Designation: C1802 − 18b

Standard Specification for
Design, Testing, Manufacture, Selection, and Installation of Fabricated Metal Horizontal Access Hatches for Utility, Water, and Wastewater Structures[1,2]

This standard is issued under the fixed designation C1802; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This specification covers the design, testing, manufacture, selection, and installation of fabricated metal access hatches for utility, water, and wastewater structures including utility vaults, drainage structures, valve vaults, meter vaults, wet wells, pump enclosures, utility trenches, piping trenches, and drainage trenches.

1.2 This specification is applicable to various configurations of access hatches constructed of fabricated metal of various materials and grades for various loading conditions, traffic speeds, or both.

1.3 Engineering design and testing criteria are provided for access hatches to be located in various areas subjected to various loading conditions, traffic speed, frequency, or combinations thereof.

1.4 Proof loading criteria is provided to allow the access hatches to be designed by engineering calculation and/or by ultimate strength load testing.

1.5 Production loading criteria is provided to allow the access hatches to be tested to verify the load capacity of the manufactured hatches.

1.6 Hatch loading selection guidelines are included to allow selection of the proper hatch design loading for the conditions of the actual area of placement.

1.7 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered the standard.

1.8 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.9 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[3]

A36/A36M Specification for Carbon Structural Steel

A53/A53M Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless

A123/A123M Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

A176 Specification for Stainless and Heat-Resisting Chromium Steel Plate, Sheet, and Strip (Withdrawn 2015)[4]

A240/A240M Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications

A242/A242M Specification for High-Strength Low-Alloy Structural Steel

A276 Specification for Stainless Steel Bars and Shapes

A325 Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength (Withdrawn 2016)[4]

A490 Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength (Withdrawn 2016)[4]

[1] This specification is under the jurisdiction of ASTM Committee C27 on Precast Concrete Products and is the direct responsibility of Subcommittee C27.10 on Utility Structures.

Current edition approved Dec. 1, 2018. Published December 2018. Originally approved in 2014. Last previous edition approved in 2018 as C1802–18a. DOI: 10.1520/C1802-18B.

[2] This specification is primarily a design, testing, manufacturing, selection, purchasing, and installation specification. The successful performance of this product depends upon the proper selection of the loading criteria based on the product's actual use and the products proper installation. The purchaser of the fabricated metal access hatches specified herein is cautioned that proper correlation of the loading conditions, proper installation for the hatch specified, and provision for inspection of the installation at the construction site, are required.

[3] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[4] The last approved version of this historical standard is referenced on www.astm.org.

A500/A500M Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
A514/A514M Specification for High-Yield-Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding
A529/A529M Specification for High-Strength Carbon-Manganese Steel of Structural Quality
A572/A572M Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
A588/A588M Specification for High-Strength Low-Alloy Structural Steel, up to 50 ksi [345 MPa] Minimum Yield Point, with Atmospheric Corrosion Resistance
A618/A618M Specification for Hot-Formed Welded and Seamless High-Strength Low-Alloy Structural Tubing
A656/A656M Specification for Hot-Rolled Structural Steel, High-Strength Low-Alloy Plate with Improved Formability
A666 Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
A786/A786M Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates
A847/A847M Specification for Cold-Formed Welded and Seamless High-Strength, Low-Alloy Structural Tubing with Improved Atmospheric Corrosion Resistance
A852/A852M Specification for Quenched and Tempered Low-Alloy Structural Steel Plate with 70 ksi [485 MPa] Minimum Yield Strength to 4 in. [100 mm] Thick (Withdrawn 2010)[4]
A913/A913M Specification for High-Strength Low-Alloy Steel Shapes of Structural Quality, Produced by Quenching and Self-Tempering Process (QST)
A992/A992M Specification for Structural Steel Shapes
B209 Specification for Aluminum and Aluminum-Alloy Sheet and Plate
B210 Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes
B211 Specification for Aluminum and Aluminum-Alloy Rolled or Cold Finished Bar, Rod, and Wire
B221 Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
B241/B241M Specification for Aluminum and Aluminum-Alloy Seamless Pipe and Seamless Extruded Tube
B247 Specification for Aluminum and Aluminum-Alloy Die Forgings, Hand Forgings, and Rolled Ring Forgings
B308/B308M Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles
B316/B316M Specification for Aluminum and Aluminum-Alloy Rivet and Cold-Heading Wire and Rods
B429/B429M Specification for Aluminum-Alloy Extruded Structural Pipe and Tube
B632/B632M Specification for Aluminum-Alloy Rolled Tread Plate
B928/B928M Specification for High Magnesium Aluminum-Alloy Products for Marine Service and Similar Environments
C478 Specification for Circular Precast Reinforced Concrete Manhole Sections
C857 Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
C890 Practice for Minimum Structural Design Loading for Monolithic or Sectional Precast Concrete Water and Wastewater Structures
E4 Practices for Force Verification of Testing Machines
E2309/E2309M Practices for Verification of Displacement Measuring Systems and Devices Used in Material Testing Machines
F467 Specification for Nonferrous Nuts for General Use
F468 Specification for Nonferrous Bolts, Hex Cap Screws, Socket Head Cap Screws, and Studs for General Use

2.2 *AASHTO Standards and Specifications:*[5]
AASHTO Standard Specifications for Highway Bridges (current edition)
AASHTO LRFD Bridge Design Specification (current edition)

2.3 *The American Institute of Steel Construction Specifications:*[6]
ANSI/AISC 360 Specification for Structural Steel Buildings (current edition)

2.4 *ASCE Specifications:*[7]
SEI/ASCE 8 Specification for the Design of Cold-Formed Stainless Steel Structural Members (current edition)

2.5 *The Aluminum Association:*[8]
Aluminum Design Manual (current edition)

2.6 *The American Welding Society Codes:*[9]
D1.1 Structural Welding Code—Steel (current edition)
D1.2 Structural Welding Code—Aluminum (current edition)
D1.6 Structural Welding Code—Stainless Steel (current edition)

2.7 *The U.S. Department of Transportation Federal Aviation Administration Advisory Circulars:*[10]
Advisory Circular No. 150/5320-6E

3. Terminology

3.1 *Definitions:*

3.1.1 *AA, n*—Aluminum Association.

3.1.2 *access hatch, n*—an assembly of a hatch door and optional frame providing a horizontal structural covering of an opening that provides access to the structure below.

3.1.3 *access hatch door, n*—the access hatch horizontal cover that is either removable or hinged to provide access to the structure below.

[5] Available from American Association of State Highway and Transportation Officials (AASHTO), 444 N. Capitol St., NW, Suite 249, Washington, DC 20001, http://www.transportation.org.

[6] Available from American Institute of Steel Construction (AISC), 1 East Wacker Drive, Suite 3100, Chicago, Illinois 60601, http://www.aisc.org.

[7] Available from American Society of Civil Engineers (ASCE), 1801 Alexander Bell Drive, Reston, Virginia, 20191, http://www.asce.org.

[8] Available from The Aluminum Association (AA), 1525 Wilson Blvd Suite 600, Arlington Virginia, 22209, http://www.aluminum.org.

[9] Available from The American Welding Society (AWS), 8669 NW 36 Street no. 130, Doral, Florida, 33166, http://www.aws.org.

[10] Available from The U.S. Department of Transportation Federal Aviation Administration, http://www.faa.gov.

3.1.4 *access hatch frame, n*—the perimeter fabrication around an access hatch door that provides attachment to the opening in the structure below.

3.1.5 *AISC, n*—American Institute of Steel Construction.

3.1.6 *ASCE, n*—American Society of Civil Engineers.

3.1.7 *ASTM, n*—ASTM International.

3.1.8 *ASD, n*—allowable stress design.

3.1.9 *AWS, n*—American Welding Society.

3.1.10 *fabricated metal, n*—an assembly of cut, bent, or machined metal parts that are welded or bolted together to become the final assembly.

3.1.11 *finite element modeling, n*—to numerically three dimensionally model an assembly by subdividing the assembly into smaller elements and applying a load to determine the stresses in each of the elements.

3.1.12 *load level, n*—a number between one and ten that corresponds to the description of the loads and applicable use in this specification.

3.1.13 *LRFD, n*—load and resistance factor design.

3.1.14 *production loading, v*—test loading to a force level less than yield strength to verify the load capacity of the manufactured hatch.

3.1.15 *proof loading, v*—test loading to a force level of the load times a safety factor to prove the design of an access hatch.

3.1.16 *protective coatings, n*—galvanizing, painting, or powder coating metal surfaces to provide corrosion and environmental protection.

3.1.17 *purchaser, n*—the person or entity buying an access hatch from the manufacturer.

3.1.18 *structural stiffeners, n*—structural metallic shapes or bent metallic shapes attached to the bottom of the top plate surface of an access door to strengthen its structural properties.

3.1.19 *top plate, n*—the metallic top surface of an access door that receives the pedestrian or vehicular load directly.

3.1.20 *ultimate strength, n*—the stress of a metallic material when failure occurs.

3.1.21 *ultimate strength load, n*—the "safety" factored load obtained by applying a load factor to the load.

3.1.22 *weld filler, n*—the material deposited by a welding operation.

3.1.23 *working stress load, n*—load applied without load factors, but with capacity reduction factors applied to the materials being utilized.

3.1.24 *yield strength, n*—the stress of a metallic material when permanent deflection first occurs and as tested at 0.2 % offset.

4. Significance and Use

4.1 This specification is intended to standardize the minimum load level criteria for structural design of fabricated metal access hatches.

4.2 The users are cautioned that they must properly identify the anticipated current and future anticipated field loading conditions and requirements with the design loads. It is not prohibited for field conditions to dictate loads greater than the minimum load levels presented here.

5. Designation

5.1 The fabricated metal hatches manufactured in accordance with this specification shall be legibly marked with the manufacturer's name or trademark, the specification designation, the load level, the nominal opening dimensions unless included in the part number, and the month and year of manufacture or a serial number on the inside of the access hatch cover or frame as described in Section 21.

6. Basis of Acceptance

6.1 Acceptability of the access hatches shall be determined based on the design in accordance with Section 9, the physical requirements described in Sections 13 – 18, the material requirements described in Section 7, and physical inspection of the access hatches.

6.2 Access hatches shall be considered ready for acceptance when they conform to all requirements of this specification.

7. Materials

7.1 The material of each component of the access hatch assembly shall be suitable for its specific application within the assembly, to be determined by the expected function, the required strength, and the environmental exposure.

7.2 *Steel Access Hatches:*

7.2.1 The minimum yield strength of all steel components of the access hatch shall be 36 000 psi (248.22 MPa) and the yield strengths utilized shall be stated on the calculations and fabrication drawings.

7.2.2 Material specifications and grades shall be selected based on required design yield strength, formability, and weld ability.

7.2.3 The following materials are considered to be appropriate materials for this application:

(1) Specification A36/A36M carbon steel plates, bars, structural shapes, and threaded rods,

(2) Specification A53/A53M Grade B carbon steel pipes,

(3) Specification A242/A242M corrosion resistant high strength low alloy steel plates, bars, and structural shapes,

(4) Specification A325 steel bolts,

(5) Specification A490 steel bolts,

(6) Specification A500/A500M Grade B carbon steel HSS rectangles and rounds,

(7) Specification A514/A514M quenched and tempered alloy steel plates,

(8) Specification A529/A529M carbon steel plates, bars, and structural shapes,

(9) Specification A572/A572M high strength low alloy steel plates, bars, and structural shapes,

(10) Specification A588/A588M corrosion resistant high strength low alloy steel plates, bars, and structural shapes,

(11) Specification A618/A618M high strength low alloy steel HSS rectangles and rounds,

(12) Specification A656/A656M high strength low alloy steel plates,

(13) Specification A786/A786M steel floor plate meeting the strength requirements of Specifications A36/A36M, A572/A572M, or A588/A588M,

(14) Specification A847/A847M corrosion resistant high strength low alloy steel HSS rectangles and rounds,

(15) Specification A852/A852M quenched and tempered low alloy steel plates,

(16) Specification A913/A913M high strength low alloy steel structural shapes, and

(17) Specification A992/A992M high strength low alloy steel structural shapes.

7.2.4 Weld filler materials shall have a minimum tensile strength of 70 000 psi (482.65 MPa) and be selected based on the various combinations of base material welded in accordance with the requirements of the American Welding Society D1.1 structural welding code.

7.2.5 If corrosion protection is provided by galvanizing, the process and material shall meet the requirements of Specification A123/A123M and have a minimum coating weight of 2.0 oz/ft^2 (0.61 kg/m^2).

7.3 *Stainless Steel Access Hatches:*

7.3.1 The minimum yield strength of all stainless steel components of the access hatch shall be 30 000 psi (206.85 MPa) and the yield strengths utilized shall be stated on the calculations and fabrication drawings.

7.3.2 Material specifications and grades shall be selected based on required design yield strength, formability, weld ability, and corrosion resistance.

7.3.3 The following materials are considered to be appropriate materials for this application:

(1) A176 stainless and heat-resisting chromium steel plate, sheet, and strip,

(2) A240/A240M chromium and chromium nickel stainless steel plate, sheet, and strip ,

(3) A276 stainless steel bars and shapes, and

(4) A666 annealed or cold worked austenitic stainless steel sheet, strip, plate, and flat bar.

7.3.4 The following material grades are considered to be appropriate materials for this application:

(1) 304 stainless steel,

(2) 304L stainlesssteel,

(3) 308 stainless steel,

(4) 308L stainless steel,

(5) 316 stainless steel, and

(6) 316L stainless steel.

7.3.4.1 The specific material grade used shall meet the chemical and mechanical properties included in the specifications referenced in 7.3.3.

7.3.5 Weld filler materials shall have a minimum ultimate tensile strength of 70 000 psi (482.65 MPa) and be selected based on the various combinations of base material welded in accordance with the requirements of the American Welding Society D1.6 structural welding code.

7.4 *Aluminum Access Hatches:*

7.4.1 The minimum tensile yield strength shall be 23 000 psi (158.585 MPa) and the minimum compressive yield strength shall be 21 000 psi (144.795 MPa) for all aluminum components of the access hatch. The yield strengths utilized shall be stated on the calculations and fabrication drawings.

7.4.2 Material specifications, alloys, and tempers shall be selected based on required design yield strengths, formability, weld ability, corrosion resistance, and potential temperature exposure.

7.4.3 The following materials are considered to be appropriate materials for this application:

(1) Specification B209 aluminum and aluminum alloy sheet and plate,

(2) Specification B210 aluminum and aluminum alloy drawn seamless tubes,

(3) Specification B211 aluminum and aluminum alloy extruded bar, rod, and wire,

(4) Specification B221 aluminum and aluminum alloy extruded bars, rods, wire, profiles, and tubes,

(5) Specification B241/B241M aluminum and aluminum alloy seamless pipe and seamless extruded tube,

(6) Specification B247 aluminum and aluminum alloy die forgings, hand forgings, and rolled ring forgings,

(7) Specification B308/B308M aluminum-alloy 6061-T6 standard structural profiles,

(8) Specification B316/B316M aluminum and aluminum alloy rivet and cold heading wire and rods,

(9) Specification B429/B429M aluminum and aluminum alloy extruded pipe and tube,

(10) Specification B632/B632M aluminum and aluminum alloy rolled tread plate,

(11) ASTM B928/B928M high magnesium aluminum alloy sheet and plate for marine service and similar environments,

(12) Specification F467 nonferrous bolts, hex cap screws and studs, and

(13) Specification F468 nonferrous nuts.

7.4.4 The following designated alloys and tempers are considered to be appropriate alloys and tempers for this application:

(1) Alloy 3004 Temper H38 wrought aluminum sheets,

(2) Alloy 5052 Temper H32 wrought aluminum sheets,

(3) Alloy 5052 Temper H36 wrought aluminum sheets

(4) Alloy 5083 Temper H321 wrought aluminum sheets and plates,

(5) Alloy 5086 Temper H34 wrought aluminum sheets, plates, and drawn tubes,

(6) Alloy 5086 Temper H116 wrought aluminum sheets,

(7) Alloy 5456 Temper H116 wrought aluminum sheets and plates,

(8) Alloy 5456 Temper H321 wrought aluminum sheets and plates,

(9) Alloy 6005 Temper T5 wrought aluminum extrusions,

(10) Alloy 6005A Temper T61 wrought aluminum extrusions,

(11) Alloy 6061 Temper T6 wrought aluminum sheets, plates, extrusions, rods, bars, drawn tubes, and pipes,

(12) Alloy 6061 Temper T651 wrought aluminum sheets, plates, extrusions, rods, bars, drawn tubes, and pipes, and

(13) Alloy 6063 Temper T6 wrought aluminum extrusions and pipes

7.4.4.1 The specific material alloy and temper used shall meet the chemical and mechanical properties included in the specifications referenced in 7.4.3.

7.4.5 Weld filler materials shall have a minimum tensile strength of 31 000 psi (213.75 MPa), a minimum ultimate shear strength of 17 000 psi (117.22 MPa), and be selected based on the various combinations of base material welded in accordance with the requirements of the American Welding Society D1.2 structural welding code.

7.4.6 Protective coatings shall be provided for the exterior portion of aluminum frames and skirts that are to be cast in fresh concrete to prevent corrosion.

8. Material Certification

8.1 All metal material deliveries to the manufacturer's facilities shall include mill certification documentation that includes the material specification designation, the chemical analysis, the yield strength, and the ultimate strength from the material's test results.

8.2 The mill certification documents shall be reviewed by the manufacturer's quality control personnel to assure compliance with the required specifications and any material not meeting the specification shall be rejected and returned to the source.

8.3 Mill certifications shall be marked with the date the material is received and maintained by the hatch manufacturer for a minimum period of seven years.

8.4 If requested by the purchaser at the time of request for quotation, specific material mill certifications for the hatches provided shall be provided by the manufacturer at the time of access hatch delivery.

9. Load Levels and Design Requirements

9.1 *Load Levels*—The following are designated load levels with their appropriate applications.

9.1.1 *Load Level 1—Light Pedestrian Load:*

9.1.1.1 It is not prohibited to utilize Load Level 1 designs in walkways and other areas that are totally inaccessible to all vehicle traffic. Examples of appropriate use include the interiors of buildings, elevated walkways, and elevated platforms with top surfaces a minimum of one foot above finished grade. Appropriate locations for Load Level 1 access hatches are shown in Fig. 1.

9.1.1.2 *Level 1 Loading*—A design loading of 150 psf (7.18 kPa) and a concentrated design load of 300 lbf (136.08 kgf) applied to a 5.50 by 5.50 in. (139.70 by 139.70 mm) area shall be analyzed non-simultaneously. If structural stiffeners are utilized, the access cover top plate shall be designed as a span between structural stiffener webs and as a cantilever at the perimeter of the cover for an applied uniform load of 10 psi (68.95 kPa) applied to a 5.50 by 5.50 in. (139.70 by 139.70 mm) area.

9.1.1.3 *Level 1—Applicable Design Methods:*

(1) Steel access hatches shall be designed by calculation utilizing the Allowable Stress Design method as specified in ANSI/AISC 360 Specification for Structural Steel Buildings, the Load and Resistance Factor Design method as specified in ANSI/AISC 360 Specification for Structural Steel Buildings, the methods included in the AASHTO Standard Specifications for Highway Bridges, or the methods included in the AASHTO LRFD Bridge Design Specification.

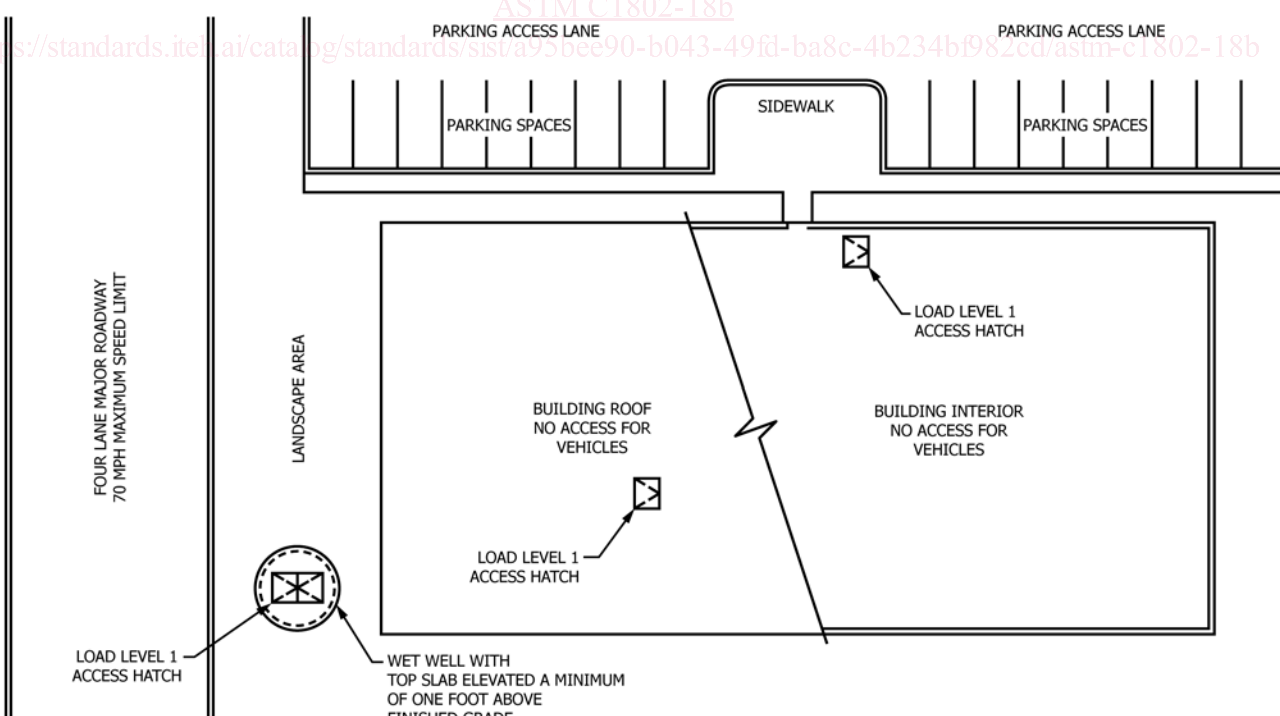

FIG. 1 Plan Showing Appropriate Locations for Load Level 1 Access Hatches—Light Pedestrian Load

(2) Stainless steel access hatches shall be designed by calculation utilizing the American Society of Civil Engineers SEI/ASCE 8 Specification for the Design of Cold-Formed Stainless Steel Structural Members Allowable Stress Design method, the American Society of Civil Engineers SEI/ASCE Specification for the Design of Cold-Formed Stainless Steel Structural Members Load and Resistance Factor Design method, the methods included in the AASHTO Standard Specifications for Highway bridges, or the methods in the AASHTO LRFD Bridge Design Specification.

(3) Aluminum access hatches shall be designed by calculation utilizing the Aluminum Association's Aluminum Design Manual Allowable Strength method, the Aluminum Association's Aluminum Design Manual Load and Resistance Factor design method, the methods included in the AASHTO Standard Specifications for Highway Bridges, or the methods in the AASHTO LRFD Bridge Design Specification. Weld affected areas of aluminum access hatches shall be considered in the calculation as specified in the applicable design method.

(4) It is not prohibited that steel, stainless steel, or aluminum access hatches be designed, instead of by calculation, by prototype proof loading to a force of 1.60 times the applicable loads, 240 psf load (11.49 kPa) and 480 lbf (217.73 kgf) on a 5.50 by 5.50 in. (139.70 by 139.70 mm) area non-simultaneously, without permanent deflection greater than 0.02 in. (0.51 mm) or cracking. Each proof loading test shall be repeated ten times on the same fabrication to demonstrate that progressive failure does not occur.

9.1.1.4 *Level 1 Deflection*—Live load deflection by calculation or by loading at working stress levels, 150 psf (7.18 kPa) and a design load of 300 lbf (136.08 kgf) applied to a 5.50 by 5.50 in. (139.70 by 139.70 mm) area applied non-simultaneously, shall not exceed the lesser of the span divided by 200 or 3⁄16 in. (4.76 mm).

9.1.2 *Load Level 2—Pedestrian Load:*

9.1.2.1 It is not prohibited to utilize Load Level 2 designs in any Load Level 1 application and in areas restricted to pedestrian use and light maintenance vehicle use. Examples of appropriate use include walkways and landscape areas where curbs, bollards, or both restrict vehicle access. Appropriate locations for Load Level 2 access hatches are shown in Fig. 2.

9.1.2.2 *Level 2 Loading*—A design loading of 300 psf (14.36 kPa) and a concentrated design load of 600 lbf (272.16 kgf) applied to a 5.50 by 5.50 in. (139.70 by 139.70 mm) area shall be analyzed non-simultaneously. If structural stiffeners are utilized, the access cover top plate shall be designed as a span between structural stiffener webs and as a cantilever at the perimeter of the cover for an applied uniform load of 20 psi (139.70 kPa) applied to a 5.50 by 5.50 in. (139.70 by 139.70 mm) area.

9.1.2.3 *Level 2—Applicable Design Methods:*

(1) Steel access hatches shall be designed by calculation utilizing the Allowable Stress Design Method as specified in ANSI/AISC 360 Specification for Structural Steel Buildings, the Load and Resistance Factor Design method as specified in ANSI/AISC 360 Specification for Structural Steel Buildings, the methods included in the AASHTO Standard Specifications for Highway Bridges, or the methods included in the AASHTO LRFD Bridge Design Specification.

(2) Stainless steel access hatches shall be designed by calculation utilizing the American Society of Civil Engineers SEI/ASCE 8 Specification for the Design of Cold-Formed Stainless Steel Structural Members Allowable Stress Design method, the American Society of Civil Engineers SEI/ASCE 8

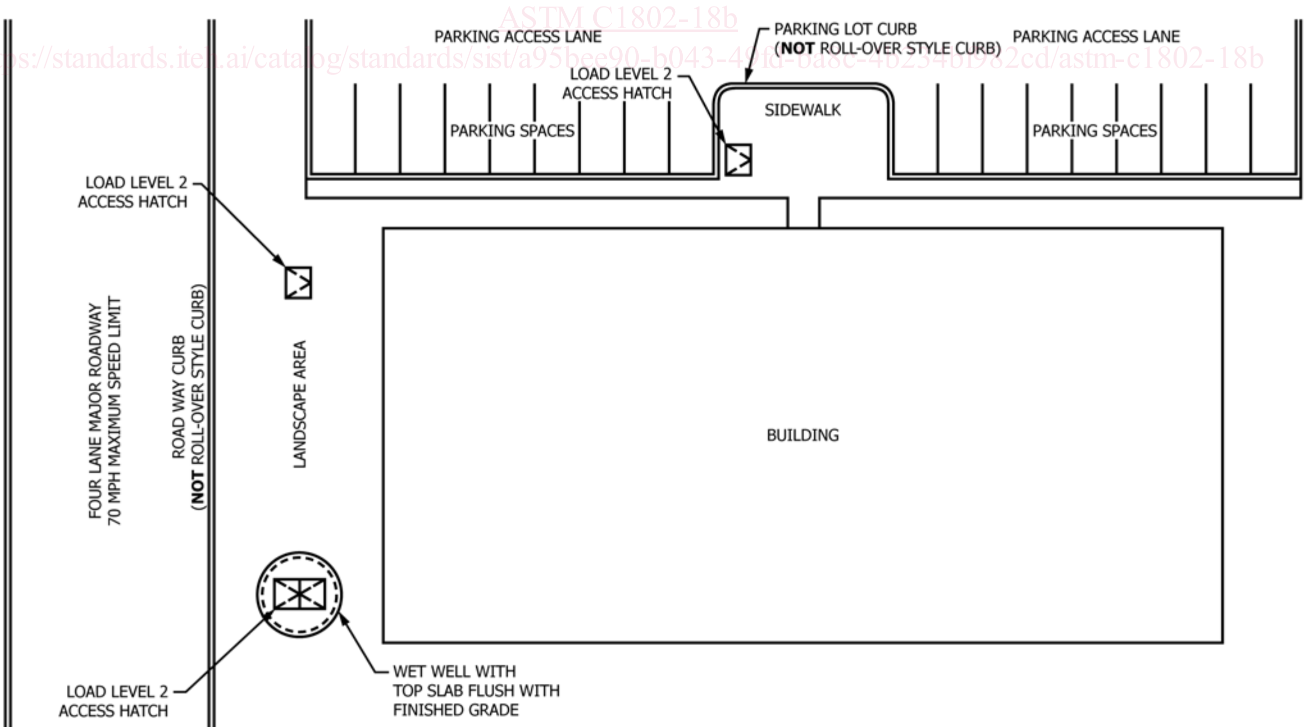

FIG. 2 Plan Showing Appropriate Locations for Load Level 2 Access Hatches—Pedestrian Load

Specification for the Design of Cold-Formed Stainless Steel Structural Members Load and Resistance Factor Design method, the methods included in the AASHTO Standard Specifications for Highway bridges, or the methods in the AASHTO LRFD Bridge Design Specification.

(3) Aluminum access hatches shall be designed by calculation utilizing the Aluminum Association's Aluminum Design Manual Allowable Strength method, the Aluminum Association's Aluminum Design Manual Load and Resistance Factor design method, the methods included in the AASHTO Standard Specifications for Highway Bridges, or the methods in the AASHTO LRFD Bridge Design Specification. Weld affected areas of aluminum access hatches shall be considered in the calculation as specified in the applicable design method.

(4) It is not prohibited that steel, stainless steel, or aluminum access hatches be designed, instead of by calculation, by prototype proof loading to a force of 1.60 times the applicable loads, 480 psf (22.98 kPa) and 960 lbf (435.46 kgf) on a 5.50 by 5.50 in. (139.70 by 139.70 mm) area non-simultaneously, without permanent deflection greater than 0.02 in. (0.51 mm) or cracking. Each proof loading test shall be repeated ten times on the same fabrication to demonstrate that progressive failure does not occur.

9.1.2.4 *Level 2 Deflection*—Live load deflection by calculation or by loading at working stress levels, 300 psf load (14.36 kPa) and a design load of 600 lbf (272.16 kgf) applied to a 5.50 by 5.50 in. (139.70 by 139.70 mm) area applied non-simultaneously, shall not exceed the lesser of the span divided by 200 or 3⁄16 in. (4.76 mm).

9.1.3 *Load Level 3—Light Vehicular Traffic:*

9.1.3.1 It is not prohibited to utilize Load Level 3 designs in any Level 1 or Level 2 application, parking spaces that are accessible only to passenger vehicles and areas that are protected within close proximity of roadways. This Level 3 loading is not applicable to unrestricted parking lot access lanes or other areas that can be accessed by heavily loaded truck traffic. Appropriate locations for Load Level 3 access hatches are shown in Fig. 3.

9.1.3.2 *Level 3 Loading:*

(1) A concentrated design loading of an 8000 lbf load (3628.80 kgf) without a dynamic (impact) load applied to a 10 by 10 in. (254 by 254 mm) footprint. The footprint shall be positioned to produce both the maximum moment and the maximum shear.

(2) If the span of an access hatch exceeds 48 in. (1219 mm), an additional load case of two 8000 lbf (3628.80 kgf) loads without a dynamic (impact) allowance applied to 10 by 10 in. (254 by 254 mm) footprints at 48 in. (1219 mm) on center span shall be investigated. The footprints shall be positioned to produce both the maximum moment and the maximum shear.

(3) If structural stiffeners are utilized, the access hatch top plate shall be designed as a span between structural stiffener webs and as a cantilever at the perimeter of the hatch for an applied uniform load of 80 psi (551.60 kPa) applied to a 10.00 by 10.00 in. (254 by 254 mm) area.

9.1.3.3 *Level 3—Applicable Design Methods:*

(1) Steel access hatches shall be designed by calculation utilizing the Allowable Stress Design method as specified in ANSI/AISC 360 Specification for Structural Steel Buildings, the Load and Resistance Factor Design method as specified in ANSI/AISC 360 Specification for Structural Steel Buildings, the methods included in the AASHTO Standard Specifications for Highway Bridges, or the methods included in the AASHTO LRFD Bridge Design Specification.

(2) Stainless steel access hatches shall be designed by calculation utilizing the American Society of Civil Engineers SEI/ASCE 8 Specification for the Design of Cold-Formed

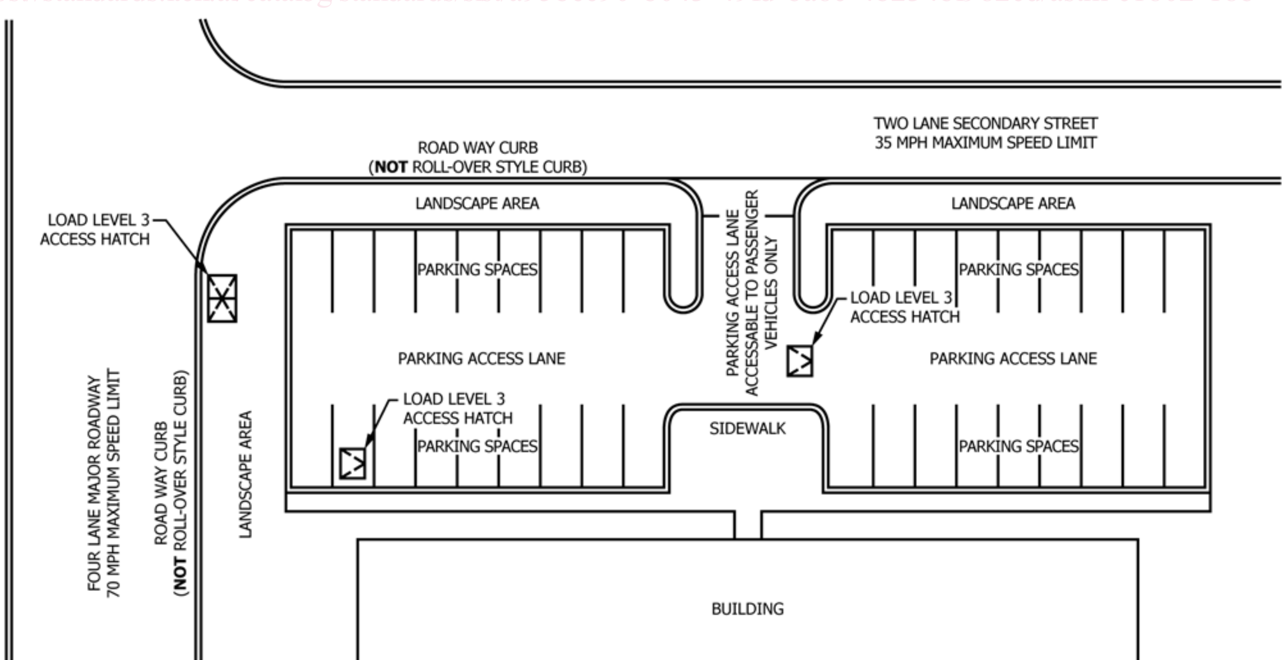

FIG. 3 Plan Showing Appropriate Locations for Load Level 3 Access Hatches—Light Vehicular Traffic

Stainless Steel Structural Members Allowable Stress Design method, the American Society of Civil Engineers SEI/ASCE 8 Specification for the Design of Cold-Formed Stainless Steel Structural Members Load and Resistance Factor Design method, the methods included in the AASHTO Standard Specifications for Highway Bridges, or the methods included in the AASHTO LRFD Bridge Design Specification.

(3) Aluminum access hatches shall be designed by calculation utilizing the Aluminum Association's Aluminum Design Manual Allowable Strength method, the Aluminum Association's Aluminum Design Manual Load and Resistance Factor design method, the methods included in the AASHTO Standard Specifications for Highway Bridges, or the methods in the AASHTO LRFD Bridge Design Specification. Weld affected areas of aluminum access hatches shall be considered in the calculation as specified in the applicable design method.

(4) It is not prohibited that steel, stainless steel, or aluminum access hatches be designed, instead of by calculation, by prototype proof loading to a force of 1.60 times the applicable load, 12 800 lbf load (5806.08 kgf), without permanent deflection greater than 0.02 in. (0.51 mm) or cracking. If the span of an access hatch exceeds 48 in. (1219 mm), the additional load cases described in 9.1.3.3 shall be prototype proof loaded to a force of 1.60 times the applicable load. The loads shall be tested in the position that produces the maximum moment and in the position that produces the maximum shear. Each proof loading test shall be repeated ten times on the same fabrication to demonstrate that progressive failure does not occur.

9.1.3.4 *Level 3 Deflection*—Live load deflection by calculation or by loading at working stress levels, 8000 lbf load (3548.80 kgf), shall not exceed the lesser of the span divided by 250 or 3⁄16 in. (4.76 mm).

9.1.4 *Load Level 4—Occasional Truck Traffic:*

9.1.4.1 It is not prohibited to utilize Load Level 4 designs in any Level 1, 2, or 3 application, unrestricted parking spaces, and areas within close proximity of roadways. This Level 4 loading is not applicable to unrestricted parking lot access lanes or other areas that can be frequently traveled by heavily loaded truck traffic. Appropriate locations for Load Level 4 access hatches are shown in Fig. 4.

9.1.4.2 *Level 4 Loading:*

(1) A concentrated design loading of a 16 000 lbf load (7257.60 kgf) without a dynamic (impact) load applied to a 10 by 20 in. (254 by 508 mm) footprint with traffic both parallel and perpendicular to the span. The footprint shall be positioned to produce both the maximum moment and the maximum shear.

(2) If the span of an access hatch exceeds 48 in. (1219 mm), an additional load case of two 16 000 lbf (7257.60 kgf) loads without a dynamic (impact) allowance applied to 10 by 20 in. (254 by 508 mm) footprints at 48 in. (1219 mm) on center with traffic perpendicular to the span shall be investigated, and an additional load case of two 12 500 lbf (5670.00 kgf) loads without a dynamic (impact) allowance applied to 10 by 20 in. (254 by 508 mm) footprints at 48 in. (1219 mm) on center with traffic parallel to the span shall be investigated. The footprints shall be positioned to produce both the maximum moment and the maximum shear.

(3) If structural stiffeners are utilized, the access hatch top plate shall be designed as a span between structural stiffener webs and as a cantilever at the perimeter of the hatch for an applied uniform load of 80 psi (551.60 kPa) applied to a 10.00 by 20.00 in. (254 by 508 mm) area.

9.1.4.3 *Level 4—Applicable Design Methods:*

(1) Steel access hatches shall be designed by calculation utilizing the Allowable Stress Design method as specified in

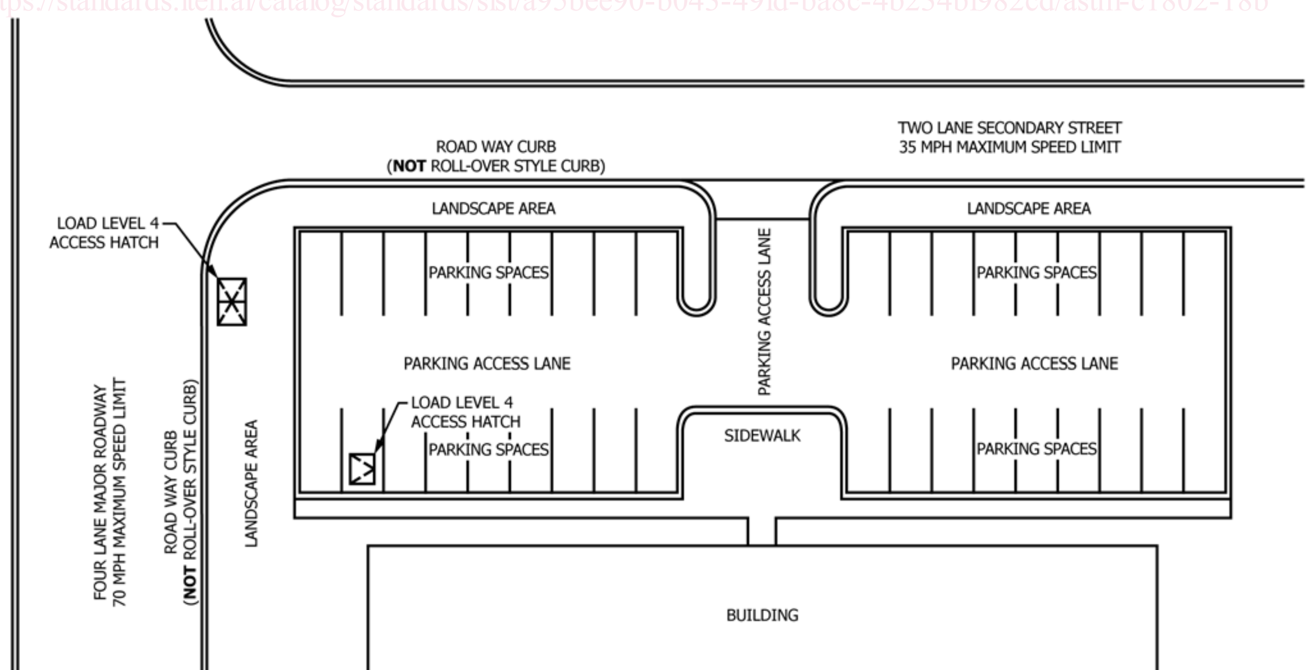

FIG. 4 Plan Showing Appropriate Locations for Load Level 4 Access Hatches—Occasional Truck Traffic

ANSI/AISC 360 Specification for Structural Steel Buildings, the Load and Resistance Factor Design method as specified in ANSI/AISC 360 Specification for Structural Steel Buildings, the methods included in the AASHTO Standard Specifications for Highway Bridges, or the methods included in the AASHTO LRFD Bridge Design Specification.

(2) Stainless steel access hatches shall be designed by calculation utilizing the American Society of Civil Engineers SEI/ASCE 8 Specification for the Design of Cold-Formed Stainless Steel Structural Members Allowable Stress Design method, the American Society of Civil Engineers SEI/ASCE 8 Specification for the Design of Cold-Formed Stainless Steel Structural Members Load and Resistance Factor Design method, the methods included in the AASHTO Standard Specifications for Highway Bridges, or the methods included in the AASHTO LRFD Bridge Design Specification.

(3) Aluminum access hatches shall be designed by calculation utilizing the Aluminum Association's Aluminum Design Manual Allowable Strength method, the Aluminum Association's Aluminum Design Manual Load and Resistance Factor design method, the methods included in the AASHTO Standard Specifications for Highway Bridges, or the methods in the AASHTO LRFD Bridge Design Specification. Weld affected areas of aluminum access hatches shall be considered in the calculation as specified in the applicable design method.

(4) It is not prohibited that steel, stainless steel, or aluminum access hatches be designed, instead of by calculation, by prototype proof loading to a force of 1.60 times the applicable load, 25 600 lbf load (11 612.16 kgf), without permanent deflection greater than 0.02 in. (0.51 mm) or cracking. If the span of an access hatch exceeds 48 in. (1219 mm), the additional load cases described in 9.1.4.2 shall be prototype proof loaded to a force of 1.60 times the applicable load. The loads shall be tested in the position that produces the maximum moment and in the position that produces the maximum shear. Each proof loading test shall be repeated ten times on the same fabrication to demonstrate that progressive failure does not occur.

9.1.4.4 *Level 4 Deflection*—Live load deflection by calculation or by loading at working stress levels, 16 000 lbf load (7257.60 kgf), shall not exceed the lesser of the span divided by 250 or 3⁄16 in. (4.76 mm).

9.1.5 *Load Level 5—Off Street Truck Traffic:*

9.1.5.1 It is not prohibited to utilize Load Level 5 designs in any Level 1, 2, 3, or 4 application, as well as in unrestricted parking access lanes, and alleyways where the traffic speed is limited to 15 mph (24.14km/h). Appropriate locations for Load Level 5 access hatches are shown in Fig. 5.

9.1.5.2 *Level 5 Loading:*

(1) A concentrated design loading of a 16 000 lbf (7257.60 kgf) load plus a 30 % dynamic (impact) allowance [20 800 lbf (9434.88 kgf) total load] applied to a 10 by 20 in. (254 by 508 mm) footprint with traffic both parallel and perpendicular to the span. The footprint shall be positioned to produce both the maximum moment and the maximum shear.

(2) If the span of an access hatch exceeds 48 in. (1219 mm), an additional load case of two 16 000 lbf (7257.60 kgf) loads, plus a 30 % dynamic (impact) allowance, 20 800 lbf (9434.88 kgf) each load, applied to 10 by 20 in. (254 by 508 mm) footprints at 48 in. (1219 mm) on center with traffic perpendicular to the span shall be investigated, and an additional load case of two 12 500 lbf (5670.00 kgf) loads plus a 30 % dynamic (impact) allowance, 16 250 lbf (7371.00 kgf) each load, applied to 10 by 20 in. (254 by 508 mm) footprints at 48 in. (1219 mm) on center with traffic parallel to the span shall be investigated. The footprints shall be positioned to produce both the maximum moment and the maximum shear.

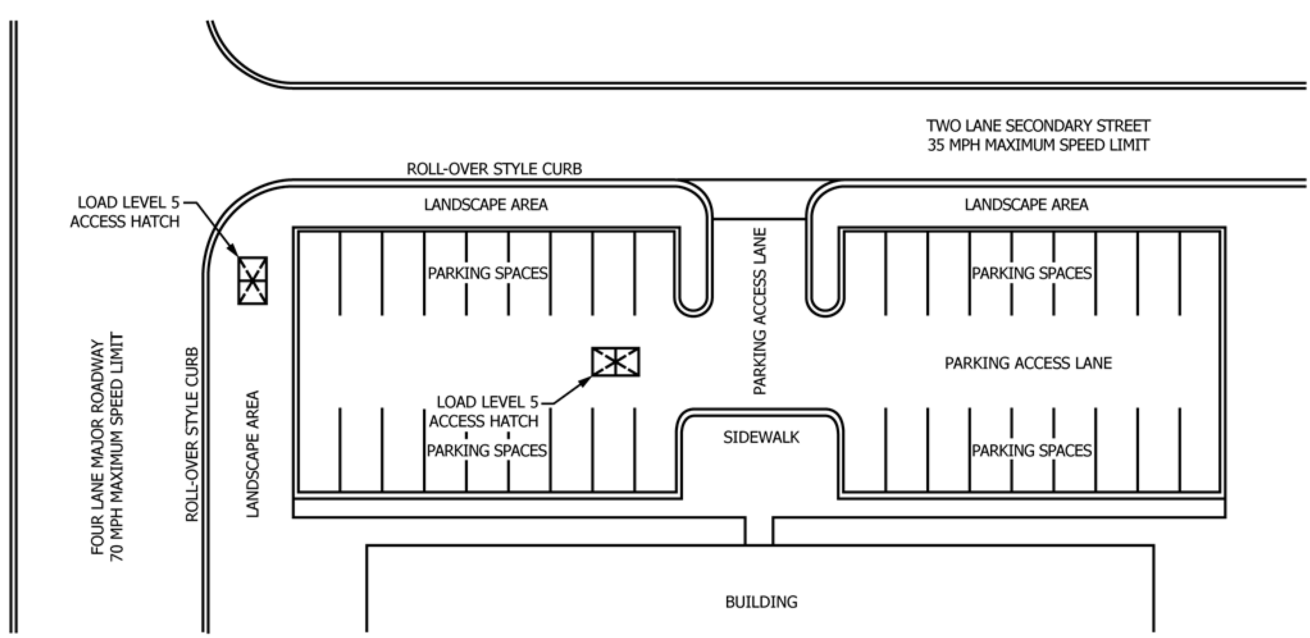

FIG. 5 Plan Showing Appropriate Locations for Load Level 5 Access Hatches—Off Street Truck Traffic

(3) If structural stiffeners are utilized, the access hatch top plate shall be designed as a span between structural stiffener webs and as a cantilever at the perimeter of the hatch for an applied uniform load of 104, 80 × 1.30, psi (717.08 kPa) applied to a 10.00 by 20.00 in. (254 by 508 mm) area.

9.1.5.3 *Level 5—Applicable Design Methods:*

(1) Steel access hatches shall be designed by calculation utilizing the Allowable Stress Design method as specified in ANSI/AISC 360 Specification for Structural Steel Buildings, the Load and Resistance Factor Design method as specified in ANSI/AISC 360 Specification for Structural Steel Buildings, the methods included in the AASHTO Standard Specifications for Highway Bridges, or the methods included in the AASHTO LRFD Bridge Design Specification.

(2) Stainless steel access hatches shall be designed by calculation utilizing the American Society of Civil Engineers SEI/ASCE 8 Specification for the Design of Cold-Formed Stainless Steel Structural Members Allowable Stress Design method, the American Society of Civil Engineers SEI/ASCE 8 Specification for the Design of Cold-Formed Stainless Steel Structural Members Load and Resistance Factor Design method, the methods included in the AASHTO Standard Specifications for Highway Bridges, or the methods included in the AASHTO LRFD Bridge Design Specification.

(3) Aluminum access hatches shall be designed by calculation utilizing the Aluminum Association's Aluminum Design Manual Allowable Strength method, the Aluminum Association's Aluminum Design Manual Load and Resistance Factor design method, the methods included in the AASHTO Standard Specifications for Highway Bridges, or the methods in the AASHTO LRFD Bridge Design Specification. The safety factor Ω utilized shall be the safety factor for bridge structures and fatigue shall be analyzed if the Aluminum Association's methods are utilized. Weld affected areas of aluminum access hatches shall be considered in the calculation as specified in the applicable design method.

(4) It is not prohibited that steel, stainless steel or aluminum access hatches be designed, instead of by calculation, by prototype proof loading to a force of 1.60 times the applicable load, 33 280 lbf load (15 095.81 kgf), without permanent deflection greater than 0.02 in. (0.51 mm) or cracking. If the span of an access hatch exceeds 48 in. (1219 mm), the additional load cases described in 9.1.5.2 shall be prototype proof loaded to a force of 1.60 times the applicable load. The load shall be tested in the position that produces the maximum moment and in the position that produces the maximum shear. Each proof loading test shall be repeated ten times on the same fabrication to demonstrate that progressive failure does not occur.

9.1.5.4 *Level 5 Deflection*—Live load deflection by calculation or by loading at working stress levels, 20 800 lbf load (9434.88 kgf), shall not exceed the lesser of the span divided by 300 or 3⁄16 in. (4.76 mm).

9.1.6 *Load Level 6—Two-lane Vehicular / Truck Traffic:*

9.1.6.1 It is not prohibited to utilize Load Level 6 designs in any Level 1, 2, 3, 4, or 5 application, as well as in roadways with a maximum of two lanes (one lane in each direction) where the posted speed limit is 35 mph (56.32km/h) or less and the shoulders or medians of other roadways. Appropriate locations for Load Level 6 access hatches are show in Fig. 6.

9.1.6.2 *Level 6 Loading:*

(1) A concentrated design loading of a 16 000 lbf (7257.60 kgf) load plus a 33 % dynamic (impact) allowance [21 280 lbf total load (9652.61 kgf)] applied to a 10 by 20 in. (254 by 508 mm) footprint shall be applied with traffic both parallel and perpendicular to the span. The footprint shall be positioned to produce both the maximum moment and the maximum shear.

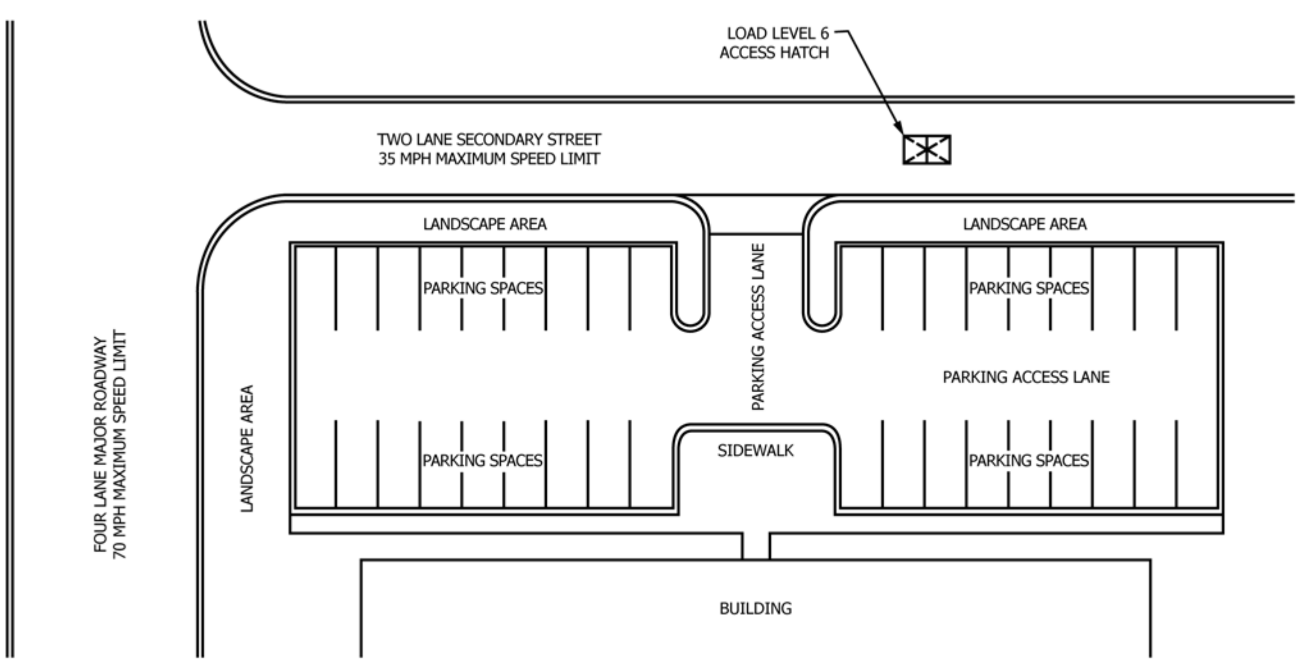

FIG. 6 Plan Showing Appropriate Locations for Load Level 6 Access Hatches—Two-lane Vehicular Traffic