

Speed Flooring System

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Abstract—The speed floor System essentially is a hybrid concrete steel tee-beam in one direction and an integrated continuous one-way slab in the other direction. Being a unique suspended concrete flooring system it is an innovation in the building industry. So quick and easy to install, speed floor is a lightweight, cost-effective system that's perfect for multi storey buildings and car parks. Whether it's one storey or fifteen, the recipe is very simple. take sufficient quantity of speed floor, add structural steel or concrete supports, mix concrete and pour at the heart of the system is a specially roll formed, galvanized steel joist that offers all the benefits of an open-webbed truss system at a more enough to be manhandled into place, reducing cranaage costs. Services are easily accommodated through the joists which are delivered to the site ready to install. speed floor the perfectly simple, simply perfect solution to multi storey construction.

I. INTRODUCTION

Speed floor is a roll formed steel joist used in a suspended concrete flooring system. The system uses modern techniques and roll forming technology for a fast, light-weight, concrete and steel composite floor at a cost-effective price. The joist is manufactured from pre-galvanized high tensile steel in a one pass roll former, where it is roll formed, punched, pressed and slotted to a high degree of accuracy at a fast production rate. The ends are bolted to the joist shipped to the job site ready for installation. No curing, no painting, no hassles. The individually marked, lightweight joists are placed on the supporting structure where the Speed floor system locks the joist into the exact position. The reinforcement is placed and the concrete floor is ready to pour

II. LITERATURE REVIEW

A. Review Stage

The speed floor, System essentially is a hybrid concrete/ steel tee-beam in one direction and an integrated continuous one-way slab in the other direction. The lock bar

The lock bar supports the temporary plywood formwork between the joists during construction. They are spaced approximately 12-18" apart with 1/2" plywood and 18-24" apart with 5/8" plywood and engage in the slotted holes punched in the top section of the joists.

Standard lock bars will position the joists 49", 37", or 25" apart. There are also special adjustable lock bars that will position the joists in increments of 2" - 13" up to 61". Other types of lock bars provide for special situations such as cantilevers or lowered soffits.

Temporary Plywood Form Work

High-density paper overlaid 1/2" or 5/8" plywood is used as form work to produce a smooth finish on the underside of the slab.

The rigid plywood sheets are used in conjunction with the lock bars and when locked in place, provide lateral stability to the entire speed floor, system during the construction phase.

Reinforcing Mesh

The mesh is laid out and tied into place. No chairs are required, as it is held off the plywood forms by the top section of the joist, which becomes embedded in the concrete.

Concrete

The standard concrete must have a minimum 28-day strength of 3,500 psi. It should be batched at 2 1/2" (60mm) and super plasticized to 4 1/1" (110mm) slump to provide good placement and shrinkage characteristics. A curing compound should be used and an expanding agent can be introduced at the

engineer's request to further control shrinkage during the curing period.

The concrete should initially be placed evenly and continuously over the area to be formed. Special attention should be given to ensure the concrete is screened and finished to the specified thickness so that designed deflections are achieved in the speed floor, joists and the supporting structure

III. MATERIALS

Edge Angles

A standard edge form is available in three heights 3" (75mm), 3 1/2" (90mm) and 4" (102mm). Special heights and specially shaped edge angles are available as well.

Joints

Precut section of galvanized sheet steel can be supplied to overlay joints on plywood to ensure they are flush and remain well supported while the concrete is poured.

Lock Bar Hanger Angles

A galvanized steel angle with prepunched lock bar holes is available for situations where the lock bars need support on slab edges parallel to the joists.

Steel

The roll formed joist is manufactured from steel coated with either 275g/sqm or 450g/sqm—this is Metric, we need US of zinc. If the joists are in a clean and dry environment, they will require no maintenance. If they are exposed, they will require a minimum amount of maintenance to ensure the expected.

Performance is achieved. Guidelines for this maintenance are:

1. Keep surface clean and free from continuous contact with moisture, dust and other debris (a 14mPa water blast every 2 years will suffice).
2. Periodically inspect the joist for any signs of surface corrosion. Remove any by-products of the corrosion by mechanical means and spot prime the exposed steel substrate with an approved steel primer. Repaint the area using an appropriate paint area using an appropriate paint to manufacture's recommendations

Concrete

Special attention is paid to the concrete mixture and the placement of the concrete in the speed floor, system to minimize the likelihood of shrinkage

cracks occurring during the initial curing period. The slump is specified at 2 1/2" (60mm) and super plasticizers is used to improve workability during placement. In parking structures an expanding agent is generally used to reduce the effect of shrinkage during the initial cure and a curing compound is used to help control the curing process.

If any cracks should appear in the concrete floor during the service life of the speed floor, system, they should be filled using an approved epoxy injection system or equivalent to completely close the crack and prevent moisture ingress.

IV. CALCULATIONS AND OBSERVATIONS

LOAD CALCULATION

Dead Load

Even though total Weight of floor depends on the type of finishes, normally it varies from 0.8 Kn/m² to 1.5 Kn/m².

Weight of the floor slab varies from 1.75 Kn/m² & 2.25 Kn/m².

Load for Roof finishing normally varies from 1.25 Kn/m² to 2.5 Kn/m²

For depending upon the water proofing treatment adopted. These are indicative values and Dead load has to be calculated based on the unit weight provided in IS 875 (Part1):1987 for each work.

Live Load

Live load for different occupancies can be considered from Table 1 of IS 875 (Part 2):1987

Wind Load

Wind loads applied on the building is a part of structural system, resisted solely by moment connection & Wind bracing, however the speed floor joist is independent of any force caused by the wind load.

Wind load analysis conduct as per IS875-Part3. The 90-degree case acts on the side elevation and 0-degree wind load case acts on the front or back elevation. Each elevation will be analysed separately and

The highest calculated load will be applied throughout the entire structure. Therefore, this technique is deemed to be conservative. Overturning (global stability) and holding down analysis is conducted for the widest cases.

Comprehensive explanation of the global stability analysis follows: -

Design wind pressure (N/m²) $P_z = 0.6 \times V_z^2$ Design wind speed (m/s) $V_z = V_b \times K_1 \times K_2 \times K_3$ Basic wind speed (m/s) V_b

Risk coefficient factor (K1)

Terrain, height and Structure factor (K2)

Topographic factor (K3)

Seismic Load

Seismic loads apply on the each floor and roof level of the buildings. The horizontal loads are transferred from the floor diaphragm to the walls tying or supporting the floors and roof. Seismic loads applied on

The building is a part of structural system, resisted solely by moment connection & bracings in the structure, however the speed floor joist is independent of any force caused by the seismic action.

Total Design lateral Force or Seismic Base Shear V (KN) = $A_h \times W$ total 53 Design Horizontal Seismic Coefficient $A_h = (Z/ISA/2Rg)$

Zone Factor, Seismic Zone Seismic Intensity Importance Factor (I)

Response Reduction Factor (R)

Average response acceleration coefficient factor (SA/g)

V. RESULT AND DISCUSSION

A. Figures and Tables

PART 1: GENERAL

1-1 Scope

Supply and Installation:

Speed floor, or the speed floor, Agent shall supply all steel joist, components, labor, material and equipment relating to the installation of the speed floor, suspended concrete floor system. Speed floor, steel joist and Lock bars shall be manufactured and marked by speed floor Holdings Ltd, or their authorized agent.

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2-1 Design Principles

The design of the speed floor, System is based on NZS 3404: Part 1 and 2 1997, AS/NZS 4600:1996, and the Australian Composite Structures Standards AS 2327, Part 1. The design loads are in accordance with AS/NZS 1170:2202 Parts 0 and 1, Structural Design Actions.

2-2 Design Parameters

•The section properties and design parameters are calculated from the section geometry supplementary full-scale tests and finite element analysis.

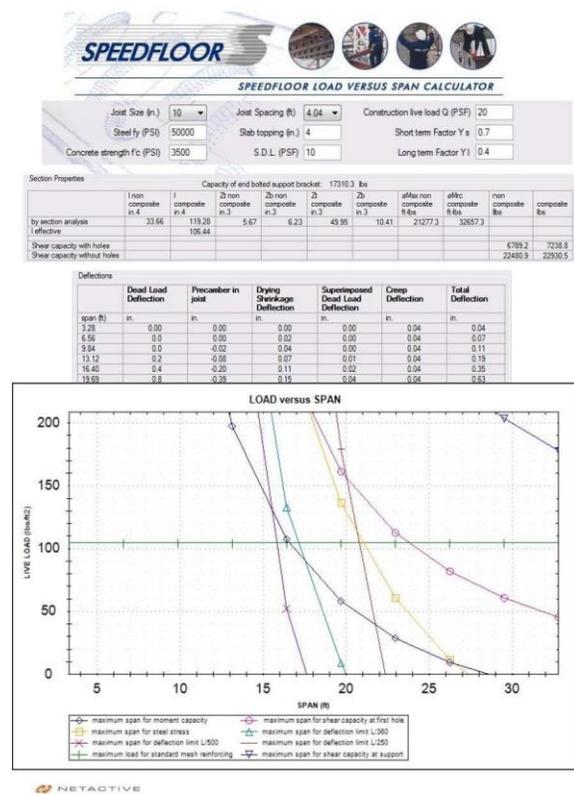
• Speed floor, joists have flanged service holes in the web to assist in web stiffening and to provide practical services access. The joist is simply supported during construction generally with no shorting required. The concrete is cast in place and acts compositely with the speed floor, joist.

2-3 Material

• Speed floor, joists are roll formed form zinc coated steel coil conforming to AS 1397. The minimum mass coating of galvanizing is 275g/m².

• The standard steel used is Grade 350 and has a minimum yield stress of 350MPa and a minimum tensile stress of 380MPa.

• The concrete slab decking requires a minimum compressive strength of 25MPa (30MPa for car parks) in 28 days and the steel mesh is high tensile cold drawn wire to NZS 3422:1975



VI. METHODOLOGY

DELIVERY AND STORAGE

Speed floor, joists are delivered on a flatbed trailer, banded in nested bundles and tagged by job. Proper equipment should be provided for off-loading the material. The bundles are ready to be placed on the supporting structure. All material must be checked by the buyer and/or installer upon arrival at the job site, with discrepancies and damages promptly reported to your speed floor supplier at time of delivery.

If the speed floor, joists are to be stored on site, the bundles should be lifted off the truck using soft straps and placed on dunnage on a level surface. The joists should remain banded and upright until they are ready to be lifted onto the supporting structure.

If the speed floor, joists are to be used immediately they should be lifted in bundles and placed on the structure.

They should remain in bundles until they are ready to be “locked out”. Care must be taken to keep the joist perpendicular and central across the supporting structure.



DAMAGED JOISTS

Care should be exercised at all times to avoid damage through careless handling during unloading, storing and installing. Damaged joists may impair the performance and safety of the system, and must be repaired or replaced prior to installation.

LOCK BAR DELIVERY

The lock bars will be delivered to the job site on pallets, banded and color coded by type. Upon job completion, all lock bars are to be sorted by color and placed back on pallets for pickup.

Upon receiving material, check shipment list for shortages and damages. The manufacturer will not

be responsible for shortages or damages unless they are noted on the shipping list.

Each bundle should be lifted at its center of gravity. Where possible, bundles should remain banded until final placement on structure. If bundles must be opened, they should be retied before lifting.

When lifting bundles with a crane, a spreader bar and nylon straps should be used.

NEVER USE WIRE ROPE OR CHAIN SLINGS. THEY WILL DAMAGE THE JOISTS.

When lifting bundles with forklift, forks must be a minimum of five feet apart. Do not transport open bundles. Drive slowly when crossing rough terrain to prevent joists from shifting.

HANDLING/JOIST STORAGE

Standing on one side of the joist, lift it by the bottom chord. If the joist is over 10' long, lift it with two or more people on one side of the joist.

Do not pick joists up by the ends.

Store bundled joists off the ground sufficiently high enough to allow air circulation beneath bundles and to prevent rising water from entering bundles. Slightly elevate one end of bundle. **PROLONGED STORAGE OF JOISTS IN A BUNDLE IS NOT RECOMMENDED.** If conditions do not permit immediate erection, extra care should be taken to protect joist from staining or water marks.

BAND ONLY

This method is used on all orders, unless otherwise specified by customer. The joists are banded together. The forklift should have at least 5' between forks. Lengths in Excess of 20' must be lifted utilizing a spreader bar.

VII. CONCLUSION

1. Lock bars are installed by sliding the lock bar through the oval holes in the joist and are engaged using the notch at each end of the lock bar. Lock the position of the first (2) joists together by rotating the lock bar into an upright position with the handles pointing down. Once engaged, the lock bar will hold the joists apart at exactly the required distance.
2. Confirm correct position of the joist before installing lock bars. When using 5/8" plywood, install lock bars at approx 18 - 24-inch centers, and when using 1/2" plywood, install lock bars at 12 -18-inch centers. Continue installing lock bars along the full length of the joist.

3. Measure and pre-determine any position of plywood joints and then add lock bars that will be positioned as close to the end of the plywood sheet as possible
 4. Install plywood backers that will hold plywood in the correct position at the end of the sheets.
 5. Install full plywood sheets from the top and confirm that one side is tight against the backer while the other side is tight against joist. Confirm that the joists are square to the building by ascertaining that the plywood is tight against the support structure at the end of the sheet.
 6. Cut and install infill plywood to completely fill this span.
 7. Repeat above items 2-7 with the next joist.
 8. Layout the rest of the joists in the bay, accurately positioning the joist with lock bars at each end. Use an extra lock bar in the center if joists are longer than 18'.
 9. Install all lock bars, making sure extra bars are positioned close to the ends of the plywood sheets.
 10. Place plywood sheets as above, making sure the infill sheets at each end are installed as each span is completed.
 11. Place plywood sheets as above, making sure the infill sheets at each end are installed as each span is completed.
 12. For safety reasons, keep one bay fully locked out with lock bars in front of the plywood decking installation.
- Note: A plywood backer should be installed at the sheet joints as per picture above. This will ensure that the first sheets of plywood are held at the correct distance and parallel to the joist

VIII. FUTURE SCOPE

1. No need of propping and speedy erection
2. The joists are lightweight, requiring less craneage than other concrete flooring systems.
3. Speedy erection
4. Cost effective
5. Less labour intensive
6. Safe to use in seismic sensitive zones
7. Easily accommodates services through pre-punched service holes
8. Bottom of the joist can support a suspended fire rated ceiling directly
9. Fixed to the joist

10. Lock bars and plywood sheets are reble
11. The speed floor joists are custom manufactured to suit particular job conditions.
12. Generally, speed floor uses a 75mm or 90mm topping.
13. A general weight saving can be made throughout the structural components of the building.

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