

**INDEPENDENT FRAME
COMPARISONS
DESIGN SUMMARY**

Quicker, Cheaper, Greener

An independent engineering study shows lightweight concrete is quicker, cheaper and greener than normal weight, when used in reinforced concrete towers.

- When using lightweight concrete or normal weight concrete, the overall costs of concrete and steel are equivalent.
- ‘Secondary’ time and costs savings in delivery, foundations, site costs, etc. make using lightweight concrete the cheaper option.
- Significant environmental CO₂e savings of up to 34% can be achieved just by changing to lightweight aggregate.

Which means that it's **Quicker, Cheaper** and **Greener** to construct reinforced concrete framed buildings using **Lightweight Concrete.**

A summary of the study follows

Learn more about these savings from
barry.mellor@lytag.com
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Raw Materials – Cost Neutral

Using lightweight concrete significantly reduces the overall volumes of concrete and reinforcement steel needed in the construction of tall buildings.

But does this reduction compensate for the higher cost of lightweight concrete?

To answer this question, we commissioned a leading independent engineering practice to undertake a comparative modelling study of reinforced concrete framed towers of 15, 30 and 45 storeys.

The results were categorical, showing no significant cost difference for raw materials:

Storeys	Total Concrete		Total Steel		Overall Cost	
	Saving m ³	%	Saving t	%	Cost diff £	% Diff
15	785	12.54	76	11.73	£21,802	2.15
30	1844	12.76	176	10.82	£1,286	0.05
45	3776	14.89	255	9.37	£93,413	2.24

When using lightweight concrete or normal weight concrete, the overall cost of concrete and steel are comparable (+/- 2.2%).

However, from these results we were able to calculate that significant ‘Secondary’ savings would result from using lightweight concrete.

Key 'Secondary' Savings

The study showed that huge savings are made in the volumes of concrete and steel when using lightweight concrete in place of normal weight concrete.

These huge savings in volume mean that significant 'Secondary' Savings can be made in:

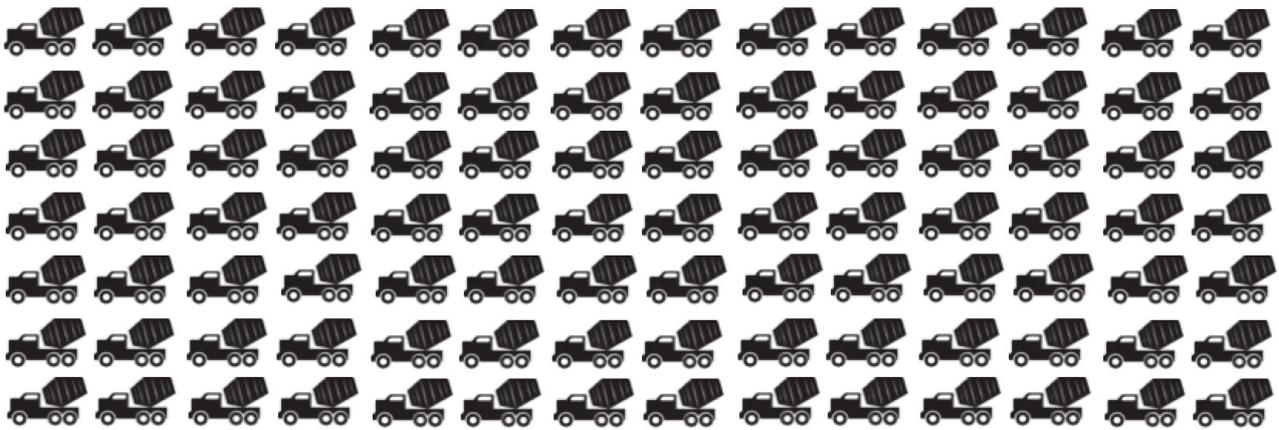
- Concrete delivery & installation.
- Steel delivery & installation.
- Foundations and piling.
- Overall site costs.
- CO₂e.

We'll now look at each of these in turn to see the details of 'Secondary' Savings in time, money and CO₂e:

15 Storey - Concrete Delivery & Installation

Concrete Delivery (using 8m³ trucks)

785 m³ less concrete = **98** less concrete deliveries.



Concrete Installation - pumping, placing & compaction (based on 40 min delivery to compaction time)

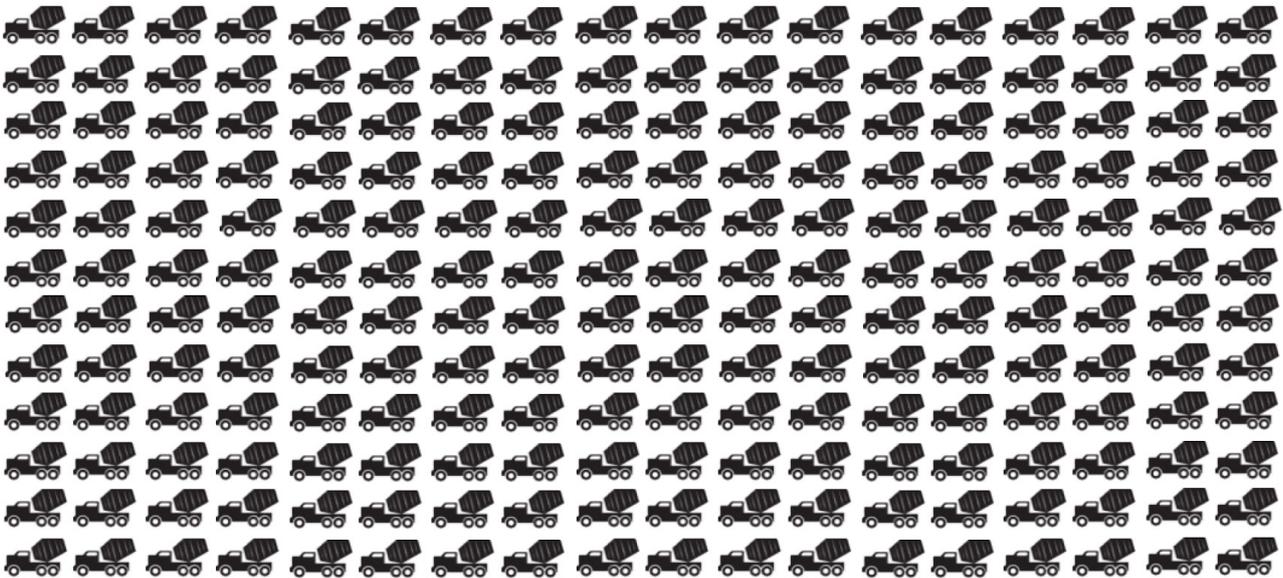
98 less deliveries = **3,920 minutes** saved or **9.3 days**.



30 Storey - Concrete Delivery & Installation

Concrete Delivery (using 8m³ trucks)

1,844 m³ less concrete = **231** less concrete deliveries.



Concrete Installation - pumping, placing & compaction (based on 40 min delivery to compaction time)

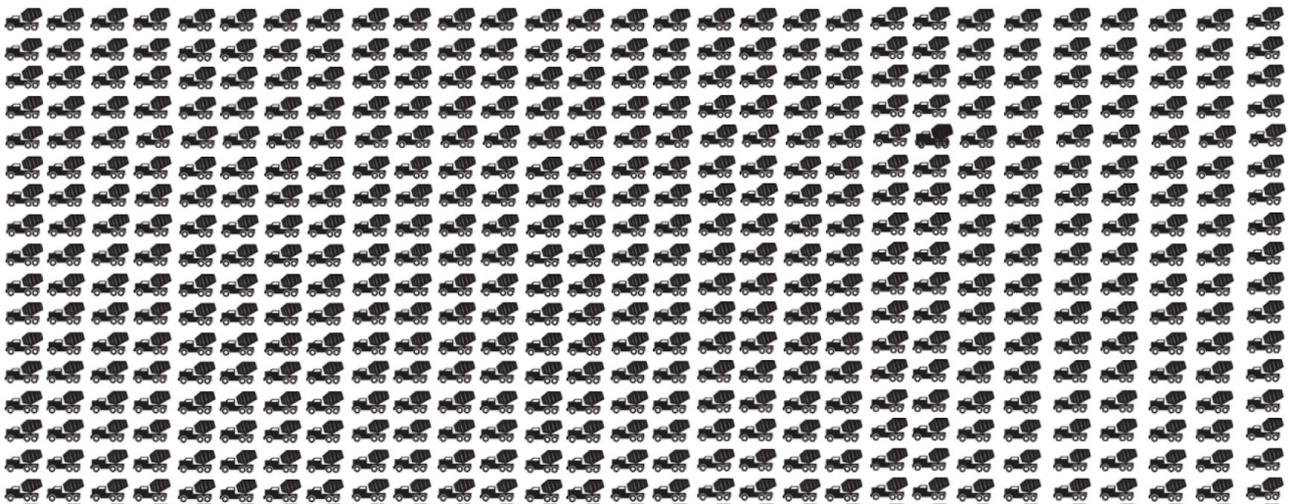
231 less deliveries = **9,240 minutes** saved or **22 days**.



45 Storey - Concrete Delivery & Installation

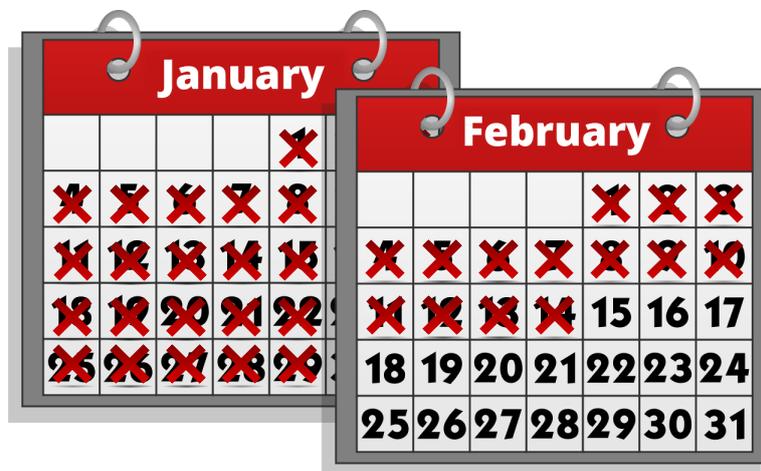
Concrete Delivery (using 8m³ trucks)

3,776 m³ less concrete = 472 less concrete deliveries.



Concrete Installation - pumping, placing & compaction (based on 40 min delivery to compaction time)

472 less deliveries = 18,880 minutes saved or 45 days.



Reinforcement Steel Savings

Savings in raw material:

- 15 storeys = 109 tonnes.
- 30 storeys = 225 tonnes.
- 45 storeys = 347 tonnes.

Which leads to savings in:

- Fewer truck deliveries.
- Storage.
- Cranage (smaller cheaper cranes, fewer lifts, less site time).
- Labour (unloading, storage and fixing).

Foundations & Piling

Smaller foundations and piles are needed due to the building's reduced dead load, leading to savings in:

- Smaller, cheaper piling rigs.
- Fewer 'muck away' trucks.
- Smaller volume of hazardous soil to remove.
- Shuttering.
- Blinding.
- Reduced mat thickness.
- Placing and hook time.
- Concrete skips.
- Vibration.

The study confirmed that overall savings in concrete and reinforcement are found mainly in the foundations. With reductions of up to 48%.

(Foundations are also one of the construction phase's largest CO₂e contributors.)

Other 'Secondary' Savings

Overall Savings

Other savings in the construction process include:

- Labour costs.
- Facilities on site.
- Formwork.
- Easier and safer logistics.
- Construction time.

CO2e Savings

Because of the savings in raw materials and ‘Secondary’ costs, a knock-on effect is that there are also significant savings in CO2e emissions. The areas where savings can be found are many, but 4 main quantifiable sectors are:

	Storeys	SAVINGS				
		CO ² e Tonnes	%			
Concrete (Raw Material)	15	181.03	8			
	30	430.67	8			
	45	970.73	10			
Reinforcement (Raw Material)	15	66.27	12			
	30	153.47	11			
	45	222.36	9			
Concrete Deliveries	15	9.01	32			
	30	20.91	32			
	45	38.57	34			
Reinforcement Deliveries	15	0.39	12			
	30	0.91	11			
	45	1.32	9			
Storeys	Raw Material CO ² e Tonnes		Delivery CO ² eTonnes		Total Savings	
	Concrete	Steel	Concrete	Steel	CO ² e	%
15	181.03	66.27	9.01	0.39	256.70	9
30	430.67	153.47	20.91	0.91	605.95	9
45	970.73	222.36	38.57	1.32	1232.97	10

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- When using lightweight concrete or normal weight concrete, the overall costs of concrete and steel are equivalent.
- ‘Secondary’ time and costs savings in delivery, foundations, site costs, etc., make using lightweight concrete the cheaper option.
- Significant environmental CO₂e savings of up to 34% can be achieved just by changing to lightweight aggregate.
- With an average overall CO₂e saving of 10%.

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and **Greener** to construct reinforced
concrete framed buildings using
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