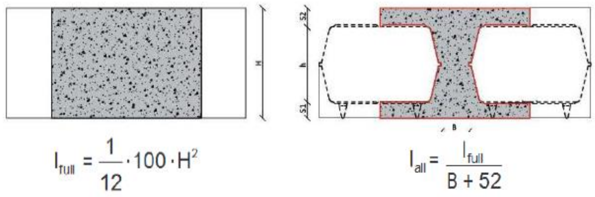

Fig. 3: Comparing moment of inertias for flat and hollow core slabs

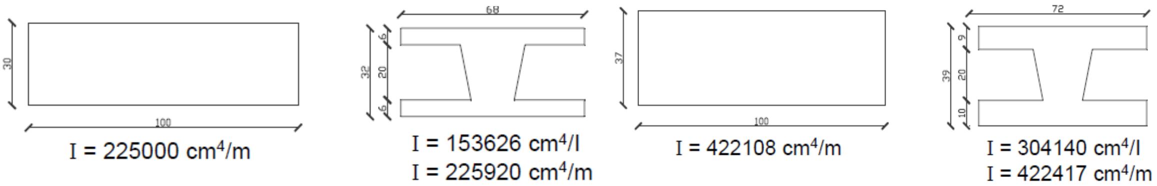

Fig. 4: Calculation of moment of inertias for flat and hollow core slabs

4 PARAMETRIC STUDY

Though plastic voided slabs can be compared to conventional one-way slabs, plastic voided slabs are most efficient when designed similar to two-way slabs without support beams. For this reason, the parametric study compares interior bays of a flat plate system to interior bays of a plastic voided slab system. The primary goal of the study was to compare the relative weight of a plastic voided slab to the relative weight of a flat plate.

Many parameters must be considered when designing a concrete slab. For a comprehensive comparison between two-way slabs and plastic voided slabs, a study must consider not only different bay sizes but also span conditions and different weights and strengths of concrete. However, the purpose of this study was to provide a quick, illustrative comparison between flat plate slabs and plastic voided slabs.

Each bay was designed as an interior span with no support beams which is typical for flat plates. An interior span was chosen since the majority of the structure is an interior span condition for buildings. In addition, each side of the bay will behave similarly.

When it comes to the implementation stage, investigated for hollow core slab system design, local and international design codes need to be followed common denominator steps are summarized below.

4.1 Types of Slab

In different types of structural slab systems, and other mandatory minimum requirements of the regulations (of the requirements) by providing primarily taking into account the size and other parameters optimization models have been developed numerical analysis made. Results of the analysis examined the applicability of reinforcement and cross-sectional effects were studied. If as a result of internal forces if there is a mismatch in terms of ordinances; Models made to deal with the consequences of turning optimization elements are used. The available 720 numerical analysis model created from nine different slab system type, Table 1.

Tab. 1: Type of Slabs

	Slab Type
BS	Beam Slab
BS1	Beam Slab 1 - Dived by 1 interior beam
BS2	Beam Slab 2 - Dived by 2 interior beams
RIB	Ribbed Slab

WFF	Waffle Slab
FLT	Flat Slab
MSH	Mushroom Slab
VS 1	Voided Slab - Mushroom Slab
VS 2	Voided Slab - Ribbed Slab

4.2 Types of Live Loads

Live loads used in this study, are based on the regulations. These load values are given in Table 2. For all types of slabs the dead load was accepted t/m^2 0.200.

Tab. 2: Type of Live Loads

	Live Load (t/m^2)	**Description**
Q200	q=0.200	Offices, Buildings
Q350	q=0.350	Schools
Q500	q=0.500	Shopping Malls
Q750	q=0.750	Stadiums
Q1000	q=1.000	Hangar, Big Stores

4.3 Geometry and Continuity of Slabs

Geometry in the selection of types, sizes and structures widely used in practice in architecture will help to create alternative solutions are used in large openings, Table 3. Great opening of a portion of the costs taken into consideration to create solutions to problems point to a particular part of the structure will be found in the singular mind laying one span to take into consideration the discontinuity is solved.

Tab. 3: Geometry and Continuity of Slabs

	Dimension in X and Y Directions	**Continuous of slabs**
6x6M	lx=6 m, ly=6 m	Multiple- 5 x 5 (Five slabs in each direction)
8x8M	lx=8 m, ly=8 m	Multiple- 5 x 5 (Five slabs in each direction)
10x10M	lx=10 m, ly=10 m	Multiple- 5 x 5 (Five slabs in each direction)
12x12M	lx=12 m, ly=12 m	Multiple- 5 x 5 (Five slabs in each direction)
14x14S	lx=14 m, ly=14 m	Single
16x16S	lx=16 m, ly=16 m	Single
6x9M	lx=6 m, ly=9 m	Multiple- 5 x 5 (Five slabs in each direction)
6x12M	lx=6 m, ly=12 m	Multiple- 5 x 5 (Five slabs in each direction)
8x12M	lx=8 m, ly=12 m	Multiple- 5 x 5 (Five slabs in each direction)
8x16M	lx=8 m, ly=16 m	Multiple- 5 x 5 (Five slabs in each direction)
10x15S	lx=10 m, ly=15 m	Single
10x20S	lx=10 m, ly=20 m	Single
12x18S	lx=12 m, ly=18 m	Single

12x24S	lx=12 m, ly=24 m	Single
14x21S	lx=14 m, ly=21 m	Single
16x24S	lx=16 m, ly=24 m	Single

5 RESULTS

5.1 Cost Comparison Charts (TL/m^2)

Material quantities, analysis metering module that is integrated within the program was obtained from. Concrete, formwork, reinforcement and Voided Slab blind mold plastic items as much as possible considering the current unit prices only without the inclusion of vertical structural costs are calculated per m^2 of floor coverings same moving load carrier systems for the different costs were compared m^2, Figure 5-6.

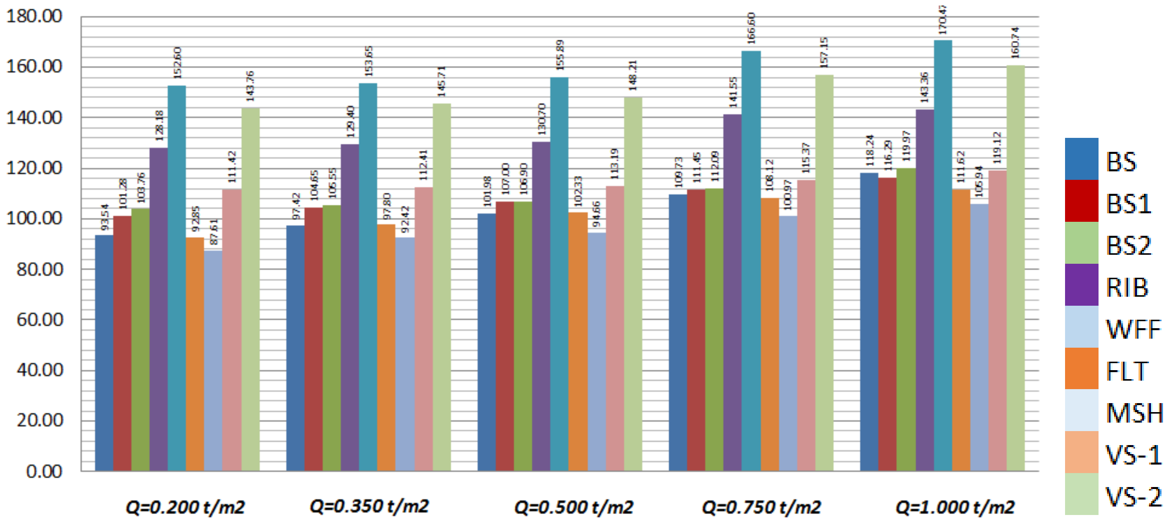

Fig. 5: 6m x 6m-Multiple Slab System Cost Comparison Chart

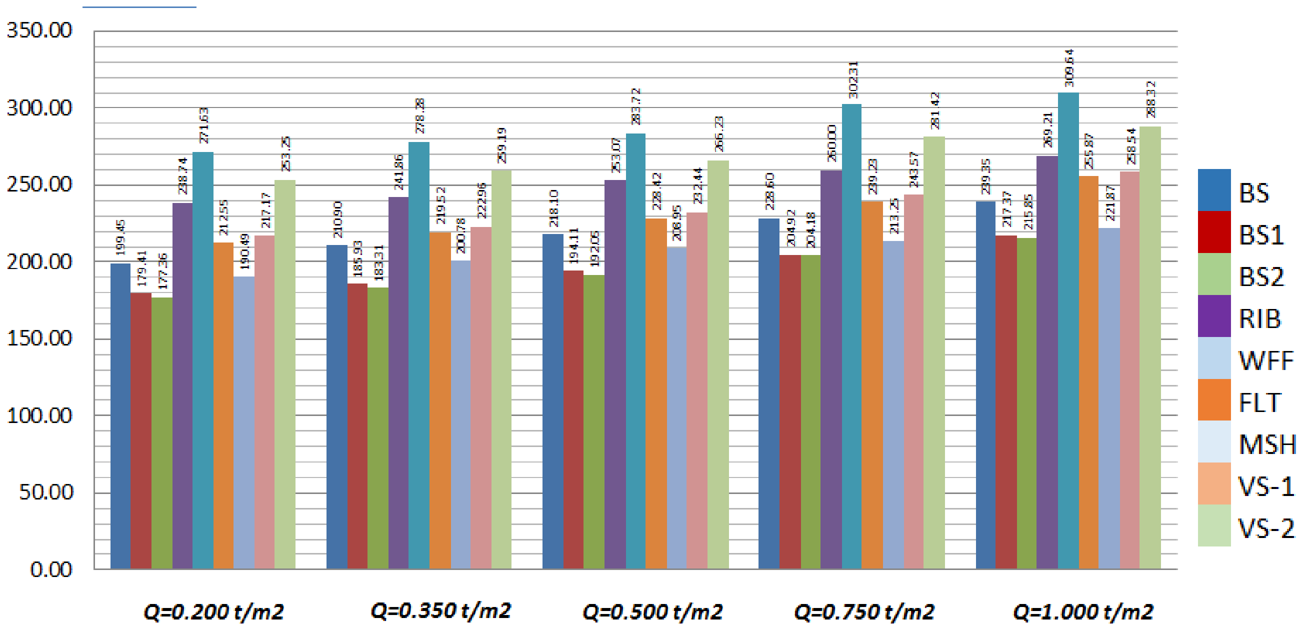

Fig. 6: 14m x 14m-Single Slab System Cost Comparison Chart

5.2 Concrete Odds Comparison Chart (m^3/m^2)

For the same moving load, without including the vertical loads, vertical loading systems of different tiles per m^2 of concrete ratios were compared, Figure 7-8.

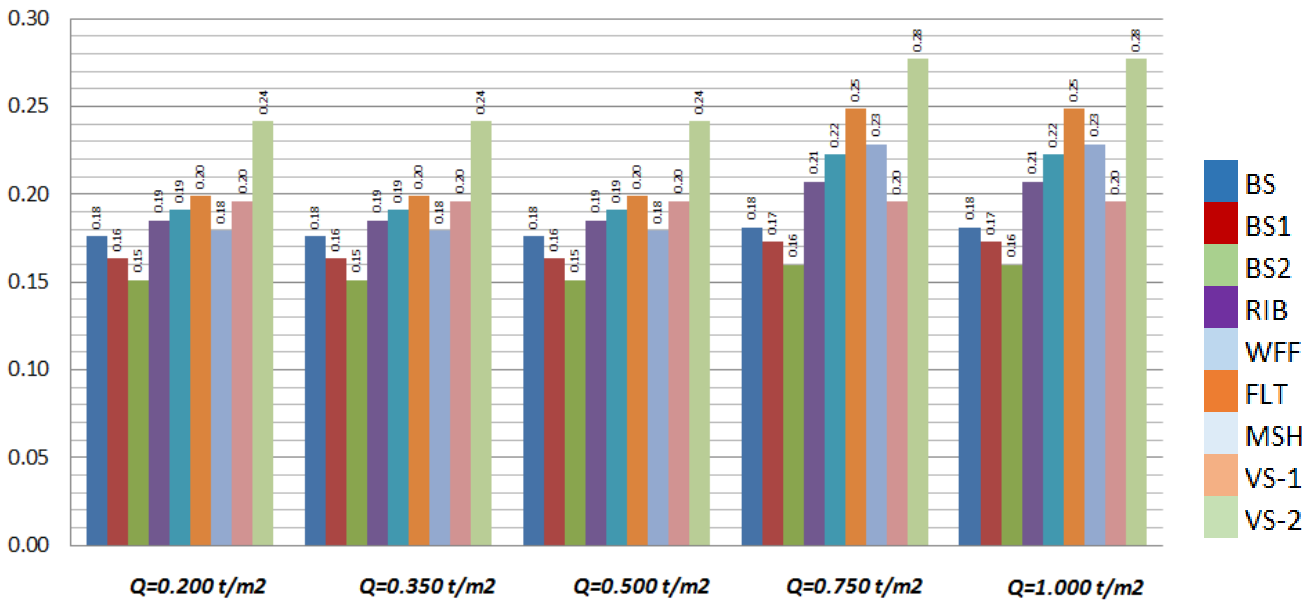

Fig. 7: 6m x 6m-Multiple Slab System Concrete Odds Comparison Chart

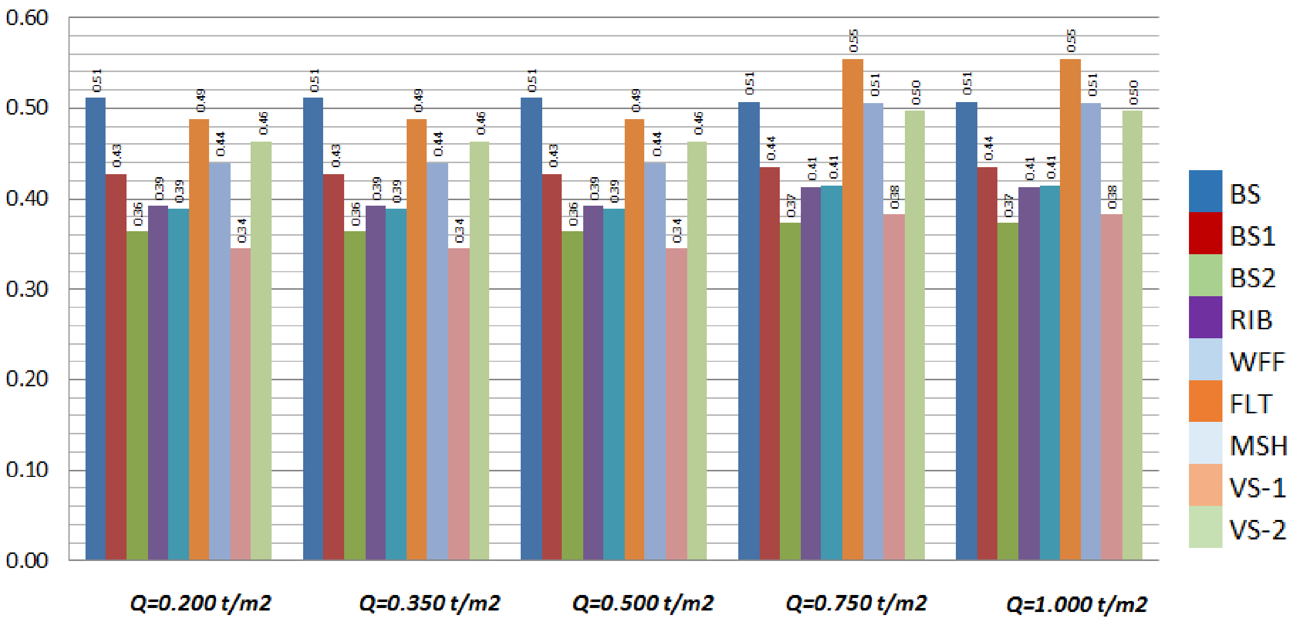

Fig. 8: 14m x 14m-Single Slab System Concrete Odds Comparison Chart

6 CONCLUSIONS

Reinforced concrete slabs are used in many modern buildings. As architects attempt to use more open layouts by utilizing larger column-to-column spans, concrete slabs can become thick and heavy when designing a traditional flat plate. As illustrated in the parametric study, plastic voided slab systems can be used to reduce the structure weight with minimal impact to the overall building design.

he benefits of using plastic voided slabs rather than solid slabs are greater for larger spans. Smaller spans do not require substantially thick slabs, therefore only small voids can be utilized and minimal savings are achieved. Larger spans are capable of using larger voids that greatly reduce the overall weight of the slab while meeting load capacity requirements.

Construction of plastic voided slabs requires more steps than solid slabs, but the construction process is not significantly more complicated. For bays of the same size, plastic voided slabs typically require less reinforcement. The only major change is placement of the plastic void formers. The void formers are placed above the bottom layer of reinforcement and are usually contained in a cage of very thin steel bars. The cage of void formers is typically constructed at the manufacturer's facility and shipped to the construction site, allowing for quick placement of the void formers and minimal changes to the construction schedule compared to solid slab systems.

Architectural freedom can also be achieved by utilizing plastic voided slabs. Plastic voided slabs make it possible to achieve longer spans with the same amount of concrete in the slab, allowing for less columns and a more open interior space.

Overall, plastic voided slab systems provide an excellent alternative to solid concrete slabs for many applications. Weight and cost savings as well as architectural flexibility can be achieved with plastic voided slabs.

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