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New SDI Diaphragm Design Manual

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Introduction

The Steel Deck Institute (SDI) has released the new and long awaited 4th Edition of the *Diaphragm Design Manual* (DDM04). This new edition complies with the requirements of the ANSI/AISI S310-13 *North American Standard for the Design of Profiled Steel Diaphragm Panels*. At 408 pages, the 4th Edition is larger than its predecessor and will be an invaluable resource to structural designers because of the background information, design examples, and extensive load tables.

The First Edition of the DDM, published in 1981, was authored by Dr. Larry Luttrell, P.E., the Technical Advisor to the SDI. The diaphragm design method developed by Dr. Luttrell was based on a rational analytical model of the deck panels and the support and side-lap fasteners, which was substantiated by extensive testing. The Second Edition of the DDM, published in 1995, added a design method and design tables for floor deck diaphragms. A Third Edition was published in 2004. The new Fourth Edition is also authored by Dr. Luttrell, with the assistance of John Mattingly, P.E.; Walter Schultz, P.E., and Dr. Thomas Sputo, P.E., S.E..

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Manual Format and Coverage

The *Diaphragm Design Manual, 4th Edition* is divided into a Forward and thirteen sections as follows:

Section 1	Introduction
Section 2	Diaphragm Strength
Section 3	Diaphragm Stiffness
Section 4	Connections
Section 5	Filled Diaphragms
Section 6	Alternate Fastener Properties
Section 7	Symbols
Section 8	References
Section 9	Fasteners, Warping, and Stiffness Properties
Section 9A	Proprietary Fasteners
Section 10	Examples
Section 11	Generic Diaphragm Load Tables
Section 12	Proprietary Diaphragm Load Tables

This new Fourth Edition improves the earlier 3rd Edition in several ways.

1. The Manual complies with the analysis and design methods contained within the AISI S310 Standard. The AISI S310 Standard puts the design method of the first three editions of the *Diaphragm Design Manual* into a building code enforceable standard. The resistance and safety factors are the same as those in the Third Edition, (DDM03).

2. The Manual contains 26 design examples illustrating the design and analysis of steel deck diaphragms, both roof and floor deck. This is an increase over the previous edition which contained 16 examples.

3. New examples include calculation of deflections of non-symmetric diaphragms, diaphragms with open areas, and perforated and acoustical deck. Additional examples also show the calculation of diaphragm strength and stiffness using the AISI S310 provisions.

4. Examples include expanded discussion of the interaction of wind uplift with diaphragm strength.

5. Fasteners included in the Manual include generic welds and mechanical fasteners in accordance with the strength and flexibility provisions of AISI S310, but also include fastener strengths calculated in accordance with the

previous DDM provisions, and proprietary screws and power actuated fasteners. The use of the previous DDM provisions and proprietary fasteners are permitted by AISI S310 as alternate fasteners with performance substantiated by testing.

6. Diaphragm load tables are separated into two sections; calculated using the generic AISI S310 weld and screw provisions, and calculated using the previous 3rd Edition DDM fastener equations and proprietary fasteners. The same resistance and safety factors apply to both methods.

7. The diaphragm buckling strength limit has been updated based on further testing and analysis by the AISI Diaphragm Subcommittee.

8. Since the Second Edition, the strength of concrete filled steel deck diaphragms has been the sum of the strength of the deck, controlled by the fasteners, and the concrete fill. AISI S310 and DDM04 place an upper limit on the contribution of the fasteners to 25% of the total diaphragm strength.

Changes to Diaphragm Tables - Roof Deck

Roof Diaphragms with Screws

Changes to bare deck diaphragm strength and stiffness for diaphragms fastened using screws can be seen by comparing Figure 5 from DDM03 to Figures 6 and 7 from DDM04. These tables tabulate the strength and flexibility of 22 gage (0.0295 inch), 1-1/2 inch steel wide rib (WR) roof deck with #12 support screws and #10 sidelap screws.

Assuming a 36/5 fastener patters with 3 sidelap screws per span, and a span length of 5 feet, we see the differences in Table 1.

The values of K2, K4 and the Moment of Inertia are taken from other tables in DDM03 and DDM04. The values of K4 and the Moment of Inertia changed in DDM04 due to slight revisions to the lower bound section properties of wide rib deck manufactured by SDI member companies. The value of G' (diaphragm stiffness) is calculated from these values.

Because the AISI S310-13 Standard permits the use of alternate fastener strength and flexibility formulations when substantiated by testing, the older DDM03 screw strength values can continue to be used, if desired. The lower strength for the generic fasteners are due to the use of the AISI S100 screw strength equations which were incorporated into S310.

	Figure 5 - DDM03	Figure 6 - DDM04 (Generic)	Figure 7 - DDM04 (Proprietary)
Nominal Shear Strength, S_{nf}	670 plf	480 plf	670 plf
Nominal Shear Strength, S_{nb}	2050 plf	5580 plf	5580 plf
K1	0.304 /ft	0.304 /ft	0.304 /ft
K2	870 kip/in	870 kip/in	870 kip/in
K4	3.78	3.55	3.55
Dxx	758 ft	607 ft	607 ft
Moment of Inertia	0.152 in^4/ft	0.173 in^4/ft	0.173 in^4/ft
G'	16.16 kip/in	19.54 kip/in	19.54 kip/in

Table 1. Comparison of Strength and Stiffness of Roof Deck with Screw Attachment

Roof Diaphragms with Welds

Changes to bare deck diaphragm strength and stiffness fastened with welds can be seen by comparing tables from DDM03 (page AV-6) and DDM04 (page 11-5). These tables tabulate the strength and flexibility of 20 gage (0.00358 inch), 1-1/2 inch steel wide rib (WR) roof deck with 3/4" arc spot welds at supports and 5/8" arc spot welds at sidelaps.

Assuming a 36/5 fastener pattern with 3 sidelap welds per span, and a span length of 5 feet, in Table 2 we see the following:

	DDM03	DDM04
Nominal Shear Strength, S_{nf}	1665 plf	1665 plf
Nominal Shear Strength, S_{nb}	2890 plf	7465 plf
K1	0.184 /ft	0.184 /ft
K2	1056 kip/in	1056 kip/in
K4	3.78	3.55
Dxx	567 ft	454 ft
Moment of Inertia	0.198 in^4/ft	0.210 in^4/ft
G'	26.03 kip/in	31.47 kip/in

Table 2. Comparison of Strength and Stiffness of Roof Deck with Welds

The diaphragm strength for welded diaphragms does not differ from what was found in DDM03. The weld strength equation from DDM03 is the same as what is found in AISI S100 and S310 for thin sheets.

Changes to Diaphragm Tables - Floor Deck

Floor Diaphragms with Welds

Changes to concrete filled deck diaphragm strength and stiffness fastened with welds can be seen by comparing tables from DDM03 (page AV-96) and DDM04 (page 11-29 and Figure 8). These tables tabulate the strength and flexibility of 20 gage (0.00358 inch), steel floor deck with 2-1/2 inches of structural concrete above the deck with 5/8" arc spot welds at supports and 5/8" arc spot welds at sidelaps.

Assuming a 36/4 fastener pattern and a span length of 5 feet, in Table 3 we see the following:

	Number of sidelap welds per span	DDM03	DDM04
Nominal Shear Strength, S_{nf}	1	5835 plf	5980 plf
Nominal Shear Strength, S_{nf}	8	8030 plf	6535 plf

Table 3. Comparison of Strength of Welded Floor Diaphragm

With one sidelap fastener per span, the diaphragm strength is approximately the same because the diaphragm strength is dominated by the contribution of the concrete fill. However, when a large number of sidelap fasteners are added, the contribution of the fasteners to the diaphragm strength increases and is limited by the AISI S310 limit that the fasteners can contribute no more than 25% of the total diaphragm strength.

In Figure 8 (DDM04 page 11-29), for this same 36/4 attachment pattern and 5 foot span that for 3 or more sidelap fasteners there is no additional diaphragm strength due to this 25% fastener limit. Likewise, for the same 36/4 attachment pattern with 4 sidelap fasteners, the diaphragm strength is the same for all deck spans up to 6 feet.

Example Highlights

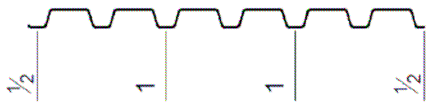
New examples added to the Manual increase the usability by illustrating commonly used applications which were not covered in DDM03.

Example 21: Shear-Tension Effects on Diaphragm Strength (Screws)

Given: Same as Example 20 except deck attachment at supports are #12 screws

Solution:

Determine Tension Force Per Fastener, T



K = NO. OF SCREWS ACROSS SHEET
= ½ + 1 + 1 + ½
= 3.00

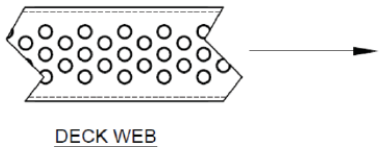
NOTE: EDGE SCREW IS 100% EFFECTIVE

Figure 1. Tension and Shear Interaction on Fasteners

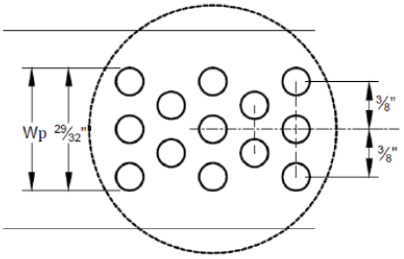
Example 22: Calculate Strength and Stiffness for Acoustical WR Deck

Given:

As in Example 17, except deck is acoustical fluted with 5 rows of 5/32 inch Φ on 3/8 inch centers.



DECK WEB



ACOUSTICAL PERFORATION PATTERN

Figure 2. Acoustical Deck Diaphragms

Example 25: Calculate Strength and Stiffness for Composite Cellular Deck without Fill

Given:

Demonstrate Strength and Stiffness of 2 inch x 12 inch x 18 gage (0.0474 inch) Hat Section With 18 gage (0.0474 inch) flat pan – Bare Deck Only

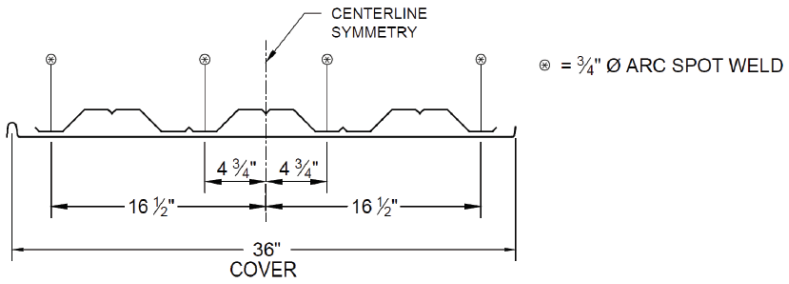


Figure 3. Cellular Deck Diaphragms

Example 26: Calculate Strength and Stiffness for Composite Cellular Acoustical Deck without Fill

Given:

Same as Example 25 except bottom sheet has 27 staggered rows of 5/32" diameter x 3/8" holes below each cell

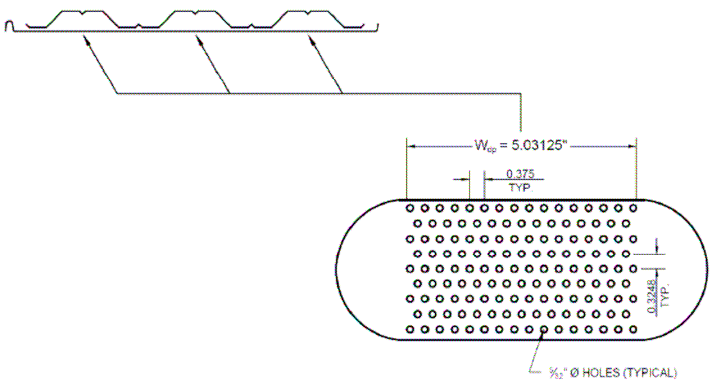


Figure 4. Acoustical Cellular Deck Diaphragms

Conclusion

The new SDI *Diaphragm Design Manual, 4th Edition*, represents a step forward for designers of buildings that incorporate steel deck diaphragms.

References

American Iron and Steel Institute (2013). ANSI/AISI S310-13 *North American Standard for the Design of Profiled Steel Diaphragm Panels*, Washington, DC

American Iron and Steel Institute (2012). ANSI/AISI S100-12 *North American Standard for the Design of Cold-Formed Steel Structural Members*, Washington, DC

Steel Deck Institute (SDI) (2004). *Diaphragm Design Manual, 3rd Edition*, Fox River Grove, IL.

Steel Deck Institute (SDI) (2015). *Diaphragm Design Manual, 4th Edition*, Glenshaw, PA.

1.5 (WR, IR, NR)
t = design thickness = 0.0295"
SUPPORT FASTENING: Buildex or Elco Textron #12 or #14 TEKS screws
SIDE-LAP FASTENING: #10 screws

ϕ (EQ): 0.65 Ω (EQ): 2.50
ϕ (WIND): 0.70 Ω (WIND): 2.35
ϕ (Other): 0.65 Ω (Other): 2.50

FASTENER LAYOUT	SIDE-LAP CONN./SPAN	NOMINAL SHEAR STRENGTH, PLF SPAN, FT 3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	K1
36/9	0	1040	915	815	720	645	590	530	485	445	0.366
	1	1185	1050	940	850	770	695	635			0.301
	2	1315	1175	1060	960	880	810	740	680	625	0.255
	3	1425	1285	1165	1065	975	900	835	775	715	0.222
	4	1530	1390	1265	1160	1070	990	920	860	805	0.196
	5	1615	1480	1360	1250	1155	1075	1000	935	880 *	0.176
	6	1695	1560	1440	1335	1240	1155	1080	1010 *	950 *	0.159
36/7	0	665	575	500	445	395	360	325	300	275	0.549
	1	835	730	650	585	525	475	430			0.414
	2	985	870	780	705	640	585	540	495	455	0.333
	3	1115	1000	900	815	745	685	635	590	550	0.278
	4	1230	1110	1010	920	845	780	725	675	630	0.239
	5	1330	1210	1105	1015	935	865	805	755	705	0.209
	6	1415	1300	1195	1105	1020	950	885	830	780	0.186
36/5	0	590	515	460	410	365	330	300	275	255	0.659
	1	730	650	585	530	485	445	405			0.474
	2	840	760	690	635	580	540	500	465	435	0.370
	3	930	855	785	725	670	625	580	545	510	0.304
	4	1005	930	865	805	750	700	655	615	580	0.257
	5	1060	995	930	870	815	770	720	680	645	0.223
	6	1105	1045	985	930	875	830	785	740	705	0.197
36/4	0	460	395	350	310	275	250	225	205	190	0.824
	1	585	525	475	430	395	365	330			0.554
	2	685	625	575	525	485	450	420	395	370	0.417
	3	755	705	655	605	565	530	495	465	440	0.334
	4	810	765	715	675	630	595	560	530	500	0.279
	5	850	810	765	725	690	650	620	585	560	0.240
	6	880	845	805	770	735	700	665	635	610	0.210
30/6	0	605	515	450	395	355	320	290	265	245	0.732
	1	780	680	605	540	480	435	395			0.538
	2	935	825	735	665	605	550	505	460	425	0.425
	3	1075	955	860	780	710	655	605	560	520	0.351
	4	1195	1075	975	885	810	750	695	645	605	0.299
	5	1300	1180	1075	985	905	840	780	725	680	0.261
	6	1385	1270	1165	1075	995	925	860	805	755	0.231
30/4	0	550	485	430	385	345	310	280	260	240	0.823
	1	685	610	550	500	460	420	390			0.585
	2	790	720	655	600	555	515	475	445	415	0.454
	3	870	805	740	685	640	595	555	520	490	0.371
	4	935	875	815	760	710	665	625	590	555	0.314
	5	985	930	875	820	775	730	690	650	615	0.272
	6	1025	975	920	875	830	785	745	705	670	0.240

* NOMINAL SHEAR SHOWN ABOVE MAY BE LIMITED BY SHEAR BUCKLING. SEE TABLE BELOW.

THE SHADED VALUES DO NOT COMPLY WITH THE MINIMUM SPACING REQUIREMENTS FOR SIDE-LAP CONNECTIONS AND SHALL NOT BE USED EXCEPT WITH PROPERLY SPACED SIDE-LAP CONNECTIONS.

ϕ (Buckling): 0.80 Ω (Buckling): 2.00

DECK PROFILE	I in^4 / ft	NOMINAL SHEAR DUE TO PANEL BUCKLING (S_N), PLF / SPAN, FT 3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0
NR	0.099	4130	3035	2320	1835	1485	1225	1030	880	755
IR	0.108	4410	3240	2480	1960	1585	1310	1100	935	810
WR	0.152	5695	4185	3205	2530	2050	1695	1420	1210	1045

Figure 5. DDM03 - 22 Gage Roof Deck - #12 Support Screw - #10 Sidelap Screw

1.5(WR, IR, NR)22
Design thickness = 0.0295 in.
Support fastening: #12 screws
Side-lap fastening: #10 screws

F_u= 45 ksi
F_y= 33 ksi

Loading	ϕ_{df}	Ω_{df}
Seismic	0.65	2.50
Wind	0.70	2.35
Other	0.65	2.50

Fastener Layout	Side-lap Conn/Span	Nominal Shear Strength, S_{nf}, plf[1,2] Span, ft. 3	3.5	4	4.5	5	5.5	6	6.5	7	K_1 1/ft
36/9	0	790	695	615	545	490					0.366
	1	885	785	700	635	570	515	470			0.301
	2	970	865	780	705	645	590	540	495	455	0.255
	3	1050	945	855	775	710	655	610	560	515	0.222
	4	1120	1015	925	845	775	715	665	620	575	0.196
	5	1185	1080	985	905	835	775	720	670	630	0.176
	6	1240	1135	1045	965	890	830	770	720	680	0.159
36/7	0	505	435	380	335	300					0.549
	1	615	540	480	430	385	345	315			0.414
	2	720	635	565	510	465	420	385	355	325	0.333
	3	810	720	645	585	535	490	455	420	385	0.278
	4	890	800	720	655	600	555	510	475	445	0.239
	5	960	870	790	725	665	615	570	530	495	0.209
	6	1025	935	855	785	725	670	625	585	545	0.186
36/5	0	445	390	350	310	275					0.659
	1	540	480	430	390	355	325	295			0.474
	2	615	555	505	460	420	390	360	335	310	0.370
	3	680	620	570	520	480	445	415	390	365	0.304
	4	735	675	625	580	535	500	465	435	410	0.257
	5	780	725	675	625	585	550	515	485	455	0.223
	6	815	765	715	670	630	590	555	525	495	0.197
36/4	0	340	300	265	235	210					0.823
	1	430	385	345	315	290	265	240			0.554
	2	500	455	415	380	350	325	300	280	260	0.417
	3	555	510	470	435	405	380	355	330	310	0.334
	4	595	555	520	485	455	425	400	375	355	0.279
	5	625	590	555	525	495	465	440	415	395	0.240
	6	650	620	590	560	530	500	475	450	430	0.210
30/6	0	455	390	340	300	270					0.732
	1	575	500	445	395	350	315	290			0.538
	2	680	600	530	480	435	395	360	330	305	0.425
	3	775	685	615	555	505	465	430	395	365	0.351
	4	860	770	695	630	575	530	490	455	425	0.299
	5	935	845	765	700	640	590	550	510	475	0.261
	6	1000	910	830	760	700	650	605	565	530	0.231
30/4	0	415	365	325	290	260					0.823
	1	505	450	405	370	335	310	280			0.585
	2	580	525	475	435	400	370	345	320	300	0.454
	3	640	585	540	495	460	425	395	370	350	0.371
	4	685	635	590	550	510	475	445	420	395	0.314
	5	725	675	635	595	555	520	490	460	435	0.272
	6	755	710	670	630	595	560	530	500	475	0.240

[1] Nominal shear strength shown above may be limited by shear buckling. See table below.

	ϕ_{db}	Ω_{db}
Buckling	0.80	2.00

Deck Profile	I in^4/ft	Nominal Shear Due to Panel Buckling, S_{nb}, plf[2] Span, ft 3	3.5	4	4.5	5	5.5	6	6.5	7
NR	0.114	11246	8263	6326	4998	4049	3346	2812	2396	2066
IR	0.125	12191	8956	6857	5418	4389	3627	3048	2597	2239
WR	0.173	15500	11388	8719	6889	5580	4612	3875	3302	2847

Figure 6. DDM04 - 22 Gage Roof Deck - #12 Support Screw - #10 Sidelap Screw (Generic)

F_u= 45 ksi
F_y= 33 ksi

Loading	ϕ_{df}	Ω_{df}
Seismic	0.65	2.50
Wind	0.70	2.35
Other	0.65	2.50

1.5(WR, IR, NR)22
Design thickness = 0.0295 in.
Support fastening: Buildex, Elco, Hilti, or Simpson Strong-Tie #12 screws
Side-lap fastening: Buildex, Elco, Hilti, or Simpson Strong-Tie #10 screws

Fastener	Side-lap	Nominal Shear Strength, S_{nf}, plf[1,2] Span, ft.									K_1
Layout	Conn/Span	3	3.5	4	4.5	5	5.5	6	6.5	7	1/ft
36/9	0	1035	910	810	720	640					0.366
	1	1180	1045	940	845	765	695	630			0.301
	2	1310	1170	1055	960	875	805	735	675	625	0.255
	3	1425	1285	1165	1060	975	900	835	775	715	0.222
	4	1525	1385	1265	1160	1070	990	920	855	805	0.196
	5	1615	1475	1355	1250	1155	1070	1000	935	875	0.176
	6	1690	1560	1440	1330	1235	1150	1075	1010	950	0.159
36/7	0	660	575	500	440	395					0.549
	1	830	730	645	580	520	470	430			0.414
	2	980	870	775	700	640	585	535	490	455	0.333
	3	1115	995	895	815	745	685	630	590	545	0.278
	4	1230	1110	1005	915	840	775	720	670	630	0.239
	5	1325	1210	1105	1015	935	865	805	750	705	0.209
	6	1410	1295	1190	1100	1020	945	885	825	775	0.186
36/5	0	585	515	460	410	365					0.659
	1	725	645	580	525	480	440	405			0.474
	2	840	760	690	630	580	535	495	465	435	0.370
	3	930	850	785	720	670	620	580	540	510	0.304
	4	1000	930	860	800	745	695	655	615	575	0.257
	5	1060	990	930	870	815	765	720	680	640	0.223
	6	1105	1045	985	930	875	825	780	740	700	0.197
36/4	0	445	395	350	305	275					0.823
	1	580	520	470	430	390	360	330			0.554
	2	680	620	570	525	485	450	420	390	365	0.417
	3	755	700	650	605	565	525	495	465	435	0.334
	4	810	760	715	670	630	595	560	530	500	0.279
	5	850	805	765	725	685	650	615	585	555	0.240
	6	880	840	805	765	730	695	665	635	605	0.210
30/6	0	600	515	445	395	350					0.732
	1	775	680	600	535	480	435	395			0.538
	2	935	825	735	660	600	550	500	460	425	0.425
	3	1070	955	860	775	710	650	600	555	515	0.351
	4	1190	1070	970	885	810	745	690	645	600	0.299
	5	1295	1175	1070	980	905	835	775	725	680	0.261
	6	1385	1270	1165	1070	990	920	860	800	755	0.231
30/4	0	545	480	430	380	340					0.823
	1	680	610	550	500	455	420	385			0.585
	2	785	715	655	600	550	510	475	445	415	0.454
	3	870	800	740	685	635	590	555	520	485	0.371
	4	935	870	810	760	710	665	625	585	555	0.314
	5	980	925	870	820	770	725	685	650	615	0.272
	6	1020	970	920	870	825	785	740	705	670	0.240

[1] Nominal shear strength shown above may be limited by shear buckling. See table below.

	ϕ_{bb}	Ω_{db}
Buckling	0.80	2.00

Deck	I	Nominal Shear Due to Panel Buckling, S_{nb}, plf[2] Span, ft								
Profile	in^4/ft	3	3.5	4	4.5	5	5.5	6	6.5	7
NR	0.114	11246	8263	6326	4998	4049	3346	2812	2396	2066
IR	0.125	12191	8956	6857	5418	4389	3627	3048	2597	2239
WR	0.173	15500	11388	8719	6889	5580	4612	3875	3302	2847

Figure 7. DDM04 - 22 Gage Roof Deck - #12 Support Screw - #10 Sidelap Screw (Proprietary)

Design thickness = 0.0358 in. F_u= 52 ksi
Support fastening: 5/8 in. arc spot welds F_y= 40 ksi
Side-lap fastening: 5/8 in. arc spot welds F_{uw}= 60 ksi

Bare Deck Diaphragm			Filled Diaphragm		
Loading	ϕ_{df}	Ω_{df}	Loading	ϕ_{df}	Ω_{df}
Seismic	0.55	3.00	Seismic	0.50	3.25
Wind	0.70	2.35	Wind	0.50	3.25
Other	0.60	2.65	Other	0.50	3.25

Type of Fill	Fastener Layout	Side-lap Conn/Span	Nominal Shear Strength, S_{nf}, plf[1,2] Span, ft. 4	5	6	7	8	9	10	11	12	K_1 1/ft
1-1/2" x 6" No Fill (Bare Deck)	36/4	0	835	660								0.802
		1	1175	900	040							0.394
		2	1440	1235	1070	945	840	745				0.261
		3	1645	1440	1270	1135	1020	920	840	770	710	0.195
		4	1800	1610	1440	1300	1175	1075	985	910	840	0.156
		5	1915	1740	1585	1440	1320	1210	1115	1035	960	0.130
		6	2005	1850	1700	1565	1445	1335	1235	1150	1075	0.111
		8	2125	2005	1880	1760	1645	1540	1445	1355	1275	0.086
2" x 12" No Fill (Bare Deck)	36/4	0	820	640								0.802
		1	1175	980	825							0.394
		2	1440	1235	1070	945	835	745				0.261
		3	1645	1440	1270	1135	1020	920	840	770	710	0.195
		4	1800	1610	1440	1300	1175	1075	985	910	840	0.156
		5	1915	1740	1585	1440	1320	1210	1115	1035	960	0.130
		6	2005	1850	1700	1565	1445	1335	1235	1150	1075	0.111
		8	2125	2005	1880	1760	1645	1540	1445	1355	1275	0.086
3" x 12" No Fill (Bare Deck)	36/4	0	785	615								0.802
		1	1175	980	815							0.394
		2	1440	1235	1070	945	835	745				0.261
		3	1645	1440	1270	1135	1020	920	840	770	710	0.195
		4	1800	1610	1440	1300	1175	1075	985	910	840	0.156
		5	1915	1740	1585	1440	1320	1210	1115	1035	960	0.130
		6	2005	1850	1700	1565	1445	1335	1235	1150	1075	0.111
		8	2125	2005	1880	1760	1645	1540	1445	1355	1275	0.086
2-1/2" NW Conc. (Above Deck)	36/4	0	5795	5615								0.802
		1	6250	5980	5800							0.394
		2	6535	6340	6100	5930	5800	5700				0.261
		3	6535	6535	6405	6190	6025	5900	5800	5720	5650	0.195
		4	6535	6535	6535	6445	6255	6105	5985	5885	5805	0.156
		5	6535	6535	6535	6535	6480	6305	6165	6050	5955	0.130
		6	6535	6535	6535	6535	6535	6505	6345	6215	6105	0.111
		8	6535	6535	6535	6535	6535	6535	6535	6535	6405	0.086
2-1/2" LW Conc. (Above Deck)	36/4	0	4355	4175								0.802
		1	4615	4540	4360							0.394
		2	4615	4615	4615	4490	4360	4260				0.261
		3	4615	4615	4615	4615	4585	4460	4360	4280	4210	0.195
		4	4615	4615	4615	4615	4615	4615	4545	4445	4365	0.156
		5	4615	4615	4615	4615	4615	4615	4615	4610	4515	0.130
		6	4615	4615	4615	4615	4615	4615	4615	4615	4615	0.111
		8	4615	4615	4615	4615	4615	4615	4615	4615	4615	0.086

[1] Nominal shear strength of bare deck shown above may be limited by shear buckling. See Table below.

	ϕ_{db}	Ω_{db}
Buckling	0.80	2.00

Deck Profile	I in^4/ft	Nominal Shear Due to Panel Buckling, S_{nb}, plf[2] Span, ft. 4	5	6	7	8	9	10	11	12
1-1/2" x 6"	0.210	11660	7465	5180	3805	2915	2300	1865	1540	1295
2" x 12"	0.377	18610	11910	8270	6075	4650	3675	2975	2460	2065
3" x 12"	0.932	35640	22810	15840	11635	8910	7040	5700	4710	3960

Figure 8. DDM04 - 20 Gage Composite Floor Deck - 5/8 inch Arc Spot Weld Support and Sidelap Fasteners