

# ICC-ES Evaluation Report

**ESR-2657**

Reissued March 2024


This report also contains:

Subject to renewal March 2026

- CBC Supplement
- FBC Supplement
- LABC Supplement

ICC-ES Evaluation Reports are not to be construed as representing aesthetics or any other attributes not specifically addressed, nor are they to be construed as an endorsement of the subject of the report or a recommendation for its use. There is no warranty by ICC Evaluation Service, LLC, express or implied, as to any finding or other matter in this report, or as to any product covered by the report.

Copyright © 2024 ICC Evaluation Service, LLC. All rights reserved.

<p><b>DIVISION: 05 00 00—METALS</b></p> <p><b>Section: 05 31 00—Steel Decking</b></p>	<p><b>REPORT HOLDER:</b></p> <p><b>NEW MILLENNIUM BUILDING SYSTEMS, LLC</b></p>	<p><b>EVALUATION SUBJECT:</b></p> <p><b>NEW MILLENNIUM STEEL ROOF DECK PANELS</b></p>	
---	---	---	---

## 1.0 EVALUATION SCOPE

**Compliance with the following code:**

- 2021, 2018, 2015, 2012, 2009, and 2006 [International Building Code® \(IBC\)](#)

For evaluation for compliance with codes adopted by the Los Angeles Department of Building and Safety (LABDS), see [ESR-2657 LABC and LARC Supplement](#).

**Property evaluated:**

- Structural

## 2.0 USES

The New Millennium Deep-Dek®, Deep-Dek® Cellular, Deep-Dek® Acoustical, Deep-Dek® Cellular Acoustical, Versa-Dek and Versa-Dek Acoustical steel deck panels are used as roof decks to support construction, gravity, and lateral loads.

## 3.0 DESCRIPTION

### 3.1 General:

The deck panels with dimensions and profiles as shown in [Figure 1](#) are cold-formed from steel sheets complying with the following:

- ASTM A653 SS Grade 40 steel with galvanized or galvanized coating. Optional primer or finish paint coatings applied over the galvanized or galvanized coating are available for the top surface, bottom surface, or both surfaces. Option varies by profile.
- ASTM A1008 SS Grade 40 steel with primer painted top and bottom surfaces. Optional finish paint coatings are available for the top surface, bottom surface, or both surfaces. Option varies by profile.

### 3.2 D4.5, D6 and D7.5 Deep-Dek® Panels:

The D4.5, D6, and D7.5 deck panels are fluted, hat sections as shown in [Figure 1](#), and are available in design thicknesses ranging from No. 14 to No. 20 gage [0.0747 inch (1.90 mm) to 0.0358 inch (0.909 mm)].

### 3.3 D4.5C, D6C and D7.5C Deep-Dek® Cellular Panels:

The deck panels consist of fluted, hat sections factory-attached to liner sections, as shown in [Figure 1](#). The deck panels are available with hat section design thicknesses ranging from No. 14 to No. 20 gage [0.0747 inch

(1.90 mm) to 0.0358 inch (0.909 mm)] and liner section design thicknesses ranging from No. 14 to No. 20 gage [0.0747 inch (1.90 mm) to 0.0358 inch (0.909 mm)].

### 3.4 D4.5A, D6A and D7.5A Deep-Dek® Acoustical Panels:

These deck panels are the same as the D4.5, D6 and D7.5 Deep-Dek® panels described in Section 3.2 above, except the webs of the panels are perforated with holes. See [Figure 3](#) for perforation patterns.

### 3.5 D4.5CA, D6CA and D7.5CA Deep-Dek® Cellular Acoustical Panels:

These deck panels are the same as the D4.5C, D6C and D7.5C Deep-Dek® Cellular panels described in Section 3.3 above, except the bottom liner sections of the panels are perforated with holes. See [Figure 3](#) for perforation patterns.

### 3.6 Versa-Dek® S, S ES, LS, LS ES and 3.5 LS Deck Panels:

The deck panels are fluted sections as shown in [Figure 1](#) and are available in design thicknesses ranging from No. 16 to No. 22 gage [0.0598 inch (1.52 mm) to 0.0295 inch (0.749 mm)]. 3.5LS panels are available in design thicknesses ranging from No. 16 to No. 20 gage [0.0598 inch (1.52 mm) to 0.0358 inch (0.909 mm)].

### 3.7 Versa-Dek® S Acoustical, S ES Acoustical, LS Acoustical, LS ES Acoustical and 3.5 LS Acoustical Deck Panels:

These deck panels are the same as those described in Section 3.6, except that the bottom flanges of the panels are perforated with holes. See [Figure 2](#) for perforation patterns.

### 3.8 Supports:

Steel Supports must comply with AISC 360. Wood supports must comply with the NDS and be structural lumber.

### 3.9 Steel to Steel Connections:

Welds, screws, or proprietary fasteners used to attach deck panels to steel supports and at sidelaps must be in accordance with AISI S100-16 S2/20 and AISI S310-16.

### 3.10 Steel to Wood Connections:

Nails and screws used to attach deck panels to wood supports must be in accordance with the NDS and AISI S310-16.

## 4.0 DESIGN AND INSTALLATION

### 4.1 General:

### 4.2 Vertical Load Design:

4.2.1 The steel roof decks must be designed in accordance with SDI RD-2017 using the section properties in [Table 1](#), web crippling values determined per Section 4.2.2, shear strength determined per Section 4.2.3, and bending strength determined per AISI S100-16 S2/20.

### 4.2.2 Web Crippling Strength:

The web crippling strength of deck panels to resist support reactions and concentrated loads must be determined in accordance with AISI S100-16 S2/20 Section G5 and deck panel properties provided in this report. Web crippling strength of deck with perforated webs (D4.5A, D6A, and D7.5A) must be determined as described in [Appendix A](#).

### 4.2.3 Shear Strength:

The shear strength of deck panels must be determined in accordance with AISI S100-16 S2/20 Section G2.1 and deck panel properties provided in this report. Shear strength of deck with perforated webs (D4.5A, D6A, and D7.5A) must be determined as described in [Appendix A](#).

### 4.3 Horizontal Load (Diaphragm) Design:

The diaphragm shear strength and stiffness of steel roof deck panels must be determined in accordance with AISI S310-16 using the section properties in [Table 1](#) and [Figures 1, 2, and 3](#). The diaphragm shear strength and stiffness of steel roof deck panels with perforations in bottom flanges (Versa-Dek® S Acoustical, S ES Acoustical, LS ES Acoustical, and 3.5 LS Acoustical) must be modified as described in [Appendix A](#).

#### 4.4 Installation:

The deck panels must be installed in accordance with this report and also with New Millennium's published installation guidelines and instructions. If there is a conflict between New Millennium's published installation guidelines and instructions and this report, this report governs.

### 5.0 CONDITIONS OF USE:

The New Millennium steel roof deck panels described in this report comply with, or are suitable alternatives to what is specified in, the code noted in Section 1.0 of this report, subject to the following conditions:

- 5.1 The design base-metal thicknesses for all steel deck panels are indicated in [Table 1](#). The thickness delivered to the jobsite must be at least 95 percent of the design base-metal thickness.
- 5.2 The minimum loads and deflection limits of IBC Chapter 16 in addition to the construction loads required by references in IBC Section 2210.1.1 must be considered by the design professional based on the specific occupancy or use, as applicable.
- 5.3 Special inspection must be provided in accordance with Chapter 17 of the IBC.
- 5.4 Use of New Millennium steel roof panels has not been evaluated for use without a roof covering.
- 5.5 Fasteners used in connections are outside the scope of this report.
- 5.6 Calculations and details demonstrating that the loads applied to the decks comply with this report must be submitted to the code official for approval. Calculations and drawings must be prepared, signed, and sealed by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed.
- 5.7 The steel deck panels are fabricated in Memphis, Tennessee under an approved quality program with inspections by ICC-ES.

### 6.0 EVIDENCE SUBMITTED

- 6.1 Data in accordance with [ICC-ES Acceptance Criteria for Steel Deck Roof and Floor Systems \(AC43\)](#), dated February 2021.

### 7.0 IDENTIFICATION

- 7.1 Each bundle of the New Millennium steel deck panels described in this report is identified by labeling bearing the manufacturer's name (New Millennium Building Systems, LLC) and the manufacturing location (MD—Memphis, Tennessee); the deck panel profile name; the design thickness; the minimum specified yield strength; the cover width of the panel; and the evaluation report number (ESR-2657).
- 7.2 The report holder's contact information is the following:

**NEW MILLENNIUM BUILDING SYSTEMS, LLC**  
**7575 WEST JEFFERSON BOULEVARD**  
**FORT WAYNE, INDIANA 46804**  
**(260) 969-3500**  
[www.newmill.com](http://www.newmill.com)

## SYMBOLS AND DEFINITIONS

Symbol	Definition
$c_p$	Perforation center-to-center spacing
$D_d$	Depth of deck panel
$d$	Panel corrugation pitch
$d_p$	Diameter of perforation
$E_p$	Width of perforation band in deck bottom flange
$e$	One-half the bottom flange width of deck panel measured between points of intercepts
$e_w$	Distance from cellular deck longitudinal fastener to web
$f$	Top flange width of panel measured between points of intercepts
$h$	Flat dimension of web measured in plane of web
$I_{DM}$	Effective moment of inertia for multi-span deck for deflection calculations under uniform load
$I_{DS}$	Effective moment of inertia for single-span deck for deflection calculations under uniform load
$I_{gx}$	Moment of inertia of full unreduced section (considering perforations for acoustical deck)
$I_{oi}$	Effective moment of inertia in inverted (negative) bending
$I_{on}$	Effective moment of inertia in normal (positive) bending
$R$	Inside bend radius
$S_{ei}$	Effective section modulus in inverted (negative) bending
$S_{en}$	Effective section modulus in normal (positive) bending
$t$	Base steel thickness of deck panel
$W_p$	Width of perforation band in deck web
$w$	Web width of deck panel measured between points of intercept in plane of web
$w_d$	Distance measured across the width and between longitudinal rows of fasteners connecting the deck hat sections to the liner panel
$w_{dp}$	Total width of perforation bands within the liner panel width $w_d$
$\theta$	Web angle

TABLE 1A—SECTION PROPERTIES 1, 2, 3, 4

DECK PANEL	GAGE	t (in.)	I <sub>gx</sub> (in. <sup>4</sup> /ft)	I <sub>on</sub> (in. <sup>4</sup> /ft)	I <sub>oi</sub> (in. <sup>4</sup> /ft)	I <sub>DS</sub> (in. <sup>4</sup> /ft)	I <sub>DM</sub> (in. <sup>4</sup> /ft)	S <sub>en</sub> (in. <sup>3</sup> /ft)	S <sub>ei</sub> (in. <sup>3</sup> /ft)	h (in.)
Deep-Dek® 4.5	20	0.0358	2.978	2.613	2.978	2.735	2.978	0.984	1.207	4.360
	18	0.0474	3.939	3.778	3.939	3.832	3.939	1.491	1.596	4.349
	16	0.0598	4.963	4.963	4.963	4.963	4.963	1.972	2.011	4.337
	14	0.0747	6.191	6.191	6.191	6.191	6.191	2.507	2.507	4.323
Deep-Dek® 6	20	0.0358	5.747	5.083	5.629	5.304	5.668	1.367	1.711	5.862
	18	0.0474	7.601	7.292	7.601	7.395	7.601	2.172	2.358	5.851
	16	0.0598	9.579	9.579	9.579	9.579	9.579	2.915	2.971	5.839
	14	0.0747	11.950	11.950	11.950	11.950	11.950	3.705	3.705	5.825
Deep-Dek® 7.5	20	0.0358	9.593	8.446	9.131	8.828	9.285	1.712	2.162	7.364
	18	0.0474	12.689	12.191	12.420	12.357	12.510	2.909	3.049	7.353
	16	0.0598	15.992	15.992	15.992	15.992	15.992	3.936	4.009	7.341
	14	0.0747	19.952	19.952	19.952	19.952	19.952	5.000	5.000	7.327
Deep-Dek® 4.5 Cellular	20/20	0.0358/ 0.0358	4.862	4.083	4.058	4.343	4.343	1.051	1.545	4.360
	20/18	0.0358/ 0.0474	5.259	4.322	4.628	4.634	4.839	1.054	1.603	4.360
	18/20	0.0474/ 0.0358	5.973	5.638	4.995	5.750	5.750	1.728	2.008	4.349
	18/18	0.0474/ 0.0474	6.459	6.085	5.626	6.210	6.210	1.727	2.076	4.349
	18/16	0.0474/ 0.0598	6.903	6.491	6.277	6.629	6.629	1.726	2.141	4.349
	16/18	0.0598/ 0.0474	7.655	7.655	6.647	7.655	7.655	2.449	2.574	4.337
	16/16	0.0598/ 0.0598	8.180	8.180	7.378	8.180	8.180	2.493	2.651	4.337
	16/14	0.0598/ 0.0747	8.730	8.730	8.157	8.730	8.730	2.539	2.726	4.337
	14/16	0.0747/ 0.0598	9.619	9.619	8.638	9.619	9.619	3.353	3.254	4.323
	14/14	0.0747/ 0.0747	10.264	10.264	9.511	10.264	10.264	3.413	3.345	4.323
Deep-Dek® 6 Cellular	20/20	0.0358/ 0.0358	9.032	7.351	7.645	7.912	8.107	1.417	2.207	5.862
	20/18	0.0358/ 0.0474	9.770	7.759	8.626	8.430	9.008	1.418	2.286	5.862
	18/20	0.0474/ 0.0358	11.092	10.524	9.414	10.713	10.713	2.346	2.862	5.851
	18/18	0.0474/ 0.0474	11.989	11.248	10.507	11.495	11.495	2.335	2.958	5.851
	18/16	0.0474/ 0.0598	12.809	11.814	11.624	12.146	12.146	2.331	3.047	5.851
	16/18	0.0598/ 0.0474	14.204	14.204	12.437	14.204	14.204	3.514	3.665	5.839
	16/16	0.0598/ 0.0598	15.167	15.167	13.682	15.167	15.167	3.500	3.772	5.839
	16/14	0.0598/ 0.0747	16.178	16.178	15.086	16.178	16.178	3.485	3.879	5.839
	14/16	0.0747/ 0.0598	17.832	17.832	16.050	17.832	17.832	4.779	4.627	5.825
	14/14	0.0747/ 0.0747	19.010	19.010	17.597	19.010	19.010	4.867	4.755	5.825
Deep-Dek® 7.5 Cellular	20/20	0.0358/ 0.0358	14.701	11.608	12.445	12.639	13.197	1.787	2.922	7.364
	20/18	0.0358/ 0.0474	15.916	12.234	13.997	13.461	14.636	1.787	3.030	7.364
	18/20	0.0474/ 0.0358	18.041	16.796	15.352	17.211	17.211	2.958	3.785	7.353
	18/18	0.0474/ 0.0474	19.504	17.772	17.060	18.349	18.349	2.948	3.916	7.353
	18/16	0.0474/ 0.0598	20.847	18.646	18.832	19.380	19.503	2.942	4.038	7.353
	16/18	0.0598/ 0.0474	23.094	23.094	20.217	23.094	23.094	4.447	4.846	7.341
	16/16	0.0598/ 0.0598	24.659	24.659	22.170	24.659	24.659	4.422	4.992	7.341
	16/14	0.0598/ 0.0747	26.307	25.934	24.426	26.059	26.059	4.404	5.141	7.341
	14/16	0.0747/ 0.0598	28.977	28.977	26.028	28.977	28.977	6.346	6.118	7.327
	14/14	0.0747/ 0.0747	30.884	30.884	28.493	30.884	30.884	6.436	6.295	7.327

For SI dimensions: 1 inch = 25.4 mm; 1 foot = 304.8 mm.

Notes:

- <sup>1</sup> Effective properties are based on yield stress of 40 ksi.
- <sup>2</sup> The design thickness is the uncoated base-metal thickness of the deck panel.
- <sup>3</sup> For the cellular deck panels, the first number is the design base metal thickness of the profiled deck panel and the second number is the design base metal thickness of the bottom liner panel.
- <sup>4</sup> Tabulated I<sub>D</sub> values calculated using the following equations are permitted for deflection calculations of deck under uniform loads:
  - I<sub>D</sub> for a simple span is permitted to be equal to (I<sub>x</sub> + 2\*I<sub>on</sub>)/3 or I<sub>on</sub>.
  - I<sub>D</sub> for multiple spans is permitted to be equal to (I<sub>x</sub> + 2\*I<sub>oi</sub>)/3, (I<sub>x</sub> + 2\*I<sub>on</sub>)/3 or the minimum of I<sub>on</sub> and I<sub>oi</sub>.

TABLE 1B—SECTION PROPERTIES 1, 2, 3, 4

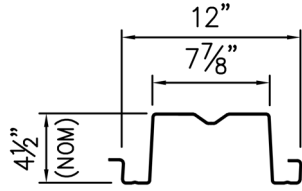
DECK PANEL	GAGE	t (in.)	I <sub>gx</sub> (in. <sup>4</sup> /ft)	I <sub>on</sub> (in. <sup>4</sup> /ft)	I <sub>oi</sub> (in. <sup>4</sup> /ft)	I <sub>os</sub> (in. <sup>4</sup> /ft)	I <sub>DM</sub> (in. <sup>4</sup> /ft)	S <sub>en</sub> (in. <sup>3</sup> /ft)	S <sub>ei</sub> (in. <sup>3</sup> /ft)	h (in.)
<b>Deep-Dek® 4.5 Acoustical</b>	20	0.0358	2.789	2.425	2.789	2.546	2.789	0.904	1.127	4.360
	18	0.0474	3.690	3.533	3.690	3.586	3.690	1.385	1.491	4.349
	16	0.0598	4.652	4.652	4.652	4.652	4.652	1.840	1.879	4.337
	14	0.0747	5.806	5.806	5.806	5.806	5.806	2.344	2.344	4.323
<b>Deep-Dek® 6 Acoustical</b>	20	0.0358	5.278	4.615	5.143	4.836	5.188	1.195	1.542	5.862
	18	0.0474	6.983	6.680	6.983	6.781	6.983	1.972	2.159	5.851
	16	0.0598	8.804	8.804	8.804	8.804	8.804	2.665	2.721	5.839
	14	0.0747	10.989	10.989	10.989	10.989	10.989	3.395	3.395	5.825
<b>Deep-Dek® 7.5 Acoustical</b>	20	0.0358	8.652	7.417	8.126	7.829	8.301	1.448	1.897	7.364
	18	0.0474	11.449	10.959	11.132	11.122	11.238	2.528	2.710	7.353
	16	0.0598	14.434	14.434	14.434	14.434	14.434	3.531	3.606	7.341
	14	0.0747	18.017	18.017	18.017	18.017	18.017	4.500	4.500	7.327
<b>Deep-Dek® 4.5 Cellular Acoustical</b>	20/20	0.0358/ 0.0358	4.727	4.001	4.061	4.243	4.283	1.051	1.545	4.360
	20/18	0.0358/ 0.0474	5.114	4.235	4.624	4.528	4.787	1.053	1.603	4.360
	18/20	0.0474/ 0.0358	5.812	5.490	4.998	5.597	5.597	1.723	2.008	4.349
	18/18	0.0474/ 0.0474	6.280	5.920	5.623	6.040	6.040	1.728	2.075	4.349
	18/16	0.0474/ 0.0598	6.711	6.315	6.261	6.447	6.447	1.726	2.139	4.349
	16/18	0.0598/ 0.0474	7.446	7.446	6.646	7.446	7.446	2.430	2.574	4.337
	16/16	0.0598/ 0.0598	7.951	7.951	7.363	7.951	7.951	2.474	2.650	4.337
	16/14	0.0598/ 0.0747	8.485	8.485	8.117	8.485	8.485	2.520	2.723	4.337
	14/16	0.0747/ 0.0598	9.354	9.354	8.624	9.354	9.354	3.327	3.252	4.323
	14/14	0.0747/ 0.0747	9.975	9.975	9.472	9.975	9.975	3.387	3.342	4.323
<b>Deep-Dek® 6 Cellular Acoustical</b>	20/20	0.0358/ 0.0358	8.785	7.210	7.647	7.735	8.026	1.417	2.207	5.862
	20/18	0.0358/ 0.0474	9.501	7.612	8.615	8.242	8.910	1.417	2.285	5.862
	18/20	0.0474/ 0.0358	10.799	10.252	9.417	10.434	10.434	2.350	2.863	5.851
	18/18	0.0474/ 0.0474	11.660	11.012	10.497	11.228	11.228	2.338	2.957	5.851
	18/16	0.0474/ 0.0598	12.455	11.570	11.590	11.865	11.878	2.332	3.044	5.851
	16/18	0.0598/ 0.0474	13.824	13.824	12.429	13.824	13.824	3.486	3.665	5.839
	16/16	0.0598/ 0.0598	14.749	14.749	13.649	14.749	14.749	3.508	3.769	5.839
	16/14	0.0598/ 0.0747	15.728	15.728	15.008	15.728	15.728	3.490	3.874	5.839
	14/16	0.0747/ 0.0598	17.351	17.351	16.019	17.351	17.351	4.741	4.624	5.825
	14/14	0.0747/ 0.0747	18.482	18.482	17.520	18.482	18.482	4.827	4.750	5.825
<b>Deep-Dek® 7.5 Cellular Acoustical</b>	20/20	0.0358/ 0.0358	14.300	11.391	12.445	12.361	13.064	1.787	2.922	7.364
	20/18	0.0358/ 0.0474	15.476	12.008	13.976	13.164	14.476	1.786	3.029	7.364
	18/20	0.0474/ 0.0358	17.571	16.474	15.354	16.840	16.840	2.961	3.785	7.353
	18/18	0.0474/ 0.0474	18.970	17.416	17.041	17.934	17.934	2.950	3.914	7.353
	18/16	0.0474/ 0.0598	20.269	18.270	18.775	18.937	19.273	2.943	4.035	7.353
	16/18	0.0598/ 0.0474	22.483	22.483	20.200	22.483	22.483	4.458	4.845	7.341
	16/16	0.0598/ 0.0598	23.982	23.982	22.115	23.982	23.982	4.430	4.988	7.341
	16/14	0.0598/ 0.0747	25.575	25.392	24.299	25.453	25.453	4.410	5.134	7.341
	14/16	0.0747/ 0.0598	28.205	28.205	25.976	28.205	28.205	6.292	6.114	7.327
	14/14	0.0747/ 0.0747	30.032	30.032	28.368	30.032	30.032	6.414	6.287	7.327

See [Table 1A](#) notes.

**TABLE 1C—SECTION PROPERTIES** 1, 2, 3, 4

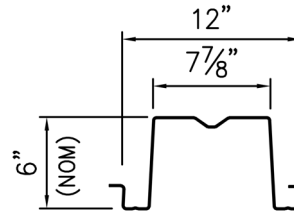
DECK PANEL	GAGE	t (in.)	I <sub>gx</sub> (in. <sup>4</sup> /ft)	I <sub>on</sub> (in. <sup>4</sup> /ft)	I <sub>oi</sub> (in. <sup>4</sup> /ft)	I <sub>DS</sub> (in. <sup>4</sup> /ft)	I <sub>DM</sub> (in. <sup>4</sup> /ft)	S <sub>en</sub> (in. <sup>3</sup> /ft)	S <sub>ei</sub> (in. <sup>3</sup> /ft)	h (in.)
<b>Versa-Dek® S</b>	22	0.0295	0.401	0.398	0.322	0.399	0.399	0.286	0.256	1.706
	20	0.0358	0.485	0.485	0.416	0.485	0.485	0.356	0.319	1.698
	18	0.0474	0.640	0.640	0.596	0.640	0.640	0.473	0.438	1.682
	16	0.0598	0.805	0.805	0.786	0.805	0.805	0.595	0.567	1.666
<b>Versa-Dek® S Acoustical</b>	22	0.0295	0.378	0.376	0.315	0.377	0.377	0.281	0.256	1.706
	20	0.0358	0.458	0.457	0.406	0.457	0.457	0.350	0.318	1.698
	18	0.0474	0.604	0.604	0.577	0.604	0.604	0.465	0.436	1.682
	16	0.0598	0.760	0.760	0.753	0.760	0.760	0.585	0.564	1.666
<b>Versa-Dek® S ES</b>	22	0.0295	0.422	0.422	0.337	0.422	0.422	0.307	0.273	1.708
	20	0.0358	0.511	0.511	0.437	0.511	0.511	0.390	0.346	1.699
	18	0.0474	0.674	0.674	0.627	0.674	0.674	0.514	0.475	1.684
	16	0.0598	0.848	0.848	0.828	0.848	0.848	0.646	0.615	1.668
<b>Versa-Dek® S ES Acoustical</b>	22	0.0295	0.399	0.399	0.331	0.399	0.399	0.302	0.269	1.708
	20	0.0358	0.483	0.483	0.427	0.483	0.483	0.383	0.345	1.699
	18	0.0474	0.637	0.637	0.607	0.637	0.637	0.506	0.473	1.684
	16	0.0598	0.802	0.802	0.794	0.802	0.802	0.636	0.612	1.668
<b>Versa-Dek® LS</b>	22	0.0295	0.399	0.396	0.370	0.397	0.397	0.284	0.280	1.706
	20	0.0358	0.483	0.482	0.464	0.482	0.482	0.354	0.345	1.698
	18	0.0474	0.637	0.637	0.637	0.637	0.637	0.471	0.463	1.682
	16	0.0598	0.801	0.801	0.801	0.801	0.801	0.593	0.589	1.666
<b>Versa-Dek® LS Acoustical</b>	22	0.0295	0.376	0.374	0.365	0.374	0.374	0.279	0.281	1.706
	20	0.0358	0.455	0.455	0.455	0.455	0.455	0.348	0.344	1.698
	18	0.0474	0.601	0.601	0.601	0.601	0.601	0.463	0.461	1.682
	16	0.0598	0.755	0.755	0.755	0.755	0.755	0.582	0.582	1.666
<b>Versa-Dek® LS ES</b>	22	0.0295	0.417	0.417	0.406	0.417	0.417	0.304	0.309	1.708
	20	0.0358	0.505	0.505	0.506	0.505	0.506	0.386	0.379	1.699
	18	0.0474	0.667	0.667	0.667	0.667	0.667	0.510	0.507	1.684
	16	0.0598	0.838	0.838	0.838	0.838	0.838	0.640	0.640	1.668
<b>Versa-Dek® LS ES Acoustical</b>	22	0.0295	0.393	0.393	0.393	0.393	0.393	0.298	0.308	1.708
	20	0.0358	0.476	0.476	0.476	0.476	0.476	0.379	0.377	1.699
	18	0.0474	0.628	0.628	0.628	0.628	0.628	0.500	0.500	1.684
	16	0.0598	0.789	0.789	0.789	0.789	0.789	0.629	0.629	1.668
<b>Versa-Dek® 3.5 LS</b>	20	0.0358	2.042	1.917	1.766	1.959	1.959	0.775	0.910	3.330
	19	0.0418	2.381	2.296	2.129	2.324	2.324	0.946	1.072	3.321
	18	0.0474	2.697	2.648	2.475	2.664	2.664	1.113	1.226	3.313
	16	0.0568	3.395	3.394	3.262	3.394	3.394	1.504	1.573	3.295
<b>Versa-Dek® 3.5 LS Acoustical</b>	20	0.0358	1.877	1.766	1.742	1.803	1.803	0.754	0.909	3.330
	19	0.0418	2.189	2.113	2.089	2.139	2.139	0.921	1.072	3.321
	18	0.0474	2.480	2.436	2.418	2.450	2.450	1.084	1.224	3.313
	16	0.0598	3.123	3.122	3.123	3.122	3.123	1.466	1.564	3.295

See [Table 1A](#) notes.



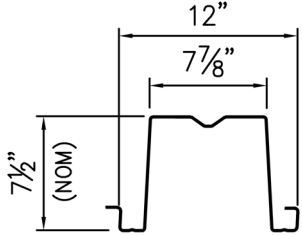
$D_d = 4.625$  in.  
 $d = 12$  in.  
 $\theta = 87$  deg.  
 $R = 0.125$  in.  
 $e = 1.91$  in.  
 $f = 7.85$  in.  
 $w = 4.631$  in.

DEEP-DEK® 4.5 & DEEP-DEK® 4.5 ACOUSTICAL



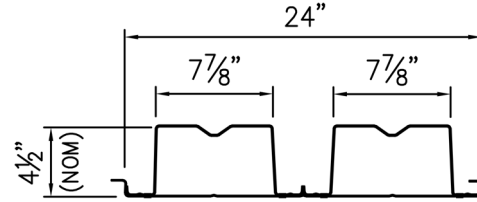
$D_d = 6.125$  in.  
 $d = 12$  in.  
 $\theta = 87$  deg.  
 $R = 0.125$  in.  
 $e = 1.84$  in.  
 $f = 7.85$  in.  
 $w = 6.133$  in.

DEEP-DEK® 6.0 & DEEP-DEK® 6.0 ACOUSTICAL



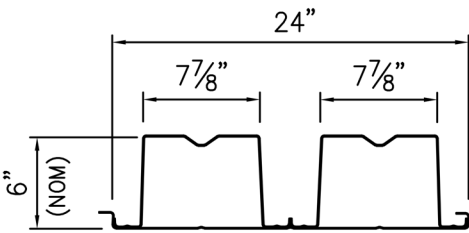
$D_d = 7.625$  in.  
 $d = 12$  in.  
 $\theta = 87$  deg.  
 $R = 0.125$  in.  
 $e = 1.76$  in.  
 $f = 7.85$  in.  
 $w = 7.635$  in.

DEEP-DEK® 7.5 & DEEP-DEK® 7.5 ACOUSTICAL



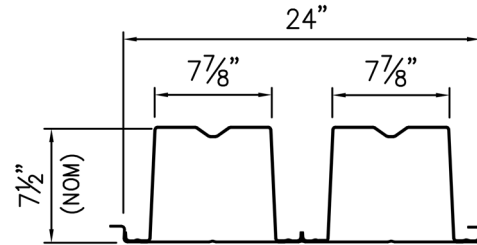
$D_d = 4.625$  in.  
 $d = 12$  in.  
 $\theta = 87$  deg.  
 $R = 0.125$  in.  
 $e = 1.91$  in.  
 $f = 7.85$  in.  
 $w = 4.631$  in.  
 $w_{d1} = 9.179$  in.  
 $w_{d2} = 2.886$  in.  
 $e_w = 0.422$  in.

DEEP-DEK® 4.5 CELLULAR & DEEP-DEK® 4.5 CELLULAR ACOUSTICAL



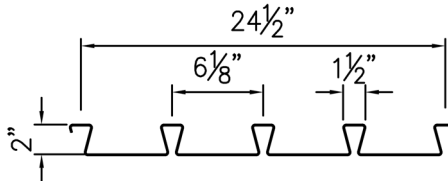
$D_d = 6.125$  in.  
 $d = 12$  in.  
 $\theta = 87$  deg.  
 $R = 0.125$  in.  
 $e = 1.84$  in.  
 $f = 7.85$  in.  
 $w = 6.133$  in.  
 $w_{d1} = 9.179$  in.  
 $w_{d2} = 2.886$  in.  
 $e_w = 0.343$  in.

DEEP-DEK® 6.0 CELLULAR & DEEP-DEK® 6.0 CELLULAR ACOUSTICAL



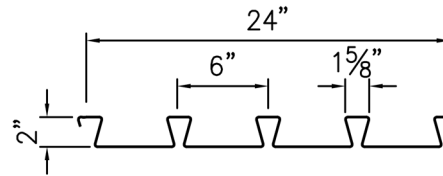
$D_d = 7.625$  in.  
 $d = 12$  in.  
 $\theta = 87$  deg.  
 $R = 0.125$  in.  
 $e = 1.76$  in.  
 $f = 7.85$  in.  
 $w = 7.635$  in.  
 $w_{d1} = 9.179$  in.  
 $w_{d2} = 2.886$  in.  
 $e_w = 0.265$  in.

DEEP-DEK® 7.5 CELLULAR & DEEP-DEK® 7.5 CELLULAR ACOUSTICAL



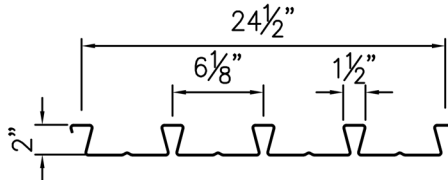
$D_d = 2$  in.  
 $d = 6.125$  in.  
 $\theta = 75.18$  deg.  
 $R = 0.125$  in.  
 $e = 2.813$  in.  
 $f = 1.5$  in.  
 $w = 2.069$  in.

VERSA-DEK® S & VERSA-DEK® S ACOUSTICAL



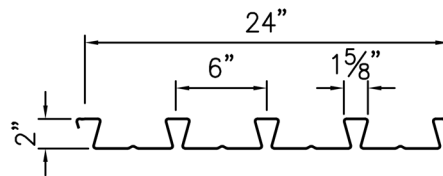
$D_d = 2$  in.  
 $d = 6$  in.  
 $\theta = 74.58$  deg.  
 $R = 0.125$  in.  
 $e = 2.688$  in.  
 $f = 1.625$  in.  
 $w = 2.075$  in.

VERSA-DEK® S ES & VERSA-DEK® S ES ACOUSTICAL



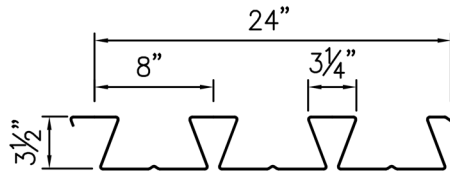
$D_d = 2$  in.  
 $d = 6.125$  in.  
 $\theta = 75.18$  deg.  
 $R = 0.125$  in.  
 $e = 2.813$  in.  
 $f = 1.5$  in.  
 $w = 2.069$  in.

VERSA-DEK® LS & VERSA-DEK® LS ACOUSTICAL



$D_d = 2$  in.  
 $d = 6$  in.  
 $\theta = 74.58$  deg.  
 $R = 0.125$  in.  
 $e = 2.688$  in.  
 $f = 1.625$  in.  
 $w = 2.075$  in.

VERSA-DEK® LS ES & VERSA-DEK® LS ES ACOUSTICAL



$D_d = 3.5$  in.  
 $d = 8$  in.  
 $\theta = 69.2$  deg.  
 $R = 0.125$  in.  
 $e = 3.625$  in.  
 $f = 3.25$  in.  
 $w = 3.744$  in.

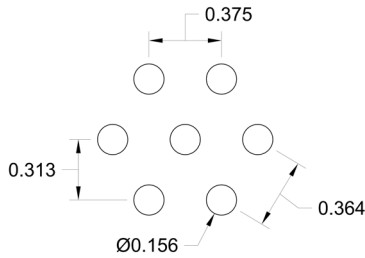
VERSA-DEK® 3.5 LS & VERSA-DEK® 3.5 LS ACOUSTICAL

FIGURE 1—STEEL DECK PANEL PROFILES

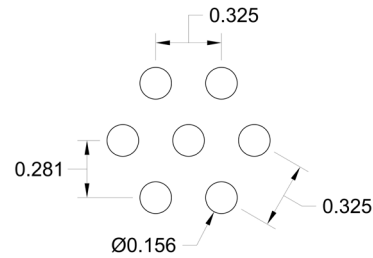


Deck Type	Diameter of Perforation, $d_p$ (in.)	Perforation Center-to-Center Spacing, $c_p$ (in.)	Perforated Band Width (in.) in Deck	
			Bottom Flange, $E_p$	Web, $W_p$
Versa-Dek® S Acoustical, Versa-Dek® LS Acoustical	0.156	0.370*	5.625	0.172
Versa-Dek® S ES Acoustical, Versa-Dek® LS ES Acoustical	0.156	0.370*	5.375	0.203
Versa-Dek® 3.5 LS Acoustical (Option 1)	0.156	0.325	7.250	0.272
Versa-Dek® 3.5 LS Acoustical (Option 2)	0.156	0.370*		0.578

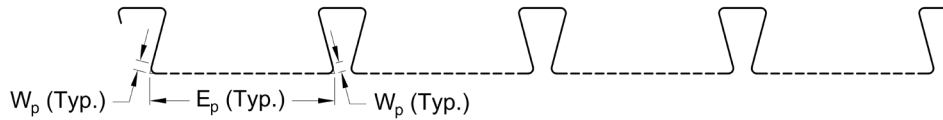
\*Note: Table shows the perforation center-to-center spacing,  $c_p$ , for deck calculation purposes taken as  $(0.375+0.364)/2=0.370$  in.



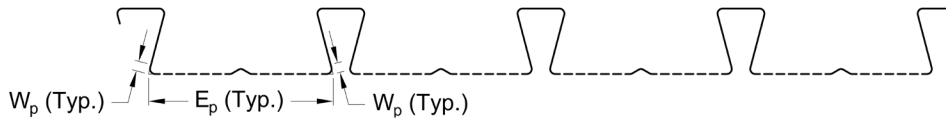
Versa-Dek® S Acoustical, Versa-Dek® LS Acoustical,  
Versa-Dek® S ES Acoustical, Versa-Dek® LS ES Acoustical,  
Versa-Dek® 3.5 LS Acoustical (Option 2)



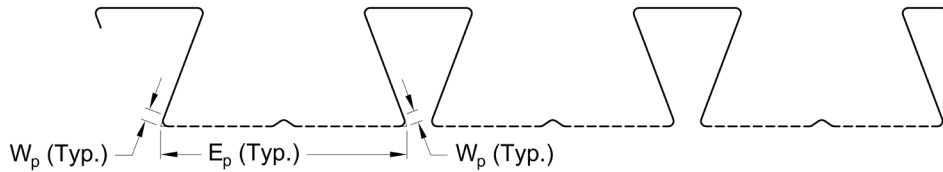
Versa-Dek® 3.5 LS Acoustical (Option 1)



Versa-Dek® S Acoustical and Versa-Dek® S ES Acoustical



Versa-Dek® LS Acoustical and Versa-Dek® LS ES Acoustical

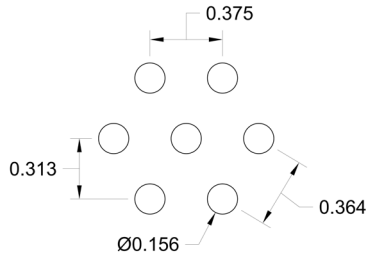


Versa-Dek® 3.5 LS Acoustical

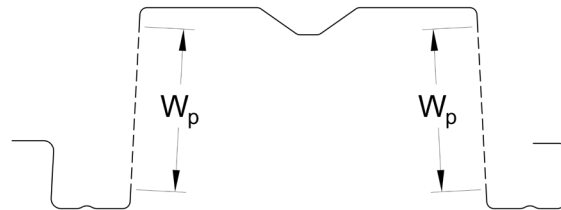
FIGURE 2—PERFORATION PATTERNS OF VERSA-DEK® ACOUSTICAL PROFILES

Deck Type	Diameter of Perforation, $d_p$ (in.)	Perforation Center-to-Center Spacing*, $c_p$ (in.)	Perforated Band Width (in.) in Deck	
			Web, $W_p$	Liner Panel, $w_{dp}$
Deep-Dek® 4.5 Acoustical	0.156	0.370	3.906	N/A
Deep-Dek® 6 Acoustical	0.156	0.370	5.406	N/A
Deep-Dek® 7.5 Acoustical	0.156	0.370	6.906	N/A
Deep-Dek® Cellular Acoustical	0.156	0.370	N/A	8.031

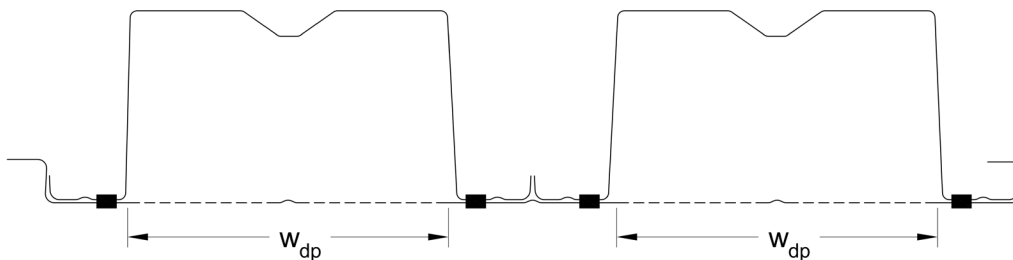
\*Note: Table shows the perforation center-to-center spacing,  $c_p$ , for deck calculation purposes taken as  $(0.375+0.364)/2=0.370$  in.



All Deep-Dek® Acoustical and Cellular Acoustical Profiles



All Deep-Dek® Acoustical Profiles



All Deep-Dek® Cellular Acoustical Profiles

FIGURE 3—PERFORATION PATTERNS OF DEEP-DEK® ACOUSTICAL & DEEP-DEK® CELLULAR ACOUSTICAL PROFILES

## APPENDIX A

## Perforated Deck Calculations

## A1.0 Web Crippling Strength of Deck Panels with Perforated Webs (D4.5A, D6A, and D7.5A)

The nominal web crippling strength of deck panels with perforated webs (D4.5A, D6A, and D7.5A),  $P_{np}$ , must be calculated in accordance with Section G5 of AISI S100-16 S2/20 with the following modified equation:

$$P_{np} = CC't^2F_y \sin \theta \left(1 - C_R \sqrt{\frac{R}{t}}\right) \left(1 + c'_N C_N \sqrt{\frac{N}{t}}\right) \left(1 - c'_h C_h \sqrt{\frac{h}{t}}\right) \leq P_n \quad (\text{AISI S100-16 S2/20 Eq. G5-1 Modified})$$

where  $C'$ ,  $c'_N$ , and  $c'_h$  are coefficients in [Table A.1](#) determined for D4.5A, D6A, and D7.5A from tests;  $P_n$  is the nominal web crippling strength calculated with AISI S100-16 S2/20 Eq. G5-1 for the deck without perforations; all other variables are as defined in AISI S100-16 S2/20 Section G5.

TABLE A.1—Web Crippling Coefficients for Web-Perforated Deck Panels

Coefficient	Loading or Reaction		
	End		Interior
	D4.5A	D6A and D7.5A	D4.5A, D6A, and D7.5A
$C'$	1	2.760	0.687
$c'_N$	1	0.094	1.039
$c'_h$	1	1.255	0.369

## A2.0 Shear Strength of Deck Panels with Perforated Webs (D4.5A, D6A, and D7.5A)

The nominal vertical shear strength of deck panels with perforated webs (D4.5A, D6A, and D7.5A),  $V_{np}$ , must be calculated per the following which is referenced by the Steel Deck Institute (SDI) Perforated Metal Deck Design with Commentary, dated November 18, 2011.:

$$V_{np} = q_s n_w V_n \sin \theta \quad (\text{Eq. A-1})$$

$$q_s = 1 - (1 - k_e) \frac{W_p}{h} \quad (\text{Eq. A-2})$$

$$k_e = \begin{cases} 1 - 2.175p_o & \text{for } p_o < 0.20 \\ 0.9 + p_o^2 - 1.875p_o & \text{for } 0.20 \leq p_o \leq 0.58 \end{cases} \quad (\text{Eq. A-3})$$

$$p_o = 0.9069 \left(\frac{d_p}{c_p}\right)^2 \quad (\text{Eq. A-4})$$

where  $q_s$  is reduction factor;  $n_w$  is number of webs per foot of deck panel width;  $V_n$  is the nominal shear strength calculated per AISI S100-16 S2/20 Section G2.1, without considering web perforations;  $\theta$  is web angle;  $k_e$  is efficiency of the perforated area relative to a solid area of the same material;  $W_p$  is perforated band width in deck web;  $h$  is flat dimension of web measured in plane of web;  $p_o$  perforation open area;  $d_p$  is diameter of perforation;  $c_p$  is perforation center-to-center spacing.

The safety and resistance factors must be in accordance with AISI S100-16 S2/20.

## A3.0 Diaphragm Shear Strength and Stiffness of Deck Panels with Perforated Bottom Flanges (Versa-Dek® S Acoustical, S ES Acoustical, LS Acoustical, LS ES Acoustical, and 3.5 LS Acoustical)

The diaphragm shear strength and stiffness of the deck panels with perforated bottom flanges (Versa-Dek® S Acoustical, S ES Acoustical, LS Acoustical, LS ES Acoustical, and 3.5 LS Acoustical) must be calculated in accordance with AISI S310-16 with the following modifications.

## A3.1 Diaphragm Shear Strength

The following nominal shear strengths of support connections must be multiplied by the reduction coefficients shown in [Table A.2](#):

- the nominal shear strengths,  $P_{nf}$  and  $P_{nfs}$ , of arc spot welds and arc seam welds on steel supports;
- the nominal shear strengths,  $P_{nf}$  and  $P_{nfs}$ , of screws on steel supports governed by the member in contact with screw head and calculated with AISI S100-16 Eqs. J4.3.1-2 and J4.3.1-4;
- the nominal shear strength of wood support connection for fully penetrated screw or nail controlled by bearing against the deck panel,  $P_{nfwS}$ ;
- the nominal shear strength,  $P_{nf}$  and  $P_{nfs}$ , of power-actuated support fasteners.

TABLE A.2—Support Connection Strength Reduction Coefficients for Deck Panels with Perforated Bottom Flanges

Gage	Deck Panel	
	Versa-Dek® S Acoustical, S ES Acoustical, LS Acoustical, LS ES Acoustical	Versa-Dek® 3.5 LS Acoustical
22	0.75	N/A
20, 18, and 16	0.67	0.65

For Versa-Dek® S Acoustical, S ES Acoustical, LS Acoustical, and LS ES Acoustical, the nominal shear strength of diaphragm controlled by connections at interior or edge panels,  $S_{ni}$ , must be calculated as follows:

$$S_{ni} = [2A(k_{\lambda a}\lambda - 1) + \beta] \frac{P_{nf}}{L} \quad (\text{AISI S310-16 Eq. D1-1 Modified})$$

where  $k_{\lambda a}=0.3$  is acoustical modification coefficient determined from tests; all other variables are as defined in AISI S310-16 Section D1.

### A3.2 Diaphragm Shear Stiffness

For screws into steel and wood supports and power-actuated fasteners, the support connection flexibility must be multiplied by the amplification coefficient of 2.4. For arc spot and arc seam welds, the support connection flexibility must be multiplied by the amplification coefficients given in [Table A.3](#). The amplification coefficients were determined from tests.

TABLE A.3—Flexibility Amplification Coefficients for Welded Support Connections of Deck with Perforated Bottom Flanges

Gage	Deck Panel	
	Versa-Dek® S Acoustical, S ES Acoustical, LS Acoustical, and LS ES Acoustical	Versa-Dek® 3.5 LS Acoustical
22	1.8	N/A
20 and 18	1.0	1.5
16	1.0	1.0

DIVISION: 05 00 00—METALS

Section: 05 31 00—Steel Decking

## REPORT HOLDER:

NEW MILLENNIUM BUILDING SYSTEMS, LLC

## EVALUATION SUBJECT:

NEW MILLENNIUM STEEL ROOF DECK PANELS

## 1.0 REPORT PURPOSE AND SCOPE

## Purpose:

The purpose of this evaluation report supplement is to indicate that steel deck panels, described in ICC-ES evaluation report [ESR-2657](#), have also been evaluated for compliance with the code noted below as adopted by the Los Angeles Department of Building and Safety (LADBS).

## Applicable code edition:

2020 *City of Los Angeles Building Code* (LABC)

## 2.0 CONCLUSIONS

The steel deck panels, described in Sections 2.0 through 7.0 of the ICC-ES evaluation report [ESR-2657](#), comply with the LABC Chapter 22, and are subject to the conditions of use described in this supplement.

## 3.0 CONDITIONS OF USE

The steel deck panels described in this evaluation report supplement must comply with all of the following conditions:

- ICC-ES The design, installation, conditions of use and identification of the steel deck panels are in accordance with the 2018 *International Building Code*® (IBC) provisions noted in the ICC-ES evaluation report [ESR-2657](#).
- The design, installation and inspection are in accordance with additional requirements of LABC Chapters 16 and 17, as applicable.
- When exposed to weather, the steel deck panels shall be galvanized.

This supplement expires concurrently with the evaluation report, reissued March 2024.

DIVISION: 05 00 00—METALS

Section: 05 31 00—Steel Decking

## REPORT HOLDER:

NEW MILLENNIUM BUILDING SYSTEMS, LLC

## EVALUATION SUBJECT:

NEW MILLENNIUM STEEL ROOF DECK PANELS

## 1.0 REPORT PURPOSE AND SCOPE

**Purpose:**

The purpose of this evaluation report supplement is to indicate that New Millennium steel roof deck panels: described in ICC-ES evaluation report ESR-2657, have also been evaluated for compliance with the code noted below.

**Applicable code edition:**2019 *California Building Code* (CBC)

## 2.0 CONCLUSIONS

The New Millennium roof deck panels, described in Sections 2.0 through 7.0 of the evaluation report ESR-2657, comply with CBC Chapters 22, provided the design and installation are in accordance with the 2018 *International Building Code*® (IBC) provisions noted in the evaluation report and the additional requirements of the CBC Chapters 16 and 17, as applicable.

**2.1 OSHPD:** The applicable OSHPD Sections of the CBC are beyond the scope of this supplement.

**2.2 DSA:** The applicable DSA Sections of the CBC are beyond the scope of this supplement.

This supplement expires concurrently with the evaluation report, reissued March 2024.

DIVISION: 05 00 00—METALS

Section: 05 31 00—Steel Decking

REPORT HOLDER:

NEW MILLENNIUM BUILDING SYSTEMS, LLC

EVALUATION SUBJECT:

NEW MILLENNIUM STEEL ROOF DECK PANELS

## 1.0 REPORT PURPOSE AND SCOPE

### Purpose:

The purpose of this evaluation report supplement is to indicate that New Millennium steel deck panels in ICC-ES evaluation report ESR-2657, have also been evaluated for compliance with the code noted below.

### Applicable code edition:

2020 *Florida Building Code—Building*

## 2.0 CONCLUSIONS

The steel deck panels, described in Sections 2.0 through 7.0 of ICC-ES evaluation report ESR-2657, comply with the *Florida Building Code—Building*. The design requirements shall be in accordance with the *Florida Building Code—Building*. The installation requirements noted in ICC-ES evaluation report ESR-2657 for the 2018 *International Building Code*® meet the requirements of the *Florida Building Code—Building*.

Use of the steel deck panels has also been found to be in compliance with the High-Velocity Hurricane Zone provisions of the *Florida Building Code—Building* except that the 22 gage steel deck panels must have a minimum G90 galvanized coating in accordance with Section 2222.6.1 of the *Florida Building Code—Building*.

For products falling under Florida Rule 61G20-3, verification that the report holder's quality assurance program is audited by a quality assurance entity approved by the Florida Building Commission for the type of inspections being conducted is the responsibility of an approved validation entity (or the code official when the report holder does not possess an approval by the Commission).

This supplement expires concurrently with the evaluation report, reissued March 2024.