

**Vehicle**

**Calculations**

Workbook for build cost and material volume calculations

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**Part of:**

**Construction Logistics Planning Training** Day 3: Advanced Practitioner

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**clocs.org.uk**

**Build cost**

**Methodology**

This method uses the total build cost of the project and an assumed vehicle mix for each phase to calculate the number of vehicles required.

First, the build cost and material spend are derived.

Second, the cost of materials is calculated as the percentage of build cost spent on materials for each construction phase. This information is provided in our case study.

Third, the cost carried per vehicle is then multiplied by the number of vehicles in an assumed vehicle mix. The total cost carried per vehicle type is then added to give a total cost carried for the assumed vehicle mix in the case study.

Fourth, the total cost of material is divided by the total cost carried for 1 vehicle mix to give us the total number of vehicles mixes used.

Fifth, the number of vehicle mixes is multiplied by the number of vehicles in the mix to give the total number of vehicle movements for the phase.

To give a monthly total across the phase, the calculated number is divided by the duration of the phase (assuming that the number of vehicles required per month is equal across all months in the phase).

**Note: In the following calculations final numbers should be rounded up to the nearest whole.**

**Phase 1: Site setup and demolition**

**Jan 2016 - Sep 2016 (9 Months)**

This phase consists of enabling and ground works, scaffolding, asbestos removal, soft strip, heavy plant delivery, de-construction and spoil away. The site setup and demolition phase of 500 London Street is expected to take 9 months. This phase will be £10 million of the total build cost with a material spend of 40%.

**Step 1:** Derive the **build cost (£)** and **material spend (%)** for the phase

|  |
| --- |
| Build cost = Material Spend =  |

**Step 2:** Calculate the **cost of materials (£)** for the phase

|  |
| --- |
| Cost of Materials (£) = Build Cost (£) x Material Spend (%) Cost of Materials =  |

**Step 3:** Using the assumed vehicle mix calculate the **total cost carried (£)** by the number of vehicles specified

|  |  |  |  |
| --- | --- | --- | --- |
| Vehicle type | Cost carried per vehicle (£) | No. of Vehicles | Total cost carried (£) |
| Large HGV | 3,000 | 1 |  |
| Medium HGV | 3,000 | 1 |  |
| Small HGV | 1,500 | 3 |  |
| LGV | 1,500 | 10 |  |
| TOTAL | N/A | 15 |  |

**Step 4:** Divide the **total cost of material (£)** by the **total cost carried (£)** for 1 vehicle mix to give us the **number of vehicle mixes** used

|  |
| --- |
| No. Vehicle Mixes = Cost of Materials (£) / Cost Carried (£) by 1 Vehicle mix No. Vehicle Mixes = |

**Step 5:** Multiply the **total number of vehicle mixes** used by the **number of vehicles in the vehicle mix** to give us the **total number of vehicles for the phase**

|  |
| --- |
| Total Vehicles = No. Vehicle Mixes x No. Vehicles in a MixTotal Vehicles = |

**Step 6:** The **total number of vehicles** is divided by the **duration (in months) of the phase**

|  |
| --- |
| Vehicles per Month = Total Vehicles / No. Months in PhaseVehicles per Month = |

**Phase 2: Basement excavation and piling**

**Sep 2016 - Jul 2017 (11 Months)**

The construction contractor will commence works by piling the perimeter basement wall with a total of 400 contiguous piles. This will require material to be removed, replaced with concrete, and reinforced with rebar. The contractor will then then excavate to a depth of 5.5m for the new basement (temporary propping will be installed as they progress). The total cost of this phase is expected to be £3 million with 50% on materials.

**Step 1:** Derive the **build cost (£)** and **material spend (%)** for the phase

|  |
| --- |
| Build cost =Material Spend =  |

**Step 2:** Calculate the **cost of materials (£)** for the phase

|  |
| --- |
| Cost of Materials (£) = Build Cost (£) x Material Spend (%) Cost of Materials =  |

**Step 3:** Using the assumed vehicle mix calculate the **total cost carried (£)** by the number of vehicles specified

|  |  |  |  |
| --- | --- | --- | --- |
| Vehicle type | Cost carried per vehicle (£) | No. of Vehicles | Total cost carried (£) |
| Large HGV | 750 | 5 |  |
| Medium HGV | 750 | 1 |  |
| Small HGV | 500 | 1 |  |
| LGV | 40 | 5 |  |
| TOTAL | N/A | 12 |  |

**Step 4:** Divide the **total cost of material (£)** by the **total cost carried (£)** for 1 vehicle mix to give us the **number of vehicle mixes** used

|  |
| --- |
| No. Vehicle Mixes = Cost of Materials (£) / Cost Carried (£) by 1 Vehicle mix No. Vehicle Mixes = |

**Step 5:** Multiply the **total number of vehicle mixes** used by the **number of vehicles in the vehicle mix** to give us the **total number of vehicles for the phase**

|  |
| --- |
| Total Vehicles = No. Vehicle Mixes x No. Vehicles in a MixTotal Vehicles = |

**Step 6:** The **total number of vehicles** is divided by the **duration (in months) of the phase**

|  |
| --- |
| Vehicles per Month = Total Vehicles / No. Months in PhaseVehicles per Month = |

**Phase 3: Sub-structure**

**Jul 2017 - Jan 2018 (7 Months)**

Following basement excavation, the Contractor will commence internal piling and reinforcement. There will be 2 piling rigs used to excavate, concrete pour, and reinforce a total of 720 piles. The total cost of this phase is expected to be £10 million with 40% on materials.

**Step 1:** Derive the **build cost (£)** and **material spend (%)** for the phase

|  |
| --- |
| Build cost =Material Spend =  |

**Step 2:** Calculate the **cost of materials (£)** for the phase

|  |
| --- |
| Cost of Materials (£) = Build Cost (£) x Material Spend (%) Cost of Materials =  |

**Step 3:** Using the assumed vehicle mix calculate the **total cost carried (£)** by the number of vehicles specified

|  |  |  |  |
| --- | --- | --- | --- |
| Vehicle type | Cost carried per vehicle (£) | No. of Vehicles | Total cost carried (£) |
| Large HGV | 5,000 | 9 |  |
| Medium HGV | 5,000 | 1 |  |
| Small HGV | 2,000 | 3 |  |
| LGV | 1,000 | 2 |  |
| TOTAL | N/A | 15 |  |

**Step 4:** Divide the **total cost of material (£)** by the **total cost carried (£)** for 1 vehicle mix to give us the **number of vehicle mixes** used

|  |
| --- |
| No. Vehicle Mixes = Cost of Materials (£) / Cost Carried (£) by 1 Vehicle mix No. Vehicle Mixes = |

**Step 5:** Multiply the **total number of vehicle mixes** used by the **number of vehicles in the vehicle mix** to give us the **total number of vehicles for the phase**

|  |
| --- |
| Total Vehicles = No. Vehicle Mixes x No. Vehicles in a MixTotal Vehicles = |

**Step 6:** The **total number of vehicles** is divided by the **duration (in months) of the phase**

|  |
| --- |
| Vehicles per Month = Total Vehicles / No. Months in PhaseVehicles per Month = |

**Phase 4: Super-structure**

**Oct 2017 - Jun 2018 (9 Months)**

The Contractor will commence jump forming the central concrete core. This will have a total volume of 250m3 of concrete with 37.5t rebar reinforcement. When the central core is 4 stories up the contractor will then form a suitably designed basement slab. The contractor will continue to raise the core to roof level and follow this activity up the building with the floors, and prefabricated glazed and solid form cladding system. The total cost of this phase is expected to be £30 million with 40% on materials.

**Step 1:** Derive the **build cost (£)** and **material spend (%)** for the phase

|  |
| --- |
| Build cost =Material Spend =  |

**Step 2:** Calculate the **cost of materials (£)** for the phase

|  |
| --- |
| Cost of Materials (£) = Build Cost (£) x Material Spend (%) Cost of Materials =  |

**Step 3:** Using the assumed vehicle mix calculate the **total cost carried (£)** by the number of vehicles specified

|  |  |  |  |
| --- | --- | --- | --- |
| Vehicle type | Cost carried per vehicle (£) | No. of Vehicles | Total cost carried (£) |
| Large HGV | 8,000 | 9 |  |
| Medium HGV | 5,000 | 1 |  |
| Small HGV | 2,000 | 3 |  |
| LGV | 1,000 | 2 |  |
| TOTAL | N/A | 15 |  |

**Step 4:** Divide the **total cost of material (£)** by the **total cost carried (£)** for 1 vehicle mix to give us the **number of vehicle mixes** used

|  |
| --- |
| No. Vehicle Mixes = Cost of Materials (£) / Cost Carried (£) by 1 Vehicle mix No. Vehicle Mixes = |

**Step 5:** Multiply the **total number of vehicle mixes** used by the **number of vehicles in the vehicle mix** to give us the **total number of vehicles for the phase**

|  |
| --- |
| Total Vehicles = No. Vehicle Mixes x No. Vehicles in a MixTotal Vehicles = |

**Step 6:** The **total number of vehicles** is divided by the **duration (in months) of the phase**

|  |
| --- |
| Vehicles per Month = Total Vehicles / No. Months in PhaseVehicles per Month =  |

**Phase 5: Cladding**

**April 2018 - December 2018 (9 Months)**

A total of 2300m2 glass panels per elevation will be lifted by crane to form the external façade. This will be from designated picking points suitably located to minimise travel over the site. It is assumed 12 panes can be delivered per HGV load. The total cost of this phase is expected to be £10 million with 40% on materials

**Step 1:** Derive the **build cost (£)** and **material spend (%)** for the phase

|  |
| --- |
| Build cost =Material Spend =  |

**Step 2:** Calculate the **cost of materials (£)** for the phase

|  |
| --- |
| Cost of Materials (£) = Build Cost (£) x Material Spend (%) Cost of Materials =  |

**Step 3:** Using the assumed vehicle mix calculate the **total cost carried (£)** by the number of vehicles specified

|  |  |  |  |
| --- | --- | --- | --- |
| Vehicle type | Cost carried per vehicle (£) | No. of Vehicles | Total cost carried (£) |
| Large HGV | 30,000 | 9 |  |
| Medium HGV | 5,000 | 1 |  |
| Small HGV | 2,000 | 3 |  |
| LGV | 1,000 | 2 |  |
| TOTAL | N/A | 15 |  |

**Step 4:** Divide the **total cost of material (£)** by the **total cost carried (£)** for 1 vehicle mix to give us the **number of vehicle mixes** used

|  |
| --- |
| No. Vehicle Mixes = Cost of Materials (£) / Cost Carried (£) by 1 Vehicle mix No. Vehicle Mixes = |

**Step 5:** Multiply the **total number of vehicle mixes** used by the **number of vehicles in the vehicle mix** to give us the **total number of vehicles for the phase**

|  |
| --- |
| Total Vehicles = No. Vehicle Mixes x No. Vehicles in a MixTotal Vehicles = |

**Step 6:** The **total number of vehicles** is divided by the **duration (in months) of the phase**

|  |
| --- |
| Vehicles per Month = Total Vehicles / No. Months in PhaseVehicles per Month = |

**Phase 6: Fit-out, testing and commissioning**

**April 2018 - November 2019 (20 months)**

All materials for the fit out of all floors will be brought into site via the Ground Floor Service Yard and manhandled into location via designated travel routes and the service lift. The fit out will commence in earnest on the water tightening of the floors and follow up the building. The fit out will include all MEP services and plant (both rooftop, and basement) and internal flooring, portioning and ceiling works. The total cost of this phase is expected to be £40 million with 40% on materials.

**Step 1:** Derive the **build cost (£)** and **material spend (%)** for the phase

|  |
| --- |
| Build cost =Material Spend =  |

**Step 2:** Calculate the **cost of materials (£)** for the phase

|  |
| --- |
| Cost of Materials (£) = Build Cost (£) x Material Spend (%) Cost of Materials =  |

**Step 3:** Using the assumed vehicle mix calculate the **total cost carried (£)** by the number of vehicles specified

|  |  |  |  |
| --- | --- | --- | --- |
| Vehicle type | Cost carried per vehicle (£) | No. of Vehicles | Total cost carried (£) |
| Large HGV | 70,000 | 1 |  |
| Medium HGV | 8,000 | 3 |  |
| Small HGV | 4,000 | 2 |  |
| LGV | 2,000 | 9 |  |
| TOTAL | N/A | 15 |  |

**Step 4:** Divide the **total cost of material (£)** by the **total cost carried (£)** for 1 vehicle mix to give us the **number of vehicle mixes** used

|  |
| --- |
| No. Vehicle Mixes = Cost of Materials (£) / Cost Carried (£) by 1 Vehicle mix No. Vehicle Mixes = |

**Step 5:** Multiply the **total number of vehicle mixes** used by the **number of vehicles in the vehicle mix** to give us the **total number of vehicles for the phase**

|  |
| --- |
| Total Vehicles = No. Vehicle Mixes x No. Vehicles in a MixTotal Vehicles = |

**Step 6:** The **total number of vehicles** is divided by the **duration (in months) of the phase**

|  |
| --- |
| Vehicles per Month = Total Vehicles / No. Months in PhaseVehicles per Month = |

**Material volume**

**Methodology**

This method uses the volumes of materials required to be transport to site and the capacity of the required vehicle to calculate the number of vehicles required.

First, each Phase is divided into sub-phases, e.g. phase 2 Basement Excavation and Piling can be broken down into:

* 2.1 Removal of Material
* 2.2 Concrete Pour
* 2.3 Reinforcement
* 2.4 Basement Excavation

The proposed vehicle is ascertained from the case study with the associated vehicle capacity in volume or weight. In reality, the supplier should provide this information.

Then the volume of material required (in m3) in each sub-phase is determined from the case study. In reality, the construction, package or section manager would provide this information.

The total number of vehicles required for the sub-phase is calculated by dividing the total volume of material required by the proposed vehicle’s capacity.

The total number of vehicles for each sub-phase in each month are aggregated to give the total number of vehicles, per month, for the whole phase.

**Note: In the following calculations, 21 has been used as the number of working days per month.**

Phase 1: Site setup and demolition

January 2016 - September 2016 (9 Months)

This phase consists of enabling and ground works, scaffolding, asbestos removal, soft strip, heavy plant delivery, de-construction and spoil away, the site setup and demolition phase of 500 London Street is expected to take 9 months. This phase will be £10 million of the total build cost with a material spend of 40%.

**Step 1:** Divide the phase into **sub-phases**

|  |
| --- |
| 1.1 Surveys1.2 Scaffold1.3 Asbestos Removal1.4 Soft Strip1.5 Roof Demolition1.6 Structural Demolition1.7 Ground Demolition |

**Step 2:** Propose a **vehicle type** for each sub-phase

|  |
| --- |
| 1.1 Surveys = Van1.2 Scaffold = 30t Flatbed HGV1.3 Asbestos Removal = Van1.4 Soft Strip = 30t Flatbed HGV1.5 Roof Demolition = 9m3 Muck Away HGV1.6 Structural Demolition = 9m3 Muck Away HGV1.7 Ground Demolition = 9m3 Muck Away HGV |

**1.1 Surveys *Proposed Vehicle: Van***

Jan 2016 - April 2016 (4 Months)

The contractor for the demolition phase will liaise with the relevant public utility companies to agree any necessary disconnections and protection works including ground movement monitoring. There will be UKPN Relocation works and site investigation works which may include test piles. In addition, there will be services diversions, installation of drainage and installation of crane bases. It is anticipated 4 vehicles a day will need to visit site during this period.

**Step 3, 4 and 5**: Ascertain the **total no. of vehicles** for the sub-phase

|  |
| --- |
| Monthly no. of vehicles = Vehicles per day x duration (working days)Monthly no. of vehicles = |

**1.2 Scaffold *Proposed Vehicle: 30t Flatbed HGV***

February 2016 - March 2016 (2 Months)

During the initial stages of the demolition, a full height scaffold will be erected to encapsulate the building. It will be suitably ventilated and sheeted. It is anticipated 24 scaffold deliveries will be required each month.

**Step 3, 4 and 5**: Ascertain the **monthly no. of vehicles** for the sub-phase

|  |
| --- |
| Monthly no. of vehicles = |

**1.3 Asbestos removal *Proposed Vehicle: Van***

March 2016 - May 2016 (3 Months)

A suitably qualified asbestos remediation company will be employed to survey, make notifications and remove all asbestos from the site in accordance with good practice to a suitably registered waste facility. It is anticipated 28 specialist vehicles will be required over 3 months.

**Step 3, 4 and 5**: Ascertain the **monthly no. of vehicles** for the sub-phase

|  |
| --- |
| Monthly no. of vehicles = Total vehicles over the phase / duration (months)Monthly no. of vehicles =  |

**1.4 Soft strip *Proposed Vehicle: 30t Flatbed HGV***

May 2016 - August 2016 (4 Months)

Piling Mat - On completion of the basement demolition works the contractor will install a suitable piling mat for the benefit of the construction phase works.

Crane - 2 tower cranes will be installed within the perimeter of the land boundary to assist in serving the demolition.

On conclusion of asbestos removal works a full soft strip of the building will commence with the removal of all fixtures and fittings, including false ceilings, architrave, doors and carpets etc. It is anticipated 7 HGVS will be required to strip each floor.

**Step 3, 4 and 5**: Ascertain the **total no. of vehicles** for the sub-phase, and the **monthly no. of vehicles**

|  |
| --- |
| Total no. of vehicles = (Vehicles per floor x No. of floors) + No. of cranesTotal no. of vehicles = Monthly no. of vehicles = Total no. of vehicles / duration (months)Monthly no. of vehicles =  |

**1.5 Roof demolition *Proposed Vehicle: 9m3 Muck Away HGV***

July 2016 (1 month)

The roof will be demolished by top-down de-construction with the use of mechanical plant and tower cranes. All spoil will be progressively removed from site in accordance with the waste management plan throughout the works.

The total material displacement is estimated to be 1,120m3 based on the dimensions of the existing building.

**Step 3:** Determine the total **material displacement**

|  |
| --- |
| Total material displacement (m3) = |

**Step 4:** Divide the **total material displacement** by the **proposed vehicle capacity**

|  |
| --- |
| Total no. of vehicles = Volume of material / vehicle capacityTotal no. of vehicles = |

**Step 5:** Divide the **total no. of vehicles** by the **duration** of the phase

|  |
| --- |
| Monthly no. of vehicles = Total no. of vehicles / duration (months)Monthly no. of vehicles = |

**1.6 Structural demolition *Proposed Vehicle: 9m3 Muck Away HGV***

August 2016 (1 month)

The total material displacement is estimated to be 5,600m3 based on the dimensions of the existing building.

**Step 3:** Determine the total **material displacement**

|  |
| --- |
| Total material displacement (m3) = |

**Step 4:** Divide the **total material displacement** by the **proposed vehicle capacity**

|  |
| --- |
| Total no. of vehicles = Volume of material / vehicle capacityTotal no. of vehicles = |

**Step 5:** Divide the **total no. of vehicles** by the **duration** of the phase

|  |
| --- |
| Monthly no. of vehicles = Total no. of vehicles / duration (months)Monthly no. of vehicles = |

**1.7 Ground demolition *Proposed Vehicle: 9m3 Muck Away HGV***

September 2016 (1 month)

The total material displacement is estimated to be 1,680m3 based on the dimensions of the existing building.

**Step 3:** Determine the total **material displacement**

|  |
| --- |
| Total material displacement (m3) = |

**Step 4:** Divide the **total material displacement** by the **proposed vehicle capacity**

|  |
| --- |
| Total no. of vehicles = Volume of material / vehicle capacityTotal no. of vehicles = |

**Step 5:** Divide the **total no. of vehicles** by the **duration** of the phase

|  |
| --- |
| Monthly no. of vehicles = Total no. of vehicles / duration (months)Monthly no. of vehicles = |

Phase 1: Site setup and demolition total

September 2016 (1 month)

**Step 6:** Aggregate the **monthly no. of vehicles** by month to get a **total no. of vehicles** for the whole phase

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Jan 2016 | Feb 2016 | Mar 2016 | Apr 2016 | May 2016 | Jun 2016 | Jul 2016 | Aug 2016 | Sep 2016 |
| 1.1 Surveys |  |  |  |  |  |  |  |  |  |
| 1.2 Scaffolding |  |  |  |  |  |  |  |  |  |
| 1.3 Asbestos Removal |  |  |  |  |  |  |  |  |  |
| 1.4 Soft Strip |  |  |  |  |  |  |  |  |  |
| 1.5 Roof Demolition |  |  |  |  |  |  |  |  |  |
| 1.6 Structural Demolition |  |  |  |  |  |  |  |  |  |
| 1.7 Ground Demolition |  |  |  |  |  |  |  |  |  |
| **Total** |  |  |  |  |  |  |  |  |  |

Phase 2: Basement excavation and piling

Sept 2016 - July 2017 (11 Months)

The construction contractor will commence works by piling the perimeter basement wall with a total of 400 contiguous piles. This will require material to be removed, replaced with concrete and reinforced with rebar. The contractor will then then excavate to a depth of 5.5m for the new basement (temporary propping will be installed as they progress). The total cost of this phase is expected to be £3 million with 50% on materials.

**Step 1:** Divide the phase into **sub-phases**

|  |
| --- |
| 2.1 Removal of Material2.2 Concrete Pour2.3 Reinforcement2.4 Basement Excavation |

**Step 2:** Propose a **vehicle type** for each sub-phase

|  |
| --- |
| 2.1 Removal of Material = 9m3 Muck Away HGV2.2 Concrete Pour = 8m3 Ready Mix HGV2.3 Reinforcement = 30t Flatbed HGV2.4 Trim Piles: Equipment = 9m3 Muck Away HGV |

**2.1 Removal of material *Proposed Vehicle: 9m3 Muck Away HGV***

September 2016 - December 2016 (4 Months)

Contiguous piles will be used to form the perimeter basement wall prior to excavation. This will require material to be removed, replaced with concrete and reinforced with rebar.

In total, 400 contiguous piles will form the perimeter wall. 3 piling rigs will be used and it is predicted that each rig has an output of 2 piles per day, amounting to a total of 6 piles per day.

The total material displacement will be 2,800m3, with each pile requiring 7m3 of concrete and 1.05t of rebar reinforcement.

**Step 3:** Determine the total **material displacement**

|  |
| --- |
| Total material displacement (m3) = |

**Step 4:** Divide the **total material displacement** by the **proposed vehicle capacity**

|  |
| --- |
| Total no. of vehicles = Volume of material / vehicle capacityTotal no. of vehicles = |

**Step 5:** Divide the **total no. of vehicles** by the **duration** of the phase

|  |
| --- |
| Monthly no. of vehicles = Total no. of vehicles / duration (months)Monthly no. of vehicles = |

**2.2 Concrete pour *Proposed Vehicle: 8m3 Ready Mix HGV***

September 2016 - Dec 2016 (4 Months)

The 400 contiguous piles will each require 7m3 of concrete.

**Step 3:** Determine the total **material displacement**

|  |
| --- |
| Total material (m3) = Total no. of piles x volume of 1 pile (m3) Total material (m3) = |

**Step 4:** Divide the **total material displacement** by the **proposed vehicle capacity**

|  |
| --- |
| Total no. of vehicles = Volume of material / vehicle capacity Total no. of vehicles = |

**Step 5:** Divide the **total no. of vehicles** by the **duration** of the phase

|  |
| --- |
| Monthly no. of vehicles = Total no. of vehicles / duration (months) Monthly no. of vehicles = |

**2.3 Reinforcement**  *Proposed Vehicle: 30t Flatbed HGV*

**September 2016 - Dec 2016 (4 Months)**

The 400 contiguous piles will each require 1.05t of rebar reinforcement.

Step 3: Determine the total material displacement

|  |
| --- |
| 1 pile = Total material = |

**Step 4**: Divide the **total material displacement** by the **proposed vehicle capacity**

|  |
| --- |
| Total no. of vehicles = Volume of material / vehicle capacity Total no. of vehicles = |

**Step 5**: Divide the **total no. of vehicles** by the **duration** of the phase

|  |
| --- |
| Monthly no. of vehicles = Total no. of vehicles / duration (months) Monthly no. of vehicles = |

**2.4 Basement excavation *Proposed Vehicle: 9m3 Muck Away HGV***

January 2017 - July 2017 (7 Months)

Across the site, a basement will be excavated to a depth of 5.5m. Temporary propping will be installed as the excavation progresses. Around 30,800m3 of spoil will need to be lifted away and removed from site by 2 gangs. It is estimated each gang can remove a load of around 100m3 per day.

**Step 3:** Determine the total **material displacement**

|  |
| --- |
| Total material (m3) = |

**Step 4**: Divide the **total material displacement** by the **proposed vehicle capacity**

|  |
| --- |
| Total no. of vehicles = Volume of material / vehicle capacity Total no. of vehicles = |

**Step 5:** Divide the **total no. of vehicles** by the **duration** of the phase

|  |
| --- |
| Monthly no. of vehicles = Total no. of vehicles / duration (months) Monthly no. of vehicles = |

**Phase 2: Basement excavation and piling total**

**Step 6:** Aggregate the **monthly no. of vehicles per subphase** by month to get a **total no. of vehicles per month** for the whole phase

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Sep 2016 | Oct 2016 | Nov 2016 | Dec 2016 | Jan 2017 | Feb 2017 | Mar 2017 | Apr 2017 | May 2017 | Jun 2017 | Jul 2017 |
| 2.1 Removal of Material |  |  |  |  |  |  |  |  |  |  |  |
| 2.2 Concrete Pour |  |  |  |  |  |  |  |  |  |  |  |
| 2.3 Reinforcement |  |  |  |  |  |  |  |  |  |  |  |
| 2.4 Basement Excavation |  |  |  |  |  |  |  |  |  |  |  |
| TOTAL |  |  |  |  |  |  |  |  |  |  |  |

Phase 3: Sub-structure

July 2017 - January 2018 (7 Months)

Following basement excavation, the Contractor will commence internal piling and reinforcement. There will be 2 piling rigs used to excavate, concrete pour and reinforce a total of 720 piles. The total cost of this phase is expected to be £10 million with 40% on materials.

**Step 1**: Divide the phase into **sub-phases**

|  |
| --- |
| 3.1 Removal of Material 3.2 Concrete Pour 3.3 Reinforcement 3.4 Trim Piles: Equipment 3.5 Trim Piles: Removal of Material 3.6 Pile Caps: Concrete Pour 3.7 Pile Caps: Reinforcement |

**Step 2:** Propose a **vehicle type** for each sub-phase

|  |
| --- |
| Removal of Material = 9m3 Muck Away HGV 3.2 Concrete Pour = 8m3 Ready Mix HGV 3.3 Reinforcement = 30t Flatbed HGV 3.4 Trim Piles: Equipment = Heavy Plant 3.5 Trim Piles: Removal of Material = 9m3 Muck Away HGV 3.6 Pile Caps: Concrete Pour = 8m3 Ready Mix HGV 3.7 Pile Caps: Reinforcement = 30t Flatbed HGV |

**3.1 Removal of material *Proposed Vehicle: 9m3 Muck Away HGV***

July 2017 - October 2017 (4 Months)

Contiguous piles will be used to form the perimeter basement wall prior to excavation. This will require material to be removed, replaced with concrete, and reinforced with rebar. There will be 2 piling rigs used to excavate, concrete pour and reinforce a total of 720 piles with a volume of 3m3 each. It is estimated that these rigs will have an output of 8 piles a day and 342t rebar reinforcement will be required in total. The piles will then be trimmed by around 0.15m3 each.

**Step 3:** Determine the total **material displacement**

|  |
| --- |
| Total material (m3) = Total no. of piles x volume of 1 pile (m³) Total material = |

**Step 4:** Divide the **total material displacement** by the **proposed vehicle capacity**

|  |
| --- |
| Total no. of vehicles = Volume of material / vehicle capacity Total no. of vehicles = |

**Step 5:** Divide the **total no. of vehicles** by the **duration** of the phase

|  |
| --- |
| Monthly no. of vehicles = Total no. of vehicles / duration (months) Monthly no. of vehicles = |

**3.2 Concrete pour** *Proposed Vehicle: 8m3 Ready Mix HGV*

**July 2017 - October 2017 (4 Months)**

The 720 piles will each require 3m3 of concrete.

Step 3: Determine the total material displacement

|  |
| --- |
| Total material (m3) = Total no. of piles x volume of 1 pile (m³) Total material = |

**Step 4**: Divide the **total material displacement** by the **proposed vehicle capacity**

|  |
| --- |
| Total no. of vehicles = Volume of material / vehicle capacity Total no. of vehicles = |

**Step 5**: Divide the **total no. of vehicles** by the **duration** of the phase

|  |
| --- |
| Monthly no. of vehicles = Total no. of vehicles / duration (months) Monthly no. of vehicles = |

**3.3 Reinforcement *Proposed Vehicle: 30t Flatbed HGV***

July 2017 - October 2017 (4 Months)

The 720 piles will each require 0.475t of rebar reinforcement.

**Step 3:** Determine the total **material displacement**

|  |
| --- |
| Total material (t) = Total no. of piles x volume of 1 pile (t) Total material (t) = |

**Step 4:** Divide the **total material displacement** by the **proposed vehicle capacity**

|  |
| --- |
| Total no. of vehicles = Volume of material / vehicle capacity Total no. of vehicles = |

**Step 5:** Divide the **total no. of vehicles** by the **duration** of the phase

|  |
| --- |
| Monthly no. of vehicles = Total no. of vehicles / duration (months) Monthly no. of vehicles = |

**3.4 Trim piles: equipment *Proposed Vehicle: Heavy Plant***

July 2017 - Jan 2018 (7 Months)

1 Heavy Plant vehicle is required to trim the piles

**3.5 Trim piles: removal of material *Proposed Vehicle: 9m3 Muck Away HGV***

July 2017 - Oct 2017 (4 Months)

The 720 piles will require 0.15m³ to be removed each.

**Step 3**: Determine the total **material displacement**

|  |
| --- |
| Total material (m3) = Total no. of piles x trim volume of 1 pile (m3) Total material = |

**Step 4:** Divide the **total material displacement** by the **proposed vehicle capacity**

|  |
| --- |
| Total no. of vehicles = Trim volume of material / vehicle capacity Total no. of vehicles = |

**Step 5:** Divide the **total no. of vehicles** by the **duration** of the phase

|  |
| --- |
| Monthly no. of vehicles = Total no. of vehicles / duration (months) Monthly no. of vehicles = |

**3.6 Pile caps: concrete pour *Proposed Vehicle: 8m3 Ready Mix HGV***

November 2017 - January 2018 (3 Months)

Over 3 months, the piles will be capped with 2m3 concrete with 1 pile cap per 4 piles. 2 gangs will operate at same time for both excavation and the formation of pile caps.

**Step 3:** Determine the total **material displacement**

|  |
| --- |
| No. Pile Caps = No. Piles / No. Caps per Pile Total Concrete = No. Pile Caps x Cap Volume No. Pile Caps = Total Concrete = |

**Step 4:** Divide the **total material displacement** by the **proposed vehicle capacity**

|  |
| --- |
| Total no. of vehicles = Total Concrete / Vehicle Capacity Total no. of vehicles = |

**Step 5**: Divide the **total no. of vehicles** by the **duration** of the phase

|  |
| --- |
| Monthly no. of vehicles = Total no. of vehicles / duration (months) Monthly no. of vehicles = |

**3.7 Pile caps: reinforcement *Proposed Vehicle: 30t Flatbed HGV***

November 2017 - January 2018 (3 Months)

The pile caps will each require 0.5t of rebar.

**Step 3:** Determine the total **material displacement**

|  |
| --- |
| Total material (t) = Total no. of piles caps x volume of 1 pile cap (t) Total material (t) = |

**Step 4**: Divide the **total material displacement** by the **proposed vehicle capacity**

|  |
| --- |
| Total no. of vehicles = Volume of material / vehicle capacity Total no. of vehicles = |

**Step 5:** Divide the **total no. of vehicles** by the **duration** of the phase

|  |
| --- |
| Monthly no. of vehicles = Total no. of vehicles / duration (months) Monthly no. of vehicles = |

**Phase 3: Sub-structure total**

**Step 6**: Aggregate the **monthly no. of vehicles** by month to get a **total no. of vehicles** for the whole phase

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Jul 2017 | Aug 2017 | Sep 2017 | Oct 2017 | Nov 2017 | Dec 2017 | Jan 2018 |
| 3.1 Removal of Material |  |  |  |  |  |  |  |
| 3.2 Concrete Pour |  |  |  |  |  |  |  |
| 3.3 Reinforcement |  |  |  |  |  |  |  |
| 3.4 Trim Piles |  |  |  |  |  |  |  |
| 3.5 Removal of Materials |  |  |  |  |  |  |  |
| 3.6 Concrete Pour |  |  |  |  |  |  |  |
| 3.7 Reinforcement |  |  |  |  |  |  |  |
| **TOTAL** |  |  |  |  |  |  |  |

Phase 4: Super-structure

October 2017 - June 2018 (9 Months)

The Contractor will commence jump forming the central concrete core. This will have a total volume of 250m3 of concrete with 37.5t rebar reinforcement. When the central core is 4 stories up the Contractor will then form a suitably designed basement slab. The Contractor will continue to raise the core to roof level and follow this activity up the building with the floors, and prefabricated glazed and solid form cladding system. The total cost of this phase is expected to be £30 million with 40% on materials.

**Step 1:** Divide the phase into **sub-phases**

|  |
| --- |
| 4.1 Concrete Pour 4.2 Reinforcement 4.3 Precast Stairs 4.4 Steel Frame 4.5 Concrete 4.6 Reinforcement |

**Step 2:** Propose a **vehicle type** for each sub-phase

|  |
| --- |
| 4.1 Concrete Pour = 8m3 Ready Mix HGV 4.2 Reinforcement = 30t Flatbed HGV 4.3 Precast Stairs = 30t Flatbed HGV 4.4 Steel Frame = 30t Flatbed HGV 4.5 Concrete = 8m3 Ready Mix HGV 4.6 Reinforcement = 30t Flatbed HGV |

**4.1 Concrete pour *Proposed Vehicle: 8m3 Ready Mix HGV***

Oct 2017 - Mar 2018 (6 Months)

The concrete core of 500 London Street will have a total volume of 250m3 of concrete, with 37.5t of reinforcement. With a total height of 10 floors, there will be 25m3 of concrete and 3.75t of steel per floor. Precast stairs will be used and installed in 36 prefabricated units.

**Step 3:** Determine the total **material displacement**

|  |
| --- |
| Total material (m3) = |

**Step 4:** Divide the **total material displacement** by the **proposed vehicle capacity**

|  |
| --- |
| Total no. of vehicles = Volume of material / vehicle capacity Total no. of vehicles = |

**Step 5:** Divide the **total no. of vehicles** by the **duration** of the phase

|  |
| --- |
| Monthly no. of vehicles = Total no. of vehicles / duration (months) Monthly no. of vehicles = |

**4.2 Reinforcement *Proposed Vehicle: 30t Flatbed HGV***

Oct 2017 - Mar 2018 (6 Months)

The 10 floors each require 3.75t of steel.

**Step 3:** Determine the total **material displacement**

|  |
| --- |
| Total material (t) = material per floor x no. of floors Total material = |

**Step 4:** Divide the **total material displacement** by the **proposed vehicle capacity**

|  |
| --- |
| Total no. of vehicles = Volume of material / vehicle capacity Total no. of vehicles = |

**Step 5:** Divide the **total no. of vehicles** by the **duration** of the phase

|  |
| --- |
| Monthly no. of vehicles = Total no. of vehicles / duration (months) Monthly no. of vehicles = |

**4.3 Precast stairs *Proposed Vehicle: 30t Flatbed HGV***

Oct 2017 - Mar 2018 (6 Months)

Precast stairs will be used and installed in 36 prefabricated units. A 30t Flatbed HGV can carry 3 prefab units.

**Step 3:** Determine the total **material displacement**

|  |
| --- |
| Total material (prefab units) = |

**Step 4:** Divide the **total material displacement** by the **proposed vehicle capacity**

|  |
| --- |
| Total no. of vehicles = Volume of material / vehicle capacity Total no. of vehicles = |

**Step 5:** Divide the **total no. of vehicles** by the **duration** of the phase

|  |
| --- |
| Monthly no. of vehicles = Total no. of vehicles / duration (months) Monthly no. of vehicles = |

**4.4 Steel frame**   ***Proposed Vehicle: 30t Flatbed HGV***

Dec 2017 - May 2018 (6 Months)

1 gang will erect approximately 1000t of steel frame.

**Step 3**: Determine the total **material displacement**

|  |
| --- |
| Total material (t) = |

**Step 4**: Divide the **total material displacement** by the **proposed vehicle capacity**

|  |
| --- |
| Total no. of vehicles = Volume of material / vehicle capacity Total no. of vehicles = |

**Step 5:** Divide the **total no. of vehicles** by the **duration** of the phase

|  |
| --- |
| Monthly no. of vehicles = Total no. of vehicles / duration (months) Monthly no. of vehicles = |

**4.5 Concrete *Proposed Vehicle: 8m3 Ready Mix HGV***

Feb 2018 - June 2018 (4.5 Months)

The typical floor plate is 5600m2 and 0.3m thick, therefore each floor will require 1680m3 (floor plate x depth) of concrete and 252t of rebar. However, floor plates 8 and 9 are smaller, requiring 1075m3 and 690m3 of concrete and 162t and 104t rebar respectively. It is predicted it will take ½ a month to complete 1 floor

**Step 3:** Determine the total **material displacement**

|  |
| --- |
| Total material (m3) = (Typical Floor x 7) + Floor 8 + Floor 9 Total material (m3) = |

**Step 4:** Divide the **total material displacement** by the **proposed vehicle capacity**

|  |
| --- |
| Total no. of vehicles = Volume of material / vehicle capacity Total no. of vehicles = |

**Step 5:** Divide the **total no. of vehicles** by the **duration** of the phase

|  |
| --- |
| Monthly no. of vehicles = Total no. of vehicles / duration (months) Monthly no. of vehicles = |

**4.6 Reinforcement *Proposed Vehicle: 30t Flatbed HGV***

Feb 2018 - June 2018 (4.5 Months)

**Step 3:** Determine the total **material displacement**

|  |
| --- |
| Total material (t) = (Typical Floor x 7) + Floor 8 + Floor 9 Total material (t) = |

**Step 4:** Divide the **total material displacement** by the **proposed vehicle capacity**

|  |
| --- |
| Total no. of vehicles = Volume of material / vehicle capacity Total no. of vehicles = |

**Step 5:** Divide the **total no. of vehicles** by the **duration** of the phase

|  |
| --- |
| Monthly no. of vehicles = Total no. of vehicles / duration (months) Monthly no. of vehicles = |

**Phase 4: Super-structure total**

**Step 6:** Aggregate the **monthly no. of vehicles** by month to get a **total no. of vehicles** for the whole phase

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Oct 2017 | Nov 2017 | Dec 2017 | Jan2018 | Feb 2018 | Mar 2018 | Apr 2018 | May 2018 | Jun2018 |
| 4.1 Concrete Pour |  |  |  |  |  |  |  |  |  |
| 4.2 Reinforcement |  |  |  |  |  |  |  |  |  |
| 4.3 Precast Stairs |  |  |  |  |  |  |  |  |  |
| 4.4 Steel Frame |  |  |  |  |  |  |  |  |  |
| 4.5 Concrete |  |  |  |  |  |  |  |  |  |
| 4.6 Reinforcement |  |  |  |  |  |  |  |  |  |
| **TOTAL** |  |  |  |  |  |  |  |  |  |

Phase 5: Cladding

**Apr 2018 - Dec 2018 (9 Months)**

There is a total of 2300m2 per elevation. It is estimated 1 floor and 1 elevation will be worked at a time over 9 months, taking just over 2 months for each facade (i.e. 4 facades). Glass panes will be installed measuring 1.5m x 3.4m. 30ft Flatbed HGVs will be used to deliver the panes to site, 12 panes can be delivered per HGV load.

**Step 1:** Divide the phase into **sub-phases**

|  |
| --- |
| 5.1 External Façade |

**Step 2:** Propose a **vehicle type** for each sub-phase

|  |
| --- |
| 5.1 External Facade = 30t Flatbed HGV |

**5.1 External façade *Proposed Vehicle: 30t Flatbed HGV***

Apr 2018 - Dec 2018 (9 Months)

**Step 3:** Determine the total **material displacement**

|  |
| --- |
| Total material (glass panes) = Total facade area (m2) / Total material (glass panes) Total material (glass panes) = (2300m2 x 4 facades) / (1.5m x 3.4m glass panes) Total material (glass panes) =  |

**Step 4:** Divide the **total material displacement** by the **proposed vehicle capacity**

|  |
| --- |
| Total no. of vehicles = Volume of material / vehicle capacity Total no. of vehicles = Total no. of vehicles =  |

**Step 5:** Divide the **total no. of vehicles** by the **duration** of the phase

|  |
| --- |
| Monthly no. of vehicles = Total no. of vehicles / duration (months) Monthly no. of vehicles = Monthly no. of vehicles =  |

**Phase 5: Cladding total**

**Step 6:** Aggregate the **monthly no. of vehicles** by month to get a **total no. of vehicles** for the whole phase

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Apr2018 | May 2018 | Jun2018 | Jul2018 | Aug2018 | Sep2018 | Oct2018 | Nov2018 | Dec2018 |
| 5.1 Cladding |  |  |  |  |  |  |  |  |  |
| TOTAL |  |  |  |  |  |  |  |  |  |

Phase 6: Fit out, testing and commissioning

**April 2018 - November 2019 (20 Months)**

All materials for the fit out of all floors will be brought in to site via the Ground Floor Service Yard and manhandled into location via designated travel routes and the service lift. The fit out will commence in earnest on the water tightening of the floors and follow up the building. The fit out will include all MEP services and plant (both rooftop, and basement) and internal flooring, portioning and ceiling works. The total cost of this phase is expected to be £40 million with 40% on materials.

**Step 1:** Divide the phase into **sub-phases**

|  |
| --- |
| 6.1 MEP Fix 6.2 Testing and Commissioning |

**Step 2:** Propose a **vehicle type** for each sub-phase

|  |
| --- |
| 6.1 MEP Fix = 30t Flatbed HGV 6.2 Testing and Commissioning = Panel Van |

**6.1 MEP Fix *Proposed Vehicle: 30t Flatbed HGV***

Apr 2018 - Dec 2018 (8 Months)

At roof level, the key plant is considered as chillers, air handling units and air extraction kit. Within the basement, the key plant will include boilers, water tanks and electrical boards etc. All roof plant and materials as required will be brought to the work face by crane, and it is the intention of the project that all kit is dropped in to place and not manually handled over long distances during installation.

The first fix will start on the ground floor the same time as the external façade. The MEP items will require 120 deliveries a month.

**Step 3, 4 and 5:** Ascertain the **total no. of vehicles** for the sub-phase

|  |
| --- |
| Monthly no. of vehicles = |

**6.2 Testing and commissioning *Proposed Vehicle: Panel Van***

Jan 2019 - Nov 2019 (11 Months)

The final 11 months of the programme will be for testing and commissioning, smaller 3.5t vans will be used to carry out the final phase of the construction programme. It is predicted that 12 vans will be required a week.

**Step 3, 4 and 5:** Ascertain the **total no. of vehicles** for the sub-phase

|  |
| --- |
| Monthly no. of vehicles = no. vehicles per week x 4 weeks in a month Monthly no. of vehicles = |

Phase 6: Fit out, testing and commissioning total

**Step 6:** Aggregate the **monthly no. of vehicles** by month to get a **total no. of vehicles** for the whole phase

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Apr 2018 | May 2018 | [Jun-Nov2018] | Dec 2018 | Jan 2019 | [Feb-Oct2019] | Nov 2019 |
| 6.1 MEP Fix |  |  |  |  |  |  |  |
| 6.2 Testing and Commissioning |  |  |  |  |  |  |  |
| TOTAL |  |  |  |  |  |  |  |



**Refine**

Methodology

To refine through planned measures, the vehicle numbers are re-calculated using a method unique to the planned measure.

This can be a percentage reduction to a relevant phase or a specific change to the calculation.

**Articulated tipper:**

In only the relevant sub-phase, the total is re-calculated using a 14.3m3 tipper, in place of the original proposed vehicle.

**Modular construction and consolidation centres:**

In only the relevant sub-phase, a percentage reduction is applied to the original calculations based on existing research:

* Modular construction = 60%, Build Offsite
* Consolidation centres = 72%, TfL

**Holding Area and Delivery Management System:**

A reduction is not applied to planned measures as these do not affect total vehicle numbers.

However, changes to vehicle arrival time at site will be applied when inputting into the CLP Tool.

Phase 1: Site setup and demolition

Jan 2016 - Sept 2016 (9 Months)

This phase consists of enabling and ground works, scaffolding, asbestos removal, soft strip, heavy plant delivery, de-construction and spoil away, the site setup and demolition phase of 500 London Street is expected to take 9 months. This phase will be £10 million of the total build cost with a material spend of 40%.

**Step 1:** Divide the phase into **sub-phases**

|  |
| --- |
| 1.1 Surveys 1.2 Scaffold 1.3 Asbestos Removal 1.4 Soft Strip 1.5 Roof Demolition 1.6 Structural Demolition 1.7 Ground Demolition |

**Step 2:** Propose a **vehicle type** for each sub-phase

|  |
| --- |
| 1.1 Surveys = Van 1.2 Scaffold = 30t Flatbed HGV 1.3 Asbestos Removal = Van 1.4 Soft Strip = 30t Flatbed HGV 1.5 Roof Demolition = 14.3m3 Muck Away HGV 1.6 Structural Demolition = 14.3m3 Muck Away HGV 1.7 Ground Demolition = 14.3m3 Muck Away HGV |

**1.1 Surveys *Proposed Vehicle: Van***

Jan 2016 - Apr 2016 (4 Months)

The contractor for the demolition phase will liaise with the relevant public utility companies to agree any necessary disconnections and protection works including ground movement monitoring. There will be UKPN Relocation works and site investigation works which may include test piles. In addition, there will be services diversions, installation of drainage and installation of crane bases. It is anticipated 4 vehicles a day will need to visit site during this period.

**Step 3, 4 and 5:** Ascertain the **total no. of vehicles** for the sub-phase

|  |
| --- |
| Monthly no. of vehicles = Vehicles per day x duration (working days per month) Monthly no. of vehicles = |

**1.2 Scaffold *Proposed Vehicle: 30t Flatbed HGV***

**Feb 2016 - Mar 2016 (2 Months)**

During the initial stages of the demolition, a full height scaffold will be erected to encapsulate the building. It will be suitably ventilated and sheeted. It is anticipated 24 scaffold deliveries will be required each month.

**Step 3, 4 and 5:** Ascertain the **monthly no. of vehicles** for the sub-phase

|  |
| --- |
| Monthly no. of vehicles = |

**1.3 Asbestos removal *Proposed Vehicle: Van***

**Mar 2016 - May 2016 (3 Months)**

A suitably qualified Asbestos remediation company will be employed to survey, make notifications and remove all asbestos from the site in accordance with good practice to a suitably registered waste facility. It is anticipated 28 specialist vehicles will be required over 3 months.

**Step 3, 4 and 5:** Ascertain the **monthly no. of vehicles** for the sub-phase

|  |
| --- |
| Monthly no. of vehicles = Total vehicles over the duration / duration (months) Monthly no. of vehicles = |

**1.4 Soft strip *Proposed Vehicle: 30t Flatbed HGV***

**May 2016 - Aug 2016 (4 Months)**

Piling Mat - On completion of the basement demolition works the contractor will install a suitable piling mat for the benefit of the construction phase works.

Crane - 2 tower cranes will be installed within the perimeter of the land boundary to assist in serving the demolition.

On conclusion of asbestos removal works a full soft strip of the building will commence with the removal of all fixtures and fittings, including false ceilings, architrave, doors and carpets etc. It is anticipated 7 HGVS will be required to strip each floor.

**Step 3, 4 and 5:** Ascertain the **total no. of vehicles** for the sub-phase, and the **monthly no. of vehicles**.

|  |
| --- |
| Total no. of vehicles = (Vehicles per floor x No. of floors) + Crane Total no. of vehicles = Monthly no. of vehicles = Total number of vehicles / duration (months) Monthly no. of vehicles = |

**1.5 Roof demolition  *Proposed Vehicle: 14.3m3 Muck Away HGV***

**Jul 2016 (1 month)**

The building will be demolished by top-down de-construction with the use of mechanical plant and tower cranes. All spoil will be progressively removed from site in accordance with the waste management plan throughout the works. The total material displacement is estimated to be 1,120m3 based on the dimensions of the existing building.

**Step 3**: Determine the total **material displacement**

|  |
| --- |
| Total material displacement (m3) = |

**Step 4: Divide the total material displacement by the proposed vehicle capacity**

|  |
| --- |
| Total no. of vehicles = Volume of material / vehicle capacity Total no. of vehicles = |

**Step 5: Divide the total no. of vehicles by the duration of the phase**

|  |
| --- |
| Monthly no. of vehicles = Total no. of vehicles / duration (months) Monthly no. of vehicles = |

**1.6 Structural demolition *Proposed Vehicle: 14.3m3 Muck Away HGV***

**Aug 2016 (1 month)**

The total material displacement is estimated to be 5,600m3 based on the dimensions of the existing building.

**Step 3:** Determine the total **material displacement**

|  |
| --- |
| Total material displacement (m3) = |

**Step 4: Divide the total material displacement by the proposed vehicle capacity**

|  |
| --- |
| Total no. of vehicles = Volume of material / vehicle capacity Total no. of vehicles = |

**Step 5: Divide the total no. of vehicles by the duration of the phase**

|  |
| --- |
| Monthly no. of vehicles = Total no. of vehicles / duration (months) Monthly no. of vehicles = |

**1.7 Ground demolition *Proposed Vehicle: 14.3m3 Muck Away HGV***

**Sept 2016 (1 month)**

The total material displacement is estimated to be 1,680m3 based on the dimensions of the existing building.

**Step 3:** Determine the total **material displacement**

|  |
| --- |
| Total material displacement (m3) = |

**Step 4: Divide the total material displacement by the proposed vehicle capacity**

|  |
| --- |
| Total no. of vehicles = Volume of material / vehicle capacity Total no. of vehicles = |

**Step 5: Divide the total no. of vehicles by the duration of the phase**

|  |
| --- |
| Monthly no. of vehicles = Total no. of vehicles / duration (months) Monthly no. of vehicles **=** |

**Phase 1: Site setup and demolition Total**

**Step 6:** Aggregate the **monthly no. of vehicles** by month to get a **total no. of vehicles** for the whole phase

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Jan2016 | Feb 2016 | Mar 2016 | Apr 2016 | May 2016 | Jun2016 | Jul2016 | Aug 2016 | Sept 2016 |
| 1.1 Surveys |  |  |  |  |  |  |  |  |  |
| 1.2 Scaffolding |  |  |  |  |  |  |  |  |  |
| 1.3 Asbestos Removal |  |  |  |  |  |  |  |  |  |
| 1.4 Soft Strip |  |  |  |  |  |  |  |  |  |
| 1.5 Roof Demolition |  |  |  |  |  |  |  |  |  |
| 1.6 Structural Demolition |  |  |  |  |  |  |  |  |  |
| 1.7 Ground Demolition |  |  |  |  |  |  |  |  |  |
| TOTAL |  |  |  |  |  |  |  |  |  |

Phase 2: Basement excavation and piling

Sept 2016 - July 2017 (11 Months)

The construction contractor will commence works by piling the perimeter basement wall with a total of 400 contiguous piles. This will require material to be removed, replaced with concrete and reinforced with rebar. The contractor will then then excavate to a depth of 5.5m for the new basement (temporary propping will be installed as they progress). The total cost of this phase is expected to be £3 million with 50% on materials.

**Step 1:** Divide the phase into **sub-phases**

|  |
| --- |
| 2.1 Removal of Material 2.2 Concrete Pour 2.3 Reinforcement 2.4 Basement Excavation |

**Step 2:** Propose a **vehicle type** for each sub-phase

|  |
| --- |
| 2.1 Removal of Material = 14.3m3 Muck Away HGV 2.2 Concrete Pour = 8m3 Ready Mix HGV 2.3 Reinforcement = 30t Flatbed HGV 2.4 Trim Piles: Equipment = 14.3m3 Muck Away HGV |

**2.1 Removal of material *Proposed Vehicle: 14.3m3 Muck Away HGV***

**Sept 2016 - Dec 2016 (4 Months)**

Contiguous piles will be used to form the perimeter basement wall prior to excavation. This will require material to be removed, replaced with concrete and reinforced with rebar.

In total, 400 contiguous piles will form the perimeter wall. 3 piling rigs will be used and it is predicted that each rig has an output of 2 piles per day, amounting to a total of 6 piles per day. The total material displacement will be 2,800m3, with each pile requiring 7m3 of concrete and 1.05t of rebar reinforcement.

**Step 3:** Determine the total **material displacement**

|  |
| --- |
| Total material (m3) = Total no. of piles x volume of 1 pile (m³) Total material (m3) = |

**Step 4: Divide the total material displacement by the proposed vehicle capacity**

|  |
| --- |
| Total no. of vehicles = Volume of material / vehicle capacity Total no. of vehicles = |

**Step 5: Divide the total no. of vehicles by the duration of the phase**

|  |
| --- |
| Monthly no. of vehicles = Total no. of vehicles / duration (months) Monthly no. of vehicles = |

**2.2 Concrete pour**

**Sept 2016 - Dec 2016 (4 Months)**

The 400 contiguous piles will each require 7m3 of concrete.

**Step 3:** Determine the total **material displacement**

|  |
| --- |
| Total material (m3) = Material per pile x no. of piles Total material (m3) = |

**Step 4**: Divide the **total material displacement** by the **proposed vehicle capacity**

|  |
| --- |
| Total no. of vehicles = Volume of material / vehicle capacity Total no. of vehicles = |

**Step 5:** Divide the **total no. of vehicles** by the **duration** of the phase

|  |
| --- |
| Monthly no. of vehicles = Total no. of vehicles / duration (months) Monthly no. of vehicles = |

**2.3 Reinforcement *Proposed Vehicle: 30t Flatbed HGV***

**Sept 2016 - Dec 2016 (4 Months)**

The 400 contiguous piles will each require 1.05t of rebar reinforcement.

**Step 3**: Determine the total **material displacement**

|  |
| --- |
| Total material (t) = Material per pile x no. of piles Total material = |

**Step 4:** Divide the **total material displacement** by the **proposed vehicle capacity**

|  |
| --- |
| Total no. of vehicles = Volume of material / vehicle capacity Total no. of vehicles = |

**Step 5:** Divide the **total no. of vehicles** by the **duration** of the phase

|  |
| --- |
| Monthly no. of vehicles = Total no. of vehicles / duration (months) Monthly no. of vehicles = |

**2.4 Basement excavation *Proposed Vehicle: 14.3m3 Muck Away HGV***

**Jan 2017 - July 2017 (7 Months)**

Across the site, a basement will be excavated to a depth of 5.5m. Temporary propping will be installed as the excavation progresses. Around 30,800m3 of spoil will need to be lifted away and removed from site by 2 gangs. It is estimated each gang can remove a load of around 100m3 per day.

**Step 3:** Determine the total **material displacement**

|  |
| --- |
| Total material (m3) = |

**Step 4:** Divide the **total material displacement** by the **proposed vehicle capacity**

|  |
| --- |
| Total no. of vehicles = Volume of material / vehicle capacity Total no. of vehicles = |

**Step 5:** Divide the **total no. of vehicles** by the **duration** of the phase

|  |
| --- |
| Monthly no. of vehicles = Total no. of vehicles / duration (months) Monthly no. of vehicles = |

**Phase 2: Basement excavation and piling total**

**Step 6:** Aggregate the **monthly no. of vehicles** by month to get a **total no. of vehicles** for the whole phase

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Sept 2016 | Oct 2016 | Nov 2016 | Dec 2016 | Jan 2017 | Feb 2017 | Mar 2017 | Apr 2017 | May 2017 | Jun 2017 | July 2017 |
| 2.1 Removal of Materials |  |  |  |  |  |  |  |  |  |  |  |
| 2.2 Concrete Pour |  |  |  |  |  |  |  |  |  |  |  |
| 2.3 Reinforcements |  |  |  |  |  |  |  |  |  |  |  |
| 2.4 Basement Excavation |  |  |  |  |  |  |  |  |  |  |  |
| TOTAL |  |  |  |  |  |  |  |  |  |  |  |

Phase 3: Sub-structure

July 2017 - January 2018 (7 Months)

Following basement excavation, the Contractor will commence internal piling and reinforcement. There will be 2 piling rigs used to excavate, concrete pour and reinforce a total of 720 piles. The total cost of this phase is expected to be £10 million with 40% on materials.

**Step 1:** Divide the phase into **sub-phases**

|  |
| --- |
| 3.1 Removal of Material 3.2 Concrete Pour 3.3 Reinforcement 3.4 Trim Piles: Equipment 3.5 Trim Piles: Removal of Material 3.6 Pile Caps: Concrete Pour 3.7 Pile Caps: Reinforcement |

**Step 2:** Propose a **vehicle type** for each sub-phase

|  |
| --- |
| 3.1 Removal of Material = 14.3m3 Muck Away HGV 3.2 Concrete Pour = 8m3 Ready Mix HGV 3.3 Reinforcement = 30t Flatbed HGV 3.4 Trim Piles: Equipment = Heavy Plant 3.5 Trim Piles: Removal of Material = 14.3m3 Muck Away HGV 3.6 Pile Caps: Concrete Pour = 8m3 Ready Mix HGV 3.7 Pile Caps: Reinforcement = 30t Flatbed HGV |

**3.1 Removal of material *Proposed Vehicle: 14.3m3 Muck Away HGV***

**July 2017 - Oct 2017 (4 Months)**

Contiguous piles will be used to form the perimeter basement wall prior to excavation. This will require material to be There will be 2 piling rigs used to excavate, concrete pour and reinforce a total of 720 piles with a volume of 3m3 each. It is estimated that these rigs will have an output of 8 piles a day and 342t rebar reinforcement will be required in total. The piles will then be trimmed by around 0.15m3 each.

**Step 3:** Determine the total **material displacement**

|  |
| --- |
| Total material (m3) = Total no. of piles x volume of 1 pile (m3) Total material (m3) = |

**Step 4: Divide the total material displacement by the proposed vehicle capacity**

|  |
| --- |
| Total no. of vehicles = Volume of material / vehicle capacity Total no. of vehicles = |

**Step 5: Divide the total no. of vehicles by the duration of the phase**

|  |
| --- |
| Monthly no. of vehicles = Total no. of vehicles / duration (months) Monthly no. of vehicles = 152 / 4 Monthly no. of vehicles = 38 |

**3.2 Concrete pour *Proposed Vehicle: 8m3 Ready Mix HGV***

**July 2017 - Oct 2017 (4 Months)**

The 720 piles will each require 3m3 of concrete.

**Step 3:** Determine the total **material displacement**

|  |
| --- |
| Total material (m3) = Total no. of piles x volume of 1 pile (m3) Total material (m3) = |

**Step 4:** Divide the **total material displacement** by the **proposed vehicle capacity**

|  |
| --- |
| Total no. of vehicles = Volume of material / vehicle capacity Total no. of vehicles = |

**Step 5:** Divide the **total no. of vehicles** by the **duration** of the phase

|  |
| --- |
| Monthly no. of vehicles = Total no. of vehicles / duration (months) Monthly no. of vehicles = |

**3.3 Reinforcement *Proposed Vehicle: 30t Flatbed HGV***

**July 2017 - Oct 2017 (4 Months)**

The 720 piles will each require 0.475t of rebar reinforcement.

**Step 3:** Determine the total **material displacement**

|  |
| --- |
| Total material (t) = Total no. of piles x volume of 1 pile (t) Total material (t) = |

**Step 4:** Divide the **total material displacement** by the **proposed vehicle capacity**

|  |
| --- |
| Total no. of vehicles = Volume of material / vehicle capacity Total no. of vehicles = |

**Step 5:** Divide the **total no. of vehicles** by the **duration** of the phase

|  |
| --- |
| Monthly no. of vehicles = Total no. of vehicles / duration (months) Monthly no. of vehicles = |

**3.4 Trim piles: equipment *Proposed Vehicle: Heavy Plant***

**July 2017 – Jan 2018 (7 Months)**

1 Heavy Plant vehicle is required to trim the piles

**3.5 Trim piles: removal of material *Proposed Vehicle: 14.3m3 Muck Away HGV***

**July 2017 - Oct 2017 (4 Months)**

The 720 piles will require 0.15m3 to be removed each.

**Step 3:** Determine the total **material displacement**

|  |
| --- |
| Total material (m³) = Total no. of piles x trim volume of 1 pile (m3) Total material (m³) = |

**Step 4: Divide the total material displacement by the proposed vehicle capacity**

|  |
| --- |
| Total no. of vehicles = Trim volume of material / vehicle capacity Total no. of vehicles = |

**Step 5: Divide the total no. of vehicles by the duration of the phase**

|  |
| --- |
| Monthly no. of vehicles = Total no. of vehicles / duration (months) Monthly no. of vehicles = |

**3.6 Pile caps: concrete pour *Proposed Vehicle: 8m3 Ready Mix HGV***

**Nov 2017 - Jan 2018 (3 Months)**

Over 3 months, the piles will be capped with 2m³ concrete with 1 pile cap per 4 piles. The 2 gangs will operate at same time for both excavation and the formation of pile caps.

**Step 3:** Determine the total **material displacement**

|  |
| --- |
| No. Pile Caps = No. Piles / No. Caps per Pile Total Concrete = No. Pile Caps x Cap Volume No. Pile Caps = Total Concrete = |

**Step 4:** Divide the **total material displacement** by the **proposed vehicle capacity**

|  |
| --- |
| Total no. of vehicles = Total Concrete / Vehicle Capacity Total no. of vehicles = |

**Step 5:** Divide the **total no. of vehicles** by the **duration** of the phase

|  |
| --- |
| Monthly no. of vehicles = Total no. of vehicles / duration (months) Monthly no. of vehicles = |

**3.7 Pile Caps: reinforcement *Proposed Vehicle: 30t Flatbed HGV***

**Nov 2017 - Jan 2018 (3 Months)**

The pile caps will each require 0.5t of rebar.

**Step 3:** Determine the total **material displacement**

|  |
| --- |
| Total material (t) = Total no. of piles caps x volume of 1 pile cap (t) Total material (t) = |

**Step 4:** Divide the **total material displacement** by the **proposed vehicle capacity**

|  |
| --- |
| Total no. of vehicles = Volume of material / vehicle capacity Total no. of vehicles = |

**Step 5:** Divide the **total no. of vehicles** by the **duration** of the phase

|  |
| --- |
| Monthly no. of vehicles = Total no. of vehicles / duration (months) Monthly no. of vehicles = |

**Phase 3: Sub-structure total**

**Step 6:** Aggregate the **monthly no. of vehicles** by month to get a **total no. of vehicles** for the whole phase

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | July 2017 | Aug 2017 | Sept 2017 | Oct 2017 | Nov 2017 | Dec 2017 | Jan 2018 |
| 3.1 Removal of Material |  |  |  |  |  |  |  |
| 3.2 Concrete Pour |  |  |  |  |  |  |  |
| 3.3 Reinforcement |  |  |  |  |  |  |  |
| 3.4 Trim Plates |  |  |  |  |  |  |  |
| 3.5 Removal of Materials |  |  |  |  |  |  |  |
| 3.6 Concrete Pour |  |  |  |  |  |  |  |
| 3.7 Reinforcement |  |  |  |  |  |  |  |
| TOTAL |  |  |  |  |  |  |  |

**Phase 4: Super-structure**

**October 2017 - June 2018 (9 Months)**

The Contractor will commence jump forming the central concrete core. This will have a total volume of 250m3 of concrete with 37.5t rebar reinforcement. When the central core is 4 stories up the contractor will then form a suitably designed basement slab. The contractor will continue to raise the core to roof level and follow this activity up the building with the floors, and prefabricated glazed and solid form cladding system. The total cost of this phase is expected to be £30 million with 40% on materials.

**Step 1:** Divide the phase into **sub-phases**

|  |
| --- |
| 4.1 Concrete Pour 4.2 Reinforcement 4.3 Precast Stairs 4.4 Steel Frame 4.5 Concrete 4.6 Reinforcement |

**Step 2:** Propose a **vehicle type** for each sub-phase

|  |
| --- |
| 4.1 Concrete Pour = 8m3 Ready Mix HGV 4.2 Reinforcement = 30t Flatbed HGV 4.3 Precast Stairs = 30t Flatbed HGV 4.4 Steel Frame = 30t Flatbed HGV 4.5 Concrete = 8m3 Ready Mix HGV 4.6 Reinforcement = 30t Flatbed HGV |

**4.1 Concrete pour *Proposed Vehicle: 8m3 Ready Mix HGV***

**Oct 2017 - Mar 2018 (6 Months)**

The concrete core of 500 London Street will have a total volume of 250m3 of concrete, with 37.5t of reinforcement. With a total height of 10 floors, there will be 25m3 of concrete and 3.75t of steel per floor. Precast stairs will be used and installed in 36 prefabricated units.

**Step 3:** Determine the total **material displacement**

|  |
| --- |
| Total material (m3) = |

**Step 4:** Divide the **total material displacement** by the **proposed vehicle capacity**

|  |
| --- |
| Total no. of vehicles = Volume of material / vehicle capacity Total no. of vehicles = |

**Step 5:** Divide the **total no. of vehicles** by the **duration** of the phase

|  |
| --- |
| Monthly no. of vehicles = Total no. of vehicles / duration (months) Monthly no. of vehicles = |

**4.2 Reinforcement *Proposed Vehicle: 30t Flatbed HGV***

**Oct 2017 - Mar 2018 (6 Months)**

The 10 floors each require 3.75t of steel.

**Step 3:** Determine the total **material displacement**

|  |
| --- |
| Total material (t) = material per floor x no. of floors Total material = |

**Step 4:** Divide the **total material displacement** by the **proposed vehicle capacity**

|  |
| --- |
| Total no. of vehicles = Volume of material / vehicle capacity Total no. of vehicles = |

**Step 5:** Divide the **total no. of vehicles** by the **duration** of the phase

|  |
| --- |
| Monthly no. of vehicles = Total no. of vehicles / duration (months) Monthly no. of vehicles = |

**4.3 Precast stairs *Proposed Vehicle: 30t Flatbed HGV***

**Oct 2017 - Mar 2018 (6 Months)**

Precast stairs will be used and installed in 36 prefabricated units. A 30t Flatbed HGV can carry 3 prefab units.

**Step 3:** Determine the total **material displacement**

|  |
| --- |
| Total material (prefab units) = |

**Step 4:** Divide the **total material displacement** by the **proposed vehicle capacity**

|  |
| --- |
| Total no. of vehicles = Volume of material / vehicle capacity Total no. of vehicles = |

**Step 5:** Divide the **total no. of vehicles** by the **duration** of the phase

|  |
| --- |
| Monthly no. of vehicles = Total no. of vehicles / duration (months) Monthly no. of vehicles = |

**4.4 Steel frame *Proposed Vehicle: 30t Flatbed HGV***

**Dec 2017 - May 2018 (6 Months)**

1 gang will erect approximately 1000t of steel frame.

**Step 3:** Determine the total **material displacement**

|  |
| --- |
| Total material (t) = |

**Step 4:** Divide the **total material displacement** by the **proposed vehicle capacity**

|  |
| --- |
| Total no. of vehicles = Volume of material / vehicle capacity Total no. of vehicles = |

**Step 5:** Divide the **total no. of vehicles** by the **duration** of the phase

|  |
| --- |
| Monthly no. of vehicles = Total no. of vehicles / duration (months) Monthly no. of vehicles = |

**4.5 Concrete *Proposed Vehicle: 8m3 Ready Mix HGV***

**Feb 2018 - June 2018 (4.5 Months)**

The typical floor plate is 5600m2 and 0.3m thick, therefore each floor will require 1680m3 (floor plate x depth) of concrete and 252t of rebar. However, floor plates 8 and 9 are smaller, requiring 1075m3 and 690m3 of concrete and 162t and 104t rebar respectively. It is predicted it will take ½ a month to complete 1 floor

**Step 3:** Determine the total **material displacement**

|  |
| --- |
| Total material (m3) = (Typical Floor x 7) + Floor 8 + Floor 9 Total material (m3) = |

**Step 4:** Divide the **total material displacement** by the **proposed vehicle capacity**

|  |
| --- |
| Total no. of vehicles = Volume of material / vehicle capacity Total no. of vehicles = |

**Step 5:** Divide the **total no. of vehicles** by the **duration** of the phase

|  |
| --- |
| Monthly no. of vehicles = Total no. of vehicles / duration (months) Monthly no. of vehicles = |

**4.6 Reinforcement** ***Proposed Vehicle: 30t Flatbed HGV***

**Feb 2018 - June 2018 (4.5 Months)**

**Step 3:** Determine the total **material displacement**

|  |
| --- |
| Total material (t) = (Typical Floor x 7) + Floor 8 + Floor 9 Total material (t) = |

**Step 4:** Divide the **total material displacement** by the **proposed vehicle capacity**

|  |
| --- |
| Total no. of vehicles = Volume of material / vehicle capacity Total no. of vehicles = |

**Step 5:** Divide the **total no. of vehicles** by the **duration** of the phase

|  |
| --- |
| Monthly no. of vehicles = Total no. of vehicles / duration (months) Monthly no. of vehicles = |

**Phase 4: Super-structure total**

**Step 6:** Aggregate the **monthly no. of vehicles** by month to get a **total no. of vehicles** for the whole phase

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Oct2017 | Nov2017 | Dec2017 | Jan2018 | Feb2018 | Mar2018 | Apr2018 | May2018 | Jun2018 |
| 4.1 Concrete Pour |  |  |  |  |  |  |  |  |  |
| 4.2 Reinforcement |  |  |  |  |  |  |  |  |  |
| 4.3 Precast Stairs |  |  |  |  |  |  |  |  |  |
| 4.4 Steel Frame |  |  |  |  |  |  |  |  |  |
| 4.5 Concrete |  |  |  |  |  |  |  |  |  |
| 4.6 Reinforcement |  |  |  |  |  |  |  |  |  |
| TOTAL |  |  |  |  |  |  |  |  |  |

Phase 5: Cladding

**Apr 2018 - Dec 2018 (9 Months)**

There is a total of 2300m2 per elevation. It is estimated 1 floor and 1 elevation will be worked at a time over 9 months, taking just over 2 months for each facade. Glass panes will be installed measuring 1.5m x 3.4m. 30ft Flatbed HGVs will be used to deliver the panes to site, 12 panes can be delivered per HGV load.

Step 1: Divide the phase into sub-phases

|  |
| --- |
| 5.1 External Façade |

**Step 2:** Propose a **vehicle type** for each sub-phase

|  |
| --- |
| 5.1 External Facade = 30t Flatbed HGV |

**5.1 External facade**  ***Proposed Vehicle: 30t Flatbed HGV***

**Apr 2018 - Dec 2018 (9 Months)**

Consolidation Centre = 68% Reduction

**Step 3:** Determine the total **material displacement**

|  |
| --- |
| Total material (glass panes) = Total facade area (m2) / Total material (glass panes) Total material (glass panes) = |

**Step 4:** Divide the **total material displacement** by the **proposed vehicle capacity**

|  |
| --- |
| Total no. of vehicles = Volume of material / vehicle capacity Total no. of vehicles = |

**Step 5:** Divide the **total no. of vehicles** by the **duration** of the phase

|  |
| --- |
| Monthly no. of vehicles = Total no. of vehicles / duration (months) Monthly no. of vehicles = |

**Apply Planned Measure:**

|  |
| --- |
| Refined Monthly no. of vehicles = Monthly no. of vehicles x (100 - planned measure reduction (%)) Refined Monthly no. of vehicles = Refined Monthly no. of vehicles =  |

**Phase 5: Cladding total**

**Step 6:** Aggregate the **monthly no. of vehicles** by month to get a **total no. of vehicles** for the whole phase

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Apr2018 | May2018 | Jun2018 | Jul2018 | Aug2018 | Sep2018 | Oct2018 | Nov2018 | Dec2018 |
| 5.1 Cladding |  |  |  |  |  |  |  |  |  |
| TOTAL |  |  |  |  |  |  |  |  |  |

Phase 6: Fit out, testing and commissioning

**April 2018 - November 2019 (20 Months)**

All materials for the fit out of all floors will be brought in to site via the Ground Floor Service Yard and manhandled in to location via designated travel routes and the service lift. The fit out will commence in earnest on the water tightening of the floors and follow up the building. The fit out will include all MEP services and plant (both rooftop, and basement) and internal flooring, portioning and ceiling works. The total cost of this phase is expected to be £40 million with 40% on materials.

Step 1: Divide the phase into sub-phases

|  |
| --- |
| 6.1 MEP Fix 6.2 Testing and Commissioning |

**Step 2:** Propose a **vehicle type** for each sub-phase

|  |
| --- |
| 6.1 MEP Fix = 30t Flatbed HGV 6.2 Testing and Commissioning = Panel Van |

**6.1 MEP Fix *Proposed Vehicle: 30t Flatbed HGV***

**Apr 2018 - Dec 2018 (9 Months)**

**Modular Construction = 60% Reduction**

**Consolidation Centre = 68% Reduction**

At roof level, the key plant is considered as chillers, air handling units and air extraction kit. Within the basement, the key plant will include boilers, water tanks and electrical boards etc. All roof plant and materials as required will be brought to the work face by crane, and it is the intention of the project that all kit is dropped in to place and not manually handled over long distances during installation.

The 1st fix will start on the ground floor the same time as the external façade. The MEP items will require 120 deliveries a month.

**Step 3, 4 and 5:** Ascertain the **total no. of vehicles** for the sub-phase

|  |
| --- |
| Monthly no. of vehicles = |

**Apply Planned Measure:**

|  |
| --- |
| Refined Monthly no. of vehicles = Monthly no. of vehicles x (100 - planned measure reduction (%)) Refined Monthly no. of vehicles = Refined Monthly no. of vehicles = Monthly no. of vehicles x (100 - planned measure reduction (%)) Refined Monthly no. of vehicles = |

**6.2 Testing and Commissioning *Proposed Vehicle: Panel Van***

**Jan 2019 - Nov 2019 (11 Months)**

The final 11 months of the programme will be for testing and commissioning, smaller 3.5t vans will be used to carry out the final phase of the construction programme. It is predicted that 12 vans will be required a week.

**Step 3, 4 and 5:** Ascertain the **total no. of vehicles** for the sub-phase

|  |
| --- |
| Monthly no. of vehicles = No. vans per week x 4 weeks in a month Monthly no. of vehicles = |

**Phase 6: Fit out, testing and commissioning total**

**Step 6:** Aggregate the **monthly no. of vehicles** by month to get a **total no. of vehicles** for the whole phase

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Apr2018 | May2018 | [Jun – Nov 2018] | Dec2018 | Jan2019 | [Feb – Oct 2019] | Nov2019 |
| 6.1 MEP Fix |  |  |  |  |  |  |  |
| 6.2 Testing and Commissioning |  |  |  |  |  |  |  |
| TOTAL |  |  |  |  |  |  |  |

**BUILD COST** ANSWERS

**Phase 1: Site Setup and Demolition**

Step 1: Derive the build cost (£) and material spend (%) for the phase

* **Build Cost = £10 million**
* **Material Spend = 40%**

Step 2: Calculate the cost of materials (£) for the phase

* **Cost of Materials (£) = Build Cost (£) x Material Spend (%)**
* **Cost of Materials = £10 million x 40%**
* **Cost of Materials = £4 million**

Step 3: Using the assumed vehicle mix calculate the total cost carried (£) by the number of vehicles specified

|  |  |  |  |
| --- | --- | --- | --- |
| Vehicle type | Cost carried per vehicle (£) | No. of Vehicles | Total cost carried (£) |
| Large HGV | 3,000 | 1 | 3,000 |
| Medium HGV | 3,000 | 1 | 3,000 |
| Small HGV | 1,500 | 3 | 4,500 |
| LGV | 1,500 | 10 | 15,000 |
| TOTAL | N/A | 15 | 25,500 |

Step 4: Divide the total cost of material (£) by the total cost carried (£) for 1 vehicle mix to give us the number of vehicle mixes used

* **No. Vehicle Mixes = Cost of Materials (£) / Cost Carried (£) by 1 Vehicle mix**
* **No. Vehicle Mixes = £4 million / £25,500**
* **No. Vehicle Mixes = 156.86**

Step 5: Multiply the total number of vehicle mixes used by the number of vehicles in the vehicle mix to give us the total number of vehicles for the phase

* **Total Vehicles = No. Vehicle Mixes x No. Vehicles in a Mix**
* **Total Vehicles = 156.86 x 15**
* **Total Vehicles = 2352.94**

Step 6: The total number of vehicles is divided by the duration (in months) of the phase

* **Vehicles per Month = Total Vehicles / No. Months in Phase**
* **Vehicles per Month = 2352.94 / 9**
* **Vehicles per Month = 262 (Rounded up to nearest whole number)**

**Phase 2: Basement Excavation and Piling**

Step 1: Derive the build cost (£) and material spend (%) for the phase

* **Build Cost = £3 million**
* **Material Spend = 50%**

Step 2: Calculate the cost of materials (£) for the phase

* **Cost of Materials = Build Cost (£) x Material Spend (%)**
* **Cost of Materials = £3 million x 50%**
* **Cost of Materials = £1.5 million**

Step 3: Using the assumed vehicle mix calculate the total cost carried (£) by the number of vehicles specified

|  |  |  |  |
| --- | --- | --- | --- |
| Vehicle type | Cost carried per vehicle (£) | No. of Vehicles | Total cost carried (£) |
| Large HGV | 750 | 5 | 3,750 |
| Medium HGV | 750 | 1 | 750 |
| Small HGV | 500 | 1 | 500 |
| LGV | 40 | 5 | 200 |
| TOTAL | N/A | 12 | 5,200 |

Step 4: Divide the total cost of material (£) by the total cost carried (£) for 1 vehicle mix to give us the number of vehicle mixes used

* **No. Vehicle Mixes = Cost of Materials / Cost Carried by 1 Vehicle mix**
* **No. Vehicle Mixes = £1.5 million / £5,200**
* **No. Vehicle Mixes = 288.46**

Step 5: Multiply the total number of vehicle mixes used by the number of vehicles in the vehicle mix to give us the total number of vehicles for the phase

* **Total Vehicles = No. Vehicle Mixes x No. Vehicles in a Mix**
* **Total Vehicles = 288.46 x 12**
* **Total Vehicles = 3461.54**

Step 6: The total number of vehicles is divided by the duration (in months) of the phase

* **Vehicles per Month = Total Vehicles / No. Months in Phase**
* **Vehicles per Month = 3461.54 /11**
* **Vehicles per Month = 315**

**Phase 3: Sub-Structure**

Step 1: Derive the build cost (£) and material spend (%) for the phase

* **Build Cost = £10 million**
* **Material Spend = 40%**

Step 2: Calculate the cost of materials (£) for the phase

* **Cost of Materials = Build Cost (£) x Material Spend (%)**
* **Cost of Materials = £10 million x 40%**
* **Cost of Materials = £4 million**

Step 3: Using the assumed vehicle mix calculate the total cost carried (£) by the number of vehicles specified

|  |  |  |  |
| --- | --- | --- | --- |
| Vehicle type | Cost carried per vehicle (£) | No. of Vehicles | Total cost carried (£) |
| Large HGV | 5,000 | 9 | 45,000 |
| Medium HGV | 5,000 | 1 | 5,000 |
| Small HGV | 2,000 | 3 | 6,000 |
| LGV | 1,000 | 2 | 2,000 |
| TOTAL | N/A | 15 | 58,000 |

Step 4: Divide the total cost of material (£) by the total cost carried (£) for 1 vehicle mix to give us the number of vehicle mixes used

* **No. Vehicle Mixes = Cost of Materials / Cost Carried by 1 Vehicle mix**
* **No. Vehicle Mixes = £4 million / £58,000**
* **No. Vehicle Mixes = 68.97**

Step 5: Multiply the total number of vehicle mixes used by the number of vehicles in the vehicle mix to give us the total number of vehicles for the phase

* **Total Vehicles = No. Vehicle Mixes x No. Vehicles in a Mix**
* **Total Vehicles = 68.97 x 15**
* **Total Vehicles = 1,034.55**

Step 6: The total number of vehicles is divided by the duration (in months) of the phase

* **Vehicles per Month = Total Vehicles / No. Months in Phase**
* **Vehicles per Month = 1,034.55 / 7**
* **Vehicles per Month = 148**

**Phase 4: Super-Structure**

Step 1: Derive the build cost (£) and material spend (%) for the phase

* **Build Cost = £30 million**
* **Material Spend = 40%**

Step 2: Calculate the cost of materials (£) for the phase

* **Cost of Materials = Build Cost (£) x Material Spend (%)**
* **Cost of Materials = £30 million x 40%**
* **Cost of Materials = £12 million**

Step 3: Using the assumed vehicle mix calculate the total cost carried (£) by the number of vehicles specified

|  |  |  |  |
| --- | --- | --- | --- |
| Vehicle type | Cost carried per vehicle (£) | No. of Vehicles | Total cost carried (£) |
| Large HGV | 8,000 | 9 | 72,000 |
| Medium HGV | 5,000 | 1 | 5,000 |
| Small HGV | 2,000 | 3 | 6,000 |
| LGV | 1,000 | 2 | 2,000 |
| TOTAL | N/A | 15 | 85,000 |

Step 4: Divide the total cost of material (£) by the total cost carried (£) for 1 vehicle mix to give us the number of vehicle mixes used

* **No. Vehicle Mixes = Cost of Materials / Cost Carried by 1 Vehicle mix**
* **No. Vehicle Mixes = £12 million / £85,000**
* **No. Vehicle Mixes = 141.18**

Step 5: Multiply the total number of vehicle mixes used by the number of vehicles in the vehicle mix to give us the total number of vehicles for the phase

* **Total Vehicles = No. Vehicle Mixes x No. Vehicles in a Mix**
* **Total Vehicles = 141.18 x 15**
* **Total Vehicles = 2117.65**

Step 6: The total number of vehicles is divided by the duration (in months) of the phase

* **Vehicles per Month = Total Vehicles / No. Months in Phase**
* **Vehicles per Month = 211.65 /9**
* **Vehicles per Month = 236**

**Phase 5: Cladding**

Step 1: Derive the build cost (£) and material spend (%) for the phase

* **Build Cost = £10 million**
* **Material Spend = 40%**

Step 2: Calculate the cost of materials (£) for the phase

* **Cost of Materials = Build Cost (£) x Material Spend (%)**
* **Cost of Materials = £10 million x 40%**
* **Cost of Materials = £4 million**

Step 3: Using the assumed vehicle mix calculate the total cost carried (£) by the number of vehicles specified

|  |  |  |  |
| --- | --- | --- | --- |
| Vehicle type | Cost carried per vehicle (£) | No. of Vehicles | Total cost carried (£) |
| Large HGV | 30,000 | 9 | 270,000 |
| Medium HGV | 5,000 | 1 | 5,000 |
| Small HGV | 2,000 | 3 | 6,000 |
| LGV | 1,000 | 2 | 2,000 |
| TOTAL | N/A | 15 | 283,000 |

Step 4: Divide the total cost of material (£) by the total cost carried (£) for 1 vehicle mix to give us the number of vehicle mixes used

* **No. Vehicle Mixes = Cost of Materials / Cost Carried by 1 Vehicle mix**
* **No. Vehicle Mixes = £4 million / £283,000**
* **No. Vehicle Mixes = 14.13**

Step 5: Multiply the total number of vehicle mixes used by the number of vehicles in the vehicle mix to give us the total number of vehicles for the phase

* **Total Vehicles = No. Vehicle Mixes x No. Vehicles in a Mix**
* **Total Vehicles = 14.13 x 15**
* **Total Vehicles = 212.01**

Step 6: The total number of vehicles is divided by the duration (in months) of the phase

* **Vehicles per Month = Total Vehicles / No. Months in Phase**
* **Vehicles per Month = 212.01 / 9**
* **Vehicles per Month = 24**

**Phase 6: Fit-out, Testing and Commissioning**

Step 1: Derive the build cost (£) and material spend (%) for the phase

* **Build Cost = £40 million**
* **Material Spend = 40%**

Step 2: Calculate the cost of materials (£) for the phase

* **Cost of Materials = Build Cost (£) x Material Spend (%)**
* **Cost of Materials = £40 million x 40%**
* **Cost of Materials = £16 million**

Step 3: Using the assumed vehicle mix calculate the total cost carried (£) by the number of vehicles specified

|  |  |  |  |
| --- | --- | --- | --- |
| Vehicle type | Cost carried per vehicle (£) | No. of Vehicles | Total cost carried (£) |
| Large HGV | 70,000 | 1 | 70,000 |
| Medium HGV | 8,000 | 3 | 24,000 |
| Small HGV | 4,000 | 2 | 8,000 |
| LGV | 2,000 | 9 | 18,000 |
| TOTAL | N/A | 15 | 120,000 |

Step 4: Divide the total cost of material (£) by the total cost carried (£) for 1 vehicle mix to give us the number of vehicle mixes used

* **No. Vehicle Mixes = Cost of Materials / Cost Carried by 1 Vehicle mix**
* **No. Vehicle Mixes = £16 million / £120,000**
* **No. Vehicle Mixes = 133.33**

Step 5: Multiply the total number of vehicle mixes used by the number of vehicles in the vehicle mix to give us the total number of vehicles for the phase

* **Total Vehicles = No. Vehicle Mixes x No. Vehicles in a Mix**
* **Total Vehicles = 133.33 x 15**
* **Total Vehicles = 2,000**

Step 6: The total number of vehicles is divided by the duration (in months) of the phase

* **Vehicles per Month = Total Vehicles / No. Months in Phase**
* **Vehicles per Month = 2,000 / 20**
* **Vehicles per Month = 100**

**MATERIAL VOLUME** ANSWERS

**Phase 1: Site Setup and Demolition**

1.1 Surveys

Step 3, 4 and 5: Ascertain the total no. of vehicles for the sub-phase

* **Monthly no. of vehicles = Vehicles per day x duration (working days)**
* **Monthly no. of vehicles = 4 x 21**
* **Monthly no. of vehicles = 84**

1.2 Scaffold

Step 3, 4 and 5: Ascertain the monthly no. of vehicles for the sub-phase

* **Monthly no. of vehicles = 24**

1.3 Asbestos Removal

Step 3, 4 and 5: Ascertain the monthly no. of vehicles for the sub-phase

* **Monthly no. of vehicles = Vehicles across duration / duration (months)**
* **Monthly no. of vehicles = 28 / 3**
* **Monthly no. of vehicles = 10 (rounded up)**

1.4 Soft Strip

Step 3, 4 and 5: Ascertain the total no. of vehicles for the sub-phase, and the monthly no. of vehicles

* **Total no. of vehicles = (Vehicles per floor x No. of floors ) + Crane**
* **Total no. of vehicles = (7 x 10) + 2**
* **Total no of vehicles = 72**
* **Monthly no. of vehicles = Total no. of vehicles / duration (months)**
* **Monthly no. of vehicles = 72 / 4**
* **Monthly no. of vehicles = 18**

1.5 Roof Demolition

Step 3: Determine the total material displacement

* **Total material displacement (m3) = 1,120**

Step 4: Divide the total material displacement by the proposed vehicle capacity

* **Total no. of vehicles = Volume of material / vehicle capacity**
* **Total no. of vehicles = 1,120 / 9**
* **Total no. of vehicles = 125 (rounded up)**

Step 5: Divide the total no. of vehicles by the duration of the phase

* **Monthly no. of vehicles = Total no. of vehicles / duration (months)**
* **Monthly no. of vehicles = 125 / 1**
* **Monthly no. of vehicles = 125**

1.6 Structural Demolition

Step 3: Determine the total material displacement

* **Total material displacement (m³) = 5,600**

Step 4: Divide the total material displacement by the proposed vehicle capacity

* **Total no. of vehicles = Volume of material / vehicle capacity**
* **Total no. of vehicles = 5,600 / 9**
* **Total no. of vehicles = 623 (rounded up)**

Step 5: Divide the total no. of vehicles by the duration of the phase

* **Monthly no. of vehicles = Total no. of vehicles / duration (months)**
* **Monthly no. of vehicles = 623 / 1**
* **Monthly no. of vehicles = 623**

1.7 Ground Demolition

Step 3: Determine the total material displacement

* **Total material displacement (m3) = 1,680**

Step 4: Divide the total material displacement by the proposed vehicle capacity

* **Total no. of vehicles = Volume of material / vehicle capacity**
* **Total no. of vehicles = 1,680 / 9**
* **Total no. of vehicles = 187 (rounded up)**

Step 5: Divide the total no. of vehicles by the duration of the phase

* **Monthly no. of vehicles = Total no. of vehicles / duration (months)**
* **Monthly no. of vehicles = 187 / 1**
* **Monthly no. of vehicles = 187**

**Phase 1: Site Setup and Demolition Total**

Step 6: Aggregate the monthly no. of vehicles by month to get a total no. of vehicles for the whole phase

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Jan 2016 | Feb 2016 | Mar 2016 | Apr 2016 | May 2016 | Jun 2016 | Jul 2016 | Aug 2016 | Sept 2016 |
| 1.1 Surveys | 84 | 84 | 84 | 84 |  |  |  |  |  |
| 1.2 Scaffolding |  | 24 | 24 |  |  |  |  |  |  |
| 1.3 Asbestos Removal |  |  | 10 | 10 | 10 |  |  |  |  |
| 1.4 Soft Strip |  |  |  |  | 18 | 18 | 18 | 18 |  |
| 1.5 Roof Demolition |  |  |  |  |  |  | 125 |  |  |
| 1.6 Structural Demolition |  |  |  |  |  |  |  | 623 |  |
| 1.7 Ground Demolition |  |  |  |  |  |  |  |  | 187 |
| TOTAL | 84 | 108 | 118 | 94 | 28 | 18 | 143 | 641 | 187 |

**Phase 2: Basement Excavation and Piling**

2.1 Removal of Material

Step 3: Determine the total material displacement

* **Total material (m3) = Total no. of piles x volume of 1 pile (m3)**
* **Total material (m3) = 400 x 7m3 piles**
* **Total material (m3) = 2,800m³ muck away**

Step 4: Divide the total material displacement by the proposed vehicle capacity

* **Total no. of vehicles = Volume of material / vehicle capacity**
* **Total no. of vehicles = 2,800 / 9**
* **Total no. of vehicles = 312 (rounded up)**

Step 5: Divide the total no. of vehicles by the duration of the phase

* **Monthly no. of vehicles = Total no. of vehicles / duration (months)**
* **Monthly no. of vehicles = 312 / 4**
* **Monthly no. of vehicles = 78**

2.2 Concrete Pour

Step 3: Determine the total material displacement

* **Total material (m3) = Total no. of piles x volume of 1 pile (m3)**
* **Total material (m3) = 400 x 7m3 piles**
* **Total material (m3) = 2,800m³ concrete pour**

Step 4: Divide the total material displacement by the proposed vehicle capacity

* **Total no. of vehicles = Volume of material / vehicle capacity**
* **Total no. of vehicles = 2,800 / 8**
* **Total no. of vehicles = 350**

Step 5: Divide the total no. of vehicles by the duration of the phase

* **Monthly no. of vehicles = Total no. of vehicles / duration (months)**
* **Monthly no. of vehicles = 350 / 4**
* **Monthly no. of vehicles = 88 (rounded up)**

2.3 Reinforcement

Step 3: Determine the total material displacement

* **1 pile = 1.05t rebar**
* **Total material = 400 piles x 1.05t rebar**
* **Total material = 420t rebar**

Step 4: Divide the total material displacement by the proposed vehicle capacity

* **Total no. of vehicles = Volume of material / vehicle capacity**
* **Total no. of vehicles = 420 / 30**
* **Total no. of vehicles = 14**

Step 5: Divide the total no. of vehicles by the duration of the phase

* **Monthly no. of vehicles = Total no. of vehicles / duration (months)**
* **Monthly no. of vehicles = 14 / 4**
* **Monthly no. of vehicles = 4 (rounded up)**

2.4 Basement Excavation

Step 3: Determine the total material displacement

* **Total material (m3) = 30,800**

Step 4: Divide the total material displacement by the proposed vehicle capacity

* **Total no. of vehicles = Volume of material / vehicle capacity**
* **Total no. of vehicles = 30,800 / 9**
* **Total no. of vehicles = 3,423 (rounded up)**

Step 5: Divide the total no. of vehicles by the duration of the phase

* **Monthly no. of vehicles = Total no. of vehicles / duration (months)**
* **Monthly no. of vehicles = 3,423 / 7**
* **Monthly no. of vehicles = 489 (rounded up)**

**Phase 2: Basement Excavation and Piling Total**

Step 6: Aggregate the monthly no. of vehicles per subphase by month to get a total no. of vehicles per month for the whole phase

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Sept 2016 | Oct 2016 | Nov 2016 | Dec 2016 | Jan 2017 | Feb 2017 | Mar 2017 | Apr 2017 | May 2017 | Jun 2017 | Jul 2017 |
| 2.1 Removal of Material | 78 | 78 | 78 | 78 |  |  |  |  |  |  |  |
| 2.2 Concrete Pour | 88 | 88 | 88 | 88 |  |  |  |  |  |  |  |
| 2.3 Reinforcement | 4 | 4 | 4 | 4 |  |  |  |  |  |  |  |
| 2.4 Basement Excavation |  |  |  |  | 489 | 489 | 489 | 489 | 489 | 489 | 489 |
| TOTAL | 170 | 170 | 170 | 170 | 489 | 489 | 489 | 489 | 489 | 489 | 489 |

**Phase 3: Sub-structure**

3.1 Removal of Material

Step 3: Determine the total material displacement

* **Total material (m3) = Total no. of piles x volume of 1 pile (m³)**
* **Total material = 720 x 3m3 piles**
* **Total material = 2,160m3 muck away**

Step 4: Divide the total material displacement by the proposed vehicle capacity

* **Total no. of vehicles = Volume of material / vehicle capacity**
* **Total no. of vehicles = 2,160 / 9**
* **Total no. of vehicles = 240**

Step 5: Divide the total no. of vehicles by the duration of the phase

* **Monthly no. of vehicles = Total no. of vehicles / duration (months)**
* **Monthly no. of vehicles = 240 / 4**
* **Monthly no. of vehicles = 60**

3.2 Concrete Pour

Step 3: Determine the total material displacement

* **Total material (m3) = Total no. of piles x volume of 1 pile (m³)**
* **Total material = 720 x 3m3 piles**
* **Total material = 2,160m3 concrete**

Step 4: Divide the total material displacement by the proposed vehicle capacity

* **Total no. of vehicles = Volume of material / vehicle capacity**
* **Total no. of vehicles = 2,160 / 8**
* **Total no. of vehicles = 270**

Step 5: Divide the total no. of vehicles by the duration of the phase

* **Monthly no. of vehicles = Total no. of vehicles / duration (months)**
* **Monthly no. of vehicles = 270 / 4**
* **Monthly no. of vehicles = 68 (rounded up)**

3.3 Reinforcement

Step 3: Determine the total material displacement

* **Total material (t) = Total no. of piles x volume of 1 pile (t)**
* **720 piles x 0.475t rebar = 342t rebar**

Step 4: Divide the total material displacement by the proposed vehicle capacity

* **Total no. of vehicles = Volume of material / vehicle capacity**
* **Total no. of vehicles = 342 / 30**
* **Total no. of vehicles = 12 (rounded up)**

Step 5: Divide the total no. of vehicles by the duration of the phase

* **Monthly no. of vehicles = Total no. of vehicles / duration (months)**
* **Monthly no. of vehicles = 12/ 4**
* **Monthly no. of vehicles = 3**

3.5 Trim Piles: Removal of Material

Step 3: Determine the total material displacement

* **Total material (m3) = Total no. of piles x trim volume of 1 pile (m3)**
* **Total material = 720 piles x 0.15m3**
* **Total material = 108m3**

Step 4: Divide the total material displacement by the proposed vehicle capacity

* **Total no. of vehicles = Trim volume of material / vehicle capacity**
* **Total no. of vehicles = 108 / 9**
* **Total no. of vehicles = 12**

Step 5: Divide the total no. of vehicles by the duration of the phase

* **Monthly no. of vehicles = Total no. of vehicles / duration (months)**
* **Monthly no. of vehicles = 12 / 4**
* **Monthly no. of vehicles = 3**

3.6 Pile Caps: Concrete Pour

Step 3: Determine the total material displacement

**No. Pile Caps = No. Piles / No. Caps per Pile Total Concrete = No. Pile Caps x Cap Volume**

**No. Pile Caps = 720 / 4 Total Concrete = 180 x 2**

**No. Pile Caps = 180 Total Concrete = 360m3**

Step 4: Divide the total material displacement by the proposed vehicle capacity

* **Total no. of vehicles = Total Concrete / Vehicle Capacity**
* **Total no. of vehicles = 360 / 8**
* **Total no. of vehicles = 45**

Step 5: Divide the total no. of vehicles by the duration of the phase

* **Monthly no. of vehicles = Total no. of vehicles / duration (months)**
* **Monthly no. of vehicles = 45 / 3**
* **Monthly no. of vehicles = 15**

3.7 Pile Caps: Reinforcement

Step 3: Determine the total material displacement

* **Total material (t) = Total no. of piles caps x volume of 1 pile cap (t)**
* **Total material (t) = 180 x 0.5**
* **Total material = 90t**

Step 4: Divide the total material displacement by the proposed vehicle capacity

* **Total no. of vehicles = Volume of material / vehicle capacity**
* **Total no. of vehicles = 90 / 30**
* **Total no. of vehicles = 3**

Step 5: Divide the total no. of vehicles by the duration of the phase

* **Monthly no. of vehicles = Total no. of vehicles / duration (months)**
* **Monthly no. of vehicles = 3 / 3**
* **Monthly no. of vehicles = 1**

**Phase 3: Sub-structure Total**

Step 6: Aggregate the monthly no. of vehicles by month to get a total no. of vehicles for the whole phase

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Jul 2017 | Aug 2017 | Sept 2017 | Oct 2017 | Nov 2017 | Dec 2017 | Jan 2018 |
| 3.1 Removal of Material | 60 | 60 | 60 | 60 |  |  |  |
| 3.2 Concrete Pour | 68 | 68 | 68 | 68 |  |  |  |
| 3.3 Reinforcement | 3 | 3 | 3 | 3 |  |  |  |
| 3.4 Trim Piles | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 3.5 Removal of Materials | 3 | 3 | 3 | 3 |  |  |  |
| 3.6 Concrete Pour |  |  |  |  | 15 | 15 | 15 |
| 3.7 Reinforcement |  |  |  |  | 1 | 1 | 1 |
| **TOTAL** | **135** | **135** | **135** | **135** | **17** | **17** | **17** |

**Phase 4: Super-structure**

4.1 Concrete Pour

Step 3: Determine the total material displacement

* **Total material (m3) = 250m3 concrete**

Step 4: Divide the total material displacement by the proposed vehicle capacity

* **Total no. of vehicles = Volume of material / vehicle capacity Total no. of vehicles = 250 / 8**
* **Total no. of vehicles = 32 (rounded up)**

Step 5: Divide the total no. of vehicles by the duration of the phase

* **Monthly no. of vehicles = Total no. of vehicles / duration (months)**
* **Monthly no. of vehicles = 32 / 6**
* **Monthly no. of vehicles = 6 (rounded up)**

4.2 Reinforcement

Step 3: Determine the total material displacement

* **Total material (t) = material per floor x no. of floors**
* **Total material = 3.75t x 10**
* **Total material = 37.5t**

Step 4: Divide the total material displacement by the proposed vehicle capacity

* **Total no. of vehicles = Volume of material / vehicle capacity Total no. of vehicles = 37.5 / 30**
* **Total no. of vehicles = 2 (rounded up)**

Step 5: Divide the total no. of vehicles by the duration of the phase

* **Monthly no. of vehicles = Total no. of vehicles / duration (months)**
* **Monthly no. of vehicles = 2 / 6**
* **Monthly no. of vehicles = 1 (rounded up)**

4.3 Precast Stairs

Step 3: Determine the total material displacement

* **Total material (prefab units) = 36**

Step 4: Divide the total material displacement by the proposed vehicle capacity

* **Total no. of vehicles = Volume of material / vehicle capacity Total no. of vehicles = 36 / 3**
* **Total no. of vehicles = 12**

Step 5: Divide the total no. of vehicles by the duration of the phase

* **Monthly no. of vehicles = Total no. of vehicles / duration (months)**
* **Monthly no. of vehicles = 12 / 6**
* **Monthly no. of vehicles = 2**

4.4 Steel Frame

Step 3: Determine the total material displacement

* **Total material (t) = 1000**

Step 4: Divide the total material displacement by the proposed vehicle capacity

* **Total no. of vehicles = Volume of material / vehicle capacity**
* **Total no. of vehicles = 1000 / 30**
* **Total no. of vehicles = 34 (rounded up)**

Step 5: Divide the total no. of vehicles by the duration of the phase

* **Monthly no. of vehicles = Total no. of vehicles / duration (months)**
* **Monthly no. of vehicles = 34 / 6**
* **Monthly no. of vehicles = 6 (rounded up)**

4.5 Concrete

Step 3: Determine the total material displacement

* **Total material (m3) = (Typical Floor x 7) + Floor 8 + Floor 9**
* **Total material (m3) = (1,680 x 7) + 1,075 + 690**
* **Total material (m3) = 13,525**

Step 4: Divide the total material displacement by the proposed vehicle capacity

* **Total no. of vehicles = Volume of material / vehicle capacity**
* **Total no. of vehicles = 13,525 / 8**
* **Total no. of vehicles = 1691 (rounded up)**

Step 5: Divide the total no. of vehicles by the duration of the phase

* **Monthly no. of vehicles = Total no. of vehicles / duration (months)**
* **Monthly no. of vehicles = 1691 / 4.5**
* **Monthly no. of vehicles = 376 (rounded up)**

4.6 Reinforcement

Step 3: Determine the total material displacement

* **Total material (t) = (Typical Floor x 7) + Floor 8 + Floor 9**
* **Total material (t) = (252 x 7) + 162 + 104**
* **Total material (t) = 2030**

Step 4: Divide the total material displacement by the proposed vehicle capacity

* **Total no. of vehicles = Volume of material / vehicle capacity**
* **Total no. of vehicles = 2030 / 30**
* **Total no. of vehicles = 68 (rounded up)**

Step 5: Divide the total no. of vehicles by the duration of the phase

* **Monthly no. of vehicles = Total no. of vehicles / duration (months)**
* **Monthly no. of vehicles = 68 / 4.5**
* **Monthly no. of vehicles = 16 (rounded up)**

**Phase 4: Super-structure Total**

Step 6: Aggregate the monthly no. of vehicles by month to get a total no. of vehicles for the whole phase

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Oct 2017 | Nov 2017 | Dec 2017 | Jan 2018 | Feb 2018 | Mar 2018 | Apr 2018 | May 2018 | June 2018 |
| 4.1 Concrete Pour | 6 | 6 | 6 | 6 | 6 | 6 |  |  |  |
| 4.2 Reinforcement | 1 | 1 | 1 | 1 | 1 | 1 |  |  |  |
| 4.3 Precast Stairs | 2 | 2 | 2 | 2 | 2 | 2 |  |  |  |
| 4.4 Steel Frame |  |  | 6 | 6 | 6 | 6 | 6 | 6 |  |
| 4.5 Concrete |  |  |  |  | 376 | 376 | 376 | 376 | 188 |
| 4.6 Reinforcement |  |  |  |  | 16 | 16 | 16 | 16 | 8 |
| TOTAL | 9 | 9 | 15 | 15 | 407 | 407 | 398 | 398 | 196 |

**Phase 5: Cladding**

5.1 External Façade

Step 3: Determine the total material displacement

* **Total material (glass panes) = Total facade area (m2) / Total material (glass panes)**
* **Total material (glass panes) = (2300m2 x 4 facades) / (1.5m x 3.4m glass panes)**
* **Total material (glass panes) = 1804 glass panes**

Step 4: Divide the total material displacement by the proposed vehicle capacity

* **Total no. of vehicles = Volume of material / vehicle capacity**
* **Total no. of vehicles = 1804 glass panes / 12 glass panes**
* **Total no. of vehicles = 151**

Step 5: Divide the total no. of vehicles by the duration of the phase

* **Monthly no. of vehicles = Total no. of vehicles / duration (months)**
* **Monthly no. of vehicles = 151 / 9**
* **Monthly no. of vehicles = 17**

**Phase 5: Cladding Total**

Step 6: Aggregate the monthly no. of vehicles by month to get a total no. of vehicles for the whole phase

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Apr 2018 | May 2018 | June 2018 | July 2018 | Aug 2018 | Sept 2018 | Oct 2018 | Nov 2018 | Dec 2018 |
| 5.1 Cladding | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 |
| TOTAL | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 | 17 |

**Phase 6: Fit Out, Testing and Commissioning**

6.1 MEP Fix

Step 3, 4 and 5: Ascertain the total no. of vehicles for the sub-phase

* **Monthly no. of vehicles = 120**

6.2 Testing and Commissioning

Step 3, 4 and 5: Ascertain the total no. of vehicles for the sub-phase

* **Monthly no. of vehicles = no. vehicles per week x 4 weeks in a month**
* **Monthly no. of vehicles = 12 x 4**
* **Monthly no. of vehicles = 48**

**Phase 6: Fit Out, Testing and Commissioning Total**

Step 6: Aggregate the monthly no. of vehicles by month to get a total no. of vehicles for the whole phase

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Apr 2018 | May 2018 | [Jun – Nov 2018] | Dec 2018 | Jan 2019 | [Feb – Oct 2019] | Nov 2019 |
| 6.1 MEP Fix | 120 | 120 | 120 | 120 |  |  |  |
| 6.2 Testing and Commissioning  |  |  |  |  | 48 | 48 | 48 |
| TOTAL | 120 | 120 | 120 | 120 | 48 | 48 | 48 |

**REFINE** ANSWERS

**Phase 1: Site Setup and Demolition**

1.1 Surveys

Step 3, 4 and 5: Ascertain the total no. of vehicles for the sub-phase

* **Monthly no. of vehicles = Vehicles per day x duration (working days per month)**
* **Monthly no. of vehicles = 4 x 21**
* **Monthly no. of vehicles = 84**

1.2 Scaffold

Step 3, 4 and 5: Ascertain the monthly no. of vehicles for the sub-phase

* **Monthly no. of vehicles = 24**

1.3 Asbestos Removal

Step 3, 4 and 5: Ascertain the monthly no. of vehicles for the sub-phase

* **Monthly no. of vehicles = Vehicles over duration / duration (months)**
* **Monthly no. of vehicles = 28 / 3**
* **Monthly no. of vehicles = 10 (rounded up)**

1.4 Soft Strip

Step 3, 4 and 5: Ascertain the total no. of vehicles for the sub-phase, and the monthly no. of vehicles

* **Total no. of vehicles = (Vehicles per floor x No. of floors ) + Crane**
* **Total no. of vehicles = (7 x 10) + 2**
* **Total no of vehicles = 72**
* **Monthly no. of vehicles = Total number of vehicles / duration (months)**
* **Monthly no. of vehicles = 72 / 4**
* **Monthly no of vehicles = 18**

1.5 Roof Demolition

Step 3: Determine the total material displacement

* **Total material displacement (m3) = 1,120**

Step 4: Divide the total material displacement by the proposed vehicle capacity

* **Total no. of vehicles = Volume of material / vehicle capacity Total no. of vehicles = 1120 / 14.3**
* **Total no. of vehicles = 79 (rounded up)**

Step 5: Divide the total no. of vehicles by the duration of the phase

* **Monthly no. of vehicles = Total no. of vehicles / duration (months)**
* **Monthly no. of vehicles = 79 / 1**
* **Monthly no. of vehicles = 79**

1.6 Structural Demolition

Step 3: Determine the total material displacement

* **Total material displacement (m3) = 5,600**

Step 4: Divide the total material displacement by the proposed vehicle capacity

* **Total no. of vehicles = Volume of material / vehicle capacity**
* **Total no. of vehicles = 5,600 / 14.3**
* **Total no. of vehicles = 392 (rounded up)**

Step 5: Divide the total no. of vehicles by the duration of the phase

* **Monthly no. of vehicles = Total no. of vehicles / duration (months)**
* **Monthly no. of vehicles = 392 / 1**
* **Monthly no. of vehicles = 392**

1.7 Ground Demolition  ***Proposed Vehicle: 14.3m3 Muck Away HGV***

Step 3: Determine the total material displacement

* **Total material displacement (m3) = 1,680**

Step 4: Divide the total material displacement by the proposed vehicle capacity

* **Total no. of vehicles = Volume of material / vehicle capacity**
* **Total no. of vehicles = 1,680 / 14.3**
* **Total no. of vehicles = 118 (rounded up)**

Step 5: Divide the total no. of vehicles by the duration of the phase

* **Monthly no. of vehicles = Total no. of vehicles / duration (months)**
* **Monthly no. of vehicles = 118 / 1**
* **Monthly no. of vehicles = 118**

**Phase 1: Site Setup and Demolition Total**

Step 6: Aggregate the monthly no. of vehicles by month to get a total no. of vehicles for the whole phase

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Jan2016 | Feb2016 | Mar2016 | Apr2016 | May2016 | Jun2016 | Jul2016 | Aug2016 | Sept2016 |
| 1.1 Surveys | 84 | 84 | 84 | 84 |  |  |  |  |  |
| 1.2 Scaffolding |  | 24 | 24 |  |  |  |  |  |  |
| 1.3 Asbestos Removal |  |  | 10 | 10 | 10 |  |  |  |  |
| 1.4 Soft Strip |  |  |  |  | 18 | 18 | 18 | 18 |  |
| 1.5 Roof Demolition |  |  |  |  |  |  | 79 |  |  |
| 1.6 Structural Demolition |  |  |  |  |  |  |  | 392 |  |
| 1.7 Ground Demolition |  |  |  |  |  |  |  |  | 118 |
| TOTAL | 84 | 108 | 118 | 94 | 28 | 18 | 97 | 410 | 118 |

**Phase 2: Basement Excavation and Piling**

2.1 Removal of Material ***Proposed Vehicle: 14.3m3 Muck Away HGV***

Step 3: Determine the total material displacement

* **Total material (m3) = Total no. of piles x volume of 1 pile (m³)**
* **400 x 7m3 piles = 2,800m3 muck away**

Step 4: Divide the total material displacement by the proposed vehicle capacity

* **Total no. of vehicles = Volume of material / vehicle capacity Total no. of vehicles = 2800 / 14.3**
* **Total no. of vehicles = 196 (rounded up)**

Step 5: Divide the total no. of vehicles by the duration of the phase

* **Monthly no. of vehicles = Total no. of vehicles / duration (months)**
* **Monthly no. of vehicles = 196 / 4**
* **Monthly no. of vehicles = 49**

2.2 Concrete Pour

Step 3: Determine the total material displacement

* **Total material (m3) = Material per pile x no. of piles**
* **Total material (m3) = 7m3 piles x 400**
* **Total material (m3) = 2,800m3 concrete pour**

Step 4: Divide the total material displacement by the proposed vehicle capacity

* **Total no. of vehicles = Volume of material / vehicle capacity**
* **Total no. of vehicles = 2800 / 8**
* **Total no. of vehicles = 350**

Step 5: Divide the total no. of vehicles by the duration of the phase

* **Monthly no. of vehicles = Total no. of vehicles / duration (months)**
* **Monthly no. of vehicles = 350 / 4**
* **Monthly no. of vehicles = 88 (rounded up)**

2.3 Reinforcement

Step 3: Determine the total material displacement

* **Total material (t) = Material per pile x no. of piles**
* **Total material = 400 piles x 1.05t rebar**
* **Total material = 420t rebar**

Step 4: Divide the total material displacement by the proposed vehicle capacity

* **Total no. of vehicles = Volume of material / vehicle capacity**
* **Total no. of vehicles = 420 / 30**
* **Total no. of vehicles = 14**

Step 5: Divide the total no. of vehicles by the duration of the phase

* **Monthly no. of vehicles = Total no. of vehicles / duration (months)**
* **Monthly no. of vehicles = 14/ 4**
* **Monthly no. of vehicles = 4 (rounded up)**

2.4 Basement Excavation ***Proposed Vehicle: 14.3m3 Muck Away HGV***

Step 3: Determine the total material displacement

* **Total material (m3) = 30,800**

Step 4: Divide the total material displacement by the proposed vehicle capacity

* **Total no. of vehicles = Volume of material / vehicle capacity**
* **Total no. of vehicles = 30,800 / 14.3**
* **Total no. of vehicles = 2,154 (rounded up)**

Step 5: Divide the total no. of vehicles by the duration of the phase

* **Monthly no. of vehicles = Total no. of vehicles / duration (months)**
* **Monthly no. of vehicles = 2,154 / 7**
* **Monthly no. of vehicles = 308**

**Phase 2: Basement Excavation and Piling Total**

Step 6: Aggregate the monthly no. of vehicles by month to get a total no. of vehicles for the whole phase

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Sept 2016 | Oct 2016 | Nov 2016 | Dec 2016 | Jan 2017 | Feb 2017 | Mar 2017 | Apr 2017 | May 2017 | Jun 2017 | July 2017 |
| 2.1 Removal of Materials | 49 | 49 | 49 | 49 |  |  |  |  |  |  |  |
| 2.2 Concrete Pour | 88 | 88 | 88 | 88 |  |  |  |  |  |  |  |
| 2.3 Reinforcement | 4 | 4 | 4 | 4 |  |  |  |  |  |  |  |
| 2.4 Basement Excavation |  |  |  |  | 308 | 308 | 308 | 308 | 308 | 308 | 308 |
| TOTAL | 141 | 141 | 141 | 141 | 308 | 308 | 308 | 308 | 308 | 308 | 308 |

**Phase 3: Sub-structure**

3.1 Removal of Material

Step 3: Determine the total material displacement

* **Total material (m3) = Total no. of piles x volume of 1 pile (m3)**
* **Total material (m3) =720 x 3m3 piles**
* **Total material (m3) = 2,160m3 muck away**

Step 4: Divide the total material displacement by the proposed vehicle capacity

* **Total no. of vehicles = Volume of material / vehicle capacity**
* **Total no. of vehicles = 2,160 / 14.3**
* **Total no. of vehicles = 152**

Step 5: Divide the total no. of vehicles by the duration of the phase

* **Monthly no. of vehicles = Total no. of vehicles / duration (months)**
* **Monthly no. of vehicles = 152 / 4**
* **Monthly no. of vehicles = 38**

3.2 Concrete Pour

Step 3: Determine the total material displacement

* **Total material (m3) = Total no. of piles x volume of 1 pile (m3)**
* **Total material (m3) = 720 x 3m3 piles**
* **Total material (m3) = 2,160m3 concrete**

Step 4: Divide the total material displacement by the proposed vehicle capacity

* **Total no. of vehicles = Volume of material / vehicle capacity**
* **Total no. of vehicles = 2,160 / 8**
* **Total no. of vehicles = 270**

Step 5: Divide the total no. of vehicles by the duration of the phase

* **Monthly no. of vehicles = Total no. of vehicles / duration (months)**
* **Monthly no. of vehicles = 270 / 4**
* **Monthly no. of vehicles = 68 (rounded up)**

3.3 Reinforcement

Step 3: Determine the total material displacement

* **Total material (t) = Total no. of piles x volume of 1 pile (t)**
* **720 piles x 0.475t rebar = 342t rebar**

Step 4: Divide the total material displacement by the proposed vehicle capacity

* **Total no. of vehicles = Volume of material / vehicle capacity**
* **Total no. of vehicles = 342 / 30**
* **Total no. of vehicles = 12 (rounded up)**

Step 5: Divide the total no. of vehicles by the duration of the phase

* **Monthly no. of vehicles = Total no. of vehicles / duration (months)**
* **Monthly no. of vehicles = 12/ 4**
* **Monthly no. of vehicles = 3**

3.5 Trim Piles: Removal of Material

Step 3: Determine the total material displacement

* **Total material (m³) = Total no. of piles x trim volume of 1 pile (m3)**
* **Total material (m³) = 720 piles x 0.15m³**
* **Total material (m³) = 108m³**

Step 4: Divide the total material displacement by the proposed vehicle capacity

* **Total no. of vehicles = Trim volume of material / vehicle capacity**
* **Total no. of vehicles = 108 / 14.3**
* **Total no. of vehicles = 8**

Step 5: Divide the total no. of vehicles by the duration of the phase

* **Monthly no. of vehicles = Total no. of vehicles / duration (months)**
* **Monthly no. of vehicles = 8 / 4**
* **Monthly no. of vehicles = 2**

3.6 Pile Caps: Concrete Pour

Step 3: Determine the total material displacement

**No. Pile Caps = No. Piles / No. Caps per Pile Total Concrete = No. Pile Caps x Cap Volume**

**No. Pile Caps = 720 / 4 Total Concrete = 180 x 2**

**No. Pile Caps = 180 Total Concrete = 360m3**

Step 4: Divide the total material displacement by the proposed vehicle capacity

* **Total no. of vehicles = Total Concrete / Vehicle Capacity Total no. of vehicles = 360 / 8**
* **Total no. of vehicles = 45**

Step 5: Divide the total no. of vehicles by the duration of the phase

* **Monthly no. of vehicles = Total no. of vehicles / duration (months)**
* **Monthly no. of vehicles = 45 / 3**
* **Monthly no. of vehicles = 15**

3.7 Pile Caps: Reinforcement

Step 3: Determine the total material displacement

* **Total material (t) = Total no. of piles caps x volume of 1 pile cap (t)**
* **Total material (t) = 180 x 0.5**
* **Total material = 90**

Step 4: Divide the total material displacement by the proposed vehicle capacity

* **Total no. of vehicles = Volume of material / vehicle capacity**
* **Total no. of vehicles = 90 / 30**
* **Total no. of vehicles = 3**

Step 5: Divide the total no. of vehicles by the duration of the phase

* **Monthly no. of vehicles = Total no. of vehicles / duration (months)**
* **Monthly no. of vehicles = 3 / 3**
* **Monthly no. of vehicles = 1**

**Phase 3: Sub-structure Total**

Step 6: Aggregate the monthly no. of vehicles by month to get a total no. of vehicles for the whole phase

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | July 2017 | Aug 2017 | Sept 2017 | Oct 2017 | Nov 2017 | Dec 2017 | Jan 2018 |
| 3.1 Removal of Material | 38 | 38 | 38 | 38 |  |  |  |
| 3.2 Concrete Pour | 68 | 68 | 68 | 68 |  |  |  |
| 3.3 Reinforcement | 3 | 3 | 3 | 3 |  |  |  |
| 3.4 Trim Piles | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| 3.5 Removal of Materials | 2 | 2 | 2 | 2 |  |  |  |
| 3.6 Concrete Pour |  |  |  |  | 15 | 15 | 15 |
| 3.7 Reinforcement |  |  |  |  | 1 | 1 | 1 |
| TOTAL | 112 | 112 | 112 | 112 | 17 | 17 | 17 |

**Phase 4: Super-structure**

4.1 Concrete Pour

Step 3: Determine the total material displacement

* **Total material (m3) = 250m3 concrete**

Step 4: Divide the total material displacement by the proposed vehicle capacity

* **Total no. of vehicles = Volume of material / vehicle capacity**
* **Total no. of vehicles = 250 / 8**
* **Total no. of vehicles = 32 (rounded up)**

Step 5: Divide the total no. of vehicles by the duration of the phase

* **Monthly no. of vehicles = Total no. of vehicles / duration (months)**
* **Monthly no. of vehicles = 32 / 6**
* **Monthly no. of vehicles = 6 (rounded up)**

4.2 Reinforcement

Step 3: Determine the total material displacement

* **Total material (t) = material per floor x no. of floors**
* **Total material = 3.75t x 10**
* **Total material = 37.5t**

Step 4: Divide the total material displacement by the proposed vehicle capacity

* **Total no. of vehicles = Volume of material / vehicle capacity**
* **Total no. of vehicles = 37.5 / 30**
* **Total no. of vehicles = 2 (rounded up)**

Step 5: Divide the total no. of vehicles by the duration of the phase

* **Monthly no. of vehicles = Total no. of vehicles / duration (months)**
* **Monthly no. of vehicles = 2 / 6**
* **Monthly no. of vehicles = 1 (rounded up)**

4.3 Precast Stairs

Step 3: Determine the total material displacement

* **Total material (prefab units) = 36**

Step 4: Divide the total material displacement by the proposed vehicle capacity

* **Total no. of vehicles = Volume of material / vehicle capacity**
* **Total no. of vehicles = 36 / 3**
* **Total no. of vehicles = 12**

Step 5: Divide the total no. of vehicles by the duration of the phase

* **Monthly no. of vehicles = Total no. of vehicles / duration (months)**
* **Monthly no. of vehicles = 12 / 6**
* **Monthly no. of vehicles = 2**

4.4 Steel Frame

Step 3: Determine the total material displacement

* **Total material (t) = 1000**

Step 4: Divide the total material displacement by the proposed vehicle capacity

* **Total no. of vehicles = Volume of material / vehicle capacity**
* **Total no. of vehicles = 1000 / 30**
* **Total no. of vehicles = 34 (rounded up)**

Step 5: Divide the total no. of vehicles by the duration of the phase

* **Monthly no. of vehicles = Total no. of vehicles / duration (months)**
* **Monthly no. of vehicles = 34 / 6**
* **Monthly no. of vehicles = 6 (rounded up)**

4.5 Concrete

Step 3: Determine the total material displacement

* **Total material (m3) = (Typical Floor x 7) + Floor 8 + Floor 9**
* **Total material (m3) = (1,680 x 7) + 1,075 + 690**
* **Total material (m3) = 13,525**

Step 4: Divide the total material displacement by the proposed vehicle capacity

* **Total no. of vehicles = Volume of material / vehicle capacity**
* **Total no. of vehicles = 13,525 / 8**
* **Total no. of vehicles = 1691 (rounded up)**

Step 5: Divide the total no. of vehicles by the duration of the phase

* **Monthly no. of vehicles = Total no. of vehicles / duration (months)**
* **Monthly no. of vehicles = 1691 / 4.5**
* **Monthly no. of vehicles = 376 (rounded up)**

4.6 Reinforcement

Step 3: Determine the total material displacement

* **Total material (t) = (Typical Floor x 7) + Floor 8 + Floor 9**
* **Total material (t) = (252 x 7) + 162 + 104**
* **Total material (t) = 2030**

Step 4: Divide the total material displacement by the proposed vehicle capacity

* **Total no. of vehicles = Volume of material / vehicle capacity**
* **Total no. of vehicles = 2170 / 30**
* **Total no. of vehicles = 68 (rounded up)**

Step 5: Divide the total no. of vehicles by the duration of the phase

* **Monthly no. of vehicles = Total no. of vehicles / duration (months)**
* **Monthly no. of vehicles = 73 / 4.5**
* **Monthly no. of vehicles = 16 (rounded up)**

**Phase 4: Super-structure Total**

Step 6: Aggregate the monthly no. of vehicles by month to get a total no. of vehicles for the whole phase

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Oct 2017 | Nov 2017 | Dec 2017 | Jan 2018 | Feb 2018 | Mar 2018 | Apr 2018 | May 2018 | June 2018 |
| 4.1 Concrete Pour | 6 | 6 | 6 | 6 | 6 | 6 |  |  |  |
| 4.2 Reinforcement | 1 | 1 | 1 | 1 | 1 | 1 |  |  |  |
| 4.3 Precast Stairs | 2 | 2 | 2 | 2 | 2 | 2 |  |  |  |
| 4.4 Steel Frame |  |  | 6 | 6 | 6 | 6 | 6 | 6 |  |
| 4.5 Concrete |  |  |  |  | 376 | 376 | 376 | 376 | 188 |
| 4.6 Reinforcement |  |  |  |  | 16 | 16 | 16 | 16 | 8 |
| TOTAL | 9 | 9 | 15 | 15 | 407 | 407 | 398 | 398 | 196 |

**Phase 5: Cladding**

5.1 External Façade Proposed Vehicle: 30t Flatbed HGV

Apr 2018 - Dec 2018 (9 Months) Consolidation Centre = 68% Reduction

Step 3: Determine the total material displacement

* **Total material (glass panes) = Total facade area (m2) / Total material (glass panes)**
* **Total material (glass panes) = (2300m2 x 4 facades) / (1.5m x 3.4m glass panes)**
* **Total material (glass panes) = 1804 glass panes**

Step 4: Divide the total material displacement by the proposed vehicle capacity

* **Total no. of vehicles = Volume of material / vehicle capacity**
* **Total no. of vehicles = 1804 glass panes / 12 glass panes**
* **Total no. of vehicles = 151**

Step 5: Divide the total no. of vehicles by the duration of the phase

* **Monthly no. of vehicles = Total no. of vehicles / duration (months)**
* **Monthly no. of vehicles = 151 / 9**
* **Monthly no. of vehicles = 17**

Apply Planned Measure:

* **Refined Monthly no. of vehicles = Monthly no. of vehicles x (100 - planned measure reduction (%))**
* **Refined Monthly no. of vehicles = 17 x (100-68%) = 17 x 32%**
* **Refined Monthly no. of vehicles = 6 (rounded up)**

**Phase 5: Cladding Total**

Step 6: Aggregate the monthly no. of vehicles by month to get a total no. of vehicles for the whole phase

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Apr 2018 | May 2018 | June 2018 | July 2018 | Aug 2018 | Sept 2018 | Oct 2018 | Nov 2018 | Dec 2018 |
| 5.1 Cladding | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |
| TOTAL | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 | 6 |

**Phase 6: Fit Out, Testing and Commissioning**

6.1 MEP Fix Proposed Vehicle: 30t Flatbed HGV

Apr 2018 - Dec 2018 (9 Months) Modular Construction = 60% Reduction

Consolidation Centre = 68% Reduction

Step 3, 4 and 5: Ascertain the total no. of vehicles for the sub-phase

* **Monthly no. of vehicles = 120**

Apply Planned Measure:

* **Refined Monthly no. of vehicles = Monthly no. of vehicles x (100 - planned measure reduction (%))**
* **Refined Monthly no. of vehicles = 120 x (100-60%) = 120 x 40%**
* **Refined Monthly no. of vehicles = 48**
* **Refined Monthly no. of vehicles = Monthly no. of vehicles x (100 - planned measure reduction (%))**
* **Refined Monthly no. of vehicles = 48 x (100-68%) = 48 x 32%**
* **Refined Monthly no. of vehicles = 16 (rounded up)**

6.2 Testing and Commissioning

Step 3, 4 and 5: Ascertain the total no. of vehicles for the sub-phase

* **Monthly no. of vehicles = No. vans per week x 4 weeks in a month**
* **Monthly no. of vehicles = 12 x 4**
* **Monthly no. of vehicles = 48**

**Phase 6: Fit Out, Testing and Commissioning Total**

Step 6: Aggregate the monthly no. of vehicles by month to get a total no. of vehicles for the whole phase

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | Apr 2018 | May 2018 | [Jun – Nov 2018] | Dec 2018 | Jan 2019 | [Feb – Oct 2019] | Nov 2019 |
| 6.1 MEP Fix | 16 | 16 | 16 | 16 |  |  |  |
| 6.2 Testing and Commissioning |  |  |  |  | 48 | 48 | 48 |
| TOTAL | 16 | 16 | 16 | 16 | 48 | 48 | 48 |