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Alternative Barrier Specifications

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Pursuant to Section 5-11(b)(2)(i)(G) of Title 34 of the Rules of the City of New York

Prepared by the New York City Department of Transportation in consultation with TY Lin



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Pursuant to the Dining Out NYC rules a barrier is defined as an object placed on all sides of a roadway cafe, other than the side that fronts the restaurant, to protect patrons of a roadway cafe, that has a fully built interior wall and bottom to hold water or such other filler approved by the New York City Department of Transportation's (NYC DOT) and that is removable. As an alternative to the barrier design requirements set forth in the Dining Out NYC rules, a barrier for a roadway cafe may comply with barrier specifications posted on the NYC DOT website.

Please see below for NYC DOT's specifications for alternative barrier designs, which allow for alternative materials that match or exceed the safety requirements set forth in the Dining Out NYC rules. Designers, businesses, and fabricators must obtain approval from NYC DOT for use of an alternative barrier design in the Dining Out NYC program.

To apply for approval, the following documents should be submitted to NYC DOT at diningoutdesign@dot.nyc.gov :

- **Design Summary**
 - The summary should include:
 - The typical design of a roadway cafe including but not limited to the materials used;
 - How the alternative barrier design complies with the Required Performance Specifications as;
 - The durability of the alternative barrier design; and
 - The method of annual removal and reinstallation of the alternative barriers and how such removal and reinstallation will occur without causing any damage that could compromise the performance of any components of the alternative barriers.
- **Alternative Barrier Design Drawings**
 - A pdf document of the typical design of a module including:
 - One plan/top view drawing;
 - Front elevation drawing;
 - Side elevation drawing; and
 - 3D view with dimensions and labels.
 - All drawings shall be signed and sealed by a professional engineer that is licensed in the State of New York.
- **Alternative Barrier Design Professional Engineer Certification**



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- A professional engineer that is licensed in the State of New York must submit a signed and sealed certification that the alternative barrier design complies with the Alternative Barrier Specifications. A form of this certification is available on NYC DOT’s Dining Out NYC’s website.

If the alternative barrier design is approved by NYC DOT, an approval letter will be issued for use of the alternative barrier design for roadway cafes in the Dining Out NYC program. Restaurants applying to the Dining Out NYC program must provide a copy of such approval letter with their Dining Out NYC application if they wish to use an approved alternative barrier design as part of their roadway cafe.

Required Performance Specifications:

i. Basis of Design – Special Criteria for Alternative Barrier Design

Crashworthiness of the alternative barrier design must be demonstrated through design calculations and analytical modeling to achieve equivalent performance to a **“base-line performance”**.

The alternative barrier design shall be based on the site and traffic conditions, including but not limited to vehicle weight, roadway speed limit, and distance to traffic lanes.

Designer may perform analysis based on crash tests complying to the criteria based on the AASHTO Testing Level 1 (TL-1) standards.

ii. Barrier Assemblies

Barrier assemblies may be contained or otherwise protected by materials or systems such that the protection compensates for any loss of connectivity to the supporting pavement and/or adjacent barriers and are demonstrated through design calculations and/or physical testing to achieve equivalent performance. Any cladding must be securely fastened or affixed to the barrier pursuant to section 5-11(b)(2)(1)(E) of Title 34 of the Rules of the City of New York (the “Dining Out NYC Rules”).

Base-Line Performance:

A **‘base-line performance’** must demonstrate equivalency to a proprietary “Yodok 2001MB- Metropolitan Barricade” including interconnecting elements to adjoining elements.



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Alternative barrier designs shall have a weight of at least 150 lb/ft and be interconnected to maintain stability and act as a group (assumed to be engaged for a total length of 18') when subject to a prescribed **failure mode***.

The following analysis must be performed by a Professional Engineer, and documentation of such analysis must be retained and provided to NYC DOT upon request:

- **Baseline Performance Calculation**
 - Determine design vehicle impact force based on site and traffic conditions, including but not limited to vehicle weight, roadway speed limit, and distance to traffic lanes
 - Calculate center of gravity of alternative barrier
 - Apply overstrength factor (factor of safety of 1.5) to get “**Design Force**”
 - Perform analysis to indicate an expected useful life estimate under normal wear/tear/seasonality conditions for the barriers or barrier and platform, if the platform is integral to the alternative barrier design
 - Perform energy dissipation analysis for the alternative barrier design based on design vehicle mass and speed

- **Point of Impact Analysis**
 - Midpoint of full barrier setup
 - Endzone
 - Other critical areas such as corner zones
 - Midpoint of individual segment

- **Overtuning Integrity at Initial Tipping**
 - Design checks for structural members
 - Design checks for connections

- **Calculation of Lateral Movements**
 - Sliding displacement – assumed to occur with a platform installed and be 0'
 - Tipping displacement and note vehicle speed at failure
 - Determine “**Design Displacement**” at platform, if applicable, and at top of barrier assembly

Additionally, barrier assemblies shall comply with the following specifications:

- Linear Design – Connecters must be designed elastically to assure overturning of three adjoining elements in one direction



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- Corner Design – Connectors must match the linear design connections (this is a practical value to avoid adding complexity to the manufacturing process)
- Barriers shall be maintained on all sides of the roadway café except the side fronting the ground floor restaurant and not be affixed to the roadway pursuant to section 5-11(b)(2)(1)(A) of the Dining Out NYC Rules
- Barriers shall be between thirty (30) inches and forty-two (42) inches in height, not including the height of any plantings above such barrier
- Barriers shall have a reflective strip of a minimum of four (4) inches located on each barrier along the entire length of the outward-facing side of such barrier pursuant to section 5-11(b)(2)(1)(F) of the Dining Out NYC Rules
- Materials and connections used for barrier assemblies must not fail prior to barrier **failure mode**, as described below.

*The purpose of the design is to preclude premature failure of individual elements or connections prior to achieving full energy absorption of this **failure mode**. The impact scenario selected is a transverse load condition created by the lateral impact of a vehicle misaligned with the roadway. No longitudinal load is considered. The **failure mode** is assumed to occur where the energy absorbed by the system is limited to that required to overturn the barriers and no lateral displacement is accounted for because lateral restraint against sliding shall be provided by the barriers and platform elements(if applicable). Other modes of failure may occur at lower force levels due to unique conditions involved in a collision. The other modes of failure may include sliding, overturning, platform budding or failure, and vertical structure collapse.

iii. Connections Between Barriers

Connections may consist of proprietary tested connections or engineered elements interconnected to maintain stability and act as a group upon a variety of lateral, and angled trajectory impact conditions. Connections shall be designed to withstand the design vehicle impact force.

The following analysis must be performed by a professional engineer, and documentation of such analysis must be retained and provided to NYC DOT upon request:

- Design checks for structural members and connections under maximum overturning forces
- Include requirements for any secondary support shims or wedges, placed beneath the barriers to transfer the full weight of the barriers directly to the pavement. Indicate size and placement to assure continuous support



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through any movements anticipated under the design force scenario. Once tipping or design force is determined the alternative barrier design must take this force down to the street level as a rigid body. The connections between the components must be designed for all applicable loadings. All computations should be accompanied by a clearly labelled force diagram and governing design forces/moments from the analysis shall be clearly labelled on output.

iv. Platform (As Applicable)

If an alternative barrier design includes a connected platform, the platforms must be designed to elastically resist the worst-case forces resulting from vehicular impact under the design forces. These forces will include axial and bending stresses. All connections between the barrier systems and the platform must also be designed using this same principle.

Platforms are to be constructed of durable materials that can be readily removed and reinstalled seasonally without causing damage or distress to connections or components that might impact the performance of the installation.

Analysis should clearly show and account for the use of a platform as part of the alternative barrier design system and how the platform is utilized to help counteract the forces of an impact.

The following analysis must be performed by a professional engineer, and documentation of such analysis must be retained and provided to NYC DOT upon request:

- Determine transfer force between barrier assembly and platform at initial tipping
 - Design checks for structural stability of the system
 - Design checks for connections
 - Platform design live loads can be taken as 100 psf minimum.