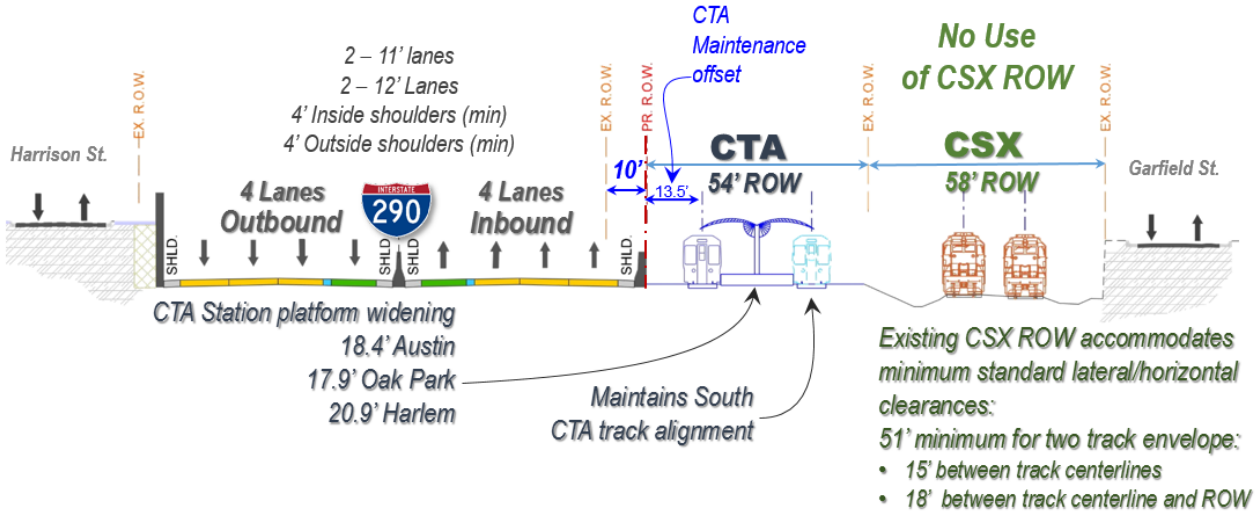
INTRODUCTION

As part of the I-290 reconstruction phase I study, IDOT has coordinated with the CTA regarding the availability of parallel CTA ROW for expressway improvements in the constrained section of the corridor, generally between Austin Boulevard and Circle Avenue. There are three existing CTA Blue Line stations within this section, Austin, Oak Park, and Harlem. Through coordination and collaboration with the CTA and CTA Blue Line Vision Study, CTA has determined that up to a 10' foot strip of existing CTA ROW is available for expressway improvements, and that the remaining CTA ROW would accommodate CTA's Blue Line rail modernization needs. IDOT has determined that the 10' of ROW would be used to accommodate wider expressway shoulders that will result in improved expressway safety performance.

The CTA Blue Line Vision Study concluded that as part of the Blue Line modernization needs, Austin, Oak Park, and Harlem stations would remain in place and that they would continue to be accessible via dual head houses located at the adjacent cross streets and track level platform access would continue to be end loaded as it is today. The Blue Line Vision study also concluded that a third or express track is not needed and is not proposed as part of the modernization.

The CTA requires a minimum 13.5-foot maintenance offset between the expressway barrier and the centerline of the closest track to accommodate maintenance activities and the south track existing alignment would be maintained. Assuming an expressway improvement that utilizes up to 10 ft. of CTA right-of-way to accommodate wider shoulders and/or lanes, and a 13.5 ft. maintenance offset, the resulting space available for platform widths were determined and evaluated assuming that the south track would remain on its current alignment and the north track would be shifted to accommodate wider platforms. The new platform widths at the three stations in this section would be: Austin – 18.4', Oak Park – 17.9', and Harlem 20.9'. The following figure illustrates how the ROW is proposed to be allocated, and more detailed plan and elevation exhibits are attached. NO CSX ROW is utilized based upon coordination with CSX.



The CTA stated that the proposed widths are adequate for the number of passengers, and requested that IDOT evaluate the proposed platform widths to determine if the widths would meet the NFPA-130 fire code egress time requirements. This document summarizes the assumptions and findings of a feasibility analysis to modify three (3) existing CTA Blue Line Forest Park Branch stations with respect to meeting the National Fire Protection Association (NFPA) -130 Standards for Fixed Guideway Transit and Passenger Rail Systems, Version 2014. This analysis was conceptual in nature to determine if the proposed platform widths could fundamentally meet fire code requirements. Further and more detailed fire codes safety analysis will be required during final design to account for any proposed platform features / amenities, obstructions, which would be fully detailed at that time.

EXISTING CONDITIONS

The existing CTA's Blue Line Harlem, Austin and Oak Park Stations are original to the 1950 design and construction. CTA platforms and tracks are located between I-290 and CSX. The platforms are located at the expressway level, with elevated stationhouses located each / opposite end(s) of the platforms at the cross-road level. The stationhouses provide access to / from the platforms via end loaded ramps or stairs that run in line with platforms. The platforms and stationhouses currently do not meet NFPA 130 -2014 standards for egress capacity.

Each station is located between, and accessible via two adjacent local streets. Therefore the travel distance, from platform to point of safety (the street) for each station, is given. At a conceptual level, the elements that can most positively affect the reduction of evacuation time are increasing clear widths of stairs and ramps from the platforms to stationhouses, and increasing clear widths and / or quantities of fare gates, emergency exit gates and doors at the stationhouses to the point(s) of safety.

Although though the goal of this analysis was to investigate proposed platform widths and their ability to comply with egress standards of NFPA 130 – 2014, it was necessary to assess the performance of the facilities as a whole, including the street level stationhouse exits. The structure of NFPA requirements assess the egress though the entire facility as a complete evacuation system. The system can be determined to be non-compliant if a single element in a system, such as emergency exit doors, are under-designed / inadequate; because that one element will cause a bottleneck and short-circuit the evacuation system as a whole.

The distances proposed for egress travel over the platforms are within the parameters set forth by NFPA 130 – 2014. The regulation stipulates that travel distance on a platform to means of egress (stair or pedestrian ramp) be no greater than 325' (100m). The existing passenger loads, provided by the CTA, and travel distances used to conduct the analysis are as follow:

Station	Occupant Load (persons)	Travel Distance (feet)		
		Platform	Platform to Station House	Stationhouse
Harlem Station	1318	260	323	35
Austin Station	1420	260	305	82
Oak Park Station	1466	260	288	100

To develop NFPA compliant conceptual configurations, this analysis considered the clear width of vertical circulation elements, stationhouse egress elements, and station exits to evacuate the station occupant loads over the travel distances noted above.

METHODOLOGY

The analysis was conducted assuming proposed concepts developed as part of the I-290 Phase I Study including proposed crossroad bridge & sidewalk widths, ADA accessibility (ADA Ramps or elevators), and previously collected data. As this was a conceptual analysis of a proposed concept, a site survey of existing physical conditions was not conducted to verify configuration of existing station elements or potential compliance. The data used to conduct this analysis was primarily from, existing plans, diagrams, and tables noting:

- Platform width and length
- Vertical circulation type (ramp and / or stair), length and height of travel
- Station depth (including sidewalk)
- Distance from the back of curb in front of one stationhouse to the back of curb to the opposite stationhouse
- Maximum train car capacity and number of cars per train (consist)
- Entraining occupant load by station turnstile entries
- Number of trains (headways) per hour of CTA Blue Line trains at peak periods by schedule

NFPA 130 – 2014 requires sufficient egress capacity to evacuate the platform occupant load from the station platform in 4 minutes or less and that the station shall be designed to permit evacuation from the most remote point on the platform to a point of safety in 6 minutes or less.

In order to anticipate and eliminate bottlenecks while evacuating stations NFPA 130 guidelines set forth calculations that assess egress time by:

- Occupant loads
- Travel distances
- Platform exit capacities (clear width of stairs and pedestrian ramps)
- Egress element capacity (clear width of fare gates, emergency exit gates and doors to safe area)

Per the NFPA standard the flow of egress should be consistent, minimizing / eliminating bottlenecks, across the platform, up / down the vertical circulation (stair and / or pedestrian ramp), through stationhouse egress elements such as turnstiles, roto gates, accessible fare gates, emergency exit gates and out of the station exit doors / gates to a point of safety. It assesses compliance by means of two tests:

- Test 1 - The station occupant load must egress the platform in 4 minutes or less
- Test 2 - Egress the entire facility to safe area (usually the street) in 6 minutes or less.

Occupant loads for the analysis were determined by assuming a worst case scenario in that all trains traveling in the direction of peak flow would be filled to crush capacity, as stipulated by CTA (8 car trains with a maximum capacity of 100 passengers per car = 800 passengers) and

half capacity in reverse peak flow direction (8 car trains with a maximum capacity of 50 passengers per car = 400 passengers). Entraining loads were estimated by taking actual 2013 counts and data from the Rail OD Model, scaling up to match May 2015 station entries, then dividing the hourly counts by the number of trains per hour, at the time of peak travel. Per the requirements for NFPA 130 – 2014, the largest entraining loads were then doubled to estimate a condition where a one (1), eight (8) car train does not arrive and the entraining load for two trains are waiting on the platform at the time of evacuation.

Using this data, the analysis evaluated the proposed platform widths to determine if they could conceptually meet the egress time requirements of NFPA 130 – 2014. The proposed platform widths analyzed were as follows:

- Harlem Station at 18.4' (18'- 4¾")
- Austin Station at 20.9' (20'- 10¾")
- Oak Park Station at 17.9' (17'- 10¾")

FINDINGS

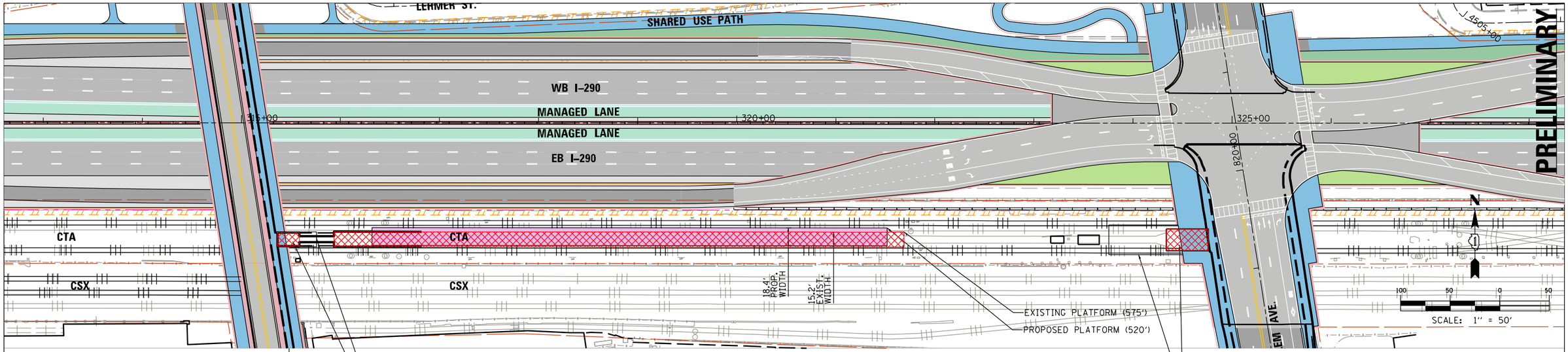
The platform widths as proposed for Harlem, Austin and Oak Park Stations could conceptually evacuate their platforms and stationhouses, to the sidewalk outside the stationhouse as the point of safety, in the times noted below:

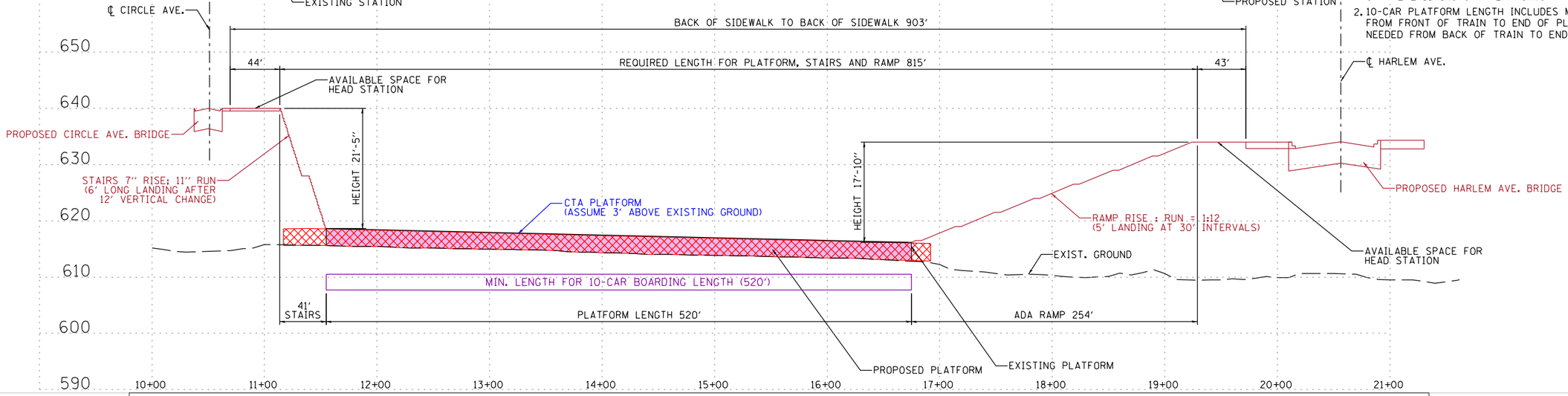
Station	Platform Exit Flow Time ≤ 4 min.	Total Exit Time ≤ 6 min.
Harlem Station	3.21	5.99
Austin Station	3.12	5.77
Oak Park Station	3.17	5.98

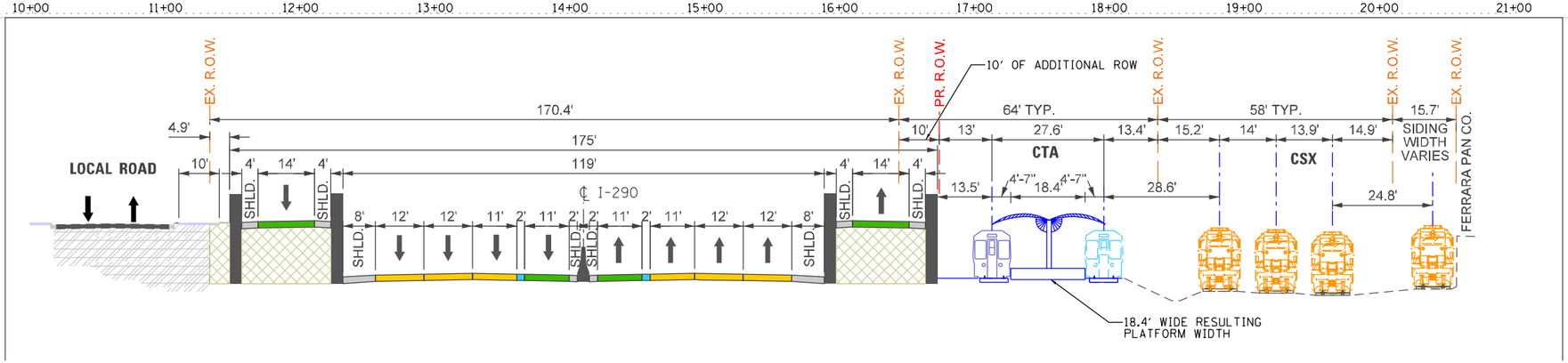
All platform exit flow times are significantly lower than the required maximum limit of 4 minutes whereas total exit time is at the limit of 6 minutes.

The analysis indicates that the limiting factor in the platform / station configurations related more to the configuration of stationhouse egress barriers (turnstiles, roto gates, accessible fare gates, emergency exit gates and station exit doors / gates) than to the width of the platforms. Harlem Station's platform exit flow time is significantly lower than the required 4 minutes, however the proposed platform width is very close to the clear width required to accommodate vertical circulation elements to achieve this evacuation time. This will require further investigation in design.

To analyze compliance with minimum egress time requirements of NFPA 130 -2014, the conceptual proposed platform width analysis also assumed overall egress system improvements including stationhouses, turnstiles, roto gates, fare gates, emergency exit gates, exit doors, and revised ADA compliant vertical circulation elements (pedestrian ramps and elevator). The analysis indicates that the proposed platform widths can be compliant as part of an overall egress system, but that all system elements need to be configured appropriately. Simply increasing platform widths beyond the proposed dimensions (and thereby the clear widths of vertical circulation elements) is not a key driver in reducing total evacuation time per NFPA 130 - 2014.







NOTES:
1. LENGTHS ARE MEASURED ALONG THE CENTERLINE OF THE EXISTING CTA PLATFORM.
2. 10-CAR PLATFORM LENGTH INCLUDES MIN. 25' NEEDED FROM FRONT OF TRAIN TO END OF PLATFORM AND 10' NEEDED FROM BACK OF TRAIN TO END OF PLATFORM.

PLAN — SURVEYED — DATE; PLOTTED — BY; ALIGNMENT CHECKED; RT. OF WAY CHECKED; CADD FILE NAME; NOTE BOOK; NO.

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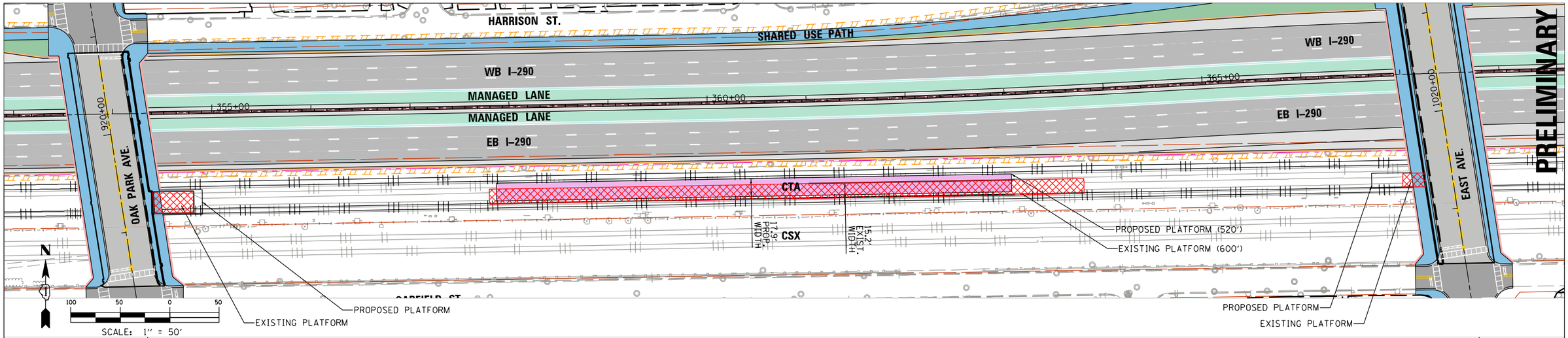
	DRAWN -	REVISED -
PLOT SCALE = 1" = 60'	CHECKED -	REVISED -
PLOT DATE = 4/26/2016	DATE -	REVISED -

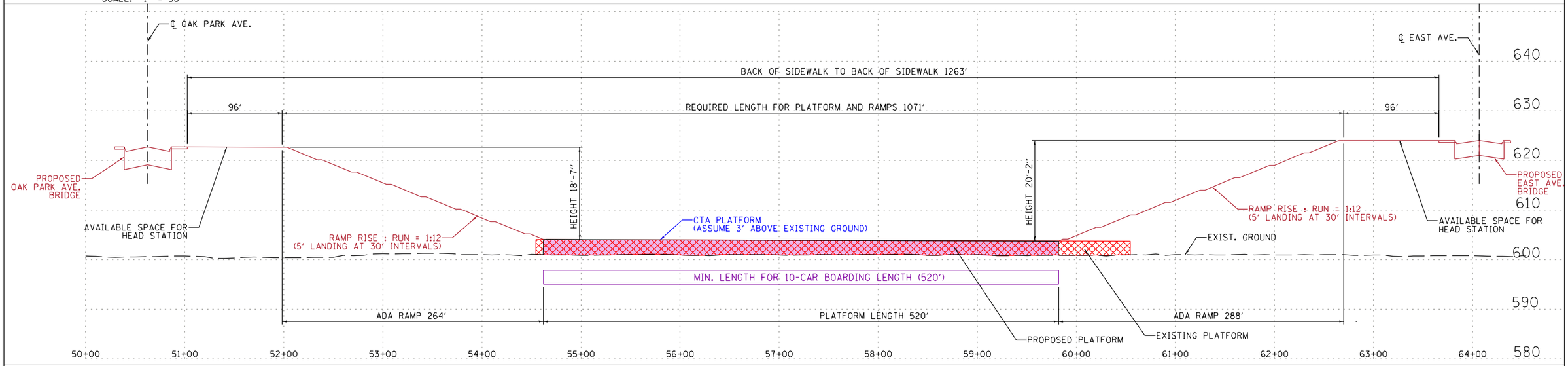
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

I-290 PHASE 1 STUDY
CTA PLATFORM STUDY: CIRCLE AVE. TO HARLEM AVE.

SCALE: 1" = 60' | SHEET ___ OF ___ SHEETS | STA. | TO STA.

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
___	___	COOK		
		CONTRACT NO.		
	ILLINOIS FED. AID PROJECT			





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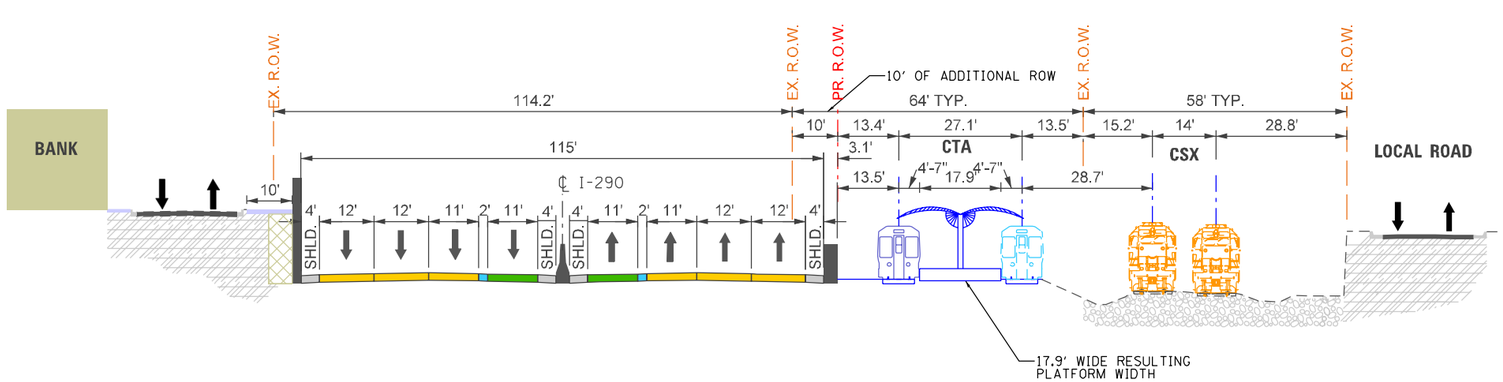

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NOTE BOOK	CADD FILE NAME		
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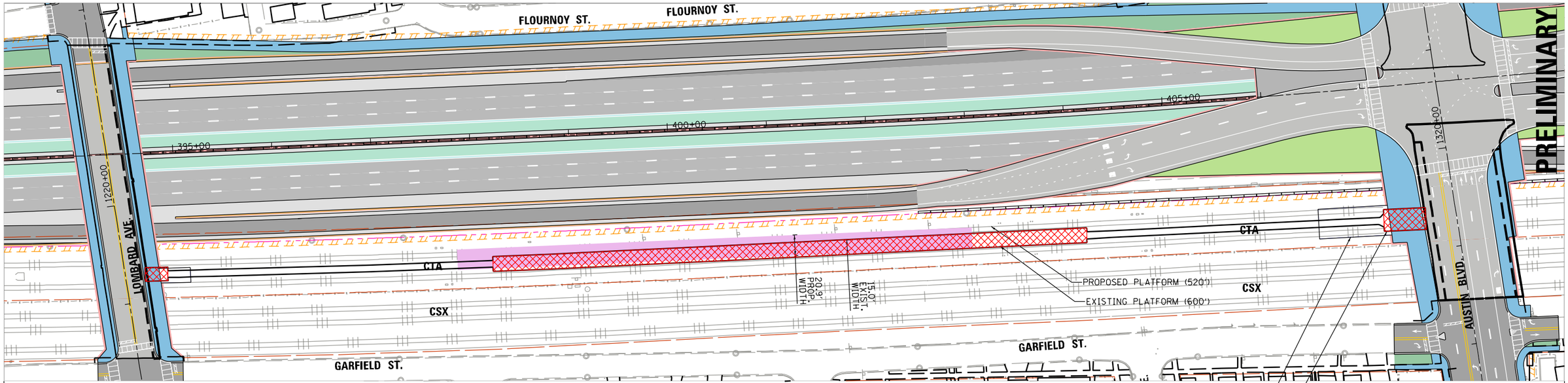
PLOT DATE = 4/26/2016	DATE -	REVISED -

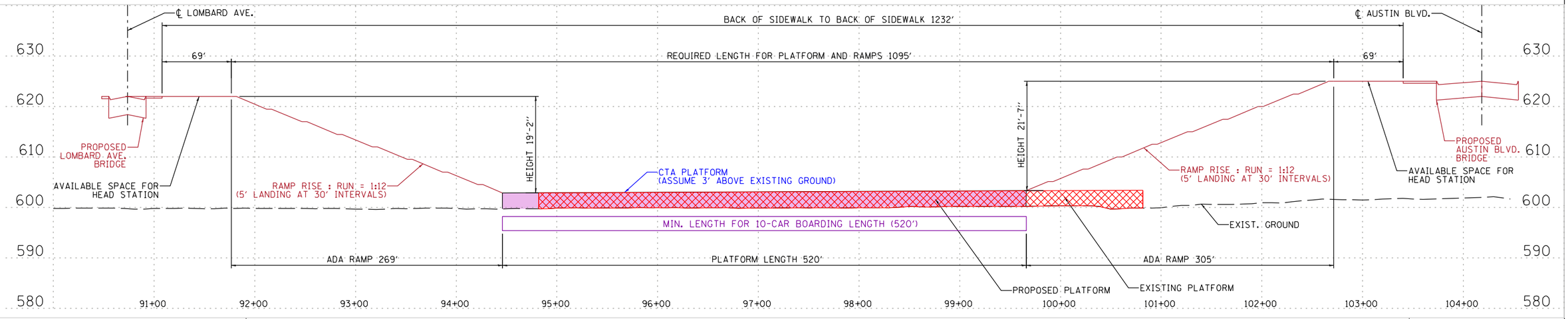
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

I-290 PHASE 1 STUDY
CTA PLATFORM STUDY: OAK PARK AVE. TO EAST AVE.

SCALE: 1" = 60' | SHEET ___ OF ___ SHEETS | STA. | TO STA.

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
		COOK		
		CONTRACT NO.		
		ILLINOIS FED. AID PROJECT		





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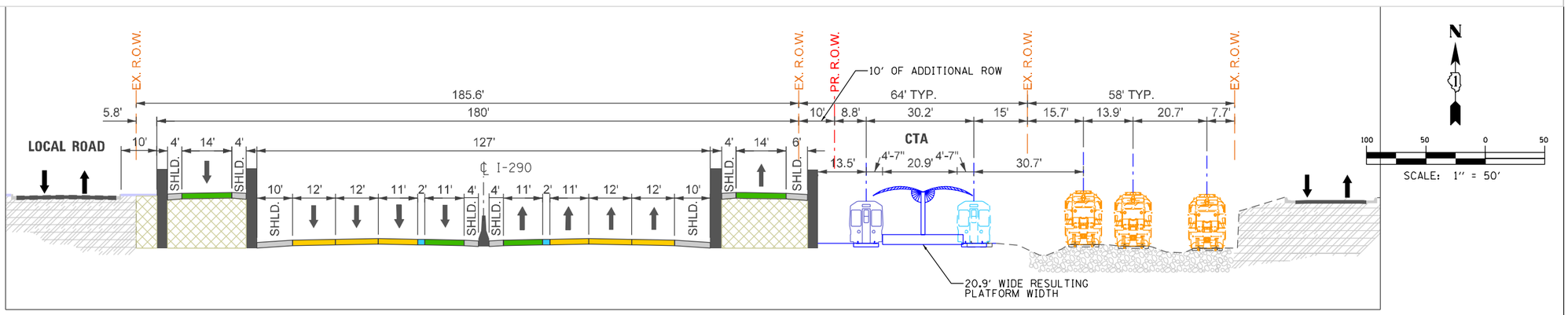

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PLOT DATE = 4/26/2016	DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

I-290 PHASE 1 STUDY
CTA PLATFORM STUDY: LOMBARD AVE. TO AUSTIN BLVD.

SCALE: 1" = 60' | SHEET ___ OF ___ SHEETS | STA. | TO STA.

F.A. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
___	___	COOK		
		CONTRACT NO.		
	ILLINOIS FED. AID PROJECT			

EXITING CALCULATIONS PER NFPA 130-2014

Application (1.3)
1.3.1 This standard shall apply to new fixed guideway transit and passenger rail systems and to extensions of existing systems

Deffinitions
pim = persons per inch per minute
ppm = people per minute
Max Travel Distance on a platform to means of egress route = 325 feet (100m)

Alternate Egress (5.3.3.7): At least two means of egress remote from each other shall be provided from each station platform (Emergency Exits)

Platforms, Corridors, and Ramps (5.3.4)
Platforms Corridors and ramps minimum clear width = 44 inches (5.3.4.1)
Means of egress capacity of platforms, corridors, and ramps shall be deducted by 12 inch at each sidewall and 18 inch at each platform edge (5.3.4.2)
Platforms, corridors, and ramps egress capacity = 2.08 pim (5.3.4.3) x width of platform, corridor, or ramp - (minus) sidewall deduction (12inches) - (minus) platform edge deduction (18 inches x both edges if applicable) as applicable.
Platforms, corridors, and ramps egress travel speed = 124 fpm (5.3.4.4)
Travel speed for concourses and other areas where lesser pedestrian density is anticipated = 200fpm (5.3.4.5)

Stairs and Escalators (5.3.5)
Means of egress stairs Minimum 44 inches (5.3.5.2)
Egress capacity = 1.41 pim x clear width of stairs (5.3.5.3 (1))
Egress travel speed = 48 fpm (5.3.5.3 (2))

Doors, Gates and Exit Hatches (5.3.7)
Egress capacity for single leaf doors and gates = Maximum of 60 ppm (5.3.7.1(1))
2.08 pim for biparting multileaf doors and gates measured for the clear width dimension (5.3.7.1(2))

Fare Barriers (5.3.8)
Turnstyle exit capacity = 25 ppm (5.3.8.5(3) (a))

CENTER PLATFORM OCCUPANT LOAD CALCULATION					
	Cars/ Train	**Occupants/ Car**	**Tracks (one train per track)**	**Train Occupant Load**	**Platform Occupant Load (POC)**
Full Train Load / Crush Load	8	100	1	800	
Actual Train Load in Reverse Peak Direction	8	50	1	400	
	Entraining Load	**Headway Time**	**One Missed Headway**	**Peak Entraining Load**	**1420**
Peak 15 Minute Entraining Load (estimated)	110	15 minutes	2	220	

PLATFORM EXIT CAPACITIES					
Center Platform	**Direction**	**Quantity**	**Width (inches)**	**Capacity (pim)**	**Total Capacity (ppm)**
Ramp to Stationhouse	up	2	124.0	2.08	515.84
Emergency Exit Stairs to Safe Area	dn	0	0.0	1.41	0.00
				Platform Exit Capacity (PEC)	**516**

EGRESS ELEMENT - EXIT CAPACITIES					
Egress Elements **Stationhouse Fare Barrier**	**Direction**	**Quantity**	**Width (inches)**	**Capacity (ppm)**	**Total Capacity (ppm)**
Turnstiles	n/a	8	n/a	25	200
RotoGates	n/a	2	n/a	25	50
Accessible Fare Gate	n/a	2	36.0	60	120
Emergency Exit Gate	n/a	2	36.0	60	120
				Fare Array Exit Capacity (FBEC)	**490**
Fare Barrier to Safe Area (Unpaid Area to Exterior)	**Direction**	**Quantity**	**Width (inches)**	**Capacity (pim)**	**Total Capacity (ppm)**
Single leaf doors and gates (minimum 36 inches wide)	n/a	0	0.0	60	0
Pairs of doors or gates (no center mullion)	n/a	4	72.0	2.08	599
				Safe Area Exit Capacity (SAEC)	**599**

WALKING TIME FOR LONGEST EXIT ROUTE					
Element - Austin Blvd. (This is the longer of the two exit routs) Platform to Safe Area	**Symbol**	**Length (feet)**	**fpm**		**Walking Time (in minutes)**
Travel Time on Platform	T1	260	124		2.10
Platform to Stationhouse (**ramp**)	T2	305	124		2.46
Stationhouse to Safe Area (to outside)	T3	82	200		0.41
				Total Walking Time (T)	**4.97**

STATIONHOUSE OCCUPANT LOAD					
	Platform Occ Load (POC)	**Platform Exit Flow Time (f_{pi})**	**Emergency Stair Capacity**	**Emergency Stair Occ. Load**	**Total Stationhouse Occ. Load**
Stationhouse Occupant Load (POC - f_{pi} x Emergency Stairs Exit Capacity)	1420	2.75	0	0	1420
				Total Stationhouse Occupant Load	**1420**

TEST NO. 1 - TIMED EXIT CALCULATIONS - CENTER PLATFORM (in miutes)					
Element	**Symbol**	**Platform Occupant Load (POC)**	**Platform Exit Capacity (PEC)**	**Platform Exit Flow Time (f_{pi})**	**4 Min. Max.Platform Exit Flow Time**
Platform Exit Flow Time (time to clear platform) (F_{pi} = POC/IPEC)	F_{pi}	1420	516	**2.75**	Exit Flow Time < 4 minutes
Waiting Time @ Platform Exits	**Symbol**	**Exit Flow Time (F_p)**	**Travel Time (T1)**		**Waiting Times (W_p)**
Waiting Time at Platform Exits (W_{pi} = F_{pi} - T1)	W_p	2.75	2.10		**0.66**

TEST NO. 2 - TIMED EXIT CALCULATIONS - STATIONHOUSE (in miutes)					
Element	**Symbol**	**Stationhouse Occ. Load**	**Fare Barrier Exit Capacity**		**Fare Barrier Exit Flow Time**
Flow Time @ Fare Barrier (Station Occupant Load / FBEC)	F_{fb}	1420	490		**2.90**
Waiting Time @ Fare Barrier	**Symbol**	**Fare Barrier Exit Flow Time**	**Platform Exit Flow Time**		**Waiting time at Fare Barrier**
Waiting Time (minutes) at Fare Barrier ($W_{fb} = F_{fb} - F_p$)	W_{fb}	2.90	2.75		**0.15**
Element	**Symbol**	**Stationhouse Occupancy Load**	**Stationhouse Exit Capacity**		**Stationhouse Exit Flow Time**
Flow Time @ Stationhouse Exits (Stationhouse Occupant Load / SAEC)	F_s	1420	599		**2.37**
Element	**Symbol**	**Stationhouse Exit Flow Time**	**Platform Exit Flow Time**	**Fare Barrier Exit Flow Time**	**Waiting Time at Station Exits**
Waiting Time @ Stationhouse Exits		F_s	F_{pi}	F_{fb}	(W_s)
Waiting Time @ Stationhouse Exits ($(F_s - \max(F_{fb} \text{ or } F_p))$)	W_s	2.37	2.75	2.90	**0.00**
			max (F_{fb} or F_p) =	2.90	

TOTAL EXIT TIME (Platform to Safe Area) (in miutes)					
	Total Walk Time T	**Platform Wait Time W_p**	**Fair Barrier Wait Time W_{fb}**	**Station House Exit Wait Time W_s**	**Total Exit Time Req. < 6 min**
Total Exit Time = $T + W_p + W_{fb} + W_s$	4.97	0.66	0.15	0.00	**5.77**
					Total Exit Time < 6 minutes

Original spreadsheet by: Muller + Muller Architects

EXITING CALCULATIONS PER NFPA 130-2014

Application (1.3)
1.3.1 This standard shall apply to new fixed guideway transit and passenger rail systems and to extensions of existing systems

Deffinitions
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ppm = people per minute
Max Travel Distance on a platform to means of egress route = 325 feet (100m)

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Platforms, Corridors, and Ramps (5.3.4)
Platforms Corridors and ramps minimum clear width = 44 inches (5.3.4.1)
Means of egress capacity of platforms, corridors, and ramps shall be deducted by 12 inch at each sidewall and 18 inch at each platform edge (5.3.4.2)
Platforms, corridors, and ramps egress capacity = 2.08 pim (5.3.4.3) x width of platform, corridor, or ramp - (minus) sidewall deduction (12inches) - (minus) platform edge deduction (18 inches x both edges if applicable) as applicable.
Platforms, corridors, and ramps egress travel speed = 124 fpm (5.3.4.4)
Travel speed for concourses and other areas where lesser pedestrian density is anticipated = 200fpm (5.3.4.5)

Stairs and Escalators (5.3.5)
Means of egress stairs Minimum 44 inches (5.3.5.2)
Egress capacity = 1.41 pim x clear width of stairs (5.3.5.3 (1))
Egress travel speed = 48 fpm (5.3.5.3 (2))

Doors, Gates and Exit Hatches (5.3.7)
Egress capacity for single leaf doors and gates = Maximum of 60 ppm (5.3.7.1(1))
2.08 pim for biparting multileaf doors and gates measured for the clear width dimension (5.3.7.1(2))

Fare Barriers (5.3.8)
Turnstyle exit capacity = 25 ppm (5.3.8.5(3) (a))

CENTER PLATFORM OCCUPANT LOAD CALCULATION					
	Cars/ Train	**Occupants/ Car**	**Tracks (one train per track)**	**Train Occupant Load**	**Platform Occupant Load (POC)**
Full Train Load / Crush Load	8	100	1	800	
Actual Train Load in Reverse Peak Direction	8	50	1	400	
	Entraining Load	**Headway Time**	**One Missed Headway**	**Peak Entraining Load**	**1318**
Peak 15 Minute Entraining Load (estimated)	59	15 minutes	2	118	

PLATFORM EXIT CAPACITIES					
Center Platform	**Direction**	**Quantity**	**Width (inches)**	**Capacity (pim)**	**Total Capacity (ppm)**
Ramp to Stationhouse	up	1	156.5	2.08	325.52
Stair to Stationhouse	up	1	60.0	1.41	84.60
Emergency Exit Stairs to Safe Area	dn	0	0.0	1.41	0.00
				Platform Exit Capacity (PEC)	**410**

EGRESS ELEMENT - EXIT CAPACITIES					
Egress Elements **Stationhouse Fare Barrier**	**Direction**	**Quantity**	**Width (inches)**	**Capacity (ppm)**	**Total Capacity (ppm)**
Turnstiles	n/a	6	n/a	25	150
RotoGates	n/a	1	n/a	25	25
Accessible Fare Gate	n/a	1	36.0	60	60
Emergency Exit Gate	n/a	3	36.0	60	180
				Fare Array Exit Capacity (FBEC)	**415**
Fare Barrier to Safe Area (Unpaid Area to Exterior)	**Direction**	**Quantity**	**Width (inches)**	**Capacity (pim)**	**Total Capacity (ppm)**
Single leaf doors and gates (minimum 36 inches wide)	n/a	0		60	0
Pairs of doors or gates (no center mullion)	n/a	4	72.0	2.08	599
				Safe Area Exit Capacity (SAEC)	**599**

WALKING TIME FOR LONGEST EXIT ROUTE					
Element - Circle Ave. (This is the longer of the two exit routs) Platform to Safe Area	**Symbol**	**Length (feet)**	**fpm**		**Walking Time (in minutes)**
Travel Time on Platform	T1	260	124		2.10
Platform to Stationhouse (**ramp**)	T2	323	124		2.60
Stationhouse to Safe Area (to outside)	T3	35	200		0.18
				Total Walking Time (T)	**4.88**

STATIONHOUSE OCCUPANT LOAD					
	Platform Occ Load (POC)	**Platform Exit Flow Time (f_{pi})**	**Emergency Stair Capacity**	**Emergency Stair Occ. Load**	**Total Stationhouse Occ. Load**
Stationhouse Occupant Load (POC - f_{pi} x Emergency Stairs Exit Capacity)	1318	3.21	0	0	1318
				Total Stationhouse Occupant Load	**1318**

TEST NO. 1 - TIMED EXIT CALCULATIONS - CENTER PLATFORM (in miutes)					
Element	**Symbol**	**Platform Occupant Load (POC)**	**Platform Exit Capacity (PEC)**	**Platform Exit Flow Time (f_{pi})**	**4 Min. Max.Platform Exit Flow Time**
Platform Exit Flow Time (time to clear platform) (F_{pi} = POC/IPEC)	F_{pi}	1318	410	**3.21**	Exit Flow Time < 4 minutes
Waiting Time @ Platform Exits	**Symbol**	**Exit Flow Time (F_p)**	**Travel Time (T1)**		**Waiting Times (W_p)**
Waiting Time at Platform Exits (W_{pi} = F_{pi} - T1)	W_p	3.21	2.10		**1.12**

TEST NO. 2 - TIMED EXIT CALCULATIONS - STATIONHOUSE (in miutes)					
Element	**Symbol**	**Stationhouse Occ. Load**	**Fare Barrier Exit Capacity**		**Fare Barrier Exit Flow Time**
Flow Time @ Fare Barrier (Station Occupant Load / FBEC)	F_{fb}	1318	415		**3.18**
Waiting Time @ Fare Barrier	**Symbol**	**Fare Barrier Exit Flow Time**	**Platform Exit Flow Time**		**Waiting time at Fare Barrier**
Waiting Time (minutes) at Fare Barrier ($W_{fb} = F_{fb} - F_p$)	W_{fb}	3.18	3.21		**0.00**
Element	**Symbol**	**Stationhouse Occupancy Load**	**Stationhouse Exit Capacity**		**Stationhouse Exit Flow Time**
Flow Time @ Stationhouse Exits (Stationhouse Occupant Load / SAEC)	F_s	1318	599		**2.20**
Element	**Symbol**	**Stationhouse Exit Flow Time**	**Platform Exit Flow Time**	**Fare Barrier Exit Flow Time**	**Waiting Time at Station Exits**
Waiting Time @ Stationhouse Exits		F_s	F_{pi}	F_{fb}	(W_s)
Waiting Time @ Stationhouse Exits ((F_s - max (F_{fb} or F_p))	W_s	2.20	3.21	3.18	**0.00**
			max (F_{fb} or F_p) =	3.21	

TOTAL EXIT TIME (Platform to Safe Area) (in miutes)					
	Total Walk Time T	**Platform Wait Time W_p**	**Fair Barrier Wait Time W_{fb}**	**Station House Exit Wait Time W_s**	**Total Exit Time Req. < 6 min**
Total Exit Time = $T + W_p + W_{fb} + W_s$	4.88	1.12	0.00	0.00	**5.99**
					Total Exit Time < 6 minutes

Original spreadsheet by: Muller + Muller Architects

EXITING CALCULATIONS PER NFPA 130-2014

Application (1.3)
1.3.1 This standard shall apply to new fixed guideway transit and passenger rail systems and to extensions of existing systems

Deffinitions
pim = persons per inch per minute
ppm = people per minute
Max Travel Distance on a platform to means of egress route = 325 feet (100m)

Alternate Egress (5.3.3.7): At least two means of egress remote from each other shall be provided from each station platform (Emergency Exits)

Platforms, Corridors, and Ramps (5.3.4)
Platforms Corridors and ramps minimum clear width = 44 inches (5.3.4.1)
Means of egress capacity of platforms, corridors, and ramps shall be deducted by 12 inch at each sidewall and 18 inch at each platform edge (5.3.4.2)
Platforms, corridors, and ramps egress capacity = 2.08 pim (5.3.4.3) x width of platform, corridor, or ramp - (minus) sidewall deduction (12inches) - (minus) platform edge deduction (18 inches x both edges if applicable) as applicable.
Platforms, corridors, and ramps egress travel speed = 124 fpm (5.3.4.4)
Travel speed for concourses and other areas where lesser pedestrian density is anticipated = 200fpm (5.3.4.5)

Stairs and Escalators (5.3.5)
Means of egress stairs Minimum 44 inches (5.3.5.2)
Egress capacity = 1.41 pim x clear width of stairs (5.3.5.3 (1))
Egress travel speed = 48 fpm (5.3.5.3 (2))

Doors, Gates and Exit Hatches (5.3.7)
Egress capacity for single leaf doors and gates = Maximum of 60 ppm (5.3.7.1(1))
2.08 pim for biparting multileaf doors and gates measured for the clear width dimension (5.3.7.1(2))

Fare Barriers (5.3.8)
Turnstyle exit capacity = 25 ppm (5.3.8.5(3) (a))

CENTER PLATFORM OCCUPANT LOAD CALCULATION					
	Cars/ Train	**Occupants/ Car**	**Tracks (one train per track)**	**Train Occupant Load**	**Platform Occupant Load (POC)**
Full Train Load / Crush Load	8	100	1	800	
Actual Train Load in Reverse Peak Direction	8	50	1	400	
	Entraining Load	**Headway Time**	**One Missed Headway**	**Peak Entraining Load**	**1466**
Peak 15 Minute Entraining Load (estimated)	133	15 minutes	2	266	

PLATFORM EXIT CAPACITIES					
Center Platform	**Direction**	**Quantity**	**Width (inches)**	**Capacity (pim)**	**Total Capacity (ppm)**
Ramp to Stationhouse	up	2	112.0	2.08	465.92
Emergency Exit Stairs to Safe Area	dn	0	0.0	1.41	0.00
				Platform Exit Capacity (PEC)	**466**

EGRESS ELEMENT - EXIT CAPACITIES					
Egress Elements **Stationhouse Fare Barrier**	**Direction**	**Quantity**	**Width (inches)**	**Capacity (ppm)**	**Total Capacity (ppm)**
Turnstiles	n/a	7	n/a	25	175
RotoGates	n/a	2	n/a	25	50
Accessible Fare Gate	n/a	2	36.0	60	120
Emergency Exit Gate	n/a	2	36.0	60	120
				Fare Array Exit Capacity (FBEC)	**465**
Fare Barrier to Safe Area (Unpaid Area to Exterior)	**Direction**	**Quantity**	**Width (inches)**	**Capacity (pim)**	**Total Capacity (ppm)**
Single leaf doors and gates (minimum 36 inches wide)	n/a	0	0.0	60	0
Pairs of doors or gates (no center mullion)	n/a	4	72.0	2.08	599
				Safe Area Exit Capacity (SAEC)	**599**

WALKING TIME FOR LONGEST EXIT ROUTE					
Element - East Ave. (This is the longer of the two exit routs) Platform to Safe Area	**Symbol**	**Length (feet)**	**fpm**		**Walking Time (in minutes)**
Travel Time on Platform	T1	260	124		2.10
Platform to Stationhouse (**ramp**)	T2	288	124		2.32
Stationhouse to Safe Area (to outside)	T3	100	200		0.50
				Total Walking Time (T)	**4.92**

STATIONHOUSE OCCUPANT LOAD					
	Platform Occ Load (POC)	**Platform Exit Flow Time (f_{pi})**	**Emergency Stair Capacity**	**Emergency Stair Occ. Load**	**Total Stationhouse Occ. Load**
Stationhouse Occupant Load (POC - f_{pi} x Emergency Stairs Exit Capacity)	1466	3.15	0	0	1466
				Total Stationhouse Occupant Load	**1466**

TEST NO. 1 - TIMED EXIT CALCULATIONS - CENTER PLATFORM (in miutes)					
Element	**Symbol**	**Platform Occupant Load (POC)**	**Platform Exit Capacity (PEC)**	**Platform Exit Flow Time (f_{pi})**	**4 Min. Max.Platform Exit Flow Time**
Platform Exit Flow Time (time to clear platform) (F_{pi} = POC/IPEC)	F_{pi}	1466	466	**3.15**	Exit Flow Time < 4 minutes
Waiting Time @ Platform Exits	**Symbol**	**Exit Flow Time (F_p)**	**Travel Time (T1)**		**Waiting Times (W_p)**
Waiting Time at Platform Exits (W_{pi} = F_{pi} - T1)	W_p	3.15	2.10		**1.05**

TEST NO. 2 - TIMED EXIT CALCULATIONS - STATIONHOUSE (in miutes)					
Element	**Symbol**	**Stationhouse Occ. Load**	**Fare Barrier Exit Capacity**		**Fare Barrier Exit Flow Time**
Flow Time @ Fare Barrier (Station Occupant Load / FBEC)	F_{fb}	1466	465		**3.15**
Waiting Time @ Fare Barrier	**Symbol**	**Fare Barrier Exit Flow Time**	**Platform Exit Flow Time**		**Waiting time at Fare Barrier**
Waiting Time (minutes) at Fare Barrier (W_{fb} = F_{fb} - F_p)	W_{fb}	3.15	3.15		**0.01**
Element	**Symbol**	**Stationhouse Occupancy Load**	**Stationhouse Exit Capacity**		**Stationhouse Exit Flow Time**
Flow Time @ Stationhouse Exits (Stationhouse Occupant Load / SAEC)	F_s	1466	599		**2.45**
Element	**Symbol**	**Stationhouse Exit Flow Time**	**Platform Exit Flow Time**	**Fare Barrier Exit Flow Time**	**Waiting Time at Station Exits**
Waiting Time @ Stationhouse Exits		F_s	F_{pi}	F_{fb}	(W_s)
Waiting Time @ Stationhouse Exits ((F_s - max (F_{fb} or F_p))	W_s	2.45	3.15	3.15	**0.00**
			max (F_{fb} or F_p) =	3.15	

TOTAL EXIT TIME (Platform to Safe Area) (in miutes)					
	Total Walk Time T	**Platform Wait Time W_p**	**Fair Barrier Wait Time W_{fb}**	**Station House Exit Wait Time W_s**	**Total Exit Time Req. < 6 min**
Total Exit Time = T + W_p + W_{fb} + W_s	4.92	1.05	0.01	0.00	**5.98** Total Exit Time < 6 minutes

Original spreadsheet by: Muller + Muller Architects