

Shaping the brief through informed choices

How material placement and coil-stacking arrangements affected factory floor loading, foundation design and estimated construction costs.



Case Studies · CS 005

Ohr initiated this study with the client to demonstrate how the placement and stacking of materials on the factory floor could significantly affect engineering requirements and construction costs. By examining the proposed operations together, we helped the client make informed choices about the investment in their new facility.

01 / Establish the operational needs

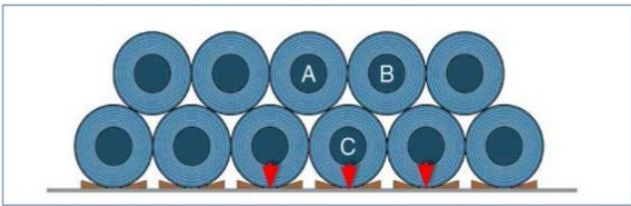
Establishing the floor loads

Work with the client to understand where materials would be stored, how they would be stacked and the weights the floor would need to support.

Ohr established the floor loads from the coil-stacking arrangements provided by the client, translating the proposed storage requirements into a basis for structural design.

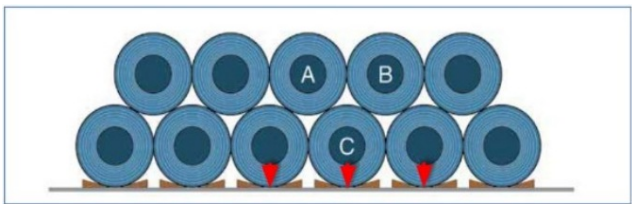
FIGURE 01 / CLIENT'S STACKING ARRANGEMENTS

Block D & E · Raw-material storage



Lower tier · Coil C	Upper tier · Coil A or B
15 tonnes	10 tonnes
x = 1,524 mm	x = 1,219 mm
y = 1,219 mm	y = 1,219 mm

Block F · Raw-material storage



Lower tier · Coil C	Upper tier · Coil A or B
25 tonnes	15 tonnes
x = 1,980 mm	x = 1,524 mm
y = 1,219 mm	y = 1,219 mm

134 kN/m² imposed load

165 kN/m² imposed load

Client-provided coil-stacking arrangements from the original loading study. The original diagrams are retained; their weights, x and y values and imposed loads are set out as readable text.

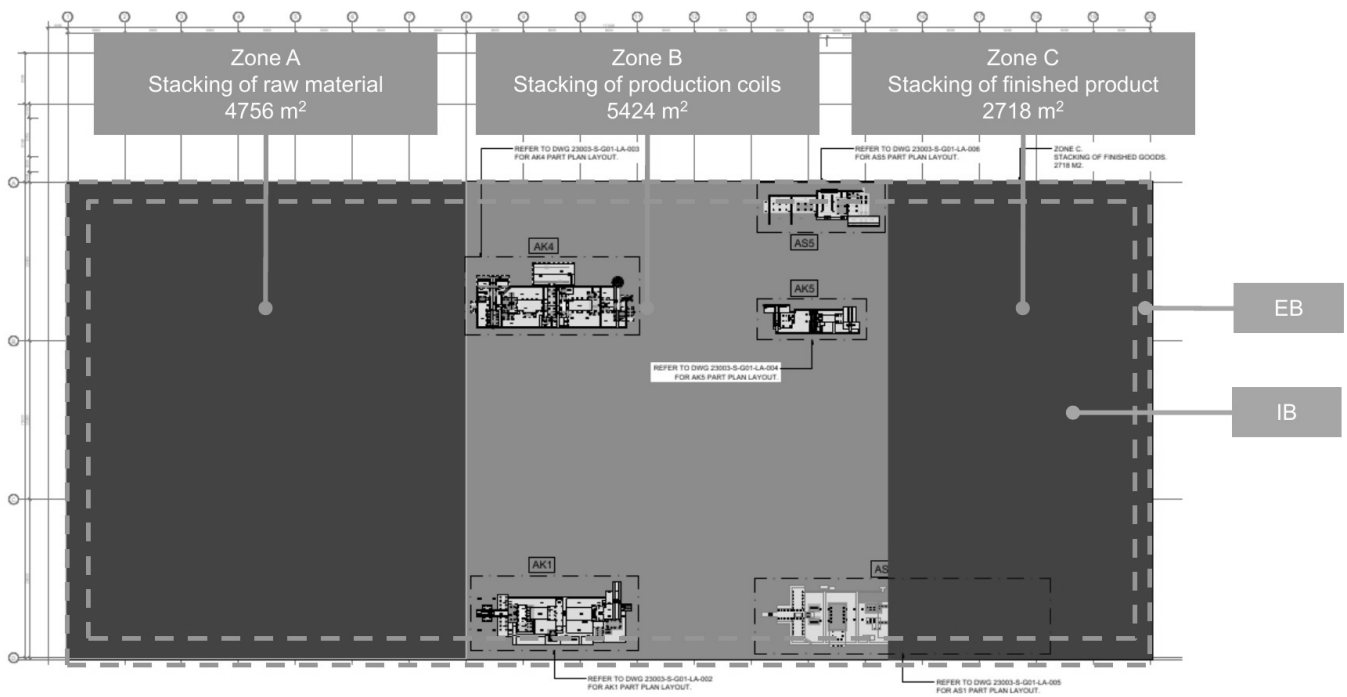
02 / Show the engineering implications

Assessing how the floor space would be used

Translate the proposed arrangements into floor loads, then assess how different choices affect slab depths, pile sizes, pile spacing and estimated construction costs.

Ohr assessed how the proposed use of the floor space—for raw-material storage, production and finished goods—affected the design requirements and subsequent construction costs.

FIGURE 02 / FLOOR USE AND BAY DEFINITIONS



Zone A

Raw-material storage
4,756 m² on zoning plan

Zone B

Production coils
5,424 m² on zoning plan

Zone C

Finished product
2,718 m² on zoning plan

Perimeter bays (EB): the first two bays from the building perimeter. **Internal bays (IB):** the rest of the floor. EP and IP denote the piles supporting perimeter and internal bays respectively.

The source plan is retained in greyscale, with its geometry and markers unchanged. Areas shown on the zoning plan differ from the areas used in the source cost schedules; they are kept distinct below.

Material placement shapes the design

These three examples show how alternative coil-stacking requirements changed the slab and foundation solution and its estimated cost.

FIGURE 03 / COMPARATIVE DESIGN-STAGE STUDY

Zone A	Two-tier stacking	Heavier two-tier stacking	Heavier three-tier stacking
Raw-material storage	Source option 1	Source option 3	Source option 5
Stacking arrangement	15-tonne coils below 10-tonne coils above	25-tonne coils below 15-tonne coils above	25-tonne coils below Two tiers of 15-tonne coils above
Imposed load · kN/m ²	134	165	226
Pile grid · m	2.25 × 2.25	2 × 2	2 × 2
Slab thickness · mm Internal / perimeter bays	225 / 275	200 / 250	250 / 325
Square precast piles · mm Internal / perimeter	350 / 400	350 / 400	450 / 450
Floor slab · RM/m ²	477	481	572
Piling · RM/m ²	1,831	2,241	4,112
Slab + piling · RM/m ²	2,308	2,723	4,684

Dimensions are shown as **internal / perimeter**. All piling is square precast concrete. Costs are indicative study estimates, not current quotations.

Selected Zone A raw-material options 1, 3 and 5, transcribed from the original comparison schedule. The source uses a floor area of 4,725 m² for this cost assessment. Source component values and totals are retained as reported; rounding means they may not sum exactly.

The study made the connection between storage arrangements, floor loading and construction provision tangible.

These options provide **different storage capacities**; the cost differences are **not like-for-like savings or savings realised in construction**.

Supporting an informed decision

Give the client a clear comparison of operational capacity and construction cost, so the design brief reflects considered choices about the new facility.

Ohr presented the study table to the client, bringing together the loading options, slab and pile requirements, and estimated costs to support an informed decision on the design requirements.

Full supporting schedule · Zone A and Zone B

The complete schedule from the third source visual is reproduced below. Shaded Zone A rows are the three examples compared above. The other source options are retained for context.

Zone A · Stacking of raw material

Source cost-schedule floor area: 4,725 m²

Option	Coil tiers ¹ tonnes	Load kN/m ²	Pile grid m	Slab ² mm	Piles ² mm square	Slab RM/m ²	Slab RM million	Piling RM/m ²	Piling RM million	Total RM/m ²	Total RM million
1	15 / 10	134	2.25 × 2.25	225 / 275	350 / 400	477	2.253	1,831	8.651	2,308	10.903
2	15 / 10 / 10	187	2 × 2	225 / 275	400 / 400	491	2.318	2,731	12.906	3,222	15.224
3	25 / 15	165	2 × 2	200 / 250	350 / 400	481	2.274	2,241	10.590	2,723	12.865
4	25 / 25	206	2 × 2	250 / 300	400 / 450	508	2.401	2,950	13.941	3,459	16.342
5	25 / 15 / 15	226	2 × 2	250 / 325	450 / 450	572	2.702	4,112	19.430	4,684	22.132

Zone B · Stacking of production material

Source cost-schedule floor area: 4,725 m²

Option	Coil tiers ¹ tonnes	Load kN/m ²	Pile grid m	Slab ² mm	Piles ² mm square	Slab RM/m ²	Slab RM million	Piling RM/m ²	Piling RM million	Total RM/m ²	Total RM million
1	25	81	2.5 × 2.5	200 / 225	350 / 350	418	1.974	1,334	6.305	1,752	8.280
2	15	104	2.5 × 2.5	225 / 275	350 / 400	488	2.306	1,381	6.526	1,869	8.832

¹ Coil tiers are listed from bottom to top. ² Slab thickness and pile sizes are shown as internal / perimeter. Values are reproduced as reported in the source. Source schedule references to Note 7 are retained in the source image; no additional Note 7 is supplied on that visual.

Informed decisions from the outset

The exercise helped the client balance operational requirements with the cost of providing them. It established a considered basis for the design loads from the outset, avoiding reliance on a generic allowance that could provide unnecessary capacity in some areas or insufficient capacity in others.

STUDY BASIS / ORIGINAL ASSUMPTIONS

Reading the comparison

Material and cost basis		Precast concrete piles	
Concrete grade	35	Grade C50 · jacked-in installation.	
Concrete	RM370/m ³	Size · length	Working load
Steel	RM5,200/t	350 mm square · 48 m	890 kN
350 mm square pile	RM8,136/pile	400 mm square · 48 m	1,075 kN
400 mm square pile	RM10,341/pile	450 mm square · 54 m	1,475 kN
450 mm square pile	RM15,569/pile		

Area bases: the zoning plan labels Zone A as 4,756 m², Zone B as 5,424 m² and Zone C as 2,718 m². The Zone A and Zone B cost schedules each state 4,725 m². The source does not reconcile these figures; the unit-cost comparisons above follow the original Zone A cost schedule.

Illustrative options from the original design-stage study. Estimates use the study’s assumed rates and exclude pile caps and formwork. Pile sizes vary between internal and perimeter bays where shown. These options provide different storage capacities; the cost differences are not like-for-like savings or savings realised in construction.

Source: 23003_Loading study_rev 00_mkp.pptx · September 2023 · stacking, zoning and Zone A/B comparison sheets.