDW	DW	OUT														
CONCURRENT PEDESTRIAN	Ø8 PED	P5-P6	DW	DW	DW	DW	DW	DW	DW	DW	DW	W/FDW	DW	DW	DW	OUT						
DETECTOR			NON-LOCK	NON-LOCK	NON-LOCK	NON-LOCK	NON-LOCK	NON-LOCK	NON-LOCK	NON-LOCK	NON-LOCK	NON-LOCK	NON-LOCK	NON-LOCK	NON-LOCK							
RECALL			OFF	MIN	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	

- NOTES:
- AUTOMATIC FLASHING OPERATION PER M.U.T.C.D. SECTIONS 4D.28 THRU 4D.31.
  - PEDESTRIAN PHASE UPON PUSH BUTTON ACTIVATION ONLY
  - PERM = PERMISSIVE LEFT-TURN
  - MAXIMUM 1 = NORMAL OPERATION  
MAXIMUM 2 = DURING COORDINATION
  - Ø4&Ø8 TO OPERATE IN DUAL ENTRY MODE



- SEQUENCE & TIMING NOTES:
- IF THE ASSIGNED RIGHT OF WAY FOR ANY TRAFFIC MOVEMENT IS TO REMAIN IN EFFECT DURING THE NEXT CALLED PHASE, THE SIGNAL INDICATIONS FOR THAT TRAFFIC MOVEMENT WILL NOT CHANGE DURING THE CLEARANCE INTERVAL.
  - THE RIGHT OF WAY MAY BE ASSIGNED TO ANY PHASE OR ANY COMBINATION OF NON-CONFLICTING PHASES.
  - IF CALLS EXIST ON ALL PHASES, THE ASSIGNMENT OF RIGHT OF WAY SHALL BE IN ACCORDANCE WITH THE PREFERENTIAL PHASE SEQUENCE.
  - IF THE ASSIGNED RIGHT-OF-WAY FOR ANY TRAFFIC MOVEMENT IS TO CHANGE DURING THE NEXT CALLED PHASE, THE SIGNAL INDICATION FOR THAT MOVEMENT WILL DISPLAY THE APPROPRIATE CLEARANCE INTERVALS.
  - PEDESTRIAN PHASE WILL ONLY BE CALLED UPON PUSH BUTTON ACTIVATION. UPON PUSH BUTTON ACTIVATION, COORDINATION WILL TERMINATE AND SERVICE PEDESTRIAN PHASE. COORDINATION WILL RESUME FOLLOWING TERMINATION OF PEDESTRIAN PHASE.

PREEMPTION PHASING & PRIORITY			
DETECTOR	PREEMPT PHASE ASSIGNMENT	MOVEMENT	VEHICLE PHASE ASSIGNMENT
D1	1	←	Ø4
D2	2	↔	Ø8
D3	3	↕	Ø1
D4	4	↕	Ø3

- CONSTRUCTION NOTES:
- THE CONSTRUCTION SHALL CONFORM WITH MASSACHUSETTS DEPARTMENT OF TRANSPORTATION, HIGHWAY DIVISION SPECIFICATIONS UNLESS OTHERWISE NOTED.
  - CONTRACTOR SHALL FINE-TUNE THE TIMING AND COORDINATION PARAMETERS IN THE PRESENCE OF THE ENGINEER AND CITY OF LOWELL REPRESENTATIVES FOLLOWING INSTALLATION.

EXISTING SIGNAL HEAD DATA							
T1-T4	A	B,J	C,D,H	E	F	G	P1-P6
ALL 12" LENSES	REPLACE GREEN BALL W/ 12" LENSE G/Y ARROW INDICATION	ALL 12" LENSES W/ 5" LOUVERED BACKPLATES				ALL 12" LENSES W/ 5" LOUVERED BACKPLATES	ALL 16" L.E.D. W/ COUNTDOWN INDICATORS

ITEM 816.05  
MARKET STREET AT DUTTON STREET  
LIST OF MAJOR ITEMS REQUIRED

QUANTITY	DESCRIPTION
1	12" L.E.D. BI-MODAL MODULE (GREEN/YELLOW LEFT-TURN ARROW) W/ INTERVAL REWIRING
2	R&R PEDESTRIAN SIGNAL HEADS
6	PEDESTRIAN PUSH BUTTON (VIBRATORY) W/ R10-3e AND SIGN SADDLE
1	VIDEO DETECTION CAMERA W/ EXTENSION ARM (OMNI-DIRECTIONAL)
1	VIDEO DETECTION CHASSIS AND CABLING
1	VIDEO DETECTION PROCESSOR MODULE
4	EMERGENCY PRE-EMPTION DETECTORS AND DETECTOR CABLING
1	EMERGENCY PRE-EMPTION 2-CHANNEL PHASE SELECTORS
1	EMERGENCY PRE-EMPTION SYSTEM CHASSIS
1	EMERGENCY PRE-EMPTION STROBE (WHITE LENS)
3	MAST ARM OR POST MOUNTED SIGNS (R10-15A, R10-15R AS NOTED - UNDER ITEM 832.)
1	CONTROLLER/COORDINATION PROGRAMMING & FINE TUNING

PLUS NECESSARY CONDUIT, CABLE, LABOR, MISCELLANEOUS MATERIAL AND EQUIPMENT TO COMPLETE THE INSTALLATION AND PROVIDE AN OPERATING TRAFFIC CONTROL SIGNAL.

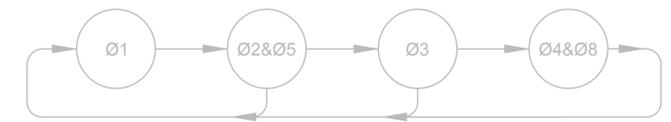
COORDINATION NOTES:

- COORDINATED WITH DUTTON ST / BROADWAY AND DUTTON ST / FLETCHER ST
- OFFSET: BEGINNING OF Ø2 YELLOW.
- SPLIT TIMES EQUAL GREEN PLUS CLEARANCES.
- INHIBIT MAX TERMINATION SHALL BE IN EFFECT DURING COORDINATION.
- CONTRACTOR AND VENDOR SHALL ADJUST SIGNAL TIMINGS AND COORDINATION IN THE FIELD AS NECESSARY AND UPON APPROVAL BY ENGINEER AND CITY OF LOWELL.

	1/1/1	2/1/1	3/1/1
CYCLE LENGTH	90 SEC	90 SEC	90 SEC
OFFSET	7	5	5
SPLIT Ø1	20	18	21
SPLIT Ø2	32	35	33
SPLIT Ø3	15	15	15
SPLIT Ø4	23	22	21
SPLIT Ø5	32	35	33
SPLIT Ø8	23	22	21
COORDINATED PHASE	Ø2	Ø2	Ø2

	MONDAY THRU FRIDAY	SATURDAY	SUNDAY
PLAN 1/1/1 90° CYCLE	0700-1000	-	-
PLAN 2/1/1 90° CYCLE	1500-1900	-	-
PLAN 3/1/1 90° CYCLE	-	1000-1400	-
FREE OPERATION	0000-0700 1000-1500 1900-2400	0000-1000 1400-2400	0000-2400
FLASH OPERATION	NO PROGRAMMED FLASH MODE CONFLICT FLASH ONLY		

EXISTING PHASE SEQUENCE

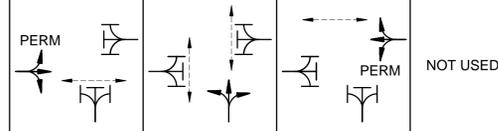


VIDEO DETECTOR DATA					
DETECTOR NO.	APPROX. SIZE	Ø CALLED	Ø EXTENDED	OPERATIONS	DELAY/ EXT.
1	15'X50'	Ø4	Ø4	PRESENCE	0
2	6'X50'	Ø2&Ø3	Ø2&Ø3	PRESENCE	0
3	6'X50'	Ø2	Ø2	PRESENCE	0
4	6'X50'	Ø8	Ø8	PRESENCE	0
5	6'X50'	Ø8	Ø8	PRESENCE	0
6	6'X50'	Ø1	Ø1	PRESENCE	0
7	6'X50'	Ø2	Ø2	PRESENCE	0

NOTE: DELAY AND EXTENSION TIMINGS SHALL BE PROGRAMMED IN THE CONTROLLER ONLY.

PROPOSED SEQUENCE AND TIMING												
APPROACH	DIRECTION	HOUSING	1	2	3	4	5	6	7	8	9	FLASHING OPERATION
MINIMUM INTERVAL			10			6			10			
VEHICLE EXTENSION			2			3			2			
MAXIMUM 1			40			20			40			
MAXIMUM 2			-			-			-			
YELLOW CLEARANCE				3.0			3.0			3.0		
RED CLEARANCE					1.0			1.0			1.0	
WALK			7.0			7.0			7.0			
PEDESTRIAN CLEARANCE			6.0	3.0	1.0	9.0	3.0	1.0	5.0	3.0	1.0	
MARKET STREET	EB	E,D	G	Y	R	R	R	R	R	R	R	FY
MARKET STREET	WB	A,B	R	R	R	R	R	R	G	Y	R	FY
ROY PARKING GARAGE	NB	C,F	R	R	R	G	Y	R	R	R	R	FR
CONCURRENT PEDESTRIAN	Ø2 PED	P3-P4	W/FDW	DW	DW	DW	DW	DW	DW	DW	DW	OUT
CONCURRENT PEDESTRIAN	Ø6 PED	P7-P8	DW	DW	DW	DW	DW	DW	W/FDW	DW	DW	OUT
CONCURRENT PEDESTRIAN	Ø4 PED	P1-P2,P5-P6	DW	DW	DW	W/FDW	DW	DW	DW	DW	DW	OUT
DETECTOR			NON-LOCK			NON-LOCK			NON-LOCK			
RECALL			SOFT			OFF			SOFT			
			Ø2			Ø4			Ø6			Ø1,Ø3,Ø5,Ø7,&Ø8

- NOTES:
- AUTOMATIC FLASHING OPERATION PER M.U.T.C.D. SECTIONS 4D.28 THRU 4D.31.
  - PEDESTRIAN CALLS UPON PUSH BUTTON ACTIVATION ONLY
  - MAXIMUM 1 = NORMAL OPERATION  
MAXIMUM 2 = NOT USED
  - Ø2&Ø6 TO OPERATE IN DUAL ENTRY MODE
  - PERM = PERMISSIVE LEFT-TURN



SEQUENCE & TIMING NOTES:

- IF THE ASSIGNED RIGHT OF WAY FOR ANY TRAFFIC MOVEMENT IS TO REMAIN IN EFFECT DURING THE NEXT CALLED PHASE, THE SIGNAL INDICATIONS FOR THAT TRAFFIC MOVEMENT WILL NOT CHANGE DURING THE CLEARANCE INTERVAL.
- THE RIGHT OF WAY MAY BE ASSIGNED TO ANY PHASE OR ANY COMBINATION OF NON-CONFLICTING PHASES.
- IF CALLS EXIST ON ALL PHASES, THE ASSIGNMENT OF RIGHT OF WAY SHALL BE IN ACCORDANCE WITH THE PREFERENTIAL PHASE SEQUENCE.
- IF THE ASSIGNED RIGHT-OF-WAY FOR ANY TRAFFIC MOVEMENT IS TO CHANGE DURING THE NEXT CALLED PHASE, THE SIGNAL INDICATION FOR THAT MOVEMENT WILL DISPLAY THE APPROPRIATE CLEARANCE INTERVALS.
- CONCURRENT PEDESTRIAN PHASES WILL ONLY BE CALLED UPON PUSH BUTTON ACTIVATION.

PREEMPTION PHASING & PRIORITY			
DETECTOR	PREEMPT PHASE ASSIGNMENT	MOVEMENT	VEHICLE PHASE ASSIGNMENT
D1	1	←	Ø6
D2	2	←	Ø2

EMERGENCY VEHICLE PRE-EMPTION NOTES:

- EMERGENCY VEHICLE PRE-EMPTION SIGNALS SHALL BE OPTICALLY TRANSMITTED BY OPTICAL EMITTERS MOUNTED IN EMERGENCY VEHICLES AND RECEIVED BY OPTICAL DETECTORS LOCATED AT EACH INTERSECTION.
- EMERGENCY VEHICLE PRE-EMPTION SIGNALS SHALL BE SERVICED ON A FIRST DETECTED FIRST SERVE BASIS.
- IN RESPONSE TO A PRE-EMPTION SIGNAL RECEIVED AT AN INTERSECTION BY OPTICAL DETECTOR D1 (OR D2) THE CONTROLLER SHALL HOLD OR ADVANCE TO AND HOLD IN EMERGENCY VEHICLE PRE-EMPTION PHASE #1 (OR #2) GREEN FOR A MINIMUM OF TEN (10) SECONDS OR UNTIL PRE-EMPTION SIGNAL CEASES. THE CONTROLLER SHALL THEN TIME PRE-EMPTION PHASE CLEARANCE (3 SECONDS: YELLOW AND 1 SECOND: ALL RED) AND SERVICE SUBSEQUENT EMERGENCY VEHICLE PRE-EMPTION PHASES AS NECESSARY.
- NORMAL CLEARANCE SHALL BE PROVIDED ON PHASES THAT ARE TO BE TERMINATED BY PRE-EMPTION DEMAND.
- CONFIRMATION STROBE SHALL BE ILLUMINATED WHENEVER ANY EMERGENCY VEHICLE PRE-EMPTION GREEN IS ON. PEDESTRIAN INDICATIONS SHALL REMAIN IN SOLID 'DON'T WALK' DURING ACTIVE PRE-EMPTION INTERVAL.

EXISTING / PROPOSED SIGNAL HEAD DATA		
A,B	C,D,E,F	P1-P8
REMOVE & RESET		
FREE-SWINGING	RIGID-MOUNTED	
	ALL 12" LENSES W/ 5" LOUVERED BACKPLATES	ALL 16" L.E.D. W/ COUNTDOWN INDICATORS

816.06  
MARKET STREET AT PALMER STREET  
LIST OF MAJOR ITEMS REQUIRED

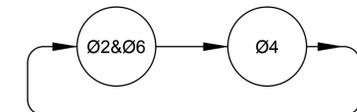
QUANTITY	DESCRIPTION
1	Ø8 TS 2 TYPE 1 CONTROLLER IN A TYPE P BASE MOUNTED CABINET ON MODIFIED FDN, PAINTED BLACK
1	R&S EXIST CONTROLLER AND CABINET
1	RE-PAINT EXIST MAST ARM & TS POLE
1	TS POLE W/ 20' MAST ARM, TYPE 2, PAINTED BLACK, INCL. FDN.
1	10' TS POST, ORNAMENTAL, PAINTED BLACK, INCL. FDN.
1	8' TS POST, ORNAMENTAL, PAINTED BLACK, INCL. FDN.
1	R&S EXIST 8' TS POST
4	SIGNAL HEAD, 3-SECTION, 12" L.E.D. MODULES, LOUVERED BACKPLATES
2	R&R SIGNAL HEAD
8	PEDESTRIAN SIGNAL HEAD, 16" L.E.D. MODULES, W/ COUNTDOWN INDICATOR & AUDIBLE WARNING DEVICES
8	PEDESTRIAN PUSH BUTTON (VIBRATORY) W/ R10-3e AND SIGN SADDLE
2	R&S PEDESTRIAN SIGNAL HEAD
2	R&S PEDESTRIAN PUSH BUTTON & SIGN SADDLE
1	7" VIDEO DETECTION L.C.D. MONITOR (TO BE USED FOR ALL INTERSECTIONS)
1	VIDEO DETECTION CAMERA W/ EXTENSION ARM (OMNI-DIRECTIONAL)
1	VIDEO DETECTION CHASSIS AND CABLING
1	VIDEO DETECTION PROCESSOR MODULE
2	EMERGENCY PRE-EMPTION DETECTORS AND DETECTOR CABLING
1	EMERGENCY PRE-EMPTION 2-CHANNEL PHASE SELECTORS
1	EMERGENCY PRE-EMPTION SYSTEM CHASSIS
1	EMERGENCY PRE-EMPTION STROBE (WHITE LENS)
1	MALFUNCTION MANAGEMENT UNIT (MMU)
1	SPARE B.I.U. (BUS INTERFACE UNITS)
2	12" X 12" PULL BOX (UNDER ITEM 811.31)
105 FEET	3" SCH. 80 PVC CONDUIT (UNDER ITEM 804.3)
3	MAST ARM OR POST MOUNTED SIGNS (R10-15R, R10-15A AS NOTED - 832.)
1	CONTROLLER/COORDINATION PROGRAMMING & FINE TUNING
1	INTERSECTION CABLING FOR NEW SIGNAL HEADS / PRE-EMPTION

PLUS NECESSARY CONDUIT, CABLE, LABOR, MISCELLANEOUS MATERIAL AND EQUIPMENT TO COMPLETE THE INSTALLATION AND PROVIDE AN OPERATING TRAFFIC CONTROL SIGNAL.

CONSTRUCTION NOTES:

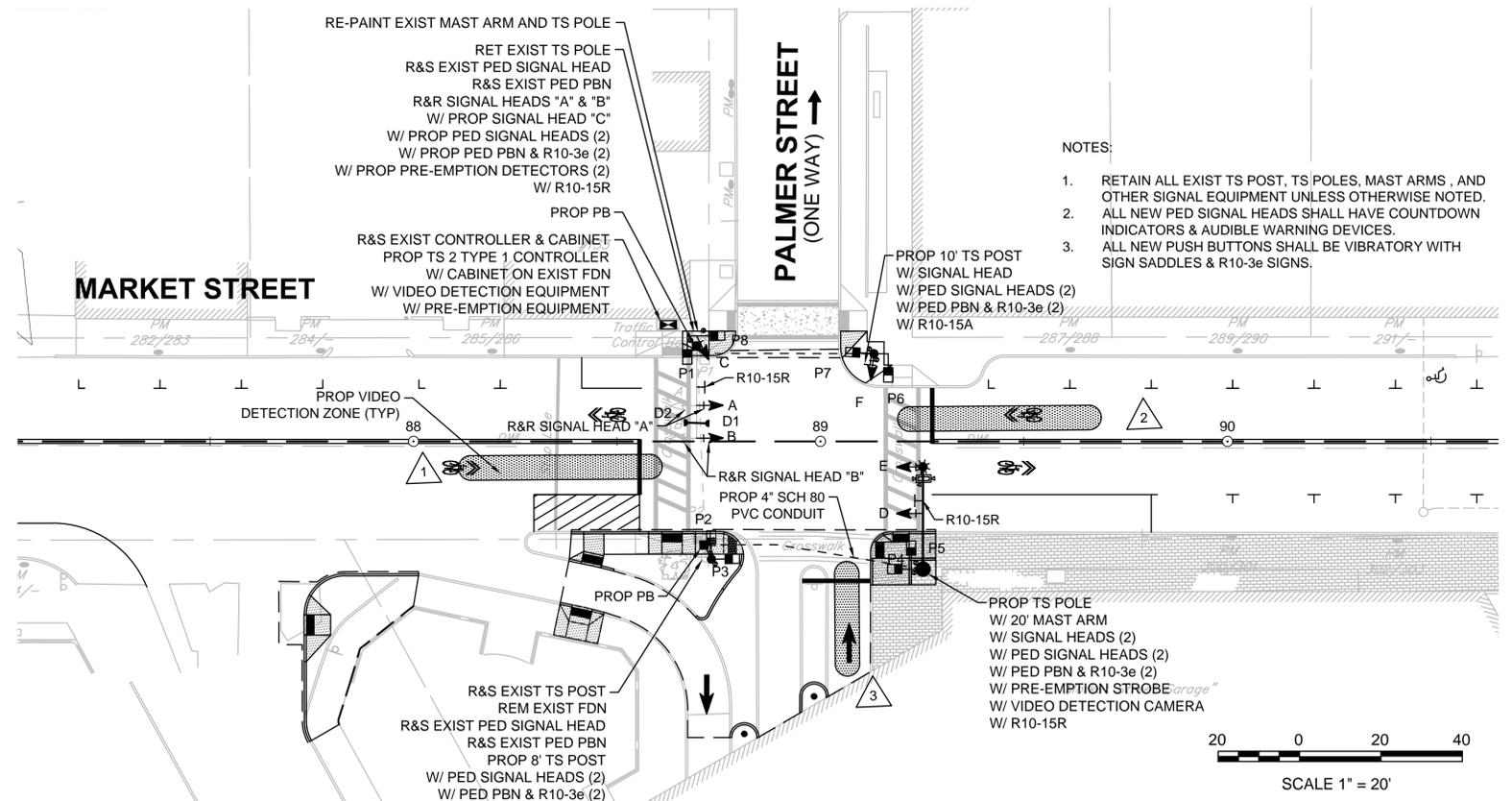
- PULL BOXES SHALL NOT BE LOCATED WITHIN WHEELCHAIR RAMPS.
- THE CONSTRUCTION SHALL CONFORM WITH MASSACHUSETTS DEPARTMENT OF TRANSPORTATION, HIGHWAY DIVISION SPECIFICATIONS UNLESS OTHERWISE NOTED.
- ALL NEW MAST ARM FOUNDATIONS SHALL CONFORM WITH MASSACHUSETTS DEPARTMENT OF TRANSPORTATION, HIGHWAY DIVISION "MAST ARM & FOUNDATION DETAILS STANDARD DRAWINGS", DATED FEBRUARY 24, 2011
- ALL NEW SIGNAL HEADS AND SIGNS ON PROPOSED MAST ARMS SHALL BE RIGIDLY MOUNTED. R&R SIGNAL HEADS SHALL BE ATTACHED TO MAST ARMS SIMILAR TO EXISTING ATTACHMENT.
- CONTRACTOR SHALL FINE-TUNE THE TIMING AND COORDINATION PARAMETERS IN THE PRESENCE OF THE ENGINEER AND CITY OF LOWELL REPRESENTATIVES FOLLOWING INSTALLATION.

PROPOSED PHASE SEQUENCE



VIDEO DETECTOR DATA					
DETECTOR NO.	APPROX. SIZE	Ø CALLED	Ø EXTENDED	OPERATIONS	DELAY/ EXT.
1	±6'X50'	Ø2	Ø2	PRESENCE	0
2	±6'X50'	Ø6	Ø6	PRESENCE	0
3	±6'X30'	Ø4	Ø4	PRESENCE	0

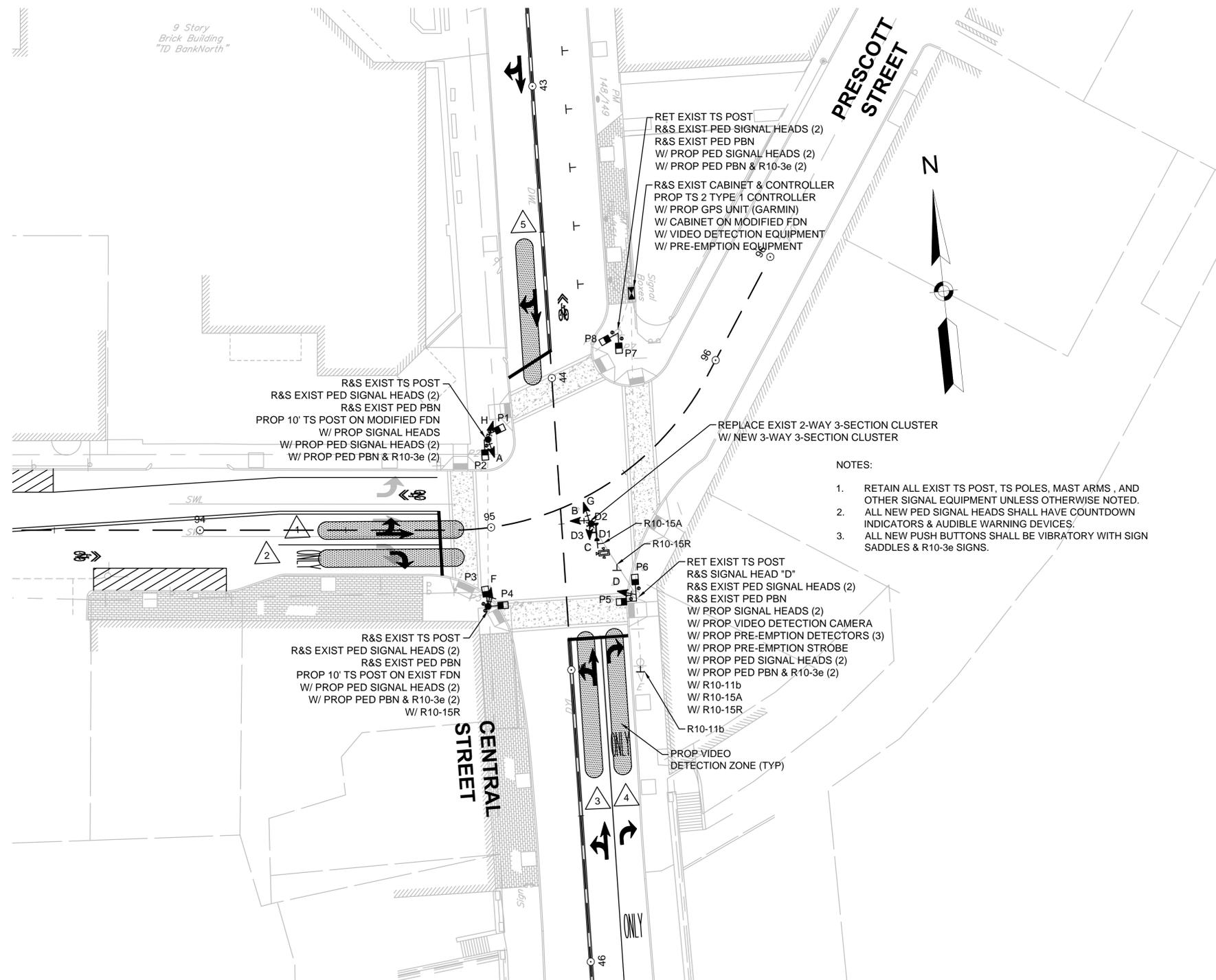
NOTE: DELAY AND EXTENSION TIMINGS SHALL BE PROGRAMMED IN THE CONTROLLER ONLY.



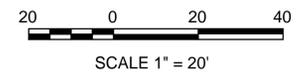
NOTES:

- RETAIN ALL EXIST TS POST, TS POLES, MAST ARMS, AND OTHER SIGNAL EQUIPMENT UNLESS OTHERWISE NOTED.
- ALL NEW PED SIGNAL HEADS SHALL HAVE COUNTDOWN INDICATORS & AUDIBLE WARNING DEVICES.
- ALL NEW PUSH BUTTONS SHALL BE VIBRATORY WITH SIGN SADDLES & R10-3e SIGNS.

SEE SHEET 12 FOR SIGN SUMMARY



- NOTES:
1. RETAIN ALL EXIST TS POST, TS POLES, MAST ARMS, AND OTHER SIGNAL EQUIPMENT UNLESS OTHERWISE NOTED.
  2. ALL NEW PED SIGNAL HEADS SHALL HAVE COUNTDOWN INDICATORS & AUDIBLE WARNING DEVICES.
  3. ALL NEW PUSH BUTTONS SHALL BE VIBRATORY WITH SIGN SADDLES & R10-3e SIGNS.



SEE SHEET 12 FOR SIGN SUMMARY

ITEM 816.07  
MARKET STREET AT CENTRAL STREET  
LIST OF MAJOR ITEMS REQUIRED

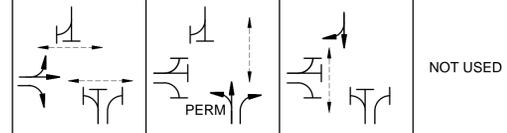
QUANTITY	DESCRIPTION
1	80 TS 2 TYPE 1 CONTROLLER IN A TYPE P BASE MOUNTED CABINET ON MODIFIED FDN, PAINTED BLACK
1	R&S EXIST CONTROLLER AND CABINET
1	R&S 8' TS POST
1	R&S 10' TS POST
2	10' TS POST, ORNAMENTAL, PAINTED BLACK, ON EXIST MODIFIED FDN
7	SIGNAL HEAD, 3-SECTION, 12" L.E.D. MODULES, LOUVERED BACKPLATES
4	R&S SIGNAL HEAD
8	PEDESTRIAN SIGNAL HEAD, 16" L.E.D. MODULES, W/ COUNTDOWN INDICATOR & AUDIBLE WARNING DEVICES
8	PEDESTRIAN PUSH BUTTON (VIBRATORY) W/ R10-3e AND SIGN SADDLE
8	R&S PEDESTRIAN SIGNAL HEAD
4	R&S PEDESTRIAN PUSH BUTTON & SIGN SADDLE
1	VIDEO DETECTION CAMERA W/ EXTENSION ARM (OMNI-DIRECTIONAL)
1	VIDEO DETECTION CHASSIS AND CABLING
1	VIDEO DETECTION PROCESSOR MODULE
3	EMERGENCY PRE-EMPTION DETECTORS AND DETECTOR CABLING
2	EMERGENCY PRE-EMPTION 2-CHANNEL PHASE SELECTORS
1	EMERGENCY PRE-EMPTION SYSTEM CHASSIS
1	EMERGENCY PRE-EMPTION STROBE (WHITE LENS)
1	MALFUNCTION MANAGEMENT UNIT (MMU)
1	SPARE B.I.U. (BUS INTERFACE UNITS)
1	GPS UNIT (GARMIN)
5	MAST ARM OR POST MOUNTED SIGNS (R10-11b, R10-15R, R3-2, R10-15A AS NOTED - UNDER ITEM 832.)
1	CONTROLLER/COORDINATION PROGRAMMING & FINE TUNING
1	INTERSECTION CABLING FOR NEW SIGNAL HEADS / PRE-EMPTION

PLUS NECESSARY CONDUIT, CABLE, LABOR, MISCELLANEOUS MATERIAL AND EQUIPMENT TO COMPLETE THE INSTALLATION AND PROVIDE AN OPERATING TRAFFIC CONTROL SIGNAL.

PROPOSED SEQUENCE AND TIMING												
APPROACH	DIRECTION	HOUSING	1	2	3	4	5	6	7	8	9	FLASHING OPERATION
MINIMUM INTERVAL			10			10			10			
VEHICLE EXTENSION			2			2			2			
MAXIMUM 1			30			45			45			
MAXIMUM 2			30			45			45			
YELLOW CLEARANCE				3.0			3.0			3.0		
RED CLEARANCE					1.0			1.0			1.0	
WALK			7.0			7.0			7.0			
PEDESTRIAN CLEARANCE			10.0	3.0	1.0	12.0	3.0	1.0	8.0	3.0	1.0	
MARKET STREET	EB	B,D	G	Y	R	R	R	R	R	R	R	FR
CENTRAL STREET	NB	A,C,E	R	R	R	G	Y	R	R	R	R	FY
CENTRAL STREET	SB	F,G,H	R	R	R	R	R	R	G	Y	R	FY
CONCURRENT PEDESTRIAN	Ø2 PED	P1,P4,P5,P8	W/FDW	DW	DW	DW	DW	DW	DW	DW	DW	OUT
CONCURRENT PEDESTRIAN	Ø4 PED	P6-P7	DW	DW	DW	W/FDW	DW	DW	DW	DW	DW	OUT
CONCURRENT PEDESTRIAN	Ø8 PED	P2-P3	DW	DW	DW	DW	DW	DW	W/FDW	DW	DW	OUT
DETECTOR			NON-LOCK			NON-LOCK			NON-LOCK			
RECALL			SOFT			SOFT			SOFT			

NOTES:

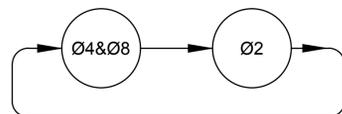
- AUTOMATIC FLASHING OPERATION PER M.U.T.C.D. SECTIONS 4D.28 THRU 4D.31.
- PEDESTRIAN CALL UPON PUSH BUTTON ACTIVATION ONLY
- MAXIMUM 1 = NORMAL OPERATION  
MAXIMUM 2 = DURING COORDINATION
- PERM = PERMISSIVE LEFT-TURN



SEQUENCE & TIMING NOTES:

- IF THE ASSIGNED RIGHT OF WAY FOR ANY TRAFFIC MOVEMENT IS TO REMAIN IN EFFECT DURING THE NEXT CALLED PHASE, THE SIGNAL INDICATIONS FOR THAT TRAFFIC MOVEMENT WILL NOT CHANGE DURING THE CLEARANCE INTERVAL.
- THE RIGHT OF WAY MAY BE ASSIGNED TO ANY PHASE OR ANY COMBINATION OF NON-CONFLICTING PHASES.
- IF CALLS EXIST ON ALL PHASES, THE ASSIGNMENT OF RIGHT OF WAY SHALL BE IN ACCORDANCE WITH THE PREFERENTIAL PHASE SEQUENCE.
- IF THE ASSIGNED RIGHT-OF-WAY FOR ANY TRAFFIC MOVEMENT IS TO CHANGE DURING THE NEXT CALLED PHASE, THE SIGNAL INDICATION FOR THAT MOVEMENT WILL DISPLAY THE APPROPRIATE CLEARANCE INTERVALS.
- CONCURRENT PEDESTRIAN PHASES WILL ONLY BE CALLED UPON PUSH BUTTON ACTIVATION. UPON PUSH BUTTON ACTIVATION.

PROPOSED PHASE SEQUENCE



EXISTING / PROPOSED SIGNAL HEAD DATA					
A,B,C	E	D	A,D,F,H	B,C,G	P1-P8
REMOVE & STACK 		REMOVE & STACK 			
			ALL 12" LENSES W/ 5" LOUVERED BACKPLATES	FREE-SWINGING	ALL 16" L.E.D. W/ COUNTDOWN INDICATORS

VIDEO DETECTOR DATA					
DETECTOR NO.	APPROX. SIZE	Ø CALLED	Ø EXTENDED	OPERATIONS	DELAY / EXTENSION
1	6'X50'	Ø2	Ø2	PRESENCE	0
2	6'X50'	Ø2	Ø2	PRESENCE	5 SEC
3	6'X50'	Ø4	Ø4	PRESENCE	0
4	6'X50'	Ø4	Ø4	PRESENCE	0
5	6'X50'	Ø8	Ø8	PRESENCE	0

NOTE: DELAY AND EXTENSION TIMINGS SHALL BE PROGRAMMED IN THE CONTROLLER ONLY.

CONSTRUCTION NOTES:

- PULL BOXES SHALL NOT BE LOCATED WITHIN WHEELCHAIR RAMPS.
- THE CONSTRUCTION SHALL CONFORM WITH MASSACHUSETTS DEPARTMENT OF TRANSPORTATION, HIGHWAY DIVISION SPECIFICATIONS UNLESS OTHERWISE NOTED.
- ALL NEW MAST ARM FOUNDATIONS SHALL CONFORM WITH MASSACHUSETTS DEPARTMENT OF TRANSPORTATION, HIGHWAY DIVISION "MAST ARM & FOUNDATION DETAILS STANDARD DRAWINGS", DATED FEBRUARY 24, 2011
- ALL NEW SIGNAL HEADS AND SIGNS ON PROPOSED MAST ARMS SHALL BE RIGIDLY MOUNTED. R&R SIGNAL HEADS SHALL BE ATTACHED TO MAST ARMS SIMILAR TO EXISTING ATTACHMENT.
- CONTRACTOR SHALL FINE-TUNE THE TIMING AND COORDINATION PARAMETERS IN THE PRESENCE OF THE ENGINEER AND CITY OF LOWELL REPRESENTATIVES FOLLOWING INSTALLATION.

COORDINATION NOTES:

- OFFSET: BEGINNING OF Ø4&Ø8 YELLOW.
- Ø4&Ø8 "CALL NOT ACTUATED" DURING COORDINATION.
- SPLIT TIMES EQUAL GREEN PLUS CLEARANCES.
- INHIBIT MAX TERMINATION SHALL BE IN EFFECT DURING COORDINATION.
- CONTRACTOR AND VENDOR SHALL ADJUST SIGNAL TIMINGS AND COORDINATION IN THE FIELD AS NECESSARY AND UPON APPROVAL BY ENGINEER AND CITY OF LOWELL.

	1/1/1	2/1/1	3/1/1
CYCLE LENGTH	70 SEC	80 SEC	80 SEC
OFFSET	0	0	0
SPLIT Ø2	24	32	32
SPLIT Ø4	46	48	48
SPLIT Ø8	46	48	48
COORDINATED PHASE	Ø4 & Ø8	Ø4 & Ø8	Ø4 & Ø8

	MONDAY THRU FRIDAY	SATURDAY	SUNDAY
PLAN 1/1/1 70" CYCLE	0600-1000	-	-
PLAN 2/1/1 80" CYCLE	1500-1900	-	-
PLAN 3/1/1 80" CYCLE	-	1000-1500	1000-1500
FREE OPERATION	0000-0600 1000-1500 1900-2400	0000-1000 1500-2400	0000-1000 1500-2400
FLASH OPERATION	NO PROGRAMMED FLASH MODE CONFLICT FLASH ONLY		

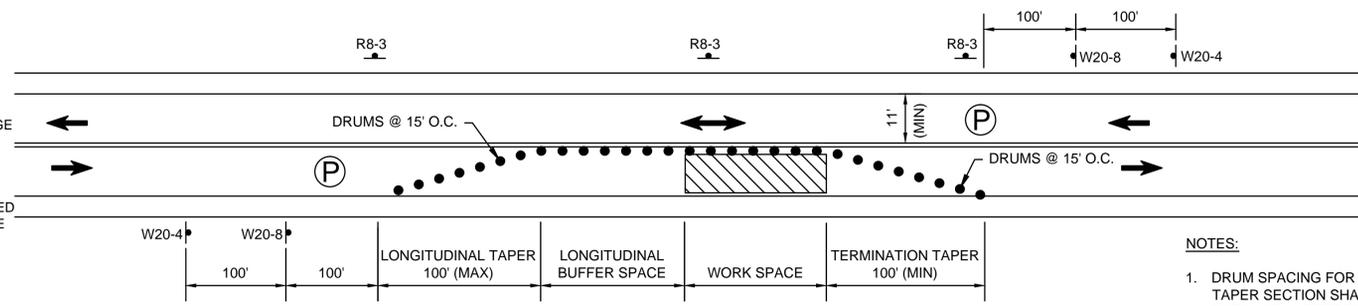
PRE-EMPTION PHASING & PRIORITY			
DETECTOR	PRE-EMPT PHASE ASSIGNMENT	MOVEMENT	VEHICLE PHASE ASSIGNMENT
D1	1		Ø4
D2	2		Ø8
D3	3		Ø2

EMERGENCY VEHICLE PRE-EMPTION NOTES:

- EMERGENCY VEHICLE PRE-EMPTION SIGNALS SHALL BE OPTICALLY TRANSMITTED BY OPTICAL EMITTERS MOUNTED IN EMERGENCY VEHICLES AND RECEIVED BY OPTICAL DETECTORS LOCATED AT EACH INTERSECTION.
- EMERGENCY VEHICLE PRE-EMPTION SIGNALS SHALL BE SERVICED ON A FIRST DETECTED FIRST SERVE BASIS.
- IN RESPONSE TO A PRE-EMPTION SIGNAL RECEIVED AT AN INTERSECTION BY OPTICAL DETECTOR D1 (OR D2, D3) THE CONTROLLER SHALL HOLD OR ADVANCE TO AND HOLD IN EMERGENCY VEHICLE PRE-EMPTION PHASE #1 (OR #2, #3) GREEN FOR A MINIMUM OF TEN (10) SECONDS OR UNTIL PRE-EMPTION SIGNAL CEASES. THE CONTROLLER SHALL THEN TIME PRE-EMPTION PHASE CLEARANCE (3 SECONDS: YELLOW AND 1.5 SECONDS: ALL RED) AND SERVICE SUBSEQUENT EMERGENCY VEHICLE PRE-EMPTION PHASES AS NECESSARY.
- NORMAL CLEARANCE SHALL BE PROVIDED ON PHASES THAT ARE TO BE TERMINATED BY PRE-EMPTION DEMAND.
- CONFIRMATION STROBE SHALL BE ILLUMINATED WHENEVER ANY EMERGENCY VEHICLE PRE-EMPTION GREEN IS ON.
- PEDESTRIAN INDICATIONS SHALL REMAIN IN SOLID "DON'T WALK" DURING ACTIVE PRE-EMPTION INTERVAL.

**GENERAL NOTES**

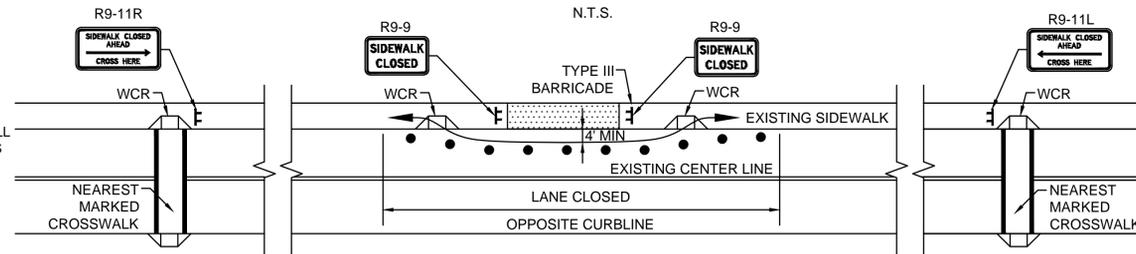
- ALL CONSTRUCTION SIGNING, DRUMS AND OTHER DEVICES SHALL CONFORM WITH THE 2009 MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (M.U.T.C.D.) AS AMENDED.
- ALL DRUMS SHALL BE APPROXIMATELY PLACED AND MOVED AS NECESSARY TO MAINTAIN ADEQUATE ABUTTER ACCESS AT ALL TIMES. WORK MAY REQUIRE ADDITIONAL SIGNS, DRUMS AND OTHER TRAFFIC CONTROL DEVICES, GRADING AND TEMPORARY PAVEMENT FOR PASSAGE OF PEDESTRIAN, VEHICULAR AND EMERGENCY TRAFFIC THROUGH THE WORK AREAS, BOTH DURING AND AFTER WORKING HOURS, TO MAINTAIN SUCH ACCESS.
- A MINIMUM OF ONE LANE OF TRAFFIC IN EACH DIRECTION ON TWO WAY STREETS SHALL BE MAINTAINED AT ALL TIMES, EXCEPT THAT DURING WORKING HOURS, TRAFFIC MAY BE REDUCED TO ONE LANE UNDER POLICE CONTROL FOR SHORT TIME PERIODS WHEN REQUIRED FOR THE WORK, AS SHOWN.
- GRADE SEPARATIONS IN EXCESS OF 2" DURING NON-WORKING HOURS SHALL REQUIRE DELINEATION BY USE OF DRUMS.
- EXCAVATION EDGES IN EXCESS OF 4" DEEP SHALL BE PROTECTED DURING NON-WORKING HOURS BY BACKFILLING WITH A WEDGE OF GRAVEL OR SOIL TO COMPACTED 4:1 SLOPE.
- 11' MINIMUM LANE WIDTHS SHALL BE MAINTAINED AT ALL TIMES.
- NON-ESSENTIAL TRAFFIC CONTROL DEVICES SHALL BE COVERED OR REMOVED DURING NON-WORKING HOURS.
- ADVISORY SPEED PLATES (W13-1) SHALL BE USED IF APPROPRIATE AND AS DIRECTED BY THE ENGINEER.
- R8-3 SIGNS, IF DRUM-MOUNTED, MAY BE REPOSITIONED AS MAY BE REQUIRED TO IDENTIFY SPECIFIC WORK AREAS.
- THE CONTRACTOR SHALL BE AWARE THAT THE WORK IS IN A RETAIL AND COMMERCIAL BUSINESS SECTION OF THE CITY AND ACCESS TO ALL BUSINESSES MUST BE MAINTAINED AT ALL TIMES. THE CONTRACTOR SHALL PROVIDE SAFE AND READY MEANS OF INGRESS AND EGRESS TO ALL STORES AND SHOPS, OFFICES AND ANY OTHER BUSINESSES IN THE PROJECT AREA, BOTH DAY AND NIGHT, FOR THE DURATION OF THE PROJECT.
- THE CONTRACTOR SHALL PROVIDE PROPERTY OWNERS WITH A MINIMUM OF TWO WEEKS' NOTICE PRIOR TO PERFORMING WORK THAT WILL IMPACT PRIVATE PROPERTY.
- R4-7 SIGNS ON SHATTUCK STREET ARE TEMPORARY AND SHALL BE REMOVED WHEN THE TEMPORARY BARRELS ARE REMOVED OR AS DIRECTED BY THE ENGINEER.



**NOTES:**

- DRUM SPACING FOR LONGITUDINAL TAPER SECTION SHALL NOT EXCEED A DISTANCE IN FEET EQUAL TO THE POSTED SPEED.
- DRUM SPACING FOR TANGENT SECTION SHALL NOT EXCEED A DISTANCE IN FEET EQUAL TO TWICE THE POSTED SPEED.
- DRUM SPACING FOR TERMINATION TAPER SECTION SHALL NOT EXCEED 20 FEET.

**TYPICAL LANE CLOSURE ON TWO-LANE ROAD USING POLICE OFFICERS**

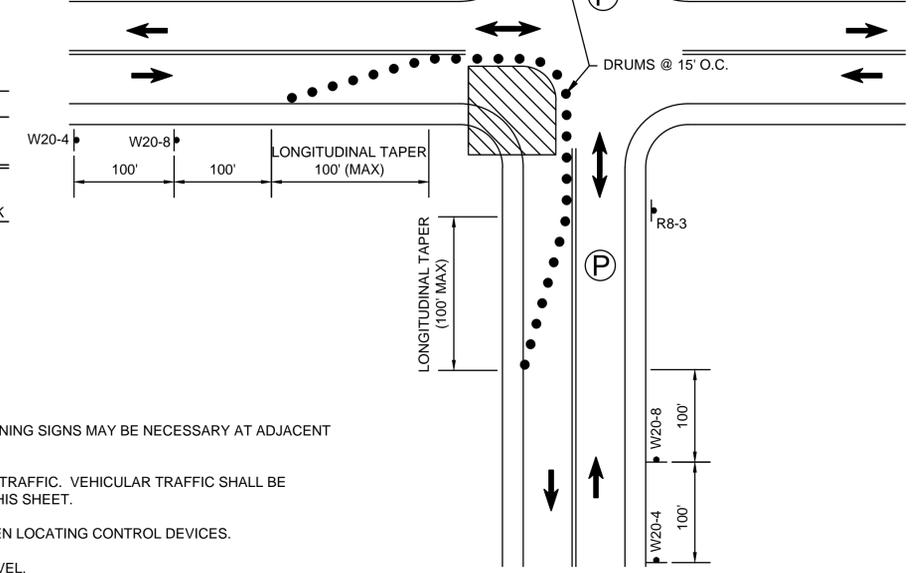


**PEDESTRIAN BYPASS**  
N.T.S.

TO BE USED IN CONJUNCTION WITH THE PROPOSED LANE CLOSURE DETAILS AND DURING CONSTRUCTION STAGING AND AS DIRECTED BY THE ENGINEER.

**NOTES:**

- DRUM SPACING FOR LONGITUDINAL TAPER SECTION SHALL NOT EXCEED A DISTANCE IN FEET EQUAL TO THE POSTED SPEED.
- DRUM SPACING FOR TANGENT SECTION SHALL NOT EXCEED A DISTANCE IN FEET EQUAL TO TWICE THE POSTED SPEED.
- DRUM SPACING FOR TERMINATION TAPER SECTION SHALL NOT EXCEED 20 FEET.



**TYPICAL LANE CLOSURE ON TWO-LANE ROAD USING POLICE OFFICERS**  
N.T.S.

**PEDESTRIAN BYPASS NOTES:**

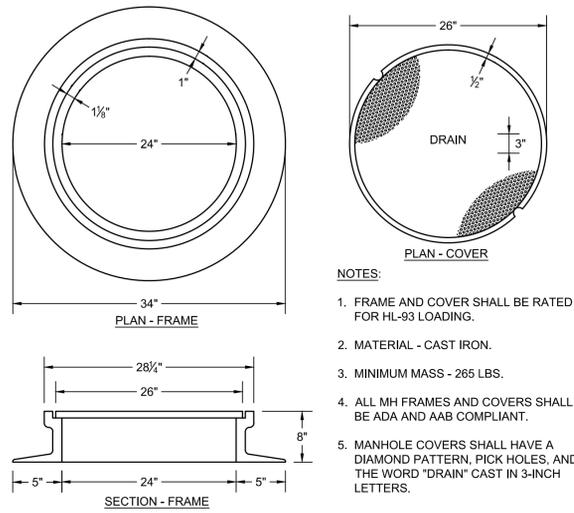
- ADDITIONAL ADVANCE "SIDEWALK CLOSED" WARNING SIGNS MAY BE NECESSARY AT ADJACENT INTERSECTIONS.
- CONTROLS ARE ONLY SHOWN FOR PEDESTRIAN TRAFFIC. VEHICULAR TRAFFIC SHALL BE MAINTAINED AS SHOWN IN OTHER DETAILS ON THIS SHEET.
- STREET LIGHTING SHOULD BE CONSIDERED WHEN LOCATING CONTROL DEVICES.
- DIRECTION OF PEDESTRIAN TRAVEL.
- TEMPORARY WHEELCHAIR RAMPS (WCR) TO MEET ALL ADA/AAB REQUIREMENTS.

ID NUMBER	SIZE OF SIGN (in)		LEGEND	TEXT DIMENSIONS(in)			BACK-GROUND	COLOR	LEGEND	BORDER	NUMBER OF SIGNS REQUIRED	UNIT AREA (SF)	TOTAL AREA (SF)
	WIDTH	HEIGHT		LETTER HEIGHT	VERTICAL SPACING	ARROW RTE. MKR.							
R4-7	24	30		SEE 2009 MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS			WHITE	BLACK	BLACK	4	5.00	20.00	
R8-3	24	30					WHITE	RED	RED	6	5.00	30.00	
R9-9	24	12					WHITE	BLACK	BLACK	2	2.00	4.00	
R9-11L	24	12					WHITE	BLACK	BLACK	1	2.00	2.00	
R9-11R	24	12					WHITE	BLACK	BLACK	1	2.00	2.00	
G20-2	36	18					ORANGE	BLACK	BLACK	8	4.50	36.00	
W20-1	36	36					ORANGE	BLACK	BLACK	8	9.00	72.00	
W20-4	36	36					ORANGE	BLACK	BLACK	2	9.00	18.00	
W20-8	36	36		MASSDOT STANDARD SIGN			ORANGE	BLACK	BLACK	2	9.00	18.00	

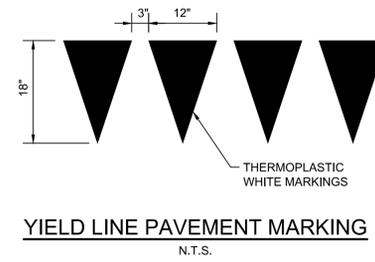
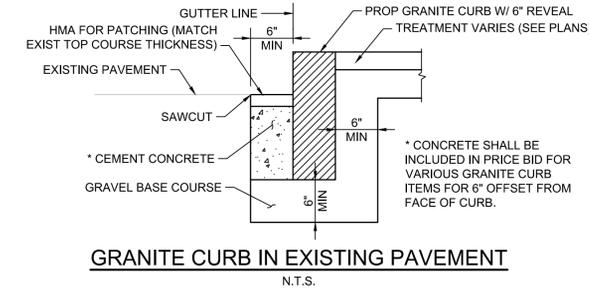
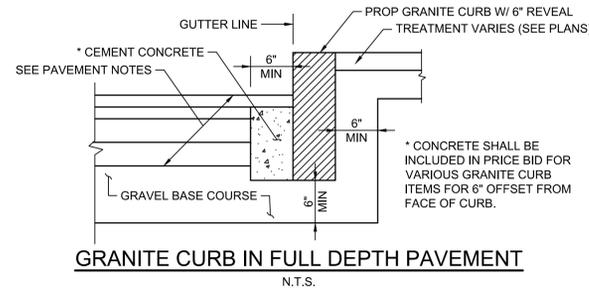


**ADVANCED SIGNING SCHEMATIC**  
N.T.S.

- EXISTING ONE-WAY TRAFFIC FLOW
- PORTABLE CHANGEABLE MESSAGE SIGN



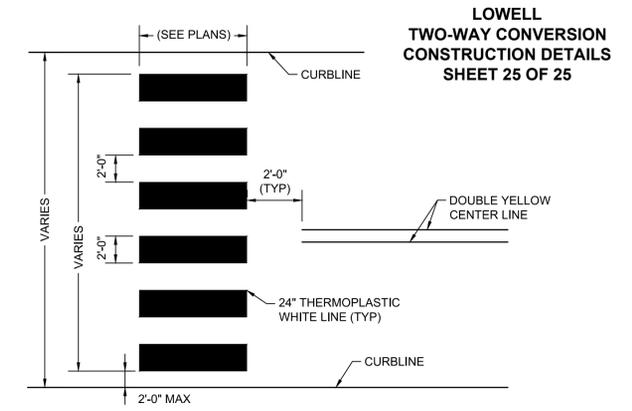
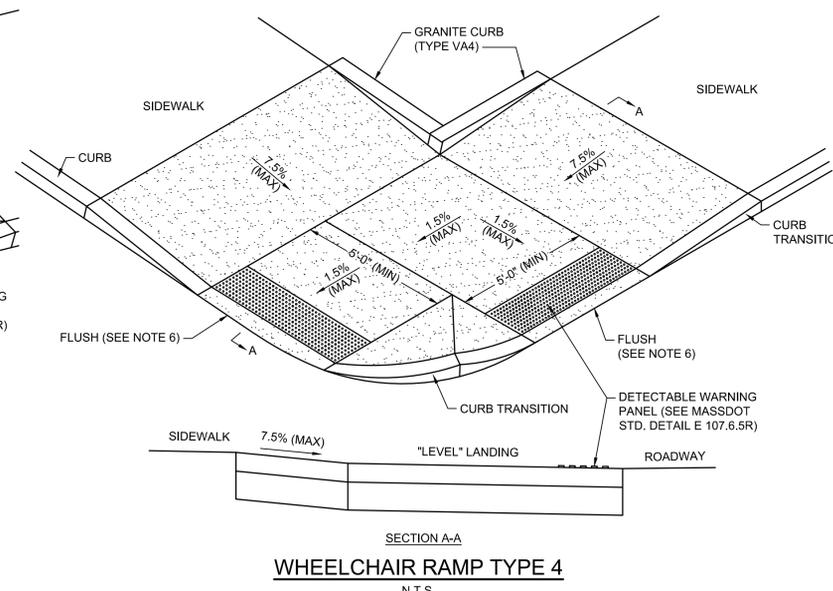
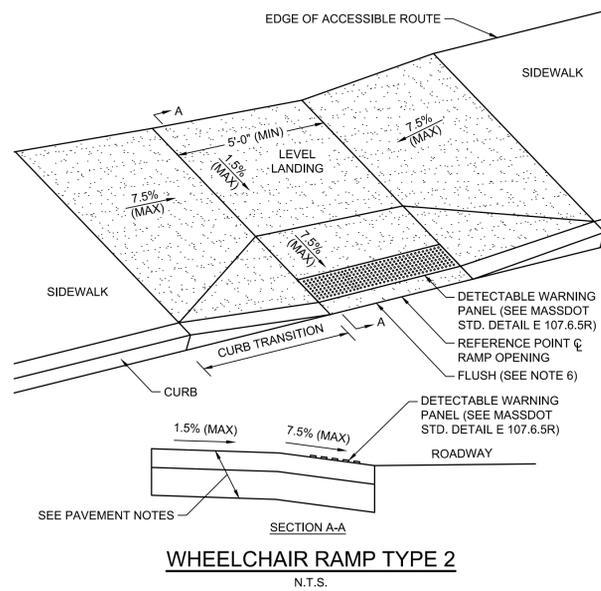
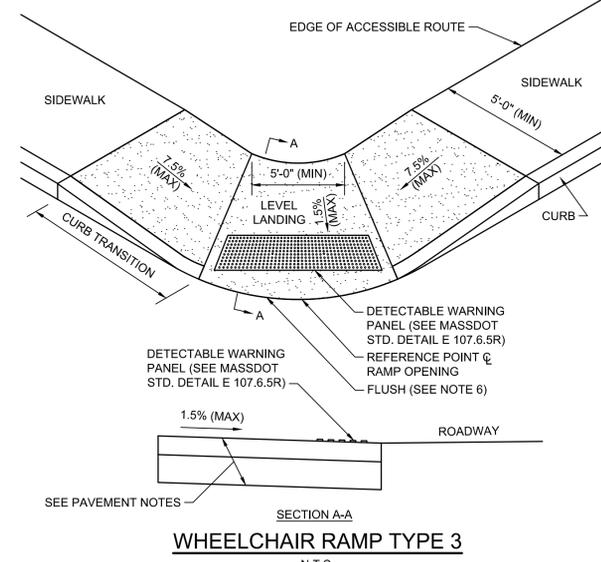
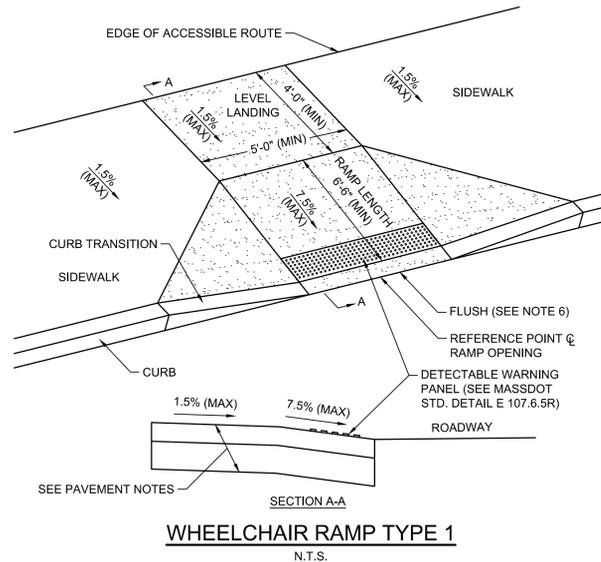
- NOTES:**
1. FRAME AND COVER SHALL BE RATED FOR HL-93 LOADING.
  2. MATERIAL - CAST IRON.
  3. MINIMUM MASS - 265 LBS.
  4. ALL MH FRAMES AND COVERS SHALL BE ADA AND AAB COMPLIANT.
  5. MANHOLE COVERS SHALL HAVE A DIAMOND PATTERN, PICK HOLES, AND THE WORD "DRAIN" CAST IN 3-INCH LETTERS.



**WHEELCHAIR RAMP NOTES:**

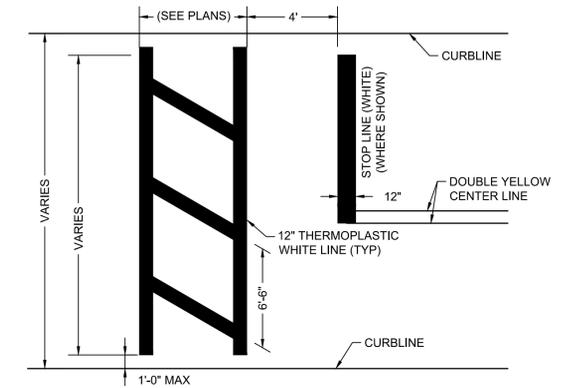
1. MAXIMUM ALLOWABLE SLOPE OF ACCESSIBLE ROUTE EXCLUDING CURB RAMPS SHALL BE DESIGNED TO 4.5% ±0.5% (7.5% ±0.5% FOR CURB RAMPS OVER 6" MAX. CHANGE IN GRADE).
2. A MINIMUM OF 3'-0" CLEAR SHALL BE MAINTAINED AT ANY PERMANENT OBSTACLE IN ACCESSIBLE ROUTE.
3. RAMP, CURB AND ADJACENT PAVEMENTS SHALL BE GRADED TO PREVENT PONDING.
4. ELIMINATE CURBING AT RAMP WHERE IT ABUTS ROADWAY.
5. DETECTABLE WARNING PANELS ARE REQUIRED ON ALL OF THE PROPOSED WHEELCHAIR RAMPS AND ARE TO BE INSTALLED IN ACCORDANCE WITH CONSTRUCTION STANDARD E 107.6.5R (MARCH 2012). CONTRACTOR SHALL PROVIDE 6" BETWEEN DETECTABLE WARNING PANEL AND EDGE OF CONCRETE WHERE IT ABUTS LOAM & SEED.
6. WHEELCHAIR RAMP SLOPES AND CROSS SLOPES SHALL HAVE A CONSTRUCTION TOLERANCE OF ±0.5%.
7. DETECTABLE WARNING PANELS SHALL BE BLACK IN COLOR AS APPROVED BY THE CITY DPW.
8. RAMP LENGTH SHALL BE 6'-6" (MIN) FOR 6" REVEAL CURBING.

**WHEELCHAIR RAMP NOTES**  
N.T.S.



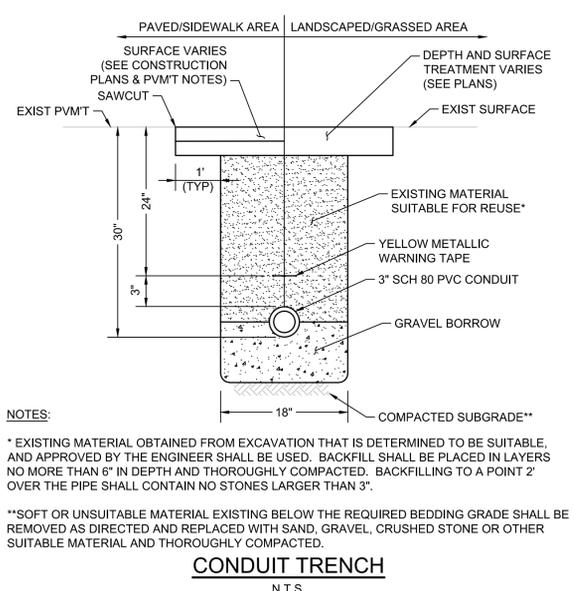
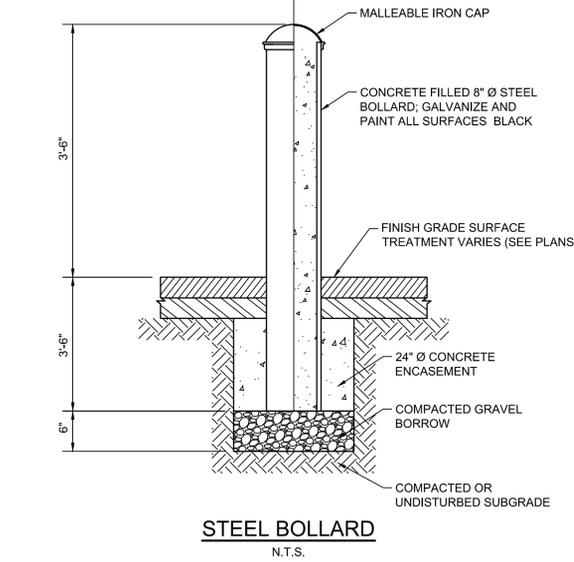
- NOTES:**
1. ALL 12" LINES SHALL BE APPLIED IN ONE APPLICATION, NO COMBINATION OF LINES (TWO - 6" LINES) WILL BE ACCEPTED.
  2. LAYOUT OF CROSSWALKS SHALL BE APPROVED BY THE ENGINEER PRIOR TO APPLICATION.
  3. CROSSWALK BARS SHALL BE PLACED OUTSIDE THE VEHICULAR WHEEL PATH WHEREVER POSSIBLE.

**CROSSWALK PAVEMENT MARKING**  
N.T.S.

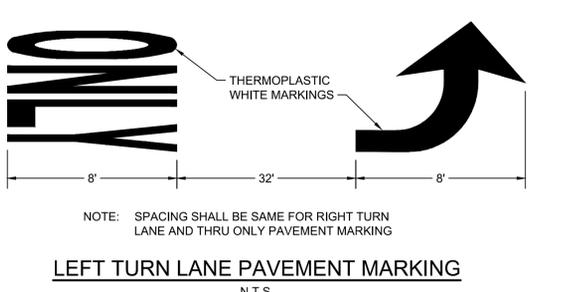
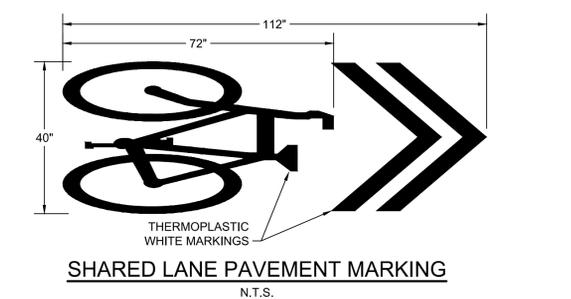


- NOTES:**
1. ALL 12" LINES SHALL BE APPLIED IN ONE APPLICATION, NO COMBINATION OF LINES (TWO - 6" LINES) WILL BE ACCEPTED.
  2. LAYOUT OF CROSSWALKS SHALL BE APPROVED BY THE ENGINEER PRIOR TO APPLICATION.
  3. WHERE STOP LINE IS NOT SHOWN, EXTEND DOUBLE YELLOW CENTER LINE 2'-0" TOWARDS CROSSWALK.

**CROSSWALK PAVEMENT MARKING**  
N.T.S.



- NOTES:**
- \* EXISTING MATERIAL OBTAINED FROM EXCAVATION THAT IS DETERMINED TO BE SUITABLE, AND APPROVED BY THE ENGINEER SHALL BE USED. BACKFILL SHALL BE PLACED IN LAYERS NO MORE THAN 6" IN DEPTH AND THOROUGHLY COMPACTED. BACKFILLING TO A POINT 2' OVER THE PIPE SHALL CONTAIN NO STONES LARGER THAN 3".
- \*\*SOFT OR UNSUITABLE MATERIAL EXISTING BELOW THE REQUIRED BEDDING GRADE SHALL BE REMOVED AS DIRECTED AND REPLACED WITH SAND, GRAVEL, CRUSHED STONE OR OTHER SUITABLE MATERIAL AND THOROUGHLY COMPACTED.



- NOTE:** SPACING SHALL BE SAME FOR RIGHT TURN LANE AND THRU ONLY PAVEMENT MARKING