Guidelines for design of podium / basements for parking and services:

1. Basements are much more difficult and expensive to build than podium. All other things being equal, podium should be preferred and basements avoided. If basements are to be constructed since podiums are insufficient, following norms to be followed:
    a. Basement sizing should be such that ratio of footprint (BUA in sq. ft.) / Perimeter (length in meters) should be > = 100 (ideally >= 125).
    b. Max. no of basements should be determined only after soil investigation (separating strata into soil, rock and sheet rock) such that following is adhered to:
        i. Of total excavation volume, ratio of sheet rock should not exceed 30%.
        ii. Soil ratio out of total excavation volume should be maximum and in any event, should not be less than 30%.
2. Basement & podiums with regular parking (i.e. ramp accessed parking) below residential plant (building) footprint are inefficient (due to closely spaced columns and shafts) for parking and should be considered only last resort. If this is done, due care should be taken to ensure that Parking efficiency is benchmarked to other projects & policy and ratios maintained. Further, where in such circumstances, other solutions like automated/robotic parking should be evaluated wrt cost and efficiency before embarking on doing significant parking below residential building footprint.
3. Natural ventilation should be used as much as feasible. Even for basements, usage of natural ventilation (in part) is possible through measures like wind scoops.
4. As far as possible, service vehicle access to the basement/podium should be avoided for security and height reasons. Service vehicles should be allowed to drop-off/deliver at the periphery of these areas.
5. Whenever there are landscape areas located on top of the basements/podiums, design should be such that it:
    a. Minimizes dead load on the slab, by limiting fill (soil or otherwise) to the extent really needed.
    b. The entire slab should NOT be sunk by the required depth of the tree pits. General slab should be designed for a 0.6 m soil depth for regular landscape (+0.05 m for waterproofing) and tree pits should be located judiciously, as per landscape design and at these locations, the soil depth should be increased as per requirement (subject to c. below) by localized lowering of the slab.
    c. Maximum depth for tree pits should not exceed 1.5 m (generally 1.2 m) ((+0.05 m for waterproofing in either case). (except in very specific cases of certain must-have trees which would not work with 1.5 m tree pits – in such limited cases, 1.8 m (+0.05 m waterproofing) is permissible which may be designed by building up above ground).
    d. In specific cases where extra depth is required (eg. 4 c. hereinabove or in case of swimming pool etc.), if there is parking located below such structural members, the clear height of parking can be reduced to as low as 2.05 m and the services can be routed around such sunk area, so that there is no excessive increase in height of that level.
6. Basements/podiums should be designed with as low as possible floor-to-floor height. As per current prevalent practice, a clear height of 2.1 m for cars is sufficient (except for PPL where different heights are required as per 'PPL Specifications'); (total height for parking oriented areas

should be limited to ~2.75-2.8 m (below and above ground), including allowance for services and structure; this may increase somewhat in those slabs where there is landscape above to accommodate localized tree pits). Calculation of FTF height for parking areas serving passenger vehicles is suggested as follows:

a. FTF: 2750-2800 mm
b. Clear height (below column capital or services to finished floor): 2100 mm (in MCGM, we need to show 2400 mm below column capital to unfinished floor Please check Annexure B)
c. Services: max. 400 mm for basements using induction fans; max. 250 mm for podiums which generally don't require mechanical ventilation (can be more in the non-driveway areas. Majority of the Services to be planned in the areas between column capitals to avoid reduction of clear height available for cars below. (Avoid large dia pipes below column capitals)

d. Floor Finish (including slope): 50 mm
e. Slab (excluding column capital): 200 mm (say)
f. Total: 2750 (may slightly vary based on slab thickness)
g. In case of the lowermost level (level just above the foundation), following additional requirements are to be provided (below the floor level of the lowest floor):
    i. 0.45 m for drainage (if there is car parking or other activities which require water drainage on this level)
    ii. 0.2 m – 0.5 m for raft (based on structural design) above the PCC (will vary in case of piling)
    iii. 0.1 m for PCC above soil/rock (will vary in case of piling).

7. The efficiency of the space built in these areas is very important, since it is not a saleable space or a space that customers value highly. The lower the area, the better the economic feasibility. Some suggested measures:
    a. Prior to completion of Structure DD, draw up a plan of each level and earmark every inch of space for usage, including parking, back-of-house common areas and services. If any space is left unallocated, one should consider how to use this either for key common areas OR creation of area which can be sold at value to customers (eg. Store rooms) OR attempt should be try to reduce the area (including leaving voids so that horizontal structure costs are avoided).
    b. Columns in parking grid should be planned such that they are as slim as possible along the length of the parking grid (depth would be available) and hence, take as little space along the length as feasible. Preferred car parking grid is for 3 to 4 cars between columns.
    c. Parking columns should be placed that they finish within 1.0 mtr of the start of the parking bay, in depth.
    d. Follow the Parking policy guidelines and ensure optimal usage of permissible allowance of small and medium cars.
8. It is very important to pay special attention to the structural design of these areas, since structure comprises more than 60% of the cost of these areas. Given that these areas are generally low rise and are primarily meant only for passenger vehicle (not service vehicle or heavy load vehicle) use,

there are significant optimization possibilities in the structure design which are generally overlooked by structural consultants.

9. The basement and podiums are a back-of-house area (does not apply to the lift lobbies in the area which are to be treated as front of house). Relevant policies for finishing should be followed in this regard (see 'Finishing of Back of House Common Areas' policy) Following additional tips on finishing:
    a. In general , Car wheel stoppers are NOT required - they shall only be placed in Luxury or Hi-end residential or Excelus or Supremus office in parking slots which are along with perimeter/edge of the parking area. Further, in case of PPL (or equivalent), these shall be placed (for perimeter/edge parking bays only) only if specifically required in the approval order/NOC.
    b. Column guards – 4 of these strips are to be placed on each column in a parking area, which is likely to be accessible by a vehicle. In case of a square/rectangular column, these shall be placed at the 4 edges ..I.The guards shall be 600mm in height,+300mm above FFL. In case of round columns, column guards which cover the entire column shall be used, shall be 100mm in width, placed at +450m above FFL(centre) Refer figure below:



    c. Speed breakers (manufactured, not in situ concrete/PCC) shall be used taking into account their high costs. Suggested usage:
        i. On driving lanes, 5-10 m before intersection with another driving lane.
        ii. After placement of 8 c i., every 150-250 mtrs in each driveway to avoid cars speeding up too much.
10. Security and lighting of these areas should be thought of in advance (Prior to DD completion) to ensure optimization of costs and ensure good functionality.
11. In basements, to ensure that water doesn't gush in from the vehicle ramps and flood basements, following precautions are suggested:
    a. Any ventilators/openings should be atleast 1 m above adjacent finished ground level.
    b. Drain with reasonable depth at the start of the ramp
    c. Drain with reasonable depth at the end of the ramp
    d. Ramp level going up by around 300/450 mm from its entry point and then sloping down to prevent water of adjacent ground from entering the basement through the ramp.
12. Where possible, the levels of the 1st basement should be decided in a manner such that the top of the basement slab is slightly (1.5 m) above surrounding ground level to enable it to be naturally ventilated with openings of atleast 1.2 m. This will reduce/eliminate the need for mechanical

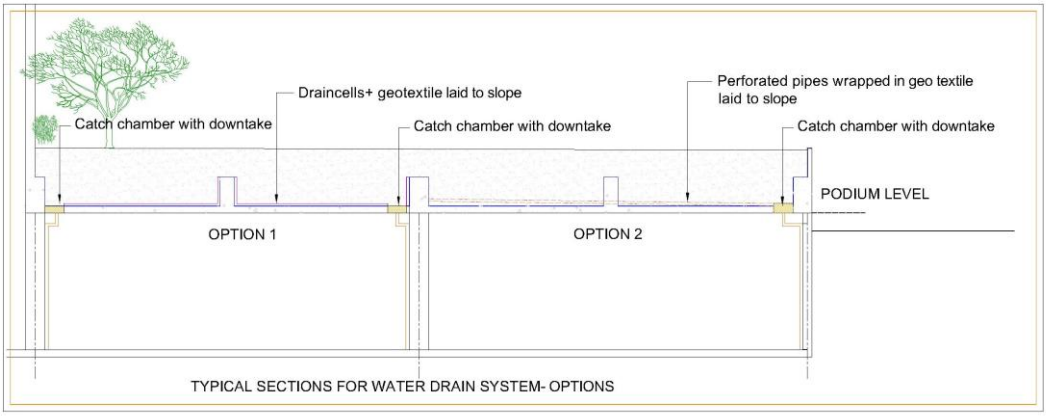
ventilation in the first basement and save both capital and operational costs. This can be achieved through a combination of raising the plinth of the building and lowering ground level in the areas close to the basement periphery. In cases where this system of natural ventilation of the 1st basement is followed, adequate measures should be taken ensure that rain water ingress into the basement through the ventilation openings is minimized, including by usage of storm water drains along the basement periphery.

13. In case of parking grid design, following guidelines to be followed:
    a. Square (or as close) to square grid is preferable. The longer dimension governs the structural costs of a grid.
    b. Given Lodha's parking dimension, ideal grid is 3 cars viz. 7.5 – 7.7 m.
    c. Generally, regardless of any cost calculation, for top slab which takes soil load, use of beam slab should be preferred (PT can be used in the beams to reduce beam size). In such case, embedded PVC sleeves should be provided in the beam for FF pipes.
    d. As in 2013, for all slabs other than top slab:
        i. For regular car loads, regular RC slab is more cost effective upto 7.5 m governing (max of the 2) dimensions.
        ii. Above 7.5 m governing dimension, PT should be considered. Unbonded PT is generally cheaper for governing dimension upto 10 m. Above 10 m, bonded PT is generally cheaper.
        iii. For heavier loads (eg. Bus parking), PT will be cheaper that regular RC slabs even if governing dimension is as 6.5 m or higher.
    e. In general, for any project the cost evaluation of all 3 options (RC, unbounded PT and bonded PT) should be done by the consultant and then final decision taken. This cost evaluation should be vetted by Cost Management before final choice of RC v. PT is made. RC is the preferred option as long as its structural cost is upto 5% more PT i.e PT should be more than 5% cheaper than RC to go with PT option.
    f. If PT is chosen, quotes should be taken on per kg of tendors, rather than per sq. ft. Also all designs of PT consultants should be approved by structural engineer.

14. It is necessary to have a concept landscape design outlining following, before finalizing structural design of any basement/podium slab which is expected to have landscape on it:
    a. Fire tender movement path
    b. Swimming pool or any other sunk feature havingdepth > 0.6 m
    c. Grids which are expected to have trees (soil fill of 1.05 / 1.2 m)
    It is necessary not to design all grids for fire tender load (Only the parts that are mandatorily required for fire path are loaded) and/or tree load. It is also suggested that, if feasible, trees be placed on column top so that they have minimal impact on structural design and hence, cost. The density of the wet soil for load calculation is 2000 kg/m3. Live loads to be considered as per structural consultants inputs.
15. In order to minimize waterproofing costs and issues, it is suggested that the slab be designed as a flat slab or with the beams protruding in the direction away from the surface which is to bear the soil load / waterproofing viz. conventional beams (facing downwards) for basement / podium top slab.

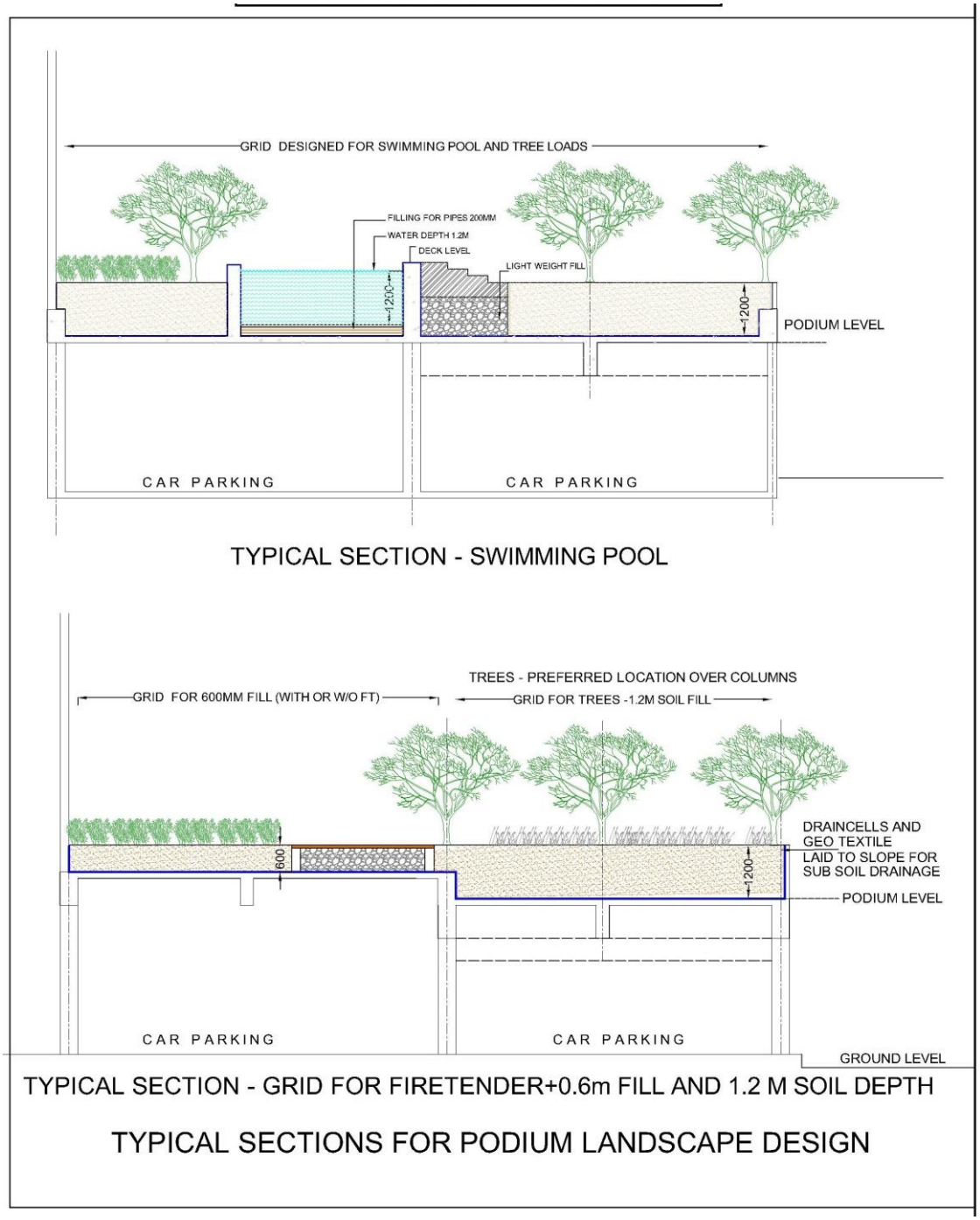
16. Prior to finalization of the structural design for such structure which is expected to bear fire tender and/or landscape load, Each grid should be marked as one of the following 3:
    a) Grid Tree (T) – 1.05 / 1.2 m soil fill (also suitable for swimming pool)
    b) Grid Grass (G) - 0.6 m soil fill (also suitable for shallow water bodies)
    c) Grid Fire Tender (F) – based on fire tender load as per fire NOC (generally 48 MT/ 12 KPA) + any other requirements for soil fill as per landscape design (max. 0.6 m soil fill in fire tender movement areas).
17. The fire-tender movement path should be marked with appropriate signage (maybe subtle) to ensure that it doesn't move on the grids not designed for taking up the FT loads.
18. Conceptual structure design for such basement / podium with landscape are provided in Annexure A below for ready reference.
19. <u>Water drainage systems (Podium gardens) are to be given special attention during design of landscape areas on top of podium/basement slab:</u>
    a. The surface water and sub soil water drainage system should be designed with extreme care to avoid any stagnation of water or prevent leakages later.
    b. In case of landscape development over inverted beams, the beams should be adequately lowered to have the minimum soil cover required for the plantation. In case, the soil depth at these stretches is shallow, the plants should be selected accordingly – patches if grasses, small shrubs and ground covers.
    c. All surface drains of hardscape areas should be clearly marked on the drawing to ensure no water stagnation in any area. Landscape VFC's should show the drainage outlet points of sub-soil drainage and take into account the loss of depth while providing slopes in the water proofing layer of the base slab. The slope provided for this layer is 1" to 6'.
    d. In case of inverted beams, the water drainage of the troughs created should be well planned. In case, draincells + geo-textile are used, the indivisual troughs should be drained with a catch chamber. This may not be possible in case of close network of beams and hence number of smaller troughs. A network of perforated pipes wrapped in geo-textile can be proposed in this case. The co-ordinates of these pipes to be marked well in advance, for leaving appropriate sleeves during casting of beams.
    e. The slabs / beams in such cases shall be designed as uncracked sections. Alternatively, post tensioning can be introduced for limited purpose of closing the cracks.

    Ref for design of landscape slab drainage:

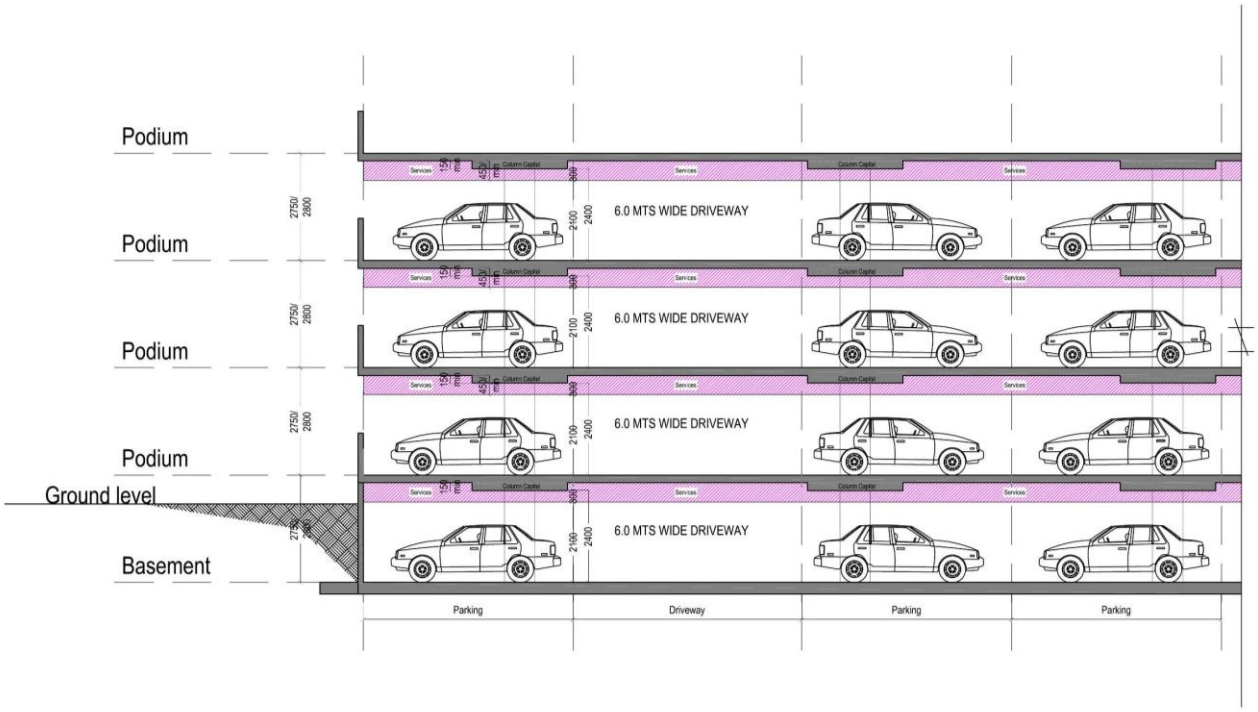


20. The travel distance for a vehicle from the start of the ramp on the highest and lowest level of the parking structure to the nearest vehicular exit out of the structure should not exceed 500 m (max. travel time of 5 min assuming average travel speed of 10 km/hr). Further, no. of ramp turns for any parking structure should not exceed 5 (for a driver to feel that he/she is only climbing up by max. of 5 levels). In order to achieve both of these objectives, in parking structures which have large no. of levels, consider use of double / triple floor ramps and ensure that that the start of the connecting ramp (at the end of one ramp) is no more than 20 m travel distance from the end of the of the last ramp and in such cases the no. of levels served before the next turn shall be numbered Alphanumerically eg. If there is a ramp serving 3 levels at a time, the numbering shall be P0, P1A, P1B, P1C, P2A, P2B, P2C and so on.
21. In any parking structure having any form of controlled entry (eg. Paid, RFID controlled boom barrier etc.), ensure that there is waiting space for atleast 2 vehicles (3 if total no. of parking slots in parking structure is > 1000) before the controlled entry and similarly, there is waiting space (after the controlled exit) for atleast 2 vehicles at the junction with the nearest road at time of exit.
22. Entrance to parking area (can be ramp or flat) to be treated as FOH area (like done for first flight of staircase) for first 15-20 m, in line with standards expected in lobby and first flight staircase for development of that nature. This is to give impression of higher quality.
23. Details of parking area painting:
    a. On non-flat (eg. curved) surfaces, use one colour to prevent issues wrt junction between two colours
24. If there are 3 or more turns to get from entry to top level, we need to draw attention away from driving time. In order to do this, 25% - 50% (ideally ~ 33%) of the ramp length to be designed with colours / graphics etc to make the driving time appear to be less than what it really is. Refer Annexure C for sample graphics
25. Ramp graphics or colour coded / painted surfaces along the ramps should be located ideally 450-600 mm above floor level to avoid staining by carbon deposits from vehicles. The lower portion could be bare finish or be painted in a dark shade to address this issue.
26. Circular ramps should be avoided if travel is 4 levels or more (i.e. acceptable for upto 3 levels). If circular ramp is required for 4 or more level travel due to space limitations, preference is to have the ramp as one-way with two-way being used in extremely rare instances. Further, for all circular ramps (even if travel is less than 4 levels and one-way or two-way) need to have protection zone of 2 feet (i.e. 0.6 m) each way between the driveway and the boundary/edge wall. Also in two-way circular ramp, solid divider (min height of 0.45 m) is required between the two sides of the driveway. Accordingly minimum ramp width shall be as follows:
    a. One-way: 4.5 + 0.6 = 5.1 m
    b. Two-way: 6 + 0.6 + 0.6 + 0.3 (divider) = 7.5 m

Annexure A – Conceptual Structural Design for podium/basement slab with landscape



Annexure B (only for MCGM)



Annexure C: Reference Sample design
(The Park)

