MEMORANDUM

TO: Pat Jones, Metro Transit

FROM: Greg Finstad, Transit Facility Design Leader
Mark Dierling, Project Manager

DATE: November 7, 2011

RE: I-35W Transit/Access Project
Transit Station Platform Configuration Evaluation
SEH No. HENNC 113114

The purpose of this technical memorandum is to provide a summary of the process used to develop recommendations regarding a preferred configuration for the transit station platform in the median of I-35W and in the proximity of Lake Street. In addition, the memo defines design and operational objectives, standards, constraining factors. Also, the alternatives considered are described including the advantages and disadvantages of each. Finally, the next steps in the development of the transit station are summarized.

1. Overview
    a. Relationship to Transit/Access Project
        i. The transit station is one of the key elements that make up the overall I-35W Transit/Access project. Both the location and the configuration of the bus platform at the freeway level have a significant influence on many of the other project components including the overall width of the freeway, efficiency of bus operations, and the accessibility of the platform from the surrounding neighborhoods and the Midtown Greenway.
        ii. A desired outcome of the Transit/Access project is to have the project development of the transit station completed in order to begin building the station in 2017 or 2018 as a first step towards the full vision for the I-35W Transit/Access project.
    b. Transit Station Location Recommendation
        i. Over the last several months the transit station design team has facilitated a process involving the Project Advisory Committee (PAC) and other project partners to identify a recommended location for the transit station platform at the freeway level.
        ii. Other key considerations in locating the platform were where vertical circulation is located north and south of Lake Street and the distance to the platform from transfer locations on Lake Street, surrounding neighborhoods and the Greenway.
        iii. During their September meeting, the PAC recommended the freeway level platform be located at or slightly north of Lake Street with vertical circulation provided on both the south and north sides of the street. Additional details regarding the freeway

platform and other elements of the transit station, including the Lake Street level will be addressed over the next several months.

iv. The PAC location recommendation was reviewed and supported by a policy maker group representing the project partners at a meeting held October 7, 2011.

c. Alternative Development and Selection Process

i. The consultant design team and staff from Metro Transit have worked collaboratively to develop several possible configurations of the freeway level platform.

ii. Over several meetings Metro Transit staff provided the design team information regarding anticipated bus and passenger operations, lessons learned from current operations and maintenance at the 46th Street Station, and safety and security considerations.

iii. Based on input from Metro Transit, the design team developed several options for their consideration. In all, eleven different configurations were considered. Over the course of several meetings, each configuration was refined resulting in the concepts described later in this document.

iv. Metro transit staff, working with the design team, developed a summary of advantages and disadvantages for each.

v. The Technical Advisory Committee (TAC) has received regular updates regarding this process. The design team provided the TAC drawings of all concepts under consideration following their September 22, 2011 meeting.

vi. The Minnesota Department of Transportation (MnDOT) and the Federal Highway Administration (FHWA) have jurisdiction over I-35W. Therefore, they have final approval authority regarding designs impacting the freeway. Metro Transit and the design team will present the findings described in this memo to them for their consideration.

2. Alternative Development

The transit station design team facilitated discussions with Metro Transit staff to define transit station design objectives for Bus Rapid Transit operation on the freeway that acknowledges safety and capacity (bus throughput) concerns. In addition, the design team worked interactively with freeway designers such that the overall length and width of various concept transit stations would realistically fit with related freeway and interchange components as part of an overall project footprint area established by previous design/public involvement engagements.

a. Operational Objectives (freeway level)

i. BRT Service Plan - Metro Transit's intended service plan for the I-35W/Lake Street Station anticipates that every local and express Metro Transit bus that operates on I-35W will stop at the Lake Street Station. In addition, it is anticipated that alternative service providers (Southwest Metro and Minnesota Valley Transit) will also make stops at the Lake Street Station. The station should be designed to facilitate stops for up to 100 buses in the peak direction during the am and pm peak hours and also accommodate 25 buses stopping in the off-peak direction. This equates to an average headway of 40 seconds in the peak period. The frequency of buses will allow relatively short waiting times for riders thereby minimizing the number of boardings (and alightings) per stop. The average dwell time for a stopped bus is estimated to be15 seconds.

ii. Station Capacity (freeway level) - Evaluation of the arrival patterns, station entry control (i.e. gates) and dwell times was performed to identify potential capacity issues based upon the desired BRT service plan and maximum hourly arrival demand (100 buses per hour). It was determined that the station should accommodate up to five buses at a time (assumes two buses loading/unloading at the platform and three buses queued on approaches to the platform). See memorandums dated September 20, 2011 and October 19, 2011 in the Appendix for more information related to arrival rates, transit vehicle queuing and the influence of entry control devices.

Any bus using the transit station may be serving a special needs patron (i.e wheelchair; elderly, etc.). Dwell times for special needs users may extend to several minutes. To maintain the desired throughput and minimize lost time for other buses, the transit station must allow buses to safely and efficiently pass the bus serving the special needs rider. A passing lane in the transit station bus way would also be beneficial in the event of mechanical breakdown of a bus at the station.

iii. Safety Considerations (freeway level) – Two primary safety concerns have been identified relative to selection of a platform type.
   1. Shared platform – FHWA staff has expressed concern related to the bus cross-over operation that is required for a shared platform configuration (similar to the 46th Street Station on I-35W). Metro transit and MnDOT continue to monitor the 46th Street Station for unsafe behaviors related to the crossover design. No incidents of concern have been reported in its first year of operation.
   2. Split platform – Metro transit staff will not support a split platform design that does not have a barrier separation prohibiting pedestrians from crossing from one platform to the other at the freeway level.

b. Freeway Design Objectives
   i. Previous preliminary design and public involvement engagements (the 2004 Access Project) established an overall freeway, access ramp, and local street improvement concept that was accepted by the Minneapolis City Council and Hennepin County Board. The current design exercise must acknowledge the 2004 footprint as the maximum project size that may be potentially acceptable to stakeholders and decision makers. The design team defined that an overall freeway width of 234 feet, 4 inches would satisfy this constraint. This width allows for 4 northbound (NB) general purpose (GP) lanes, 1 NB managed lane and 1 NB auxiliary/exit lane; 4 southbound (SB) GP lanes, 1 SB managed lane, with inside and outside shoulders on both sides of the traveled lanes in each direction. A 2 foot 2 inch wide crash barrier is required on each side of the transit station/bus-way area to separate the high speed lanes from the transit station facilities. The width remaining for the transit station envelope is 58 to 66 feet depending upon the assumptions made for inside shoulder widths adjacent to the transit station lanes.

ii. Freeway Design Standards
    1. General Purpose (GP) Lanes – 12 feet
    2. Managed Lanes – 12 feet with a 4 foot buffer separating the HOT lane from the adjacent GP lane.
    3. Shoulders
        a. Right side adjacent to GP through lane 10 feet
        b. Right side adjacent to an auxiliary/exit lane – 6 feet
        c. Left side adjacent to a managed lane – 12 feet
    4. Design Exceptions – It is anticipated that no exception will be requested or granted for GP lanes, managed lanes, buffer areas, or right side shoulders. It is expected that a design exception will be needed for left shoulder widths adjacent to the transit station.
        a. A 58 foot wide transit station envelope would require a left shoulder width design exception (width reduction) of 4 feet (from 12 feet to 8 feet)
        b. A 66 foot wide transit station envelope will require a left shoulder width design exception (width reduction) of 8 feet (from 12 feet to 4 feet).

iii. Transit Station Design Criteria (cross-sectional/width elements)
    1. Minimum bus-way width accommodating snow storage and removal – 16 feet
    2. Minimum bus-way width to allow low speed passing maneuvers at the station - 22 feet
    3. Functional shared platform width – varies from 16 to 26 feet (dependent upon specific layout and position of vertical circulation elements)
    4. Functional split platform width – varies from 10 to 16.5 feet (dependent upon specific layout and position of vertical circulation elements)
    5. Transit-way barrier separating opposing bus-ways – 1 foot.

iv. Project Location Constraints
    1. The Project Advisory Committee and Technical Advisory Committee have endorsed a “Lake Street Proximate” station location. The station must provide vertical circulation from the south side of Lake Street (for eastbound bus transfers), the north side of Lake Street (for westbound transfers) and must provide convenient accessibility to the Midtown Greenway for existing pedestrian/bicycle riders and future street car riders. The greenway access has been conceptually defined as the “green crescent” – an on-grade trail connection between the greenway and Lake Street adjacent to Stevens Avenue.
    2. Project Phasing – It is anticipated that the Transit Access project will be constructed in increments over an extended time frame. It is generally agreed that the highest priority project (aside from mandated freeway bridge replacements) is the transit station. The highway design team has identified “thresholds” of infrastructure replacement that could be implemented as part of a “first” project that includes the transit station.

a. Potential "First" Project - A Lake Street Proximate station could be constructed within a $50-55 million budget if the northern "limits" of the transit station related freeway bridge replacement are managed within approximately 210 feet north of the existing south curb line of Lake Street. A project of this scale would defer replacement of the I-35W bridge(s) over the Midtown Greenway and the 28th Street Bridge over I-35W until needed as part of a subsequent project (i.e. constructing the proposed freeway access ramps). If the I-35W/Greenway Bridge and the 28th Street bridge require full replacement as part of the "first" project – the project cost will increase in magnitude to $80-85 million.
b. Braid Bridge - Replacement of the SB I-35W braid bridge should be replaced before or in conjunction with opening of the Lake Street Proximate transit station to allow SB TH 65 buses to enter mainline I-35W in the inside lane providing direct access to the transit station without weaving across general purpose lanes.
c. Subsequent Projects – One or more of the proposed access ramps to and from Lake Street and to 28th Street could be implemented with the transit station or as separate projects. It will be desirable to keep the Lake Street Transit Station operational during any subsequent freeway project. Staging for reconstruction of the freeway segments north and south of the transit station should be planned such that the station can remain operational.

v. Platform/Station Objectives
    1. Bus Operations
        a. A bus must be able to pass another bus which is delayed at any point along the platform
        b. Pulling away from platform directly into bus way is preferred. Maneuvering around other buses may occasionally be necessary, but permanent obstructions which cause every bus to maneuver to the left to proceed should be minimized.
    2. Maintenance Considerations
        a. Convenience of access for maintenance vehicles at the freeway level.
        b. Parking for maintenance vehicles should be provided
        c. The ease of snow removal from the bus lanes and from the platform area
        d. The use of durable low maintenance materials
        e. Energy efficient design
    3. Security Considerations
        a. Convenience of access to the freeway level (response time to platform area(s) from both directions)
        b. User security (ability to apply/achieve Crime Prevention Through Environmental Design principles)
        c. Visibility of platforms and circulation areas

d. Visibility and openness of the connection to the Midtown greenway

4. User Needs
    a. Clarity/Way finding – directional access to the appropriate platform waiting area is intuitive or can be effectively provided through informational signing
    b. ADA Accessibility – ease of access for handicapped, elderly, or blind users
    c. Vertical Circulation – elevators and stairways can be sized to serve the number and mix of users including bikes, wheelchairs or other mobility impaired individuals
    d. The platform should be sized to accommodate patrons a positive and comfortable experience (elbow room)

3. Preliminary Screening

a. Alternatives Considered / Dismissed – Drawings of each scheme are included in the appendix

i. SK-1 – Is similar to the 46th Street and I-35W Center Platform and is eliminated because it does not allow a bus which is loading or unloading a disabled person to be passed by another bus.

ii. SK-2 – Is a center platform design with bays at the ends of the platform which allows passing of buses loading and unloading. This scheme does not allow passing of a bus at all locations along the platform such that a stalled bus at rear of the station would inhibit the passing of the bus in a 16' width

iii. SK-3 – This is a center platform design with bays in the middle of the platform and has a wider platform at the ends for added space for vertical circulation. This scheme does not allow passing of a bus at all locations along the platform such that a stalled bus at the ends of the station would inhibit the passing of the bus in a 16' width. Another negative is the buses leaving the station would not have a straight movement

iv. SK-4 – Is the split platform with a center barrier with a 58 foot width and is eliminated because it does not allow a bus which is loading and unloading a disabled person to be passed by another bus.

v. SK-5 – Is a split platform with a 74 foot width with a center barrier with 2-12 foot lane adjacent to each platform to allow buses loading and unloading a disabled person to be passed by another bus. This platform design was eliminated because the 74 width exceeds the right-of-way footprint from the 2004 Access Project

vi. SK-6 – Is a platform design with a center lane which allows buses traveling in either direction to pass a bus which is loading and unloading. The station width is 60 feet which can be accommodated if shoulder width exceptions are granted from FHWA and MNDOT. This design was eliminated because of safety concerns raised by Metro

Transit for bus operations in both directions sharing the center lane. Also it was eliminated because pedestrians were able to cross from one platform to the other resulting in the potential for pedestrians to be hit by buses or other maintenance vehicles

vii. SK-7 – Is a split platform with bays enabling a bus to pass a bus which was loading and unloading. The width of the station is 78 feet. The platform/station design was eliminated because it exceeded the right-of-way footprint in the 2004 Access Project.

viii. SK-8 – Is a split platform design with a staggered center barrier. This design was eliminated because it does not allow a bus to pass another at any point along the platform. In addition, the platform width of 9 feet did not allow adequate room for vertical circulation at the ends of the platform.

ix. SK-9 – Is a center platform design with 22 feet wide bus lanes on each side. This design was eliminated because the overall length was not sufficient to provide room for 5 buses (2 loading/unloading and up to 3 waiting) within the platform area.

b. Alternatives Accepted for Further Study – Drawings of each scheme are included in the appendix

i. SK-10 – Is a split design with center barrier which widens at the tail end of the station to allow extra width for the vertical circulation area while still maintaining a 16’ wide thru lane. The station can be accommodated in a width of 66 feet and would require a greater degree of design exceptions from FHWA and MNDOT than needed for 58 foot configuration.

Pro’s:

- Easy for users to understand where buses stop for pick-up and drop-off
- Fewer passengers on the platform at any given time resulting in fewer conflicts
- Can handle higher bus volumes

Con’s:

- Requires four elevators and stairs
- Impacts adjacent traffic lane for maintenance
- Requires center barrier to prevent passengers from crossing bus lanes
- Exposure to errant vehicles
- Snow removal pushes snow toward the platform
- Higher capital cost compared to Scheme II

ii. SK-11 – Is a center platform with 22 feet wide bus lanes allowing a bus to bypass another which is loading or unloading. The width of the station is 66 feet and would

require a greater degree of design exceptions for FHWA and MNDOT than needed for a 58 foot configuration.

Pro's:

- Efficiency of inside space utilization for passengers
- Snow removal pushes snow away from platform (with reverse flow plowing)
- Additional space at ends of platform for vertical circulation, mechanical and electrical rooms
- More efficient for maintenance with one platform
- Protection from errant drivers
- More options for wider stairways
- Lower capital costs
- Security monitoring is easier with passengers all on one platform

Con's:

- FHWA safety concern related to crossover design
- Gate operation reduces maximum throughput

4. Conclusions/Next Steps
    a. A split platform concept (SK-10) and a shared platform concept (SK-11) have been identified as configurations that may satisfy the primary physical, operational, and safety objectives identified through the alternatives evaluation process.
    b. Both alternatives have an overall platform/bus-way envelop width of 66 feet which will require that a design exception for shoulder width be granted by FHWA and MnDOT.
    c. Metro transit strongly prefers the shared platform configuration (SK-11) that has distinct advantages in terms of snow removal, maintenance, security, user space and comfort, efficient use of vertical circulation components and a probable lower overall cost. Bus throughput capacity concerns have been resolved through extension of the platform island to allow waiting buses to queue within the station area. Operation of the cross-over design at the 46th Street Station has proven to be safe in its first year of operation. Further capacity improvement is possible if gate control operations can be modified to eliminate the long errant vehicle clearance intervals currently in operation at the 46th Street Station.

Appendix:

Drawings SK-1 through SK-11
SEH memorandum (dated 9-20-11) regarding BRT Station Alternative Analysis
SEH memorandum (dated 10-19-11) regarding BRT Station Traffic Analysis

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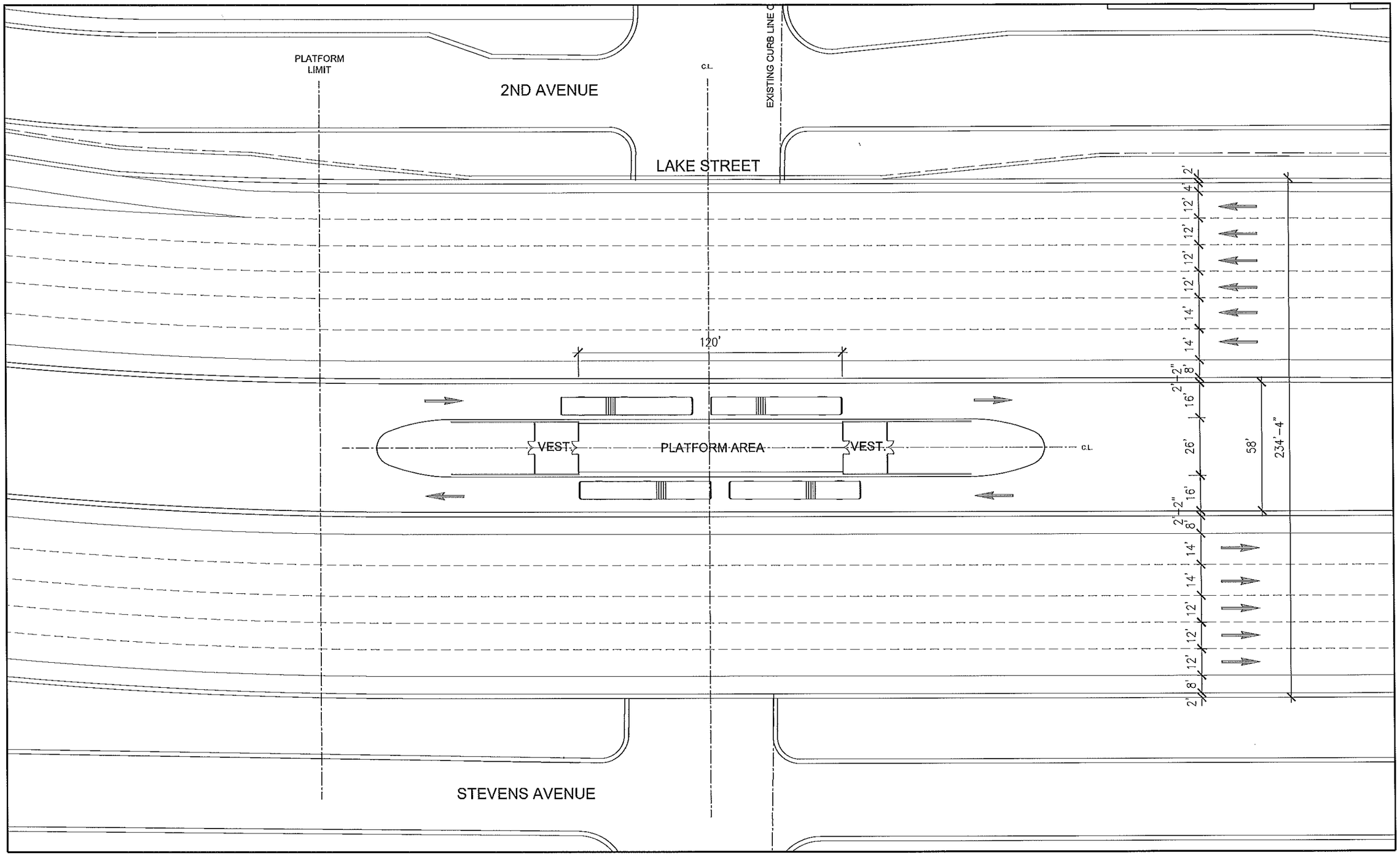

EHRENKRANTZ ECKSTUT & KUHN ARCHITECTS

I-35W

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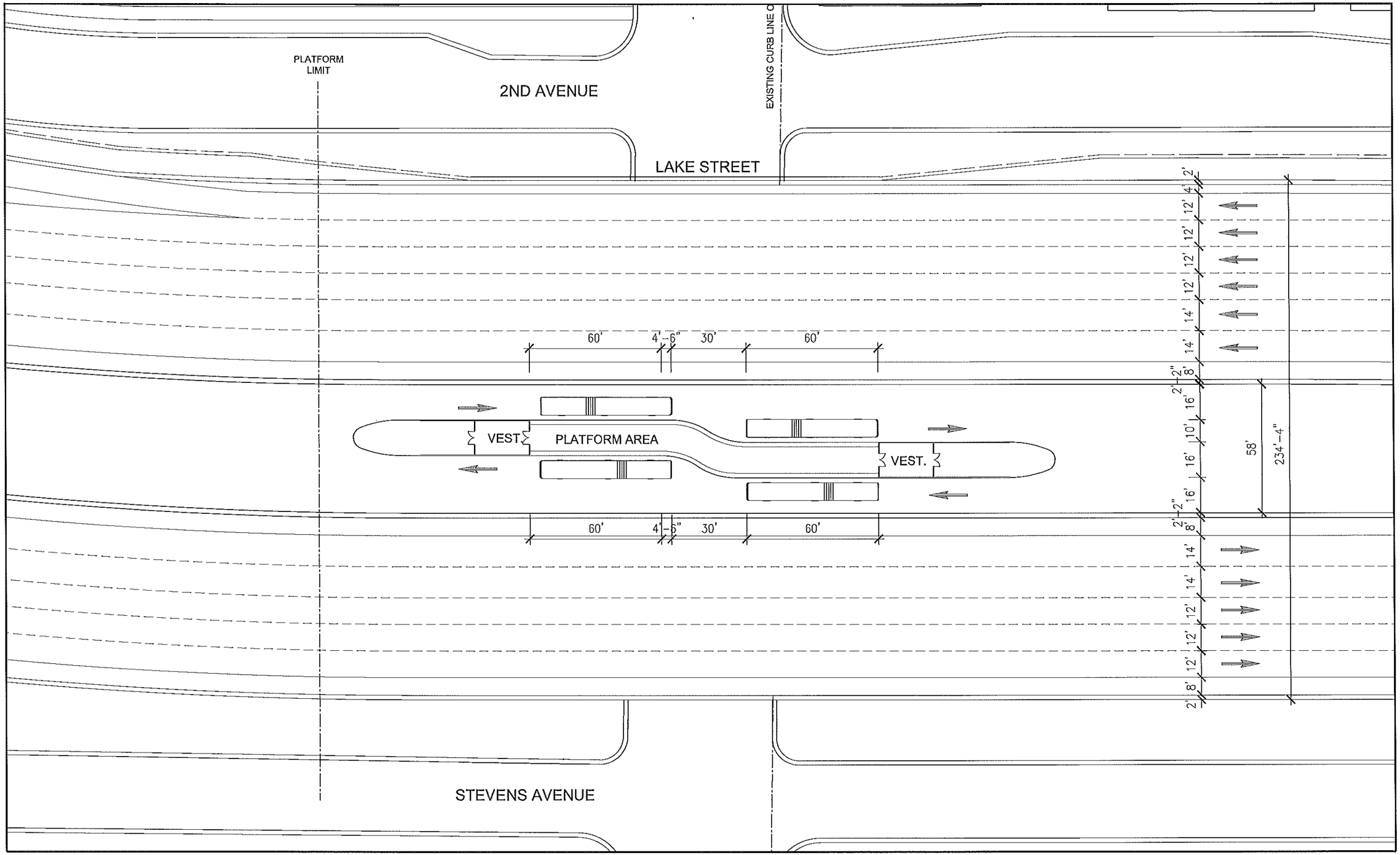

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I-35W

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SK 2

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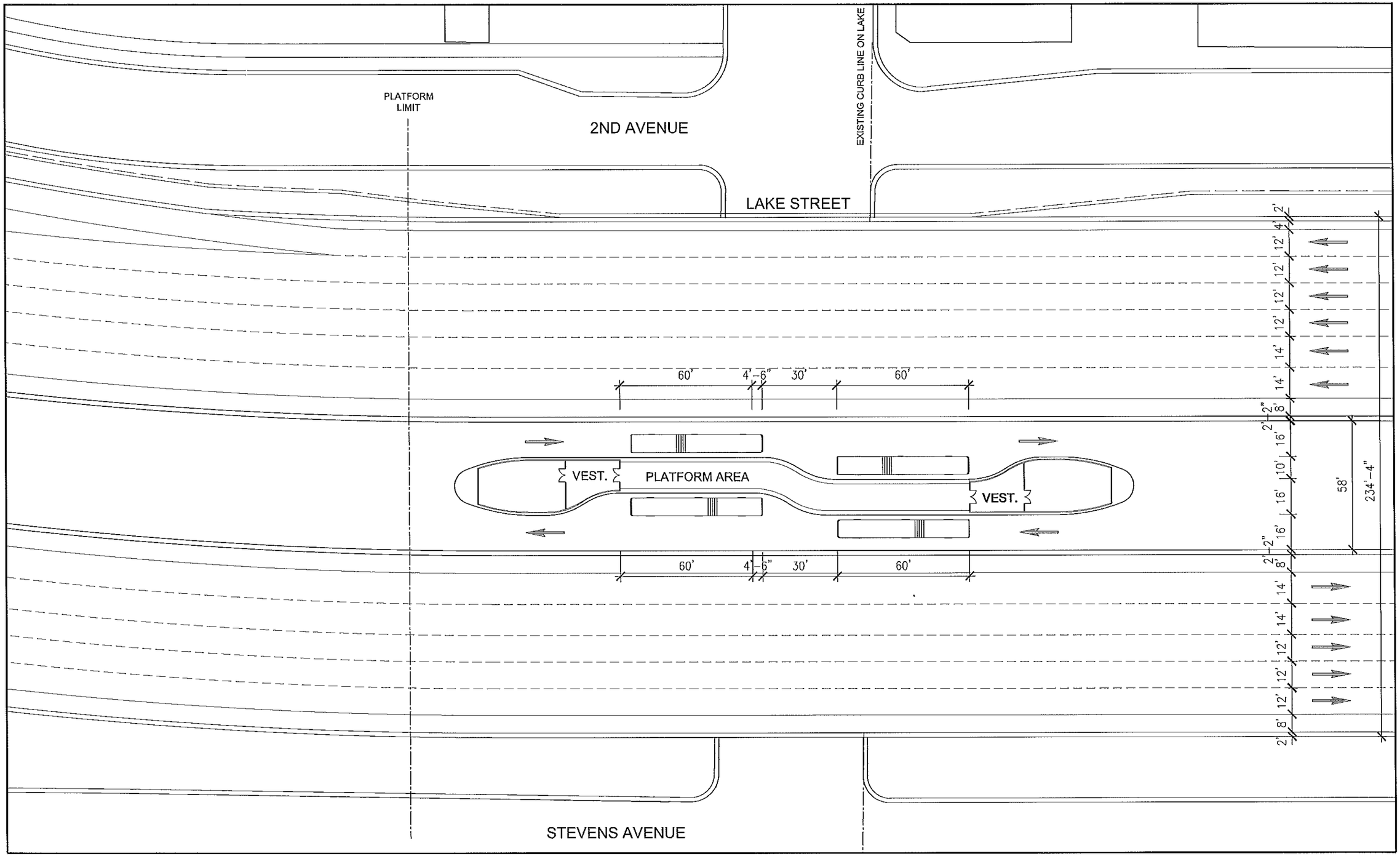

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I-35W

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SK 3

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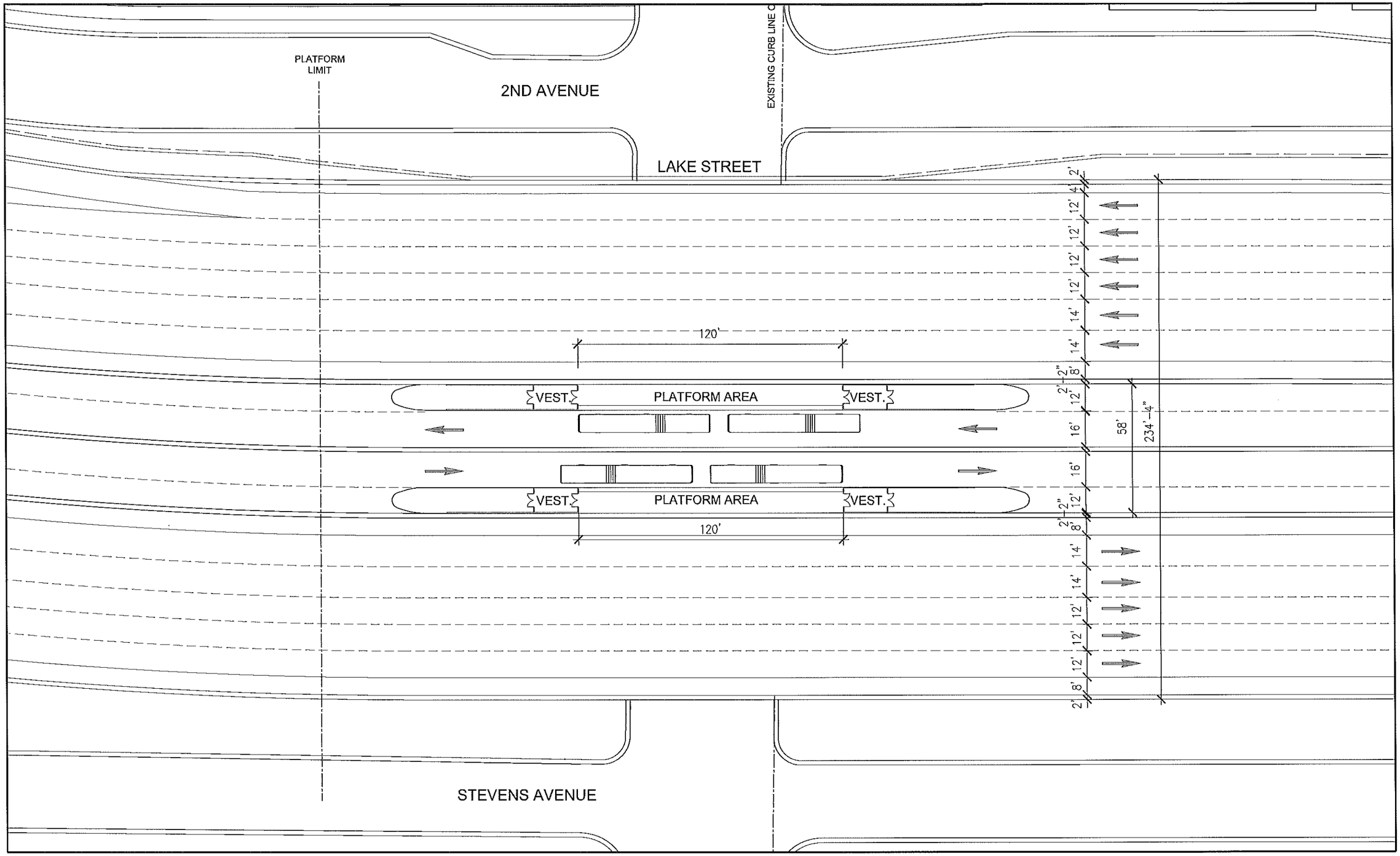

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I-35W

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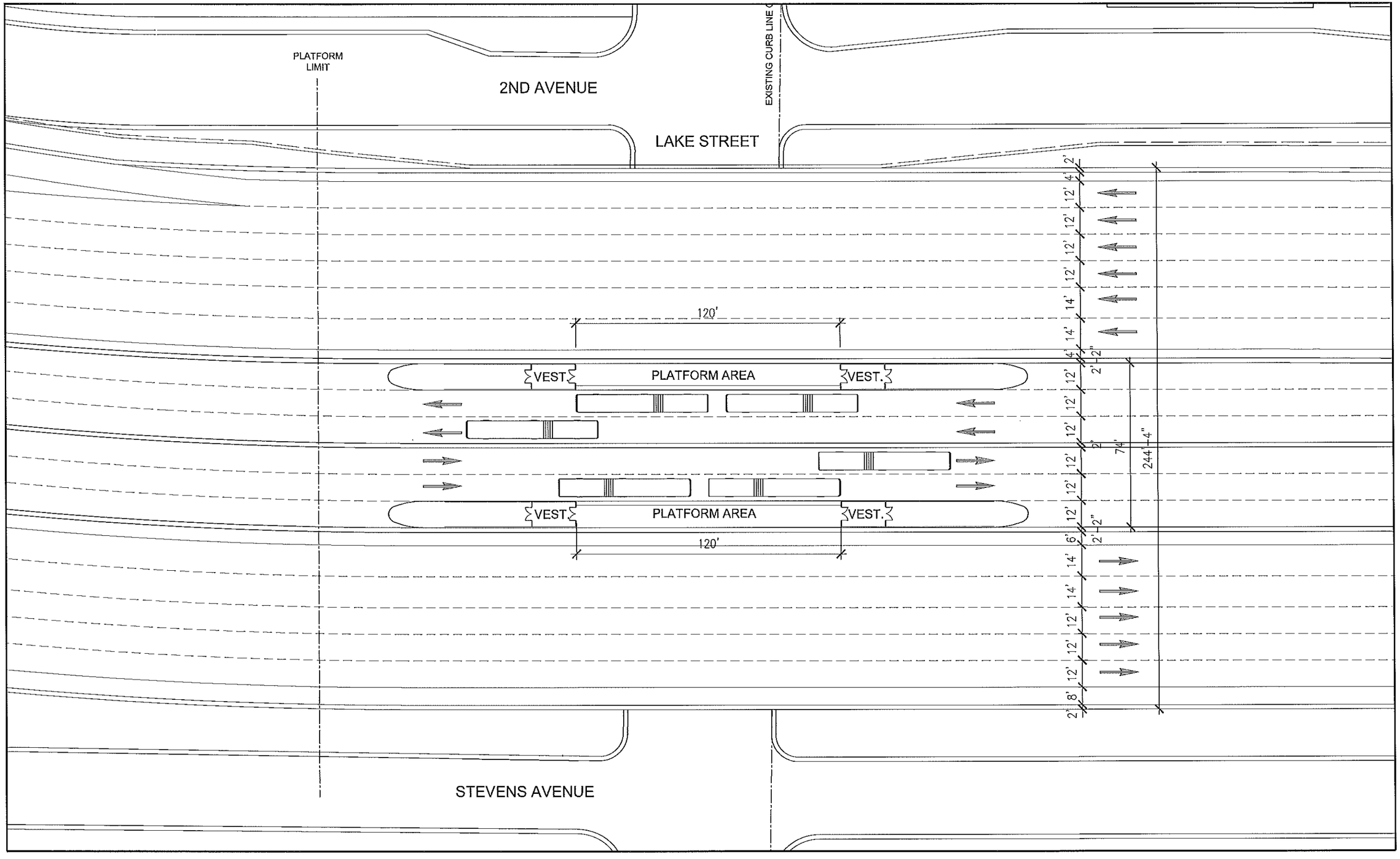

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I-35W

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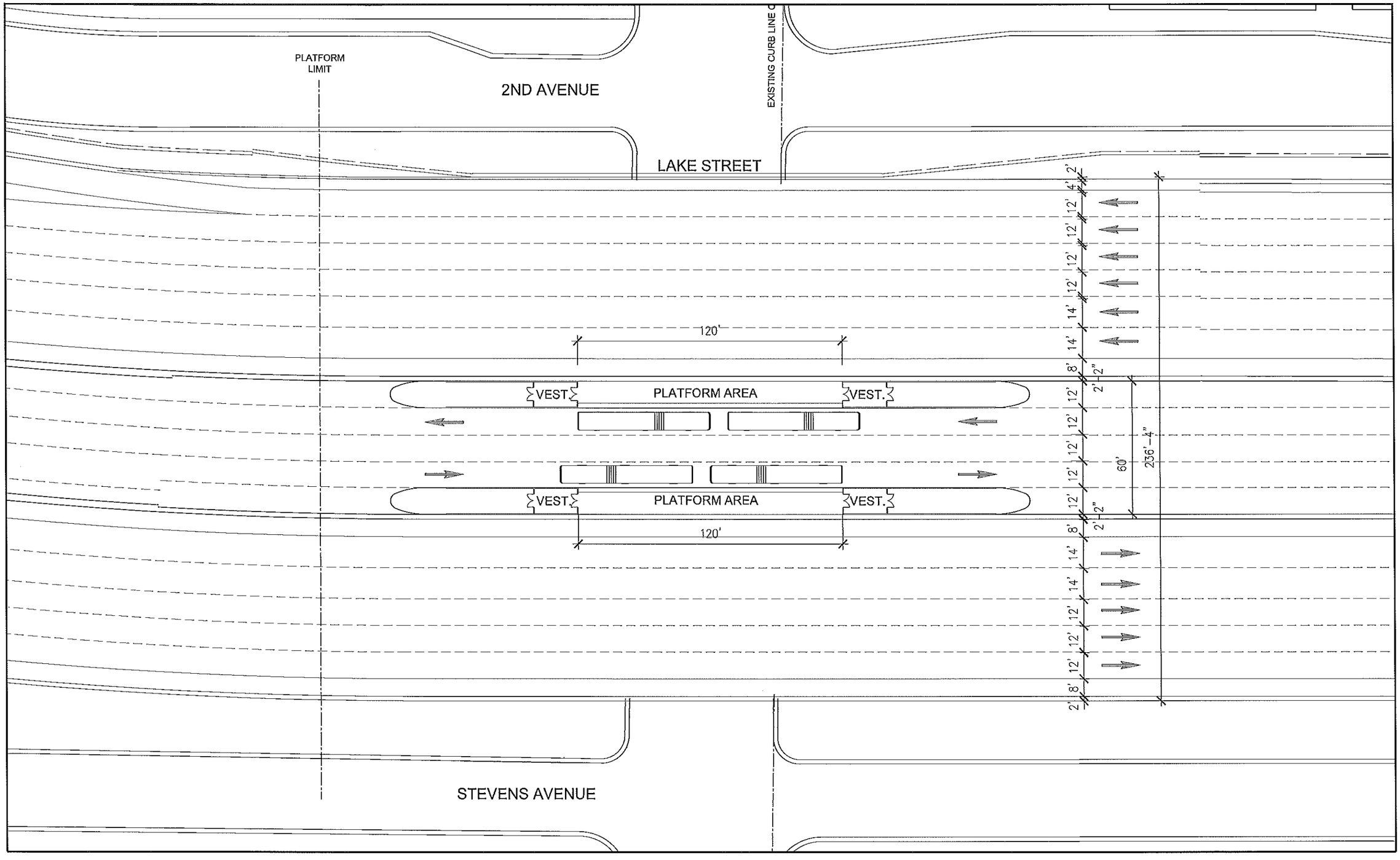

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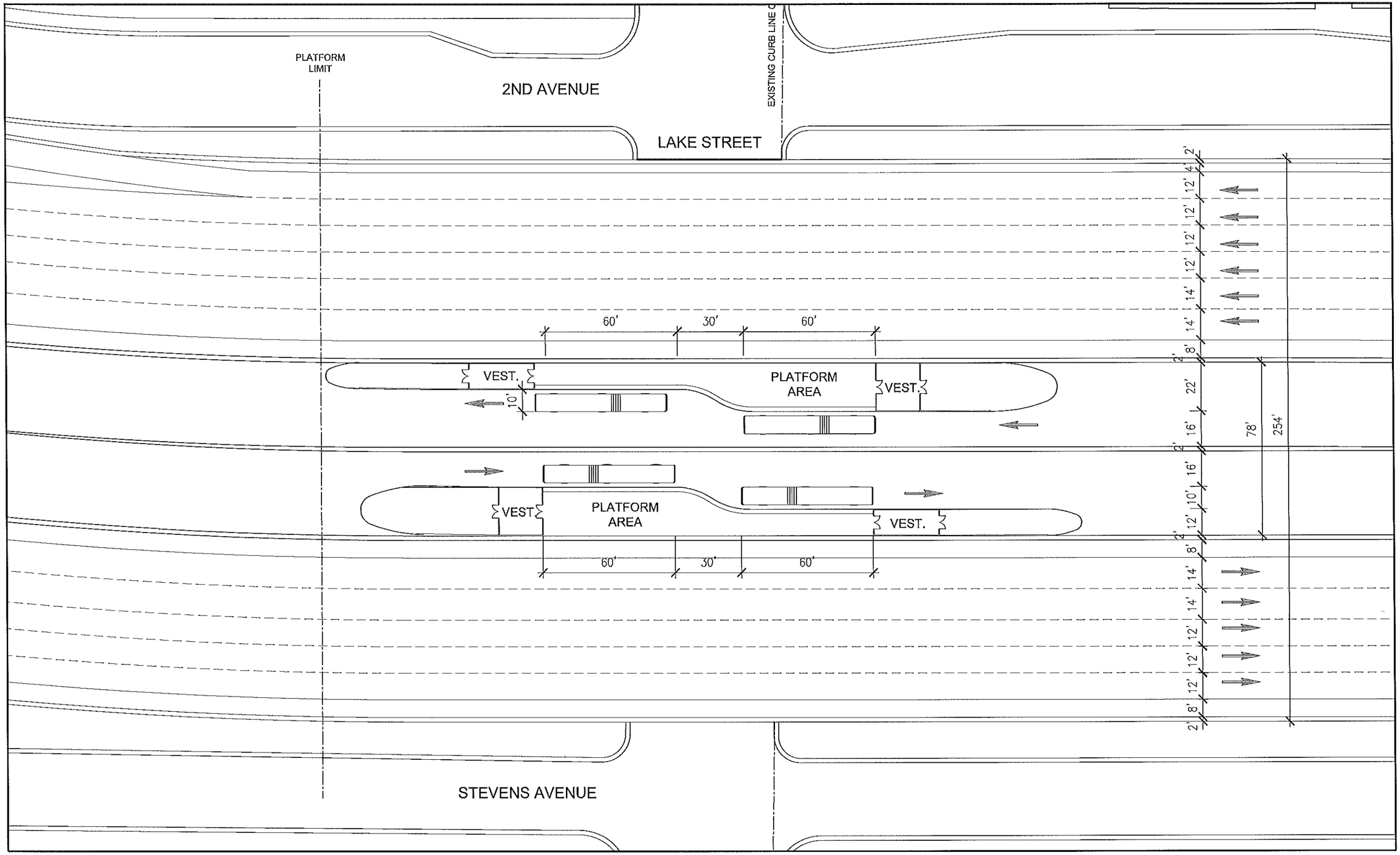

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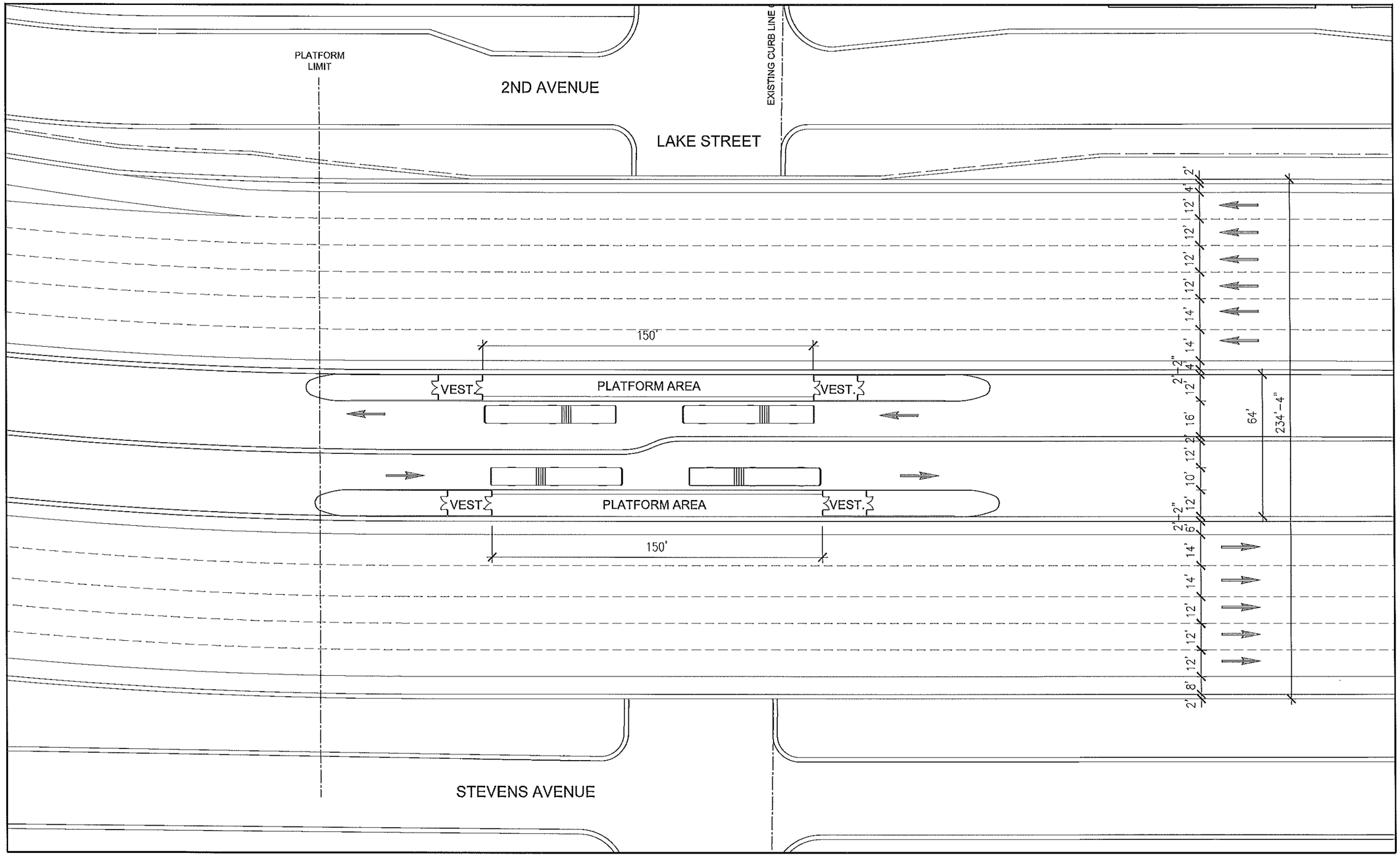

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I-35W

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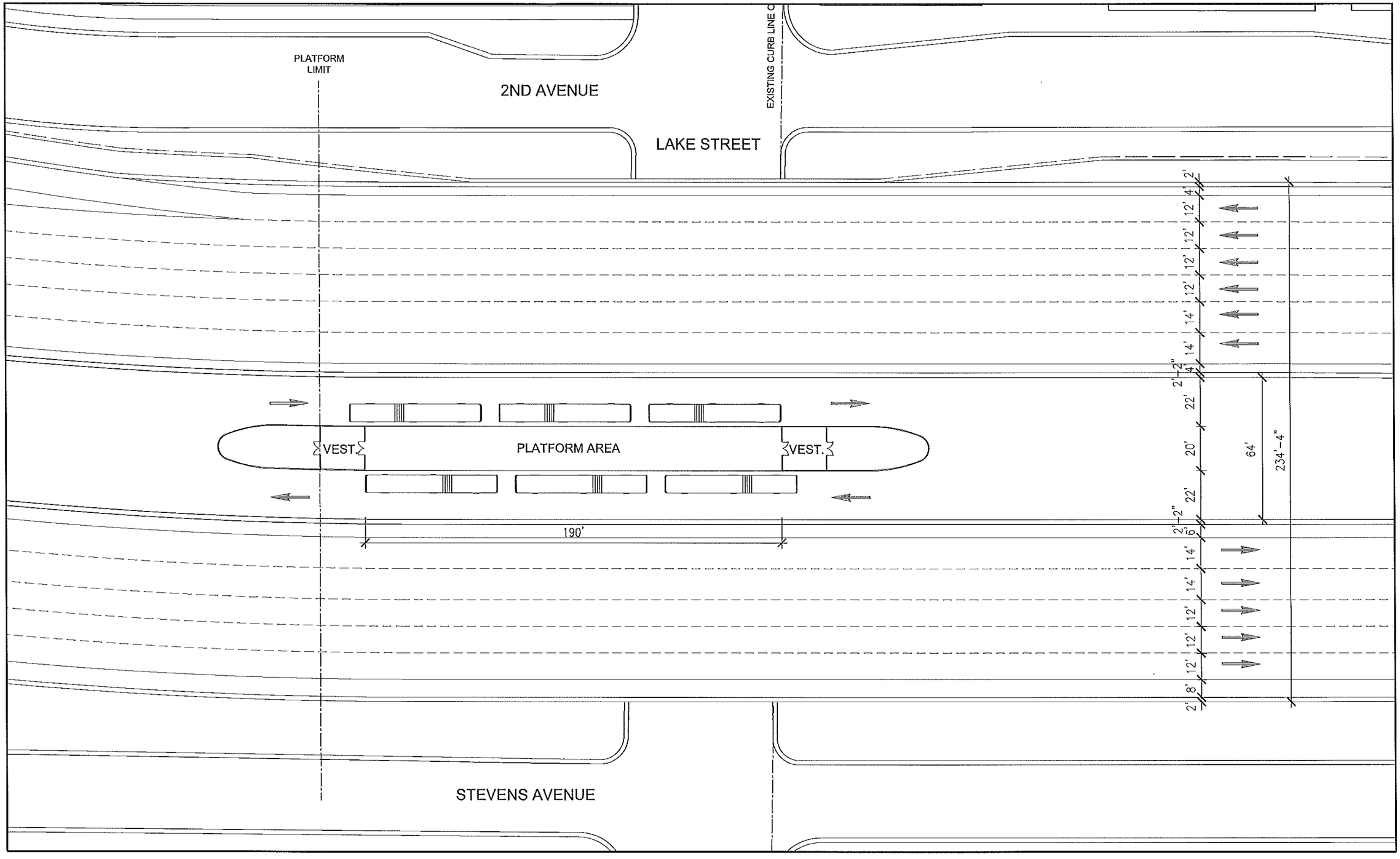

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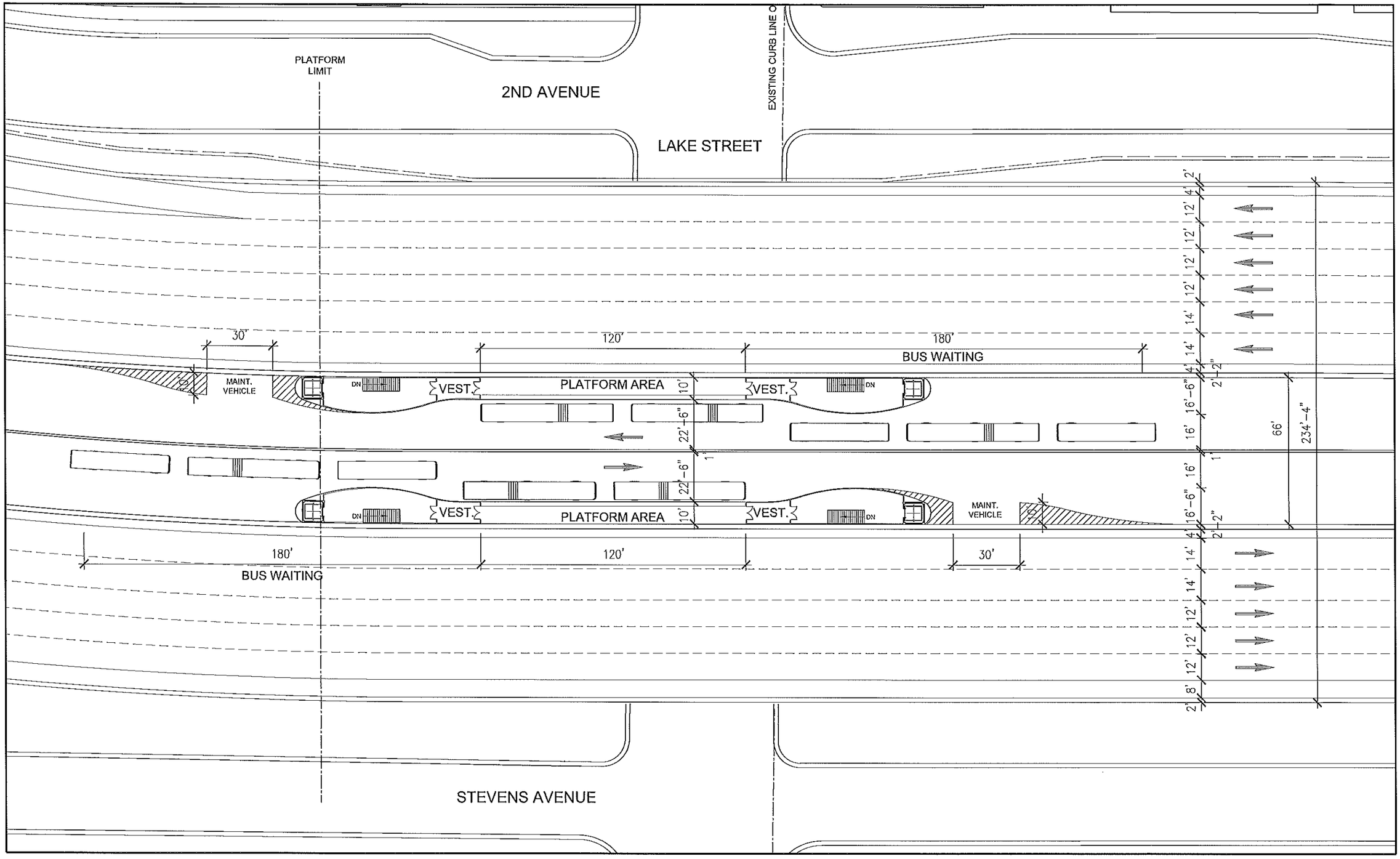

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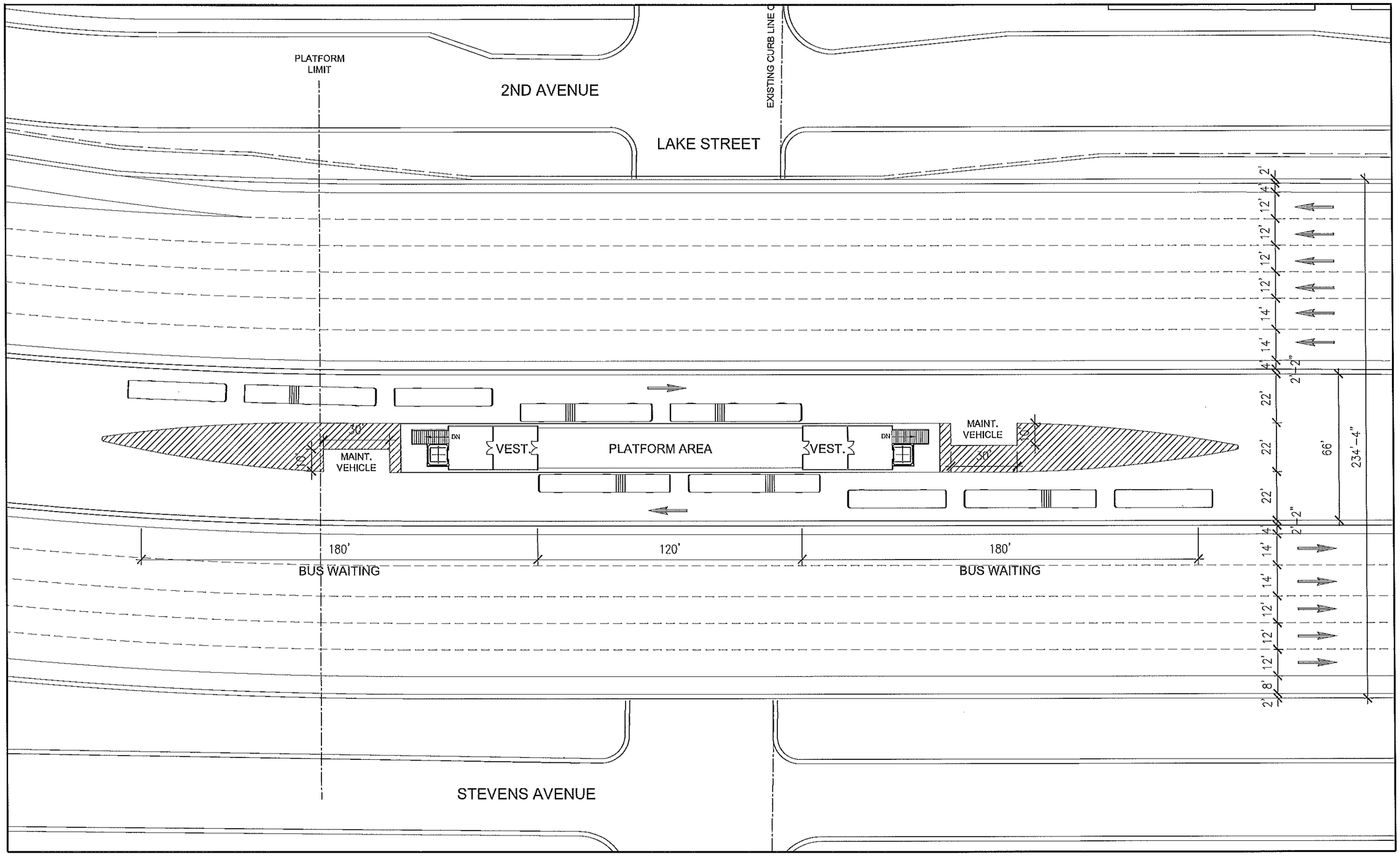

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I-35W

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SEH **MEMORANDUM**

TO: Greg Finstad, Mike Kotila, Mark Dierling

FROM: Roger Plum

DATE: September 20, 2011

RE: I-35W Lake Street BRT Station Alternative Analysis

I have analyzed the BRT station proposed for Lake Street using the assumption that this station would have essentially the same integrated traffic signal/gate-arm control system for managing freeway-level traffic as the existing Kingfield Station at I-35W and 46th Street.

Per the e-mail from Charles Carlson (Metro Transit), for this analysis it was assumed that the BRT station demand would be 100 buses per hour in the peak direction and 25 buses per hour in the opposite direction during the peak hour. Realizing that the bus arrivals would not be uniform, a small network was set up using Synchro/SimTraffic to simulate the operation. In addition, a probability analysis was performed to determine the peaking characteristics likely to be experienced in the station due to the random nature of the arrivals.

From these analyses, it was determined that a traffic control system identical to the Kingfield Station system would not provide adequate capacity to accommodate the volume of buses desired. Additional analyses were performed to for other bus volumes indicated in the Carlson e-mail. Bus demand based on existing patterns (89 buses northbound, 9 buses southbound, with 30 of the 89 buses arriving during the peak 15-minute period) was analyzed, as was the minimum acceptable demand of 60 buses in the peak direction and 15 buses in the off-peak direction.

The conclusions were essentially the same, with only the magnitude of the resulting problem varying from one analysis to another. In all cases, the reverse peak direction demand played little role in the capacity issues. Instead, it was the bus frequency and variability in the peak direction which determined the analysis outcomes. With a storage capacity of three buses per direction in the platform area, capacity issues arise when there is a fourth bus wanting to enter the station area. If that fourth bus is permitted to enter the station area, due to the crossover it is likely to block the departure path for buses in the reverse direction. If that fourth bus is held at the gate-arm prior to the station, it will be detected as an errant vehicle and trigger a sequence which in effect alters the station operation and prevents other vehicles from entering the station for approximately 60 seconds. During peak periods, this 60-second interruption in normal operation has a cascading effect which repeats the interruption until bus arrivals are reduced significantly.

Therefore, a key element in the analysis was identifying if and how frequently four buses would be attempting to use and enter the station in a relatively short period of time. Based on the assumed 15-second dwell time and a travel time of 23 seconds from the entry point of the station to the far end of the platform, the critical time is 38 seconds. In other words, if four buses attempt to enter the station within a 38-second period, the interruption sequence begins. Once the interruption sequence begins, repetition of the interruption can only be avoided if there is a 60-second gap before the next bus arrives (from either direction).

For the existing demand, the critical demand was identified as 30 vehicles arriving in 15 minutes, an average of 2 vehicles per minute. Through probability analysis it was determined that, on average, there will be one instance within that 15-minute period in which four or more vehicles will arrive within 38 seconds of each other, and there will be only an 11 percent probability that the gap following this occurrence will be greater than the 60 seconds needed to avoid further interruptions in the normal system control.

For the projected demand (100 peak direction buses in the peak hour), it was determined that there will be two occurrences in the peak hour when there is a surge of four or more buses, and the probability of a subsequent gap of 60 seconds or more is 12 percent.

Finally, for the "minimum acceptable" demand (60 peak direction buses in the peak hour), it was determined that a surge of four or more buses at the same time would occur far less frequently, approximately once during the peak hour every three days. When that happens, the probability of a subsequent gap of 60 seconds or more, though higher than the previous two analyses, is still only 29 percent.

The anticipated capacity failure of the station control system to accommodate the bus traffic is due to a combination of the higher bus demand at Lake Street and the special sequence employed at Kingfield station to accommodate vehicles which do not possess the special equipment installed on the buses.

The Kingfield traffic control system consists of an integrated traffic signal and gate arm system which accommodates specially-equipped buses as they approach the station by providing a green indication and raising a gate arm to allow entry into the platform area. With a center platform, buses must cross over from the station approach lane to the left side of the platform (to allow boarding and alighting from the platform through the doors on the right side of the bus) and then cross over back to the right side to depart the station. These crossover areas are controlled by the integrated traffic signal-gate arm system. Vehicles entering the station which do not contain the special detection equipment are detected via loop detectors embedded in the pavement at the gate arm, which activates a special sequence which first clears the station area, then allows this vehicle to enter and pass through the station. This special sequence accommodates errant vehicles and maintenance vehicles which pass through the station following the same path as the buses and snowplows which pass through the platform area in the direction opposite that followed by buses.

For the integrated traffic signal-gate arm system to perform acceptably with a center platform (i.e., crossovers required at each end of the station), the control system would require changes which would eliminate the special sequence when non-specially-equipped buses enter the station. In this revised scenario, all vehicles would be treated equally and would be detected by the system in the same fashion, for example through loop detectors embedded in the pavement. Buses entering this station would, therefore, not require special equipment to be detected. NOTE: THIS SYSTEM CONTROL MODIFICATION WOULD REQUIRE APPROVAL FROM THE FEDERAL HIGHWAY ADMINISTRATION (FHWA) AND THE MINNESOTA DEPARTMENT OF TRANSPORTATION (MNDOT). This approval may be possible due to the lack of errant vehicles experienced at the Kingfield station in its operation thus far, though accommodations for snowplows will need to be taken into account.

The numeric results presented above are based on the values provided by Metro Transit. A significant factor in the analysis was the dwell time of 15 seconds. While this may represent a realistic average value, it should be realized that even a single occurrence of a much longer dwell time – for example, for a

wheelchair boarding or alighting – has the potential of disrupting the station control system for the entire remainder of the peak period if the Kingfield Station control system is duplicated here.

SEH **MEMORANDUM**

TO: Greg Finstad, Mike Kotila, Mark Dierling

FROM: Roger Plum

DATE: October 19, 2011

RE: Lake St BRT Station Traffic Analysis
SEH No. 113114 14.00

Based on comments received at meetings with Metro Transit, I have performed additional analysis of the anticipated operation of a freeway level center platform design of the proposed Lake Street BRT station.

Many of the same assumptions used in my previous analysis have not changed: during the peak hour, 100 buses in the peak direction and 25 buses in the reverse direction, including 30 buses arriving in the peak direction within the peak 15 minutes; a speed limit of 10 mph in the station area; two boarding/alighting locations in each direction on the platform; and a typical dwell time for each bus of 15 seconds. After discussions at a previous meeting, it was determined that accommodations must be made for buses to pass another bus at the platform which may be loading or unloading a customer in a wheelchair. The "typical" 15-second dwell time does not account for dwell times in these cases.

The primary difference in this analysis is the length of the station. In the previous analysis, the length of the station, measured from the nose of the median on the north side to the nose of the median on the south side was approximately 600 feet, essentially the same as the existing BRT station at 46th Street. For this analysis, the length of the station was assumed to be 730 feet, which was determined to be the maximum length which could be accommodated within the geographic and geometric limitations imposed by design considerations.

The overall conclusion of this analysis is that a center platform design can accommodate the projected bus demands, assuming the station design can provide sufficient queuing space.

With the bus demands specified above it was determined that between 250 feet and 350 feet of queuing distance would need to be provided, depending on the sizes of buses expected to be using the station. The 350-foot queuing distance was determined through multiple operational simulations in which all buses were assumed to be articulated, i.e. 60-foot buses. The 250-foot queuing distance was determined through simulations in which all buses were assumed to be 40 feet in length. An additional simulation series was conducted in which the split between bus lengths was 80/20 (80 percent at 60 feet, 20 percent at 40 feet), with a resulting queue length requirement of 335 feet.

Essentially, in all cases enough queuing distance is needed to accommodate 5 buses, which is the maximum number of buses expected to be queued in one direction at any time during the peak hour, regardless of size. In these cases, two buses would be boarding/alighting passengers, and three buses would be waiting in line to reach the boarding areas.

As mentioned in a previous memo and at two meetings with Metro Transit, these analyses did not account for errant vehicles or snowplows, both of which would trigger a special sequence likely cause major disruption in the station operation for at least the remainder of the peak hour.

With respect to the special sequence, and also as mentioned earlier, based on experience at the 46th Street station, there have been very few, if any, errant vehicles entering the system. Therefore, it may be appropriate to approach the FHWA and MnDOT about relaxing the system control in this case to allow any vehicle to trigger a green light and gate opening rather than having errant vehicles and snowplows forcing a special sequence, creating the disruption in operation mentioned above. The EMTRAC system could continue to be used to provide calls to the system controller which, in turn, would raise the gate in advance of the bus arrival (if it is safe to do so). In addition, detectors could be positioned in the approach lane in each direction and be programmed in the controller to allow non-EMTRAC-equipped buses to receive the same priority treatment.

The disadvantage of relaxing the station control system as described above is that snowplows would also be required to follow the same path as buses, crossing over to the opposite side of the roadway at each end of the platform area. Because snow is pushed to the right side of the snowplow, this path would result in snow being plowed toward the passenger platform. Currently at the 46th Street station, snowplows drive through the platform area in the opposite direction that buses do, allowing them to plow the snow away from the platform. On the other hand, by its design the split (side) platform alternative has this same disadvantage of plowing snow toward the passenger platform. Therefore, regardless of station design, snowplowing will need to be addressed.

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