1. DESIGN

Finally, EURO FLOOR BUSINESS SRL was the flooring contractor commissioned to design and to supply the industrial floors works for the investment objective: Offices, Warehouse & Production Unit. The requirements made by the main contractor LUJAN SA for the completion of the industrial floors were the following:

- Production Unit at 0.00 Level: made in concrete with dry shake hardener finish
- Warehouses: made in concrete with dry shake hardener finish
- Offices, technical rooms: made in concrete with tiling finishing or epoxy coating

In connection with the loads, in Table A2.1 can be seen the expected static and dynamic loads that will bear the building.

<table>
<thead>
<tr>
<th>Area</th>
<th>Uniform distributed loads (UDL)</th>
<th>Forklifts</th>
<th>Robots</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production area, Warehouses,</td>
<td>50 kN/m²</td>
<td>65 kN/aches* 100 cycles/day**</td>
<td>KR 360-3</td>
</tr>
<tr>
<td>Canopy Building</td>
<td></td>
<td></td>
<td>KR 500-3</td>
</tr>
<tr>
<td>Technical rooms</td>
<td>15 kN/m²</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Offices</td>
<td>5 kN/m²</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Table A2.1 – Static and dynamic loads
Moreover, according to the static calculations and on site built subbase, the slab thickness will have two values:

- Production area: 20 cm
- Technical rooms, Offices: 15 cm

In the same way, the concrete mix design will be provided by the concrete plant. Depending on its use, it will be found two different mixes:

- Production area, Warehouses, Technical rooms, Canopy building: C25-30
- Offices, Social rooms: C20-25

When talking about the reinforcement, as it is known, the main one will be 35 kg/m$^3$ of steel fibers type HardX 1-50. Additionally, will be used steel meshes and rebar for details reinforcements. The general rules for the installation of the reinforcement are detailed next.

- **Reinforcement along the dilatation profiles type Durojoint, each side:**
  - One mesh φ4/100x100 mm – 500 mm width in the middle of the cross section
  - Three φ12 bars at a distance of 100 mm
  - Snake spacers 100 mm in order to keep the right distance for the mesh at the soil

- **Reinforcement around the columns:**
  - One mesh φ4/100x100 mm – 3000x3000 mm width in the middle of the cross section
  - Three φ12 bars by every corner – 800 mm of length
  - Snake spacers 100 mm in order to keep the right distance for the mesh at the soil

- **Reinforcement between two columns:**
  - One mesh φ4/100x100 mm – 3000x3000 mm width in the middle of the cross section
Method of statement

- Two φ12 bars which will be bounded at the existing anchors at the foundation with bars bended by 45º
- Snake spacers 100 mm in order to keep the right distance for the mesh at the soil

There were also some specifications for the finished floors. They will be finished by power trowel, being smooth and glossy, except for the tiled and epoxy floors, free from excessive trowel marks, color variations and open textured areas. On the Production areas and Warehouses the surface will be hardened with dry shake hardener Duroquarz sealed with Durosealer. Meanwhile, the Technical rooms will be flat, power trowel but in a rough effect (less than 0.50 mm) as well as, at 0.00 level and in the first floor, the concrete surface will be covered with an epoxy resin (type Rompox) coating with a 2 mm thickness.

Finally, regarding to the joints in the floor saw cut joints will be distributed by every 5x7 m in the main axes and by 1/3 of the thickness deep (60 mm) around the columns, to provide the concrete from cracking. The surfaces in the Warehouses and Production areas will be closed pores, shiny, anti-dust, easy to wash and to maintain, with a pleasant aspect, water-repellent and difficult to penetrate by oil.

2. METHOD OF STATEMENT

The method of statement proposed by SC EURO FLOOR BUSINESS SRL was the following.

1. Reception of the Support Layer

The requirements for the subbase are the following:
- There must be no “fluid pockets” in the ballast mass.
- The elasticity module determined with the Lucas should be higher than 100 MPa under the requested conditions by the technical prescriptions DIN 1834- minimum 2 tests/1000 m².
- The bed coefficient, k, should be higher than 0.07 N/mm³.
- It is forbidden a sand layer on the top of the platform. Sand will only fill the gaps between the upper rocks.
- The accepted evenness is of ± 1.5 cm/3 m
- It won’t be accepted any concrete thickness under 19 cm.
- No surface stones bigger than 30 mm on the top of the sub base will be accepted, as they could pierce the polyethylene film.

2. **Minimum requirements for the building**

   The basis conditions in this part are the next:

   - It must be a complete protection against any type of weather (perfect tightness of the warehouse roof and walls). In the doors and openings areas provisory polyethylene membranes will be installed as a protection against the wind, sun and rain.

   - Total prohibition of any activity on the plate that will be covered with concrete at least 12 hours before starting to cast the concrete.

   - Before starting to put the concrete on the ground, the surface must be free from any activity and material because the contractor people must have enough time to prepare the surface for casting.

   - The surface that has to be prepared in order to be covered with concrete must be free and cleaned of any materials at least 24 hours before starting to cast the concrete.

   - It won’t be permitted any subbase work nearer than 50 m from the fresh concrete plate.

3. **Preparatory works before the floor casting**

   By the preparatory works may be understood all the works and measures that will be performed before casting the first reinforced concrete layer with steel fibers. They are all described below:

   - According to the design, it will be installed all the additional reinforcement described before.

   - The separation between the floor, the structural elements, such as pillars and walls, or the manholes will be noted by laying and expanded polyethylene strip of 2 cm thickness on the entire concrete section height.

   - It will be taken over the ± 0.00 official quota, in a single spot, from which all the subsequent floor quotas will be transmitted. For a floor planarity with a good quality and accuracy must be only one reference quota.

   - The working and dilatation joints will be installed on the specified axes in the design.
- The additional light sources for the appropriated work during the night will be installed.

- Some insulation of panels, pillars and other finishing elements will be set up with polyethylene film on a 1.0 m height from the floor quota in order to protect them against concrete spraying.

- The polyethylene film will be stretched in two layers on the ballast support layer in one sheet, being the minimal covering of 20 cm and being made in the concrete casting direction (new film under old film).

4. Concrete preparation

The requirements for the concrete preparation before casting it in the floor were the following:

- It was requested the use of a C25-30 concrete with clean aggregates and without risible parts, with 0 - 20 mm edges. Before starting the work, preliminary tests are required.

- The concrete will content fluidizers and plasticizers. The formula of the concrete will be approved by the contractor, the designer and the independent survey company Integral. The water-cement ratio will not exceed 0.52.

- The concrete will be produced in centralized installations, provided with humidity sensors for the aggregates.

- The accepted cone settling will not be bigger than 17 before steel fibers admixture and no less than 14 after it.

- The reinforcement with steel fibers will be done at the concrete plant from a special platform in order to have an appropriated mixing duration: for every 1 m$^3$ will be added 35 kg of steel fibers.

- The reinforcement will be done gradually in the concrete truck.

- The steel fibers will be added manually, being made carefully and avoiding overturning the box. There will be no more than 0.5 - 1.0 kg on a throw.

- If on the building site are noticed fiber agglomerations in the concrete mass, commonly known as hedgehogs, these will be removed and a uniform dispersion will be locally made.

- If the exterior temperature rises over 30 °C, the concrete will be prepared and casted by night.
5. **Concrete casting in the floor**

Once everything is ready to start the concrete casting in the floor, these are the requirements to take into account:

- Once arrived on the building site the concrete will be placed directly from the mixing machine, from a dumper or the pump.

- The movement of the mixing machine on the ballast base will be done without turning maneuvers on same spot. It will preferably be moved backwards directly on the casting place.

- If traces are formed on the ballast layer, these will be manually leveled and will be compacted with a light vibrating mass.

- The concrete will be casted in 3.5 - 4 m wide strips, on the entire surface width. Between each two stripes there will be a waiting interval of no more than 1 hour for under 15° exterior temperatures or of 45 minutes for exterior temperatures around 15° - 25°. Over 25° the time will be reduced to 30 minutes.

- The concrete supplying will be done in a sustained rhythm of at least 40 m³/hour uninterruptedly.

- If the concrete station announces the casting ceasing for more than 1 hour, it will be rapidly performed the casing and casting finishing measures.

- After casting the concrete, it will be executed its leveling and vibrating with the Laser Screed machine, at the final quota in the design.

- The floor edges will be vibrated with a vibrating ball and the leveling to the quota will be made with the floating vibrating beam.

- No water will be mixed with the concrete mass at the building site.

- For each 50 m³ of concrete used, three cylindrical samples will be taken for the compression test and one prism-shaped 150x150x600 mm sample will be taken for the bending test.

- The receipt of concrete having a different consistency from that established within the project at the building site will be denied and the concrete will be returned to the concrete station.

- The rectification of the concrete will not be accepted. If the concrete does not have the requested specification, it will be sent to the concrete station and it will be not reusable.
6. **Surface finish**

   In order to assure a good surface finish, it will be requested the following:

   - As soon as the concrete can be walked, with footprints less than 1 cm, a simple 4-90 power trowel fitted with a floating disc will be used to both activate the concrete surface and perform a first-stage leveling.

   - After this first-stage, 2 kg/m$^2$ of Duroquarz will be spread on the surface using a topping spreader type Barikell.

   - After this, the two previous steps will be repeated.

   - Then, double power trowels fitted with discs will be used in a vigorous manner over the entire surface in two directions until the roughness of the surface is lower than 3 mm.

   - The power trowels fitted with polishing pallets will be used over the entire surface until it becomes uniform and the grey floor becomes glassy.

   - During the polishing, the personnel moving across the surface must wear clean footwear with no traces of cement or mud.

   - The equipment consumables will be replaced each time that small scratches or black spots appear.

7. **Concrete protection following casting and the silicate sealer apply**

   After the concrete casting, some protections must be taken:

   - The floor will be covered with a polyethylene foil during minimum one week after the cast.

   - The floor will also be maintained under a thin film of water during all the time.

   - After two weeks, it will be started the application of the material Durosealer on the floor as follows:

     1. The floor will be intensive washed using also an alkaline cleaner type Obtego C10 and diamonded pads red color. The wash will be completed with a walk behind floor with a machine-scrubber.

     2. The floor will be flooded with 120 gr/m$^2$ of Durosealer.

     3. When after 30 minutes more or less, the surface begins to be slippery, it will be sprayed with fresh water and the material will be reactivated with brushes.

     4. By the next appearance of the slipping effect, the surface will be cleaned
with clear water. No spots of material will be accepted after this process because white spots will damage the optical aspect of the floor.

8. **Saw joints cutting**

   The steps to follow in order to cut the joints are the following:
   - Within 24 hours after the concrete finishing, the saw joints will be cut. The general rule says that these joints will be cut at the intersection of the axes.
   - The cutting will be made at 1/3 from the total thickness.
   - No other subcontractors will enter on the surface until the surface is treated with the sealer.

9. **Permanent filling of the saw joints**

   In order to maintain the saw joints, they will have to accomplish the follow rule:
   - At least 2 months after the concrete casting, when its contractions will have taken place to an extent of at least 85%, the grooves will be permanently filled using a poly urea or polyurethane (Thiokol or equivalent).

10. **Surface delivery**

    Finally, following the fulfillment of all the contractual obligations listed above, the surface may be delivered to the beneficiary and put into service.

    The delivery will take place on the grounds of a qualitative and quantitative receipt minutes, drawn up following the determining phase as described in the Quality Control Program.