Specifications Marcore-S and Marcore-SR

I. Engineering Tables

1. Scope

The engineering tables were made for composite floor deck with corrugated light gauge steel deck MARCORE, manufactured by Marlyn Steel Decks, Inc. (Marlyn). The composite steel deck is the structural element, which is made with light gauge cold-formed steel deck and concrete that is poured over the deck. This particular type of deck can span up to 21 feet long and act as a simple supported beam or up to 25 feet long and act as a two-span beam. In cases where the deck lays over an intermediate support, additional reinforcement must be added into the concrete to take negative bending moment over this support. Positive bending moment is taken by the steel deck, which works at the same time as a form.

2. Materials

2.1 Steel deck

MARCORE steel deck is two inches deep.
This steel deck is fabricated from a steel sheet, zinc coated (galvanized) by a hot dip process in coils per ASTM A653.
Performance tables are given:

2.1.a. Steel decks made with 22 & 20 gauges, steel based on yield strength of 50 ksi (grade 50).

2.1.b. Steel decks made with 18 gauge, steel based on yield strength of 40 ksi (grade 40).

2.2 Concrete

Composite deck contains concrete that is poured over the MARCORE deck. Performance tables are given for composite deck made with normal and lightweight concrete.

2.2.a. Normal weight concrete (145 lb/ft^3) with a compressive strength fc'=4000 psi at 28 days as per ACI 318 Building Code Requirements for Reinforced Concrete shall be used. No admixture containing chlorides is allowed.

2.2.b. Lightweight concrete (110 lb/ft^3) with a compressive strength fc'=3000 psi at 28 days as per ACI 318 Building Code Requirements for Reinforced Concrete shall be used. No admixture containing chlorides is allowed.

2.3 Reinforcing steel

In composite steel floor deck, three types of reinforcing are used:

2.3.a. "**Positive**" reinforcing, which takes tension stress in the positive bending moment. In this case, the steel deck acts as reinforcing for one and two-span conditions.
2.3.b. "**Negative**" reinforcing, which takes tension stress in the negative bending moment for two-span condition only. Bars shall be grade 60 as per ASTM A615.

2.3.c. "**Temperature**" reinforcing (for one- and two-span conditions) shall be welded wire fabric as per ASTM A 185. The type of wire mesh is given in tables for each deck thickness. The sufficient steel area is 0.075% of concrete area per foot of width above the flutes.

How to place reinforcing:

a. "Negative" reinforcing in composite floor deck must be located 3/4" clear below the top of the concrete and extended in each direction from the intermediate support at least one third of the span.
b. "Temperature" reinforcing is placed above the steel deck.

3. Design Assumptions

3.0 General

Composite steel deck was designed for two main conditions: one-span and two-span conditions. The overall thickness of the deck (for both conditions) is the sum of the thickness of the steel deck (2") and the thickness of the concrete above the corrugation height of the steel deck (varies from 2" to 6" in 0.5" increments).

3.0.a. One-span condition: A composite steel deck has two supports and was designed as a simple supported beam.

3.0.b. Two-span condition: A composite steel deck that has three supports (two end supports and one intermediate) and was designed as a continuous beam with two equal spans.

Notes:

1. The calculations of the moments were based on the length of the span from center to center of the supports.
2. The tables and design data in this publication are based on deck that is properly connected to the frame in accordance with SDI specifications.

3.1 Loads

Calculations for one and two span conditions were based on LRFD procedure.

3.1.a. Self-weight of the composite deck and construction live load was applied to calculate the unshored span:
Concrete is Normal/light weight concrete.
Steel deck gauge from 22 to 18. Construction live load is 20 pounds per square foot.

3.1.b. Superimposed loads:

One-span condition: In the tables, working loads are the sum of maximum superimposed dead and live loads given relative to the thickness of the composite slab thickness and its span.
Note: No additional construction load is included.

Two-span condition: Three working load combinations were considered relative to the thickness of the composite slab and its spans. Provided minimum "negative" reinforcing was calculated based on load combinations:

Dead Load (DL) = 25 psf: Live Load (LL) = 40 psf
Dead Load (DL) = 25 psf: Live Load (LL) = 50 psf
Dead Load (DL) = 5 psf: Live Load (LL) = 100 psf
Note: No additional construction load is included.

3.2 Deflection

All load combinations were checked for their deflection. The maximum allowable deflection was not to exceed the lowest of these three values:

1. L/180 (for Dead and Live loads).
2. L/360 (for Live loads only).
3. Or ¾".

Where L is the span of the beam center to center between supports.

3.3 Additional calculations

Shear was checked (for one- and two-span conditions).
Combination of shear and bending moment was performed for the two-span condition assuming that the sum of the ratio of actual to allowable shear in the second power and ratio of actual and allowable moment in the second power cannot exceed 1; $(V_{act}/V_{all})^2 + (M_{act}/M_{all})^2 \leq 1$.

Specifications Marcore-R and Marcore-RA

I. Engineering Tables

1. Scope

The engineering load tables were made for MARCORE roof deck made by Marlyn. A similar shaped deck if often called “dovetail.” The roof steel deck is the structural element, which is made with light gauge cold-formed steel deck. The deck is 2” deep. It can span one, two, three or more spans.

2. Materials

MARCORE steel deck is two inches deep.
This steel deck is fabricated from a steel sheet, zinc coated (galvanized G60 or G90) by a hot dip process in coils per ASTM A653.
Performance tables are given:

2.1. Steel decks made with 22 & 20 gauges, steel based on yield strength of 50 ksi (grade 50).

2.2. Steel decks made with 18 & 16 gauges, steel based on yield strength of 40 ksi (grade 40).

3. Design Assumptions

3.1. Gravity load tables.

3.1.0. General

Roof steel deck was designed for three main conditions: one-span, two-span, and three-span conditions.

- One-span condition: It is a roof steel deck that has two supports and was designed as a simple supported beam.
- Two-span condition: It is a roof steel deck that has three supports (two end supports and one intermediate) and was designed as a continuous beam with two equal spans.
- Three or more-span condition: It is a roof steel deck that has four or more supports (two end supports and the others are intermediate) and was designed as a continuous beam with equal spans.

3.1.1. Calculations assumptions:

- The calculations of the moments were based on the length of the span from center to center of the supports provided they do not differ in length more than 10%.

- The tables and design data in this publication are based on deck that is properly connected to the frame in accordance with SDI Specifications:

    a. Maximum side lap splices cannot be more than 12” between adjacent points.

    b. Deck has to be properly attached to prevent blow-off and slip-off from supporters.

    c. The maximum uniform loads determined in tables 3,5, and 7 are based on assumptions that end bearing of deck is not less than 2” and the deck bearing at the interior support is not less than 4”.

    d. The maximum uniform loads determined in tables 3, 5, and 7 are based on LRFD (load resistance factor design) and ASD (allowable stress design). Both calculations are combined of dead and live loads.

    e. Maximum deflection of the deck is designed not to exceed L/240 or 3/4” whichever is less under the uniformly distributed load.

    f. Construction and maintenance loads on one or more spans: The determined maximum span under concentrated construction load and maintenance load equal to 200 lb. at mid-span on 12” wide section of deck with deflection not to exceed L/240.

Commentary:

1. Suspended loads: If applied, additional calculations shall be made by the Engineer of Record to verify the deck deflections and stresses. Suspended loads may include ceilings, light fixtures, or other utilities. The designer must be informed of any loads applied after the roofing has been installed.
2. Openings: It is the responsibility of the Engineer of Record to verify openings in the deck. Additional framing between main supports has to be specified and detailed.
3. Installation: Deck ends are butted over supports. Gaps up to 1 inch shall be permitted.

3.2 Roof uplift load tables.

Roof net uplift calculations were made based on the information provided by Steel Deck Institute publication “Roof Deck Construction Handbook.”
The welding pattern is 24.5/4. The side lap spacing is 12”.
Fastener uplift (resistance) was calculated, based on formula:

$U=(k*P)/(C*L)$

Where:

P, lb – Simplified uplift values generally based on deck gauge and puddle weld diameter.
L, ft – Deck span.
Used safety factor is 2.5.
C & k – factors given in the mentioned above publication for the wide rib deck (see note below).

Note:

The following assumptions were made for the factors k & C:
The wide rib deck and the dovetail deck have the same C and k factors for the same fastener spacing. If later different additional information for the dovetail deck is provided, some modifications will be made.