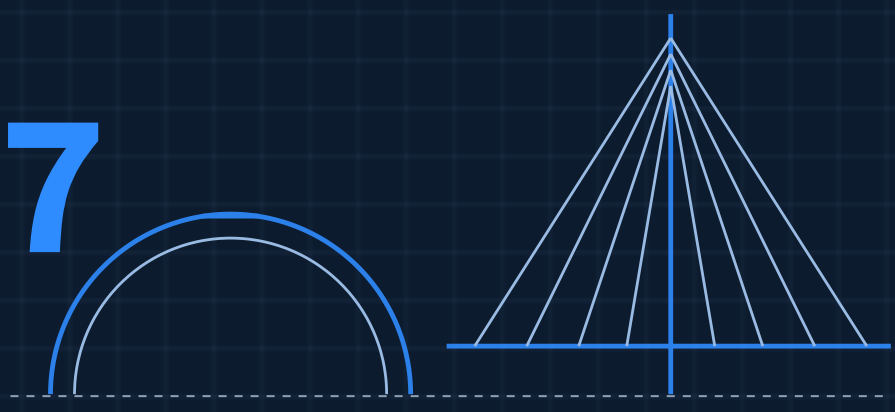
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TWELVE SHEETS, A3 PORTRAIT

Engineer's Calendar 2027

Twelve major structures. How the force travels, how each one is built, and what to watch for on site.



READ THE DRAWING

Each month draws one structure. The letters A, B, C follow the order the force travels or the work is built, and the notes use the same letters.

LEARN IT ON SITE

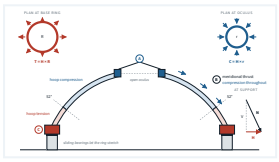
Every sheet ends with three site lessons and one calculation to check yourself, the kind you can do with a pencil in the cabin.

PLAN THE WEEK

Write in the ruled day boxes, or type on screen where notes stay in your browser. Switch on date alarms to colour and flash key dates. Weeks are ISO numbered. Weekends shaded: Friday and Saturday in KSA, Qatar, Kuwait, Bahrain and Oman; Saturday and Sunday in the UAE. Holidays: untagged apply in all six GCC states; UAE, KSA Saudi Arabia, QA Qatar, KW Kuwait, BH Bahrain, OM Oman.

January 01

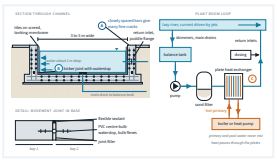
Dome rings



Wk	M	T	W	T	F	S	S
53					1	2	3
1	4	5	6	7	8	9	10
2	11	12	13	14	15	16	17
3	18	19	20	21	22	23	24
4	25	26	27	28	29	30	31

February 02

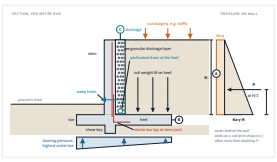
Heated lazy river



Wk	M	T	W	T	F	S	S
5	1	2	3	4	5	6	7
6	8	9	10	11	12	13	14
7	15	16	17	18	19	20	21
8	22	23	24	25	26	27	28

March 03

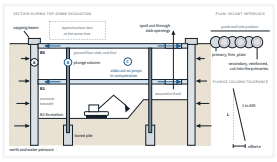
Cantilever retaining wall



Wk	M	T	W	T	F	S	S
9	1	2	3	4	5	6	7
10	8	9	10	11	12	13	14
11	15	16	17	18	19	20	21
12	22	23	24	25	26	27	28
13	29	30	31				

April 04

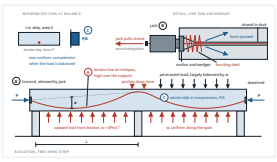
Top-down basement



Wk	M	T	W	T	F	S	S
13				1	2	3	4
14	5	6	7	8	9	10	11
15	12	13	14	15	16	17	18
16	19	20	21	22	23	24	25
17	26	27	28	29	30		

May 05

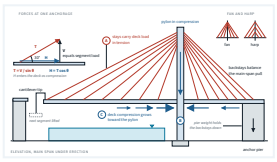
Post-tensioned slabs



Wk	M	T	W	T	F	S	S
17						1	2
18	3	4	5	6	7	8	9
19	10	11	12	13	14	15	16
20	17	18	19	20	21	22	23
21	24	25	26	27	28	29	30
22	31						

June 06

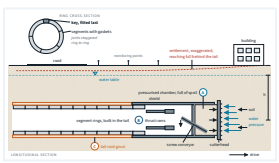
Cable-stayed bridges



Wk	M	T	W	T	F	S	S
22		1	2	3	4	5	6
23	7	8	9	10	11	12	13
24	14	15	16	17	18	19	20
25	21	22	23	24	25	26	27
26	28	29	30				

July 07

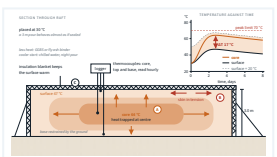
EPB tunnelling



Wk	M	T	W	T	F	S	S
26				1	2	3	4
27	5	6	7	8	9	10	11
28	12	13	14	15	16	17	18
29	19	20	21	22	23	24	25
30	26	27	28	29	30	31	

August 08

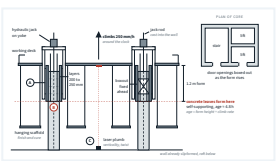
Mass concrete raft



Wk	M	T	W	T	F	S	S
30							1
31	2	3	4	5	6	7	8
32	9	10	11	12	13	14	15
33	16	17	18	19	20	21	22
34	23	24	25	26	27	28	29
35	30	31					

September 09

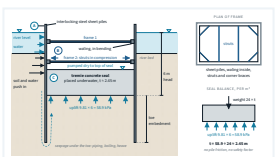
Slipformed core



Wk	M	T	W	T	F	S	S
35			1	2	3	4	5
36	6	7	8	9	10	11	12
37	13	14	15	16	17	18	19
38	20	21	22	23	24	25	26
39	27	28	29	30			

October 10

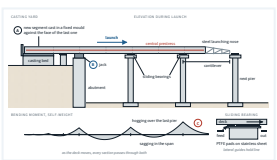
Sheet pile cofferdam



Wk	M	T	W	T	F	S	S
39					1	2	3
40	4	5	6	7	8	9	10
41	11	12	13	14	15	16	17
42	18	19	20	21	22	23	24
43	25	26	27	28	29	30	31

November 11

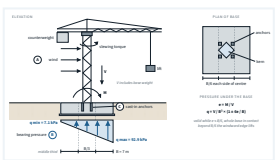
Incremental launching



Wk	M	T	W	T	F	S	S
44	1	2	3	4	5	6	7
45	8	9	10	11	12	13	14
46	15	16	17	18	19	20	21
47	22	23	24	25	26	27	28
48	29	30					

December 12

Tower crane foundation



Wk	M	T	W	T	F	S	S
48			1	2	3	4	5
49	6	7	8	9	10	11	12
50	13	14	15	16	17	18	19
51	20	21	22	23	24	25	26
52	27	28	29	30	31		

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01 # January 2027

SUBJECT
Dome rings: how a dome holds itself together

SCALE	REV	DRAWN
NTS	A	AMELIE·AI

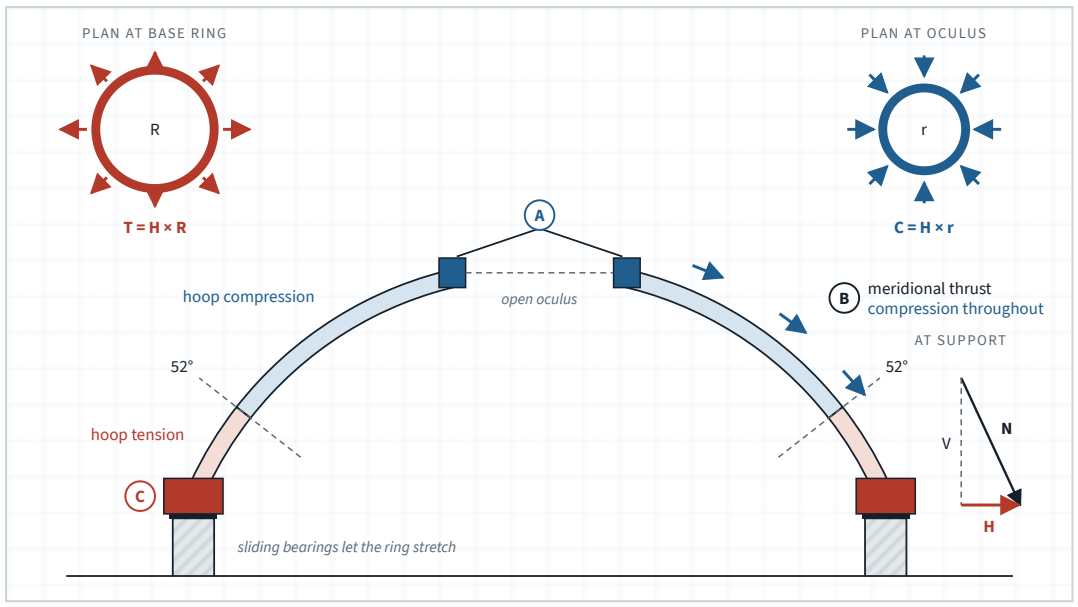


Fig. 01. Section through a concrete dome with an oculus, not to scale

The 52° boundary is the textbook value for a complete hemispherical shell under its own weight. An oculus, a lantern or a flatter profile moves it, so the designer's analysis governs.

THIS MONTH **DOME RINGS**

Two rings that hold a dome together

A dome carries its weight to the supports along curved lines called meridians. The shell is thin, so it works almost entirely in direct force, compression or tension, with very little bending. Follow the load from the top down.

A **Compression ring at the oculus**
Cutting a hole in the crown removes what propped each meridian, so they lean in on its edge. A stiff ring gathers that thrust as uniform compression, an arch keystone turned through 360°. Ring force **C = H × r**, H being the thrust per metre at this ring. The Pantheon's oculus, about 8 m across on a 43.3 m dome, has worked this way since its rebuilding in AD 118 to 128.

B **The shell**
Meridional force is compression all the way down. Hoop force, acting round the dome, is compression near the crown but turns to tension below about 52° from the crown. Below that line the shell wants to split along its meridians, which is why old masonry domes crack vertically near the base. St Peter's in Rome had extra iron rings fitted in the 1740s for exactly this.

C **Tension ring at the base**
At the support the thrust *N* leans outward. Resolve it into *V*, taken by walls or columns, and *H*, which tries to push the supports apart. A steel or post-tensioned concrete ring beam holds *H* as hoop tension, **T = H × R**. With R = 20 m and H = 50 kN/m, the ring carries 1,000 kN.

ON SITE

- The dome is not stable until both rings are complete. Keep the falsework in until the ring concrete reaches striking strength, then lower it evenly to the temporary works design, never one side first.
- Stagger laps in the ring steel or use couplers. A ring has no alternative load path, so one weak section is a weak ring.
- Let the ring move. Sliding or elastomeric bearings allow it to stretch under load and temperature, so the walls see mainly vertical load.

CHECK YOURSELF

A base ring has R = 15 m and the shell thrust gives H = 40 kN/m. What hoop tension must the ring carry?

ANSWER *T = 40 × 15 = 600 kN*

WK	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY WEEKEND EXCEPT UAE	SATURDAY WEEKEND, ALL GCC	SUNDAY WEEKEND IN UAE
WK 53	28 DEC	29 DEC	30 DEC	31 DEC	1 FRI *New Year's Day* UAE, KW, BH	2 SAT	3 SUN
WK 1	4 MON	5 TUE *Isra and Miraj, expected* KW, OM	6 WED	7 THU	8 FRI	9 SAT	10 SUN
WK 2	11 MON *Accession Day* OM	12 TUE	13 WED	14 THU	15 FRI	16 SAT	17 SUN
WK 3	18 MON	19 TUE	20 WED	21 THU	22 FRI	23 SAT	24 SUN
WK 4	25 MON	26 TUE	27 WED	28 THU	29 FRI	30 SAT	31 SUN

Islamic dates are expected and depend on moon sighting. Wait for official announcements.

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02 # February 2027

SUBJECT
Heated lazy river: a watertight channel and its plant

SCALE	REV	DRAWN
NTS	A	AMELIE·AI

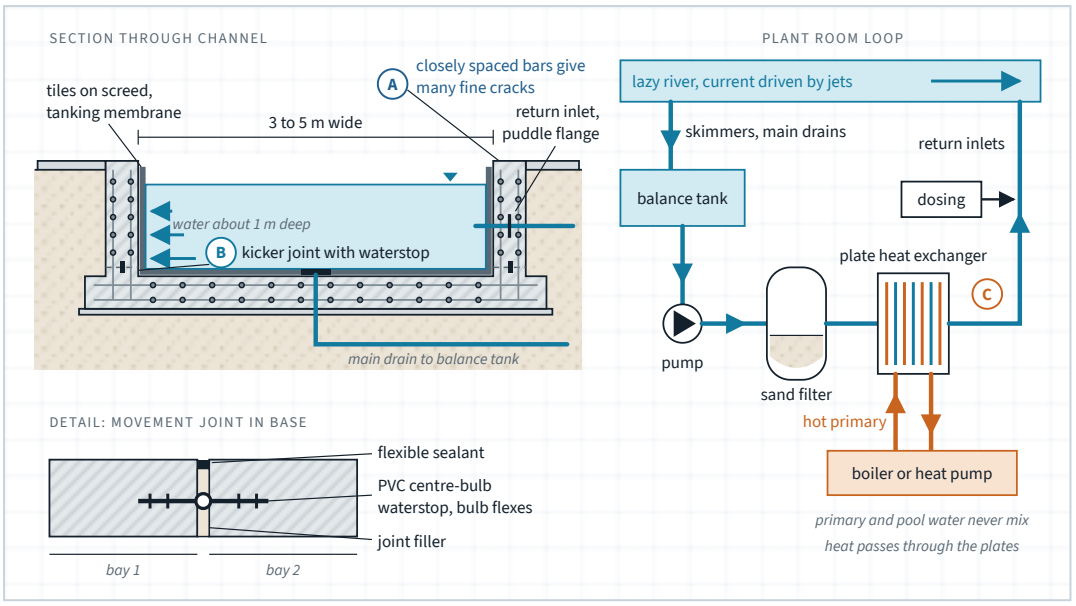


Fig. 02. Section through channel and plant schematic, not to scale

Crack limits, waterstop types and plant sizes are set by the designer and the pool specialist for each project. Heat losses from the surface and pipework add substantially to the warm-up figure.

THIS MONTH **HEATED LAZY RIVER**

Holding warm water and keeping it moving

A lazy river is a long, shallow concrete channel that must hold water for decades without leaking, while a plant room filters, heats and doses that water and drives a gentle current round the loop.

A **A water-retaining channel**
Design the channel as a liquid-retaining structure to BS EN 1992-3. Its tightness classes set the crack limit: class 1 accepts through-cracks narrow enough to self-heal, about 0.2 mm where the head is small relative to wall thickness; class 2 generally avoids through-cracks. Closely spaced distribution steel spreads early thermal and shrinkage movement into many fine cracks.

B **Watertight joints and finish**
Construction joints, such as the wall kicker, take a hydrophilic strip that swells on contact with water, or a cast-in PVC waterstop. Movement joints take a PVC centre-bulb waterstop, whose bulb flexes as the joint opens. The finish is tiles on a screed with a tanking membrane, or a pool render or membrane. It backs up the concrete, never replaces it.

C **Circulation and heating loop**
Skimmers, gutters and main drains feed a balance tank. Pumps push the water through sand filters, then a plate heat exchanger: hot primary water from a boiler or heat pump on one side, pool water on the other, never mixing. Dosing follows, then return inlets. Jets or booster pumps drive the current. Heat needed **Q = m × c × ΔT**.

ON SITE

- Water test the shell before any finishes: fill it, let the level stabilise, then measure the drop over several days, allowing for evaporation, and walk the outside faces looking for damp patches.
- Support waterstops so they stay central and straight during the pour. Weld or fit proper junction pieces at corners and tees, and compact the concrete well around them. A folded waterstop is a leak.
- Seal every pipe through the shell with a cast-in puddle flange. Fix the pipes before the pour and never core through the wall afterwards without an approved sealing detail.

CHECK YOURSELF

The river holds 500 m³ of water. How much heat raises it by 1 °C? Take 1 m³ = 1,000 kg and c = 4.19 kJ/kg·K, and ignore losses.

ANSWER $Q = 500{,}000 \times 4.19 \times 1 = 2{,}095{,}000$ kJ, ÷ 3,600 ≈ 582 kWh

WK	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY WEEKEND EXCEPT UAE	SATURDAY WEEKEND, ALL GCC	SUNDAY WEEKEND IN UAE
WK 5	1 MON	2 TUE	3 WED	4 THU	5 FRI	6 SAT	7 SUN
WK 6	8 MON *Ramadan begins, expected*	9 TUE ***National Sports Day*** QA	10 WED	11 THU	12 FRI	13 SAT	14 SUN
WK 7	15 MON	16 TUE	17 WED	18 THU	19 FRI	20 SAT	21 SUN
WK 8	22 MON ***Founding Day*** KSA	23 TUE	24 WED	25 THU ***National Day*** KW	26 FRI ***Liberation Day*** KW	27 SAT	28 SUN

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03 **March** 2027

SUBJECT		
Cantilever retaining wall: earth pressure, base, drainage		
SCALE	REV	DRAWN
NTS	**A**	**AMELIE·AI**

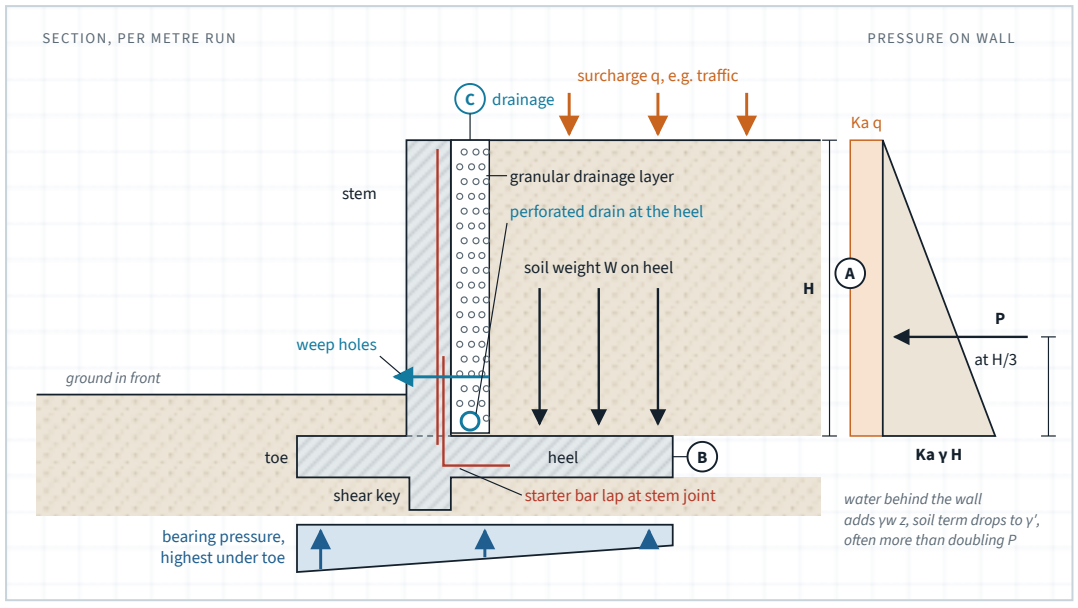


Fig. 03. Section through a cantilever retaining wall, not to scale

Ka = 0.33 matches a level, cohesionless backfill with a friction angle of about 30°. Sloping fill, cohesive soil, wall friction or a stiff, propped wall change the pressure, so the designer's figures govern.

ON SITE

- Keep heavy rollers away from the wall. Within about 2 m of the stem, or the distance the specification sets, compact with light plates or small rollers, as heavy plant locks in pressures well above active.
- Backfill only after the wall reaches the strength the designer specifies, and place fill in thin compacted layers, bringing the drainage layer up with it. Never tip a full height of fill against a green wall.
- Check the starter bars at the stem to base joint: lap length, cover and position, before the base pour. Keep weep holes and drains clear, and rod them at handover so the outfall is proven to run.

THIS MONTH **CANTILEVER RETAINING WALL**

Holding back the ground with an inverted T

A cantilever retaining wall is a reinforced concrete stem fixed into a base slab. The soil behind pushes the stem over; the soil sitting on the base holds it down. Follow the load from the retained ground into the foundation.

A **Active earth pressure**

As the wall yields slightly, the soil behind mobilises active pressure, rising linearly with depth: **p = Ka × γ × z**. The resultant per metre run is **P = 0.5 Ka γ H²**, at H/3 above the base. A surcharge q adds Ka × q, resultant at H/2. For stability take H to the underside of the base. The stem bends as a cantilever, tension on the soil face.

B **The base and the three checks**

The heel runs under the retained soil, whose weight holds the wall down and resists overturning. The toe spreads the load and keeps bearing pressure within what the ground can take. A shear key below the base adds passive resistance against sliding. Check sliding, overturning about the toe, and bearing pressure, keeping the resultant within the middle third of the base.

C **Drainage behind the wall**

Water pressure acts on the full height at γw = 9.81 kN/m³ and is not reduced by Ka. A saturated, undrained backfill can more than double the horizontal load. A free-draining granular layer against the stem, a perforated drain at the heel to an outfall, and weep holes through the stem keep the water table down, so the wall only sees the earth pressure it was designed for.

CHECK YOURSELF

A wall retains H = 4 m of soil with Ka = 0.33 and γ = 18 kN/m³, no surcharge or water. Find the resultant per metre run and where it acts.

ANSWER *P = 0.5 × 0.33 × 18 × 4² ≈ 47.5 kN/m, acting at 4/3 ≈ 1.33 m above the base*

WK	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY WEEKEND EXCEPT UAE	SATURDAY WEEKEND, ALL GCC	SUNDAY WEEKEND IN UAE
WK 9	1 MON	2 TUE	3 WED	4 THU	5 FRI	6 SAT	7 SUN
WK 10	8 MON	9 TUE *Eid al-Fitr begins, expected*	10 WED	11 THU	12 FRI	13 SAT	14 SUN
WK 11	15 MON	16 TUE	17 WED	18 THU	19 FRI	20 SAT	21 SUN
WK 12	22 MON	23 TUE	24 WED	25 THU	26 FRI	27 SAT	28 SUN
WK 13	29 MON	30 TUE	31 WED	1 APR	2 APR	3 APR	4 APR

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04 April 2027

SUBJECT
Top-down basement inside a secant piled wall

SCALE	REV	DRAWN
NTS	A	AMELIE·AI

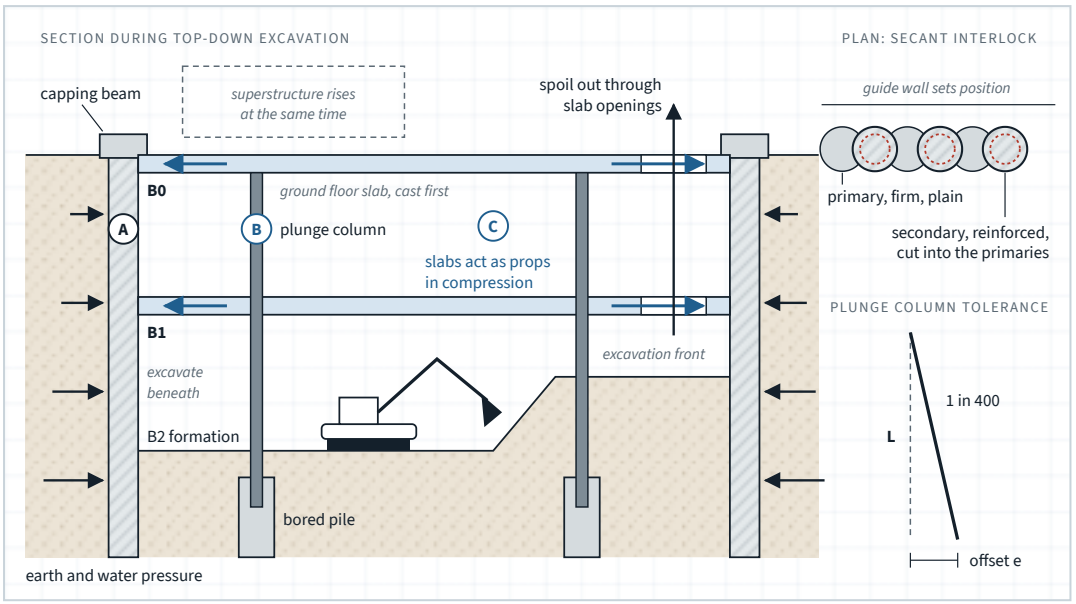


Fig. 04. Section through a top-down basement, not to scale

Pile sizes, interlock and verticality limits vary with depth and ground, and secant walls are not fully watertight. The designer's monitoring plan and trigger levels govern.

ON SITE

- Monitor the walls throughout with inclinometers and survey targets on the capping beam and neighbouring buildings. Compare each reading with the designer's trigger levels and act at once on an amber.
- Seal leaks at secant joints as soon as excavation reveals them, by grouting or local repair, before fines wash out and leave a void behind the wall.
- Plan muck-away through the slab openings from day one: crane or conveyor, lorry routes and haul times. Below slab, provide forced ventilation, gas monitoring and lighting to every working face.

THIS MONTH **TOP-DOWN BASEMENT**

Building a basement from ground level down

On a tight urban site the basement can be built downwards. The perimeter wall goes in first, the floors are cast one by one as the ground is dug out beneath them, and each new slab props the walls.

A — The secant piled wall
A shallow reinforced guide wall fixes the pile positions. Primary piles, in firm unreinforced concrete (soft mixes suit temporary walls only), are cast first at a gap. Secondary piles, reinforced and in full-strength concrete, are bored between them, cutting into each primary to form an interlocking, largely water-resisting wall. A capping beam ties the pile heads together.

B — Plunge columns
Before any digging, bored piles are cast inside the basement footprint. While the concrete is still wet, a steel column is plunged into each one, using a frame or guidance system to hold it to tight verticality. These columns carry the slabs and the rising building during construction, and are often cased later to become the permanent columns.

C — The top-down sequence
Cast the ground floor slab first, on the ground, with openings for spoil removal. It becomes a stiff prop across the site. Excavate beneath it to the next level, cast that slab to prop the wall again, and repeat to formation. The slabs are very stiff props placed before each dig, so the walls deflect far less than on temporary props, and the superstructure can rise meanwhile.

CHECK YOURSELF

A 24 m plunge column must be vertical to 1 in 400. What is the largest allowed offset at the bottom?

ANSWER $e = 24{,}000 \div 400 = 60$ mm

WK	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY WEEKEND EXCEPT UAE	SATURDAY WEEKEND, ALL GCC	SUNDAY WEEKEND IN UAE
WK 13	29 MAR	30 MAR	31 MAR	1 THU	2 FRI	3 SAT	4 SUN
WK 14	5 MON	6 TUE	7 WED	8 THU	9 FRI	10 SAT	11 SUN
WK 15	12 MON	13 TUE	14 WED	15 THU	16 FRI	17 SAT	18 SUN
WK 16	19 MON	20 TUE	21 WED	22 THU	23 FRI	24 SAT	25 SUN
WK 17	26 MON	27 TUE	28 WED	29 THU	30 FRI	1 MAY	2 MAY

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05 **May** 2027

SUBJECT		
Post-tensioned floor slab: load balancing tendons		
SCALE	REV	DRAWN
NTS	**A**	**AMELIE·AI**

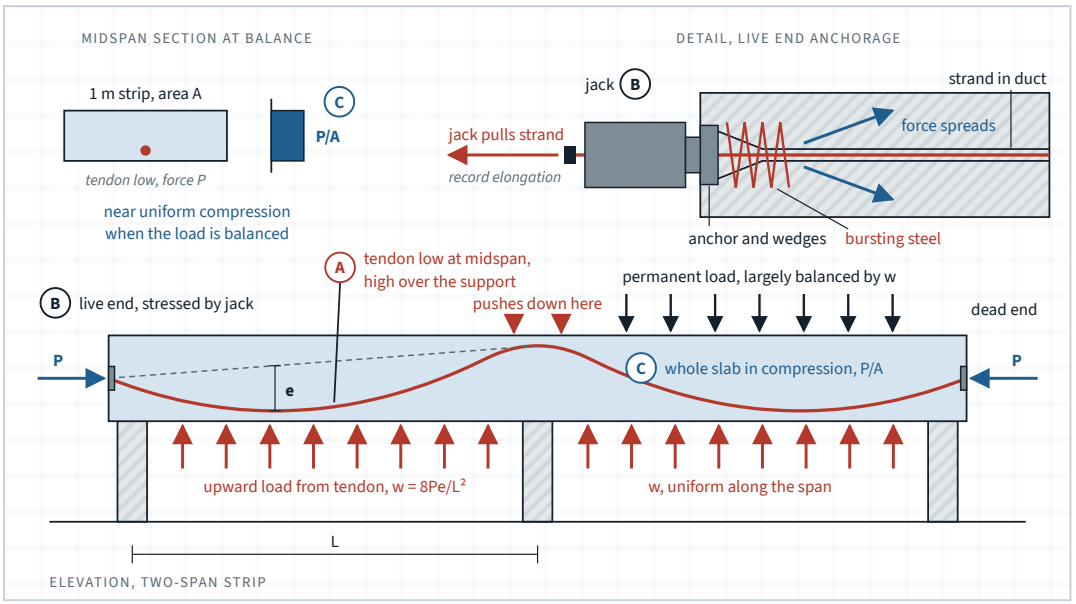


Fig. 05. Elevation of a two-span slab strip, vertical scale exaggerated

$8Pe/L^2$ assumes one parabola between high and low points and ignores friction and long-term losses, which reduce P along the tendon. The designer's profile and loss calculation govern.

ON SITE

- Check tendon heights on the chairs against the profile drawing before the pour. A few millimetres at a high or low point change the drape and the balancing load. Tie chairs so the pour cannot shift them.
- Stress only when cube results show the specified transfer strength. Record each elongation against the calculated value and report any outside tolerance before strand tails are cut.
- Never core or drill a PT slab without scanning and marking the tendons first. Back-props stay in place until the designer releases them.

THIS MONTH **POST-TENSIONED SLABS**

A curved tendon that holds the slab up

A post-tensioned slab contains steel strand that is stressed after the concrete has hardened. The tendon is draped so that, once stressed, it pushes up on the slab and squeezes it along its length. Follow the force from the jack into the concrete.

A **The draped tendon**

The tendon sits high over the supports and low at midspan. Stressed to force *P*, the curved strand presses up on the concrete in each span and down over the supports, where its curve reverses. A parabolic drape *e* over span *L* gives a uniform upward load $\mathbf{w = 8Pe / L^2}$. The designer sets *P* and *e* so that *w* balances much of the permanent load.

B **Live and dead anchorages**

At the live end a jack grips the strand, pulls it to the specified force and locks it off with wedges. The dead end is cast in and is not jacked. Each anchor drives a concentrated force into the slab edge, so a helix or links behind it carry the bursting tension. Strand runs in ducts grouted after stressing (bonded) or in greased plastic sheathing (unbonded).

C **The slab in compression**

Anchored at both ends, the tendon squeezes the whole slab with an average stress $\mathbf{\sigma = P / A}$. Where the drape balances the load, that stress is close to uniform through the depth. Compression keeps cracks closed and cuts deflection, so slabs can be thinner and spans longer. With $P = 200$ kN/m on a 250 mm slab, $\sigma = 0.8$ N/mm².

CHECK YOURSELF

A slab strip carries P = 200 kN per metre width with a parabolic drape e = 0.15 m over a span L = 8 m. What uniform upward load does the tendon apply?

ANSWER $w = 8 \times 200 \times 0.15 / 8^2 = 240 / 64 = 3.75$ kN/m²

WK	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY WEEKEND EXCEPT UAE	SATURDAY WEEKEND, ALL GCC	SUNDAY WEEKEND IN UAE
WK 17	26 APR	27 APR	28 APR	29 APR	30 APR	1 SAT *Labour Day* BH	2 SUN
WK 18	3 MON	4 TUE	5 WED	6 THU	7 FRI	8 SAT	9 SUN
WK 19	10 MON	11 TUE	12 WED	13 THU	14 FRI	15 SAT *Arafat Day, expected*	16 SUN *Eid al-Adha begins, expected*
WK 20	17 MON	18 TUE	19 WED	20 THU	21 FRI	22 SAT	23 SUN
WK 21	24 MON	25 TUE	26 WED	27 THU	28 FRI	29 SAT	30 SUN
WK 22	31 MON	1 JUN	2 JUN	3 JUN	4 JUN	5 JUN	6 JUN

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06 **June** 2027

SUBJECT		
Cable-stayed bridge: stays, pylon and deck		
SCALE	REV	DRAWN
NTS	**A**	**AMELIE·AI**

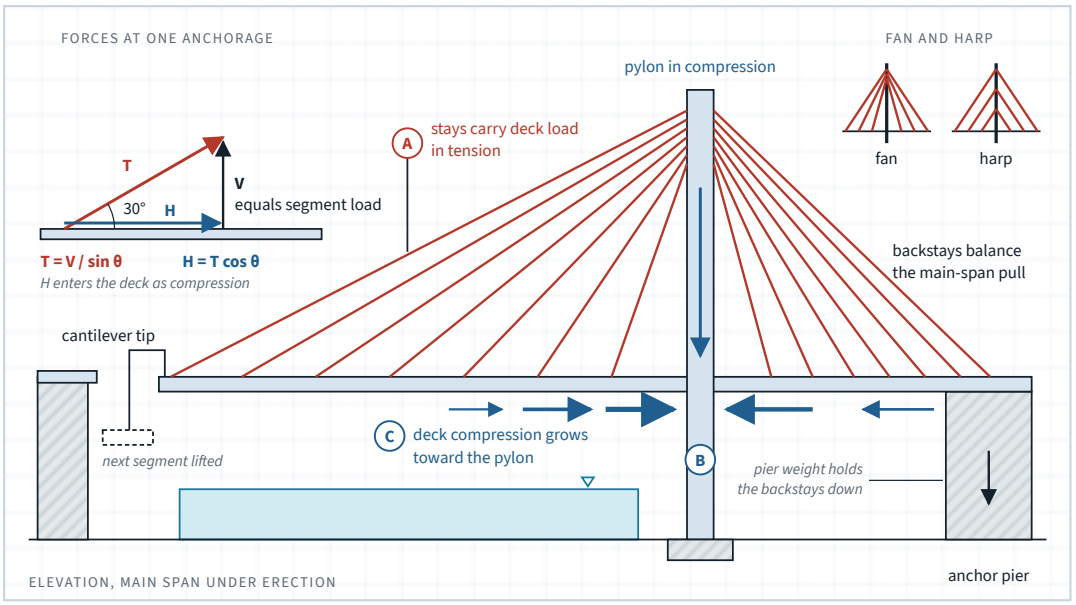


Fig. 06. Elevation of a single pylon cable-stayed bridge, not to scale

Real stays share load with the stiff deck and the pylon, and each is stressed to a planned force rather than a simple share of segment weight. The force triangle shows the principle.

THIS MONTH **CABLE-STAYED BRIDGES**

Hanging a deck from one tall pylon

A cable-stayed bridge hangs its deck from straight stays anchored high on a pylon. Each stay lifts its share of deck weight, and its slope means it also pushes along the deck. Follow the load from a deck segment up to the pylon and back down.

A **Stays in tension**

Each stay picks up a length of deck at its lower anchorage and carries that weight up to the pylon in tension. Because the stay is inclined, its tension is larger than the load it lifts, **T = V / sin θ**. Flat stays work hard for little lift, which is why the outer stays of a long span are the heaviest.

B **Pylon and backstays**

The stays pull the pylon head toward the main span. Backstays on the other side, landing on the back span and its heavy anchor pier, pull it back so that the pylon is left carrying vertical compression with little bending. The anchor pier must hold the backstays down by its weight or by ground anchors.

C **Deck compression and erection**

The horizontal part of each stay force, **H = T cos θ**, pushes the deck toward the pylon, so deck compression builds up toward it. The deck is built as a cantilever, each cycle placing a segment, installing and stressing its stay, then checking geometry. A fan gathers stays near the pylon top; a harp keeps them parallel.

ON SITE

- Survey the deck and pylon at the same time of day and temperature each cycle, ideally early morning before the sun warms one face. Compare with the erection manual's predicted profile, not the final one.
- Stress each stay in the sequence the erection manual sets and record the force at every stage. Check forces with lift-off or load cells and report any stay outside the specified tolerance.
- Watch for wind and rain-wind induced stay vibration, and fit dampers as soon as the design allows. Protect stay sheathing from welding, grinding and impact damage during erection.

CHECK YOURSELF

A deck segment load V = 2,000 kN is carried by a stay at 30° to the horizontal. What is the stay tension, and how much compression does it put into the deck?

ANSWER $T = 2{,}000 / \sin 30° = 2{,}000 / 0.5 = 4{,}000$ kN; $H = 4{,}000 \times \cos 30° \approx 3{,}464$ kN

WK	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY WEEKEND EXCEPT UAE	SATURDAY WEEKEND, ALL GCC	SUNDAY WEEKEND IN UAE
WK 22	31 MAY	1 TUE	2 WED	3 THU	4 FRI	5 SAT	6 SUN *Islamic New Year, expected* UAE, KW, BH, OM
WK 23	7 MON	8 TUE	9 WED	10 THU	11 FRI	12 SAT	13 SUN
WK 24	14 MON *Ashura, expected* BH	15 TUE *Ashura, expected* BH	16 WED	17 THU	18 FRI	19 SAT	20 SUN
WK 25	21 MON	22 TUE	23 WED	24 THU	25 FRI	26 SAT	27 SUN
WK 26	28 MON	29 TUE	30 WED	1 JUL	2 JUL	3 JUL	4 JUL

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07 July 2027

SUBJECT
Bored tunnel: earth pressure balance TBM

SCALE **NTS** | REV **A** | DRAWN **AMELIE·AI**

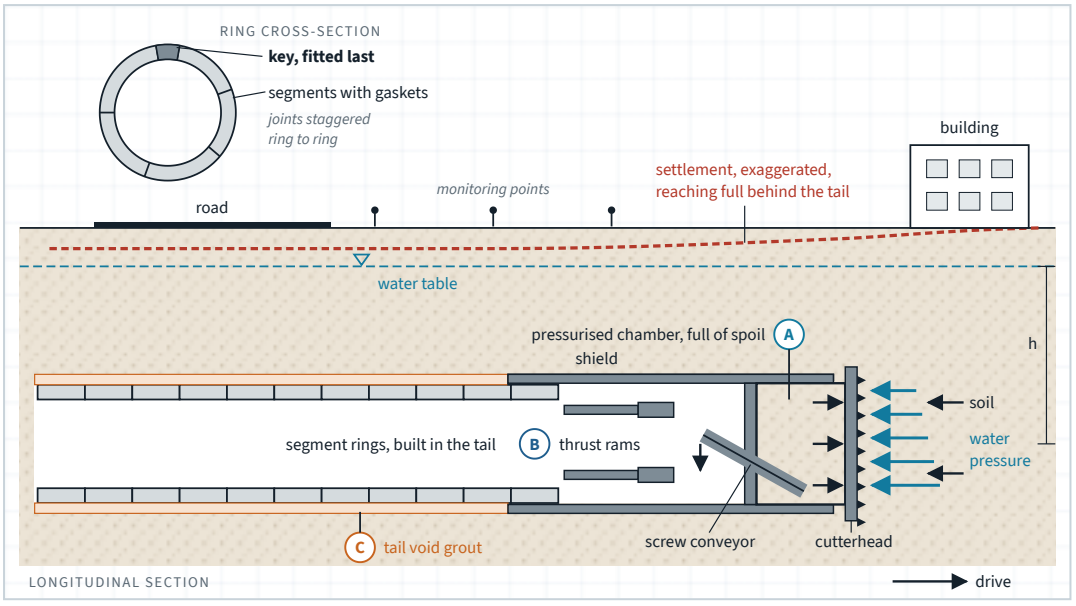


Fig. 07. Longitudinal section through an EPB tunnel drive, not to scale

The check covers groundwater only. Face pressure must also resist the soil's lateral pressure and allow for the pressure gradient over the face height, so the required range comes from the designer.

THIS MONTH **EPB TUNNELLING**

Holding the face while the tunnel moves on

An earth pressure balance machine bores through soft ground below the water table without letting the face collapse or the ground flow in. It holds the face with its own spoil, builds the lining inside its tail and grouts behind it. Follow the ground from the face back to the finished ring.

A The face
The cutterhead loosens soil into a sealed chamber behind it. Packed and conditioned with foam, that spoil is held at a pressure that balances the earth and groundwater pressure on the face. The operator controls it with screw conveyor speed against advance rate: slow the screw and pressure rises. Groundwater alone gives $u = \gamma_w h$.

B The ring
Inside the shield tail the erector places precast concrete segments to form a ring, with the key fitted last. Gaskets on every joint seal against groundwater. To advance, thrust rams push off the last completed ring, so the lining takes the jacking load in compression from the first day.

C Tail void grouting
The shield is larger than the ring, so it leaves an annular gap as it moves on. Grout is injected through the tail as the machine advances to fill that gap at once. Any void left lets the ground move in, and the surface settles in a trough centred over the tunnel. Volume loss is kept small by face pressure and prompt, full grouting.

ON SITE

- Read surface and building monitoring at the frequency the plan sets, and act on each trigger level, amber and red, exactly as the agreed response plan states, before the machine moves on.
- Check every ring for lipping, stepping and ovality as it is built, against the specified tolerances. Keep gaskets clean and undamaged; a torn gasket is a future leak.
- Store segments on level bearers to the stacking plan and lift only with the approved gear. Inspect edges and corners before each segment goes down the shaft; chipped segments leak and crack.

CHECK YOURSELF

The tunnel axis is 20 m below the water table. Roughly what groundwater pressure must the chamber resist at axis level?

ANSWER $u = 20 \times 9.81 \approx 196$ kPa, about 2 bar

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WK 26	28 JUN	29 JUN	30 JUN	1 THU	2 FRI	3 SAT	4 SUN
WK 27	5 MON	6 TUE	7 WED	8 THU	9 FRI	10 SAT	11 SUN
WK 28	12 MON	13 TUE	14 WED	15 THU	16 FRI	17 SAT	18 SUN
WK 29	19 MON	20 TUE	21 WED	22 THU	23 FRI	24 SAT	25 SUN
WK 30	26 MON	27 TUE	28 WED	29 THU	30 FRI	31 SAT	1 AUG

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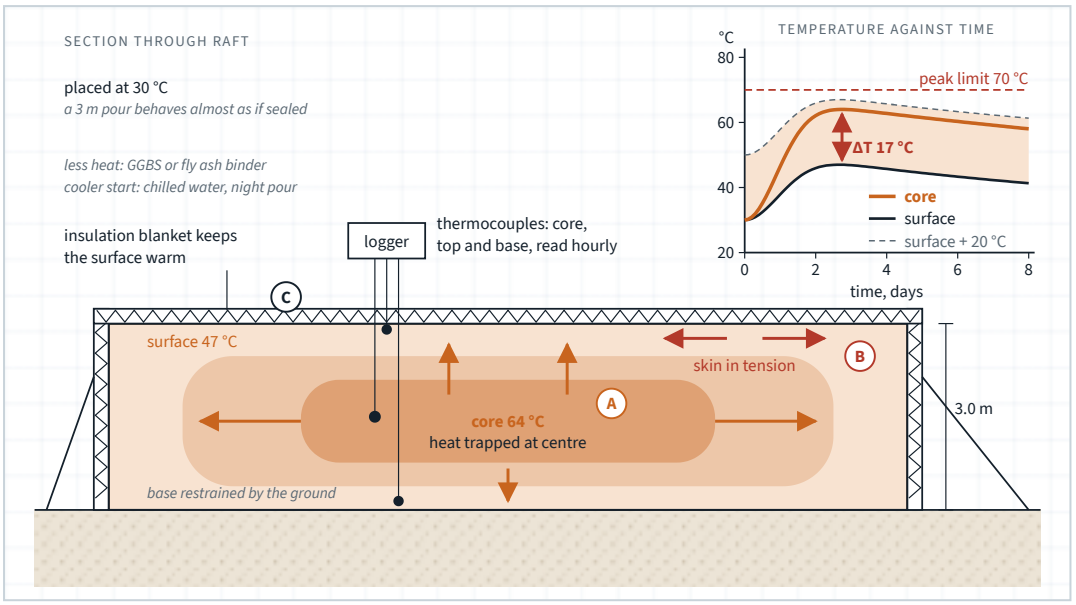
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08 August 2027

SUBJECT
Mass concrete: heat of hydration in a thick raft

SCALE	REV	DRAWN
NTS	A	AMELIE·AI



Heat, darker is hotter Limits Soil Fig. 08. Section through a 3 m raft, not to scale; graph to scale

Limits vary by specification. Insulation narrows the differential but can raise the core peak slightly, so both are checked. Temperatures shown are typical for a hot climate pour placed at 30 °C.

ON SITE

- Log thermocouple readings at set intervals through the night and weekend, with a named person responsible and an agreed action if the differential approaches the limit.
- Do not strip insulation early. Remove it gradually, in stages, only when the readings allow. A sudden exposure chills the surface and cracks it, often days after the pour.
- Plan the pour as continuous: backup pump and plant, a second batching source, lighting and relief crews. A cold joint in a raft is far worse than a slow pour.

THIS MONTH **MASS CONCRETE RAFT**

Keeping the heat in a thick raft pour

A thick raft is a large block of reacting cement. Heat builds up in the core faster than it can escape, while the surfaces lose heat to the air and ground. The job is to control the gap between core and surface, and the peak.

A **Hydration heats the core**
Cement gives off heat as it hydrates, most of it in the first few days. Concrete conducts heat poorly, so in a pour more than about 2 m thick the core behaves almost as if sealed and can rise 30 to 50 °C above its placing temperature. The surfaces cool to air and ground. **Peak = placing temperature + rise**.

B **The differential cracks it**
The hot core expands more than the cooler surface, so the surface is pulled into tension and cracks early. Later, as the whole pour cools and shrinks against the ground, restraint can crack it deeper. Specifications commonly limit the core to surface differential to about 20 °C, to control cracking, and the peak to about 70 °C, to avoid delayed ettringite formation.

C **The controls**
Make less heat: replace part of the cement with GGBS or fly ash. Start cooler: chilled mix water or ice, shaded aggregates, night pours. Keep the surface warm with insulation blankets and insulated formwork, so it follows the core. Measure with thermocouples at core and surface. Very thick pours may also need embedded cooling pipes.

CHECK YOURSELF

Thermocouples read core 64 °C and surface 47 °C. The limits are 20 °C differential and 70 °C peak. Is the pour within both?

ANSWER *ΔT = 64 − 47 = 17 °C, within 20 °C; peak 64 °C, below 70 °C. Within both.*

WK	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY WEEKEND EXCEPT UAE	SATURDAY WEEKEND, ALL GCC	SUNDAY WEEKEND IN UAE
WK 30	26 JUL	27 JUL	28 JUL	29 JUL	30 JUL	31 JUL	1 SUN
WK 31	2 MON	3 TUE	4 WED	5 THU	6 FRI	7 SAT	8 SUN
WK 32	9 MON	10 TUE	11 WED	12 THU	13 FRI	14 SAT *Prophet's Birthday, expected* UAE, KW, BH, OM	15 SUN
WK 33	16 MON	17 TUE	18 WED	19 THU	20 FRI	21 SAT	22 SUN
WK 34	23 MON	24 TUE	25 WED	26 THU	27 FRI	28 SAT	29 SUN
WK 35	30 MON	31 TUE	1 SEP	2 SEP	3 SEP	4 SEP	5 SEP

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09 September 2027

SUBJECT
Slipforming: a tall building core cast without joints

SCALE	REV	DRAWN
NTS	A	AMELIE·AI

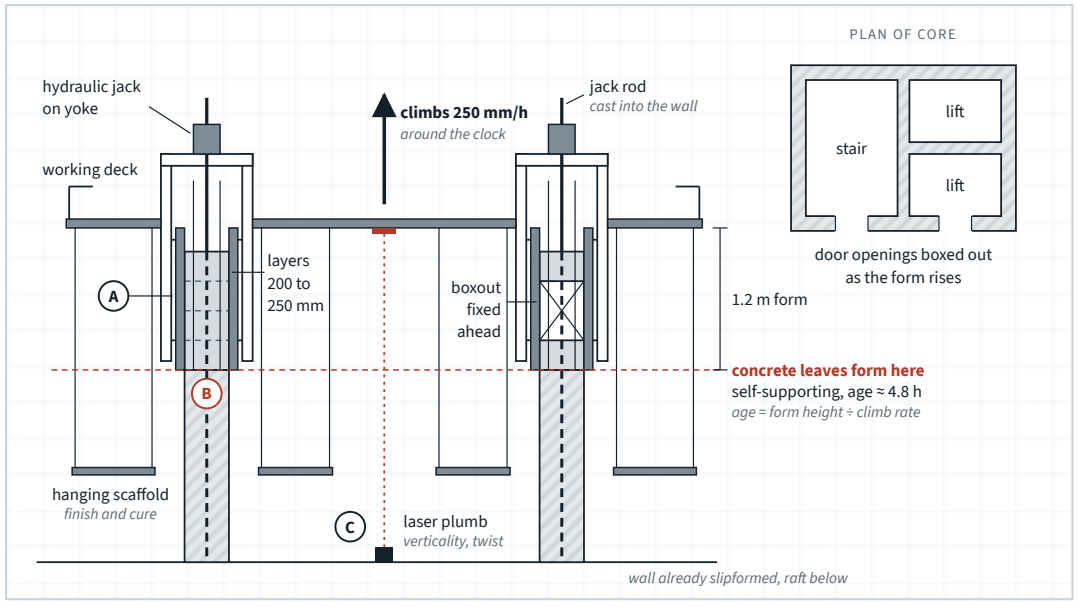


Fig. 09. Section through a pair of core walls, not to scale

Exit age is approximate: concrete is placed a little below the top of the form, and each layer takes time to place. The setting time of the actual mix at the actual temperature decides the rate.

THIS MONTH **SLIPFORMED CORE**

A form that climbs without stopping

A slipform casts a building core as one continuous wall. The form rises steadily on jacks while concrete is placed into its top and emerges from its bottom hard enough to stand. Fixing, placing, lifting and finishing all go on at once.

A **The rig**

Form panels about 1.0 to 1.5 m high line both faces of every wall, held by yokes. A hydraulic jack on each yoke climbs a steel jack rod standing in the wall. The working deck on top carries rebar fixing and concrete placing. A hanging scaffold below the form gives access to finish and cure the emerging face.

B **Climb rate and setting**

Concrete is placed in even layers, typically 200 to 250 mm, all round the core. The climb rate is set so that concrete leaving the bottom of the form can support itself, yet is still soft enough to finish. Rates of a few hundred millimetres per hour are common. Age at exit $t = H \div v$, form height over climb rate.

C **Control as it rises**

Verticality and twist are checked continuously with laser plumbs or survey, and corrected gently by adjusting the jacks. Boxouts, embed plates and door openings are fixed into the rebar ahead of the concrete. The operation runs around the clock, so supply, crews and survey must too.

ON SITE

- Match the concrete to the climb rate with trial mixes, at the temperatures expected by day and night. Setting time and supply rate decide the safe speed, not the jacks.
- Plan for stoppages. If the climb must halt, keep lifting the form a few millimetres at intervals so the concrete does not bond to the panels, and agree the restart procedure beforehand.
- Check boxout, embed and opening set-out against the drawings on the deck before it disappears into the wall. A missed embed means coring and post-fixing later.

CHECK YOURSELF

A slipform is 1.2 m high and climbs at 250 mm/h. How old is the concrete when it leaves the bottom of the form?

ANSWER $t = 1.2 \div 0.25 = 4.8$ hours

WK	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY WEEKEND EXCEPT UAE	SATURDAY WEEKEND, ALL GCC	SUNDAY WEEKEND IN UAE
WK 35	30 AUG	31 AUG	1 WED	2 THU	3 FRI	4 SAT	5 SUN
WK 36	6 MON	7 TUE	8 WED	9 THU	10 FRI	11 SAT	12 SUN
WK 37	13 MON	14 TUE	15 WED	16 THU	17 FRI	18 SAT	19 SUN
WK 38	20 MON	21 TUE	22 WED	23 THU *National Day* KSA	24 FRI	25 SAT	26 SUN
WK 39	27 MON	28 TUE	29 WED	30 THU	1 OCT	2 OCT	3 OCT

Islamic dates are expected and depend on moon sighting. Wait for official announcements.

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10 October 2027

SUBJECT
Cofferdams: a dry box built in a river

SCALE	REV	DRAWN
NTS	A	AMELIE·AI

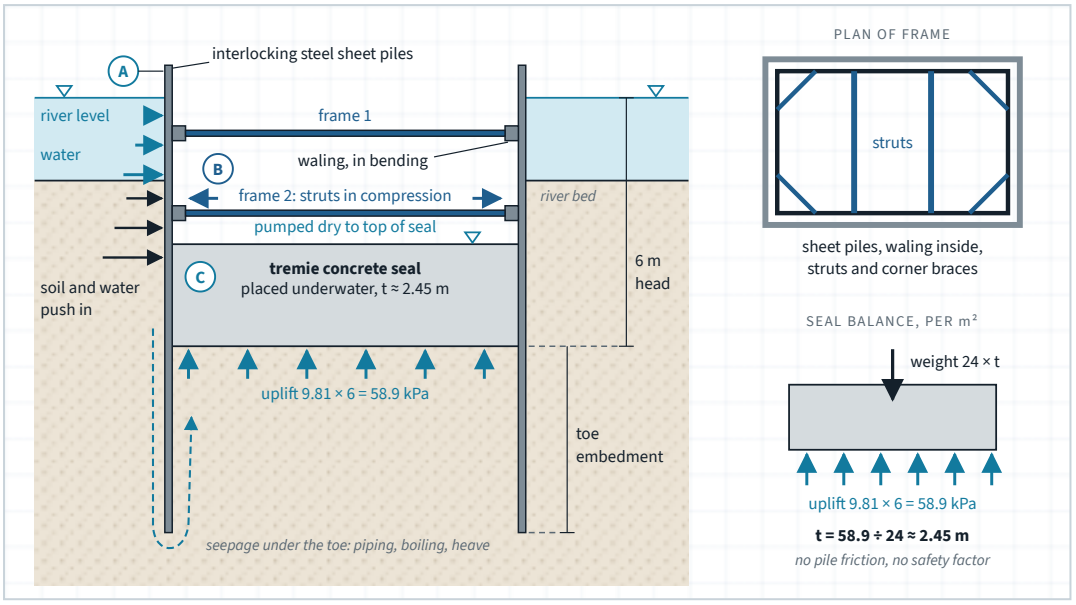


Fig. 10. Section through a sheet pile cofferdam, not to scale

In practice the seal is often thinner, because friction and bond to the piles, or tension piles, help resist uplift. The designer applies a factor of safety against uplift.

THIS MONTH **SHEET PILE COFFERDAM**

Keeping a river out of the excavation

A cofferdam is a temporary box of steel sheet piles that lets a pier or foundation be built dry below water. The piles hold back the sides, internal frames hold the piles apart, and the base must resist water trying to come up from below.

A — The sheet pile wall
Interlocking steel sheet piles are driven to a design toe level well below the excavation. Outside, water and soil push inward, and the pressure grows with depth. Water pressure alone at depth *h* is $p = 9.81 \times h$ kPa, so it is greatest at the base, just when the excavation is deepest.

B — Walings and struts
Each frame is a ring of walings round the inside of the piles, held apart by struts and corner braces. The walings span between struts and work in bending; the struts carry the load across in compression. Frames go in from the top down, each one placed before any digging or pumping below it.

C — The base
Water flows down outside the piles, under the toe and up inside. Too steep a flow lifts the soil: piping, boiling or base heave. Deeper toe embedment and dewatering reduce it. A tremie concrete seal, placed underwater, plugs the base and must balance uplift by its weight, $24 \times t \geq 9.81 \times h$, h to the seal underside.

ON SITE

- Install each strut frame before digging or pumping below it, and never dig ahead of the frames. Each frame gains load as the dig goes on below it and is often most loaded just before the next frame goes in.
- Watch the interlocks during driving. A pile that declutches leaves a gap that will leak or let soil run. Check alignment and verticality, and seal small leaks before pumping down further.
- If the base starts to boil or heave, stop pumping and flood the cofferdam to balance the water. Pumping harder only steepens the flow and speeds the failure.

CHECK YOURSELF

Underside of a tremie seal is 6 m below river level. Concrete weighs 24 kN/m³. What seal thickness balances uplift, ignoring pile friction and any safety factor?

ANSWER $u = 6 \times 9.81 = 58.9$ kPa; $t = 58.9 \div 24 \approx 2.45$ m

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WK 39	27 SEP	28 SEP	29 SEP	30 SEP	1 FRI	2 SAT	3 SUN
WK 40	4 MON	5 TUE	6 WED	7 THU	8 FRI	9 SAT	10 SUN
WK 41	11 MON	12 TUE	13 WED	14 THU	15 FRI	16 SAT	17 SUN
WK 42	18 MON	19 TUE	20 WED	21 THU	22 FRI	23 SAT	24 SUN
WK 43	25 MON	26 TUE	27 WED	28 THU	29 FRI	30 SAT	31 SUN

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11 November 2027

SUBJECT
Incremental launching: pushing a concrete deck out

SCALE	REV	DRAWN
NTS	A	AMELIE·AI

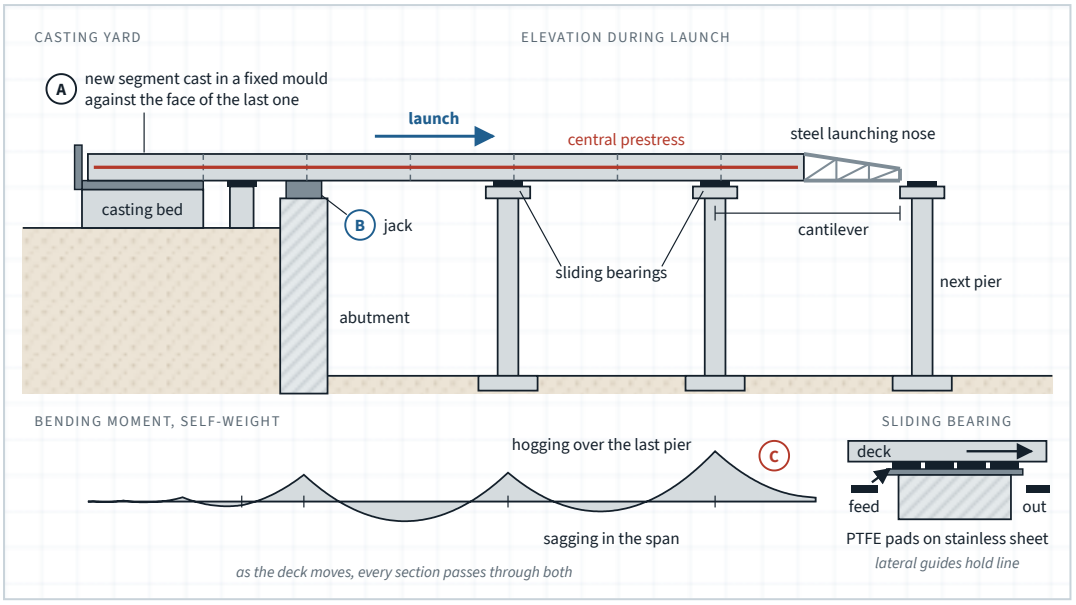


Fig. 11. Elevation at one launch stage, not to scale

The moment sketch is for self-weight at one stage only. Gradient, plan curvature, starting friction and pier flexibility all change the forces, so the launch designer's stage-by-stage analysis governs.

ON SITE

- Drill the pad feeding team. Pads go in at every bearing, every push, the right way up and the right way round. A missed pad lets the soffit drag on the bearing and damages the deck.
- Survey line and level at the nose and at agreed points after every push. Compare with the predicted values before the next push and correct line with the guides early, in small steps.
- On a downhill gradient the deck wants to run away. Provide brakes or restraint that hold the deck at every stage, to the temporary works design, and test them before the first push.

THIS MONTH **INCREMENTAL LAUNCHING**

Cast behind the abutment, pushed over the piers

An incrementally launched deck is built in one place and moved into position. Segments are cast in a yard behind the abutment and the growing deck is jacked forward over the piers, one segment length at a time.

A **Casting yard and fixed mould**
Each segment, typically 15 to 30 m long, is cast in a fixed mould on a stiff bed behind the abutment. It is cast directly against the end face of the previous segment, so the joint matches and reinforcement or couplers run through. Once it has reached strength it is stressed to the deck, and the whole deck is pushed forward one segment length. The mould never moves.

B **Jacking over sliding bearings**
Hydraulic jacks at the abutment push or pull the whole deck. It slides on temporary bearings, PTFE pads riding on stainless steel, with lateral guides holding line. Friction is low, so on the flat **F = μ × W**. A steel nose, far lighter than the deck, reduces the cantilever moment until it lands on the next pier.

C **Hogging and sagging in turn**
As the deck moves, every section passes over supports, where it hogs, and through midspans, where it sags. Launch prestress is therefore central (concentric), giving near uniform compression that covers both. The worst hogging is over the last pier while the front cantilevers. Continuity tendons are added after the launch to suit the final continuous deck.

CHECK YOURSELF

A deck weighing 40,000 kN slides on PTFE bearings with μ = 0.03. What jacking force is needed on the flat, ignoring gradient and starting friction?

ANSWER $F = 0.03 \times 40{,}000 = 1{,}200$ kN

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WK 44	1 MON	2 TUE	3 WED	4 THU	5 FRI	6 SAT	7 SUN
WK 45	8 MON	9 TUE	10 WED	11 THU	12 FRI	13 SAT	14 SUN
WK 46	15 MON	16 TUE	17 WED	18 THU	19 FRI	20 SAT *National Day* OM	21 SUN *National Day* OM
WK 47	22 MON	23 TUE	24 WED	25 THU	26 FRI	27 SAT	28 SUN
WK 48	29 MON	30 TUE	1 DEC	2 DEC	3 DEC	4 DEC	5 DEC

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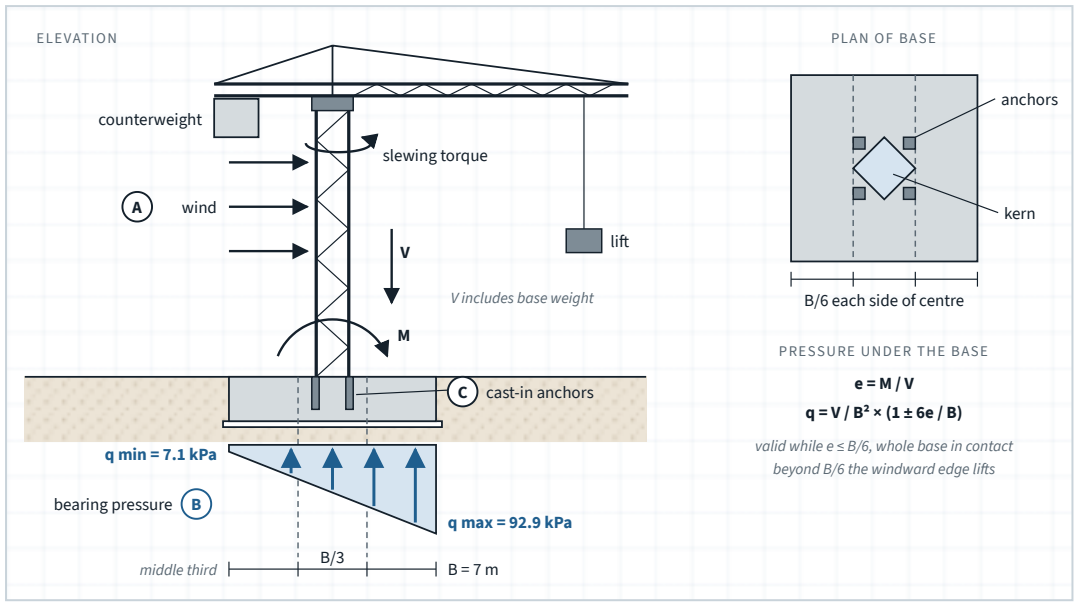
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12 # December 2027

SUBJECT: **Tower crane foundation: keeping the crane standing**

SCALE: **NTS** | REV: **A** | DRAWN: **AMELIE·AI**



Concrete base · Crane steel · Soil · Bearing pressure

Fig. 12. Elevation and plan of a free-standing crane base, not to scale

The pressure formula assumes a rigid base turning about one axis. Wind on the diagonal gives a higher corner pressure, and the kern there reaches only B/(6√2), 0.83 m here, so check it too.

ON SITE

- The crane base is temporary works. It needs its own designer and an independent checker, working from the crane maker's base loads for the actual mast height, jib length and wind zone.
- Before the pour, survey anchor level and position against the template and record it. Check bearing on the formation before blinding; soft spots are dug out and replaced, not covered over.
- Keep the base drained so water cannot soften the formation. Do not allow later excavations, drainage runs or service trenches near it without the temporary works designer's agreement.

THIS MONTH **TOWER CRANE FOUNDATION**

A heavy block that keeps a crane upright

A tower crane is a tall, slender mast with a big moment at its foot. A free-standing crane relies on a mass concrete or reinforced base to stop it overturning and to spread its load safely into the ground.

A **Loads from the crane**

The base receives vertical load from the mast, jibs and counterweight, a large overturning moment from the lift or from wind, and a slewing torque. Out of service the crane slews freely with the wind, but a storm on the full height of mast and jib often gives the governing moment. The crane maker gives the base loads for each configuration and mast height.

B **Weight resists overturning**

The base holds the crane down with its own weight and the crane's, so V includes both. The resultant sits at **e = M / V** from the centre. If e ≤ B/6 it lies in the middle third, the whole base bears, and for a square base turning about one axis **q = V / B² × (1 ± 6e / B)**. Beyond B/6 part of the base lifts and q max rises fast.

C **The connection and the ground**

The mast is fixed through cast-in anchors, fixing angles or an embedded mast section, to the crane maker's pattern. They are held by a template and set to tight tolerances of level and position, because a mast that starts out of plumb only gets worse with height. On weak ground the base sits on piles, which take the moment as push and pull, so some piles need tension capacity.

CHECK YOURSELF

A 7 m square crane base carries V = 2,450 kN, including its own weight of about 1,760 kN, and M = 2,450 kNm. Find e, q max and q min.

ANSWER *e = 2,450 / 2,450 = 1.0 m ≤ 7 / 6 = 1.17 m. q = 2,450 / 49 × (1 ± 6 × 1.0 / 7) = 50 × (1 ± 0.857), so q max ≈ 92.9 kPa and q min ≈ 7.1 kPa*

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WK 48	29 NOV	30 NOV	1 WED	2 THU *National Day* UAE	3 FRI *National Day* UAE	4 SAT	5 SUN
WK 49	6 MON	7 TUE	8 WED	9 THU	10 FRI	11 SAT	12 SUN
WK 50	13 MON	14 TUE	15 WED	16 THU *National Day* BH	17 FRI *National Day* BH	18 SAT *National Day* QA	19 SUN
WK 51	20 MON	21 TUE	22 WED	23 THU	24 FRI	25 SAT *Isra and Miraj, expected* KW, OM	26 SUN
WK 52	27 MON	28 TUE	29 WED	30 THU	31 FRI	1 JAN	2 JAN

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