# THE POTENTIAL BENEFITS OF DRONE DELIVERY FOR AUSTRALIAN CONSTRUCTION AND MAINTENANCE

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## Each year in Australia, construction and maintenance work is impacted by 60 million unplanned trips to the store

- Tradespeople leave the worksite **60 million** times a year to replace hardware items that have run out or that are needed to complete a specific task
- At an average of **one hour each**, these unplanned trips represent more than **$2 billion** annually in labour and vehicle costs

## By replacing a share of these trips, drones will deliver…

### BENEFITS FOR HOUSEHOLDS

Save an annual **$120 million** on construction and maintenance work

Save up to **$2,500** and reduce build time by **1 week** on a $250,000 renovation

…or up to **$250** and **1 day** on a $25,000 kitchen or bathroom renovation[1]

Save **1.5 million hours** of time spent waiting for tradespeople to pick up items during maintenance jobs by replacing **10%** of trips to the store

### BENEFITS FOR CONSTRUCTION TRADESPEOPLE

Save construction businesses **$230 million** a year in labour and vehicle expenses

Free up time for a trades team to complete **1 more construction project** per year[1,2]

Save apprentices **2-3 days** a year in time spent picking up items offsite, freeing up time for on-the-job learning

### BENEFITS FOR MAINTENANCE TRADESPEOPLE

Save **$55 million** of costs by replacing **10%** of unplanned trips to the store

Free up time for a tradesperson to complete **10 more** maintenance jobs per year[1]

Note: Figures are rounded. Impact estimates imply a mature drone industry (modelled for the year 2030). Benefits are estimated for small drones only. Amounts are specified in 2019 Australian dollars. National totals imply that tradespeople use drones to replace 30% of unplanned trips within range and size restrictions (or 10-15% of all unplanned trips). See Appendix for details.

1 Best case impacts on individual projects and tradespeople are estimated by assuming tradespeople use drones in all cases within range and size restrictions. See Appendix for details.

2 Example for a trades team of 3 people working on home renovations, spending 3 weeks on each project and using drones to deliver all small items. Each project involves multiple trades teams.

# BENEFITS FOR AUSTRALIAN CONSTRUCTION AND MAINTENANCE

This paper has been prepared by AlphaBeta for Wing. It is an addendum to the original reports entitled 'Faster, greener and less expensive: The potential impact of delivery drones in Queensland', which was released in 2019, and 'Faster, greener and less expensive: The potential impact of delivery drones in the Australian Capital Territory', which was released in 2018.

The amounts in this report are estimated and specified in 2019 Australian dollars. All statistics are national (rather than state or territory specific) unless otherwise noted.

# THE COST OF UNPLANNED TRIPS

Unplanned trips to the store represent a significant cost to Australia's construction and maintenance industries. Across the country, tradespeople such as builders make a total of 60 million unplanned trips to the store each year to collect hardware items that they have either run out of or didn't know they needed until commencing the job. These interruptions are costly. At an average of one hour each, they amount to $2 billion annually in labour and vehicle costs. They can also result in larger workflow disruptions, leading to lost time for clients and, in some cases, expensive contract penalties for delayed projects.

Residential construction projects account for more than a third of these unplanned trips (23 million) due to the size of the segment and the nature of these worksites. Each year, Australia spends $70 billion on residential construction projects, including some 150,000 new homes and major renovations.[1] These worksites have limited administrative support and storage space for on-site inventory, meaning tradespeople are more likely to run out of items such as paint brushes, spark plugs, drill bits and others, and require a trip to the hardware store. Reducing these trips would benefit homeowners, construction and maintenance businesses, while amplifying the impact of the Federal Government's HomeBuilder stimulus package which will fund 27,000 new projects in the coming months.

Even in non-residential projects, which are typically supported by administrative personnel such as quantity surveyors and dedicated purchasers, last-minute hardware shortages remain to some degree unavoidable. Trades teams on small and medium infrastructure projects make an average of one unplanned trip every two days to collect small tools and equipment such as nuts, bolts, switches and other hardware items. These trips represent a significant opportunity to improve productivity as governments look to fund more infrastructure in response to COVID-19.

For maintenance tradespeople such as plumbers, electricians, general maintenance and others, unplanned trips to the hardware store are typically needed once in every three jobs. Maintenance tradespeople often cannot determine the exact tools, materials or components they need for a job until physically inspecting the site. Most try to avoid unnecessary travel by arriving with an arsenal of common spare parts. Still, maintenance tradespeople make an estimated total of 15 million unplanned trips to the hardware store each year.

1 The 150,000 estimate includes 110,000 home building projects and 40,000 'significant renovations' worth $200,000 or more.

# CASE STUDY

## How a single delivery could ensure projects run to plan

Most building projects involve plumbers, carpenters, electricians and other trades who work in concert to meet contractual timeframes. A single missing part can disrupt the entire schedule.

After 30+ years in the industry, East Melbourne property developer Lyman Deng is enthusiastic about the prospect of on-demand hardware delivery, which he expects will cut costs and help projects run more smoothly.

“There are many things that go wrong on a construction site: parts can break; they can go missing; you can run out of the supplies you need; and you could have also ordered the wrong materials,” says Deng, a Partner at Global Design.

When additional materials are needed on site, tradespeople currently stop work to go to a store. Individual trips may not take long, averaging 30-90 minutes per trip. However, productivity costs and flow-on effects are more severe.

For example, an hour-long carpentry delay may mean that electricians cannot finish their work until the next day. As tradespeople often schedule back-to-back projects during busy periods, the electrician may not be available for several more days, holding up other tradespeople such as painters.

"If we are unable to get the materials we need, it is very costly,” Deng says. “Often one trade connects with another, and if one team is held up then so are others. This creates flow-on effects for work schedules and can delay projects.”

"Being able to have something delivered in 10 minutes would greatly benefit builders. It would save costs and also ensure the project runs according to plan.”

# THE ROLE OF DELIVERY DRONES

Drones are a faster and less expensive way to transport items from hardware stores to worksites, compared with having professional tradespeople personally travel to pick them up. Using small delivery drones in this context can benefit households, industry and government.

- **Households will save money and spend less time waiting for tradespeople.** By avoiding disruptions to homebuilding projects and allowing maintenance tasks to be completed in a single visit, delivery drones could save households a total of $120 million a year. By using drones, the typical $250,000 renovation project could be completed a week faster and could save as much as $2,500. Similarly, a $25,000 renovation (for example, a new kitchen or bathroom) could be completed half a day faster and could save $250. Across Australia, households will save 1.5 million hours otherwise spent waiting for maintenance tradespeople to leave the site and pick up items from the store by replacing 10% of unplanned trips.
- **The construction industry will complete more projects and offer better opportunities for apprentices.** Delivery drones could generate $230 million in annual cost savings for the construction industry. The average project that uses drones to deliver all small items could see a reduction of two full weeks of worker hours, while also avoiding more serious disruptions that can delay some projects up to several weeks. With those savings, construction trades teams could complete an additional construction project each year. Apprentices are often tasked with many last-minute hardware pick-ups and could repurpose 2-3 days per year towards higher-value tasks and on-the-job learning.
- **Maintenance work will become more efficient, allowing businesses to take on more jobs per year.** Maintenance tradespeople deal with unpredictable projects and typically need to make multiple unplanned visits to the store each day. For approximately 1 in 3 jobs, tradespeople do not have the parts or materials they need and may need to travel to and from the site a second time. Delivery drones could avoid 10% of second visits (or 1.5 million per year), saving the maintenance industry up to an estimated total of $55 million in labour and vehicle costs. A tradesperson using drones to deliver all of their small items could free up enough time to complete an additional 10 maintenance/repair jobs per year.
- **Government will save time and money, particularly for social infrastructure projects.** Federal, state and local governments could save up to an estimated total of $30 million a year in project costs, especially for social infrastructure such as schools, social housing, healthcare and recreational facilities. Efficiency gains from hardware delivery drones could reduce project timelines, amplifying the impact of important new initiatives including the infrastructure stimulus packages introduced in response to COVID-19.

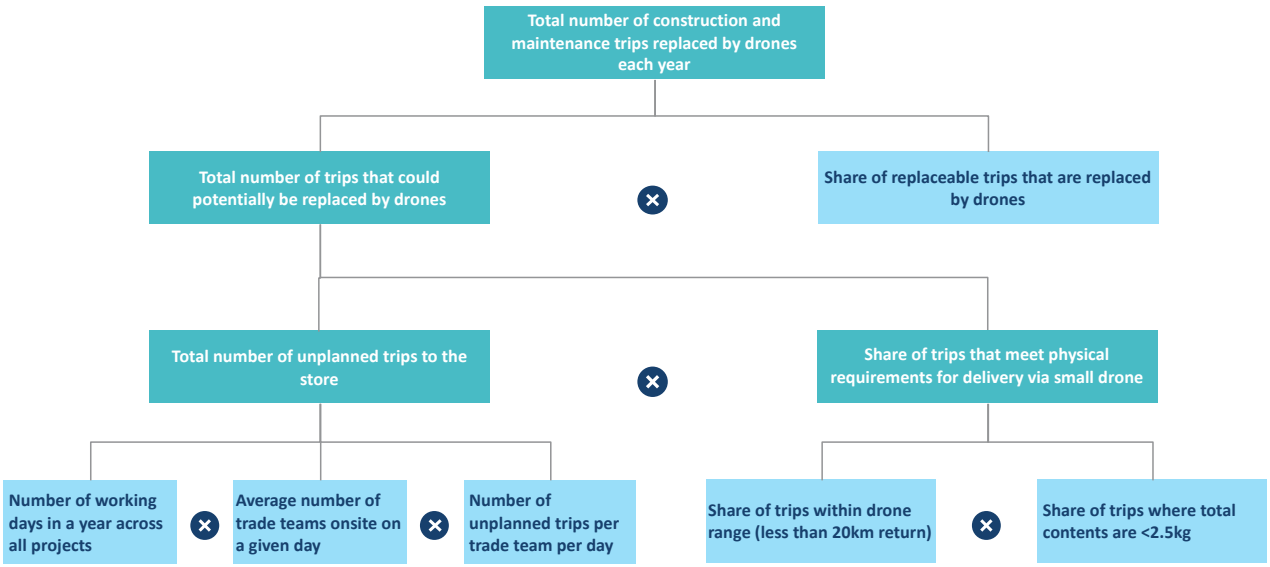
# APPENDIX – Detailed methodology

## Step 1 – Estimating the number of trips

The first step in estimating the benefits of drone delivery for Australian construction and maintenance is estimating the total number of trips that drones could replace (Exhibits 1-3).

## Exhibit 1

### Estimating the total number of trips replaced by drones



# Exhibit 2

## Inputs and sources for calculating total number of trips replaced by drones

| Area | Metric | Source |
|---|---|---|
| Adoption of drone delivery | Share of replaceable trips that are replaced by drones | When reporting national totals, it is assumed that 30% of unplanned trips within range and size restrictions are replaced by drones, consistent with adoption rates used in AlphaBeta (2019), 'Faster, Greener and Less Expensive: The Potential Impact of Delivery Drones in Queensland' |
| Share of trips that meet physical requirements for delivery via small drone | Share of trips where total contents <2.5kg and fits in small box | Interviews with 15 construction and maintenance professionals |
| | Share of trips within drone range (less than 20km return) | |
| Total number of unplanned trips to the store | Average frequency of an unplanned trip for each project type | Interviews with construction and maintenance professionals (see Exhibit 3) |
| | Average time away from site, per trip (hours) | |
| | Average sites per project | ABS (2019) 8752.0 - Building Activity (Value of Building Work Done)<br>ABS (2019) 6302.0 – Average Weekly Earnings (Construction)<br>Interviews with 14 construction and maintenance professionals |
| | Average working days per project | |
| | Average teams per site | |
| | Number of projects completed a year for each segment | *Construction:*<br>*ABS (2019) 8752.0 - Building Activity (Number of Dwelling Unit Completions)*<br>*ABS (2019) 8755.0 – Construction Work Done*<br>*Maintenance: ABS Census (2016) employment counts of relevant occupations and industries for bottom up estimate, combined with interviews with maintenance professionals. Verified by industry valuation from IBISWorld* |

The number of unplanned trips per day was estimated separately for each segment of construction and maintenance. The frequency of unplanned trips (and the primary reasons for these trips) was obtained from interviews with 15 construction and maintenance professionals (Exhibit 3).

# Exhibit 3

## The use case for delivery using small drones is most clear for residential and smaller non-residential projects

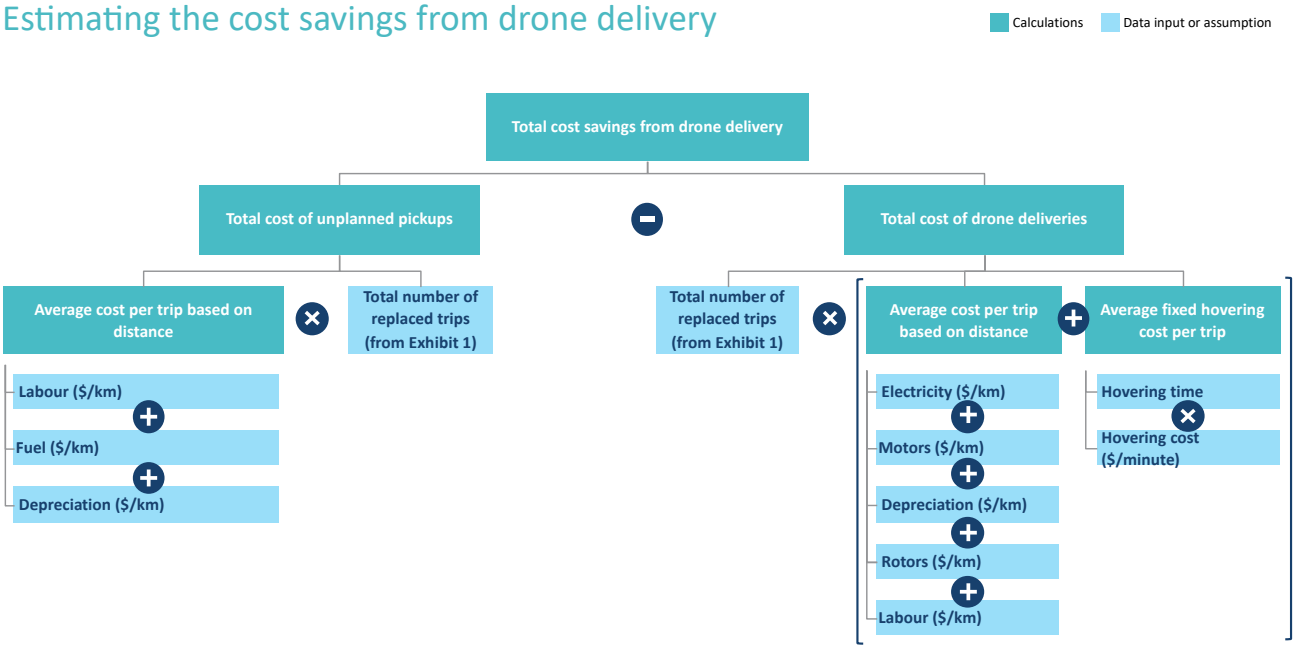
| Segments of construction sector | | Examples | Feasibility of drone delivery and rationale | Frequency of unplanned trips to store |
|---|---|---|---|---|
| Residential | Building | ▪ Home builds<br>▪ Renovations | Workers typically hold limited inventories or require items they did not know they needed | ~1 trip per day per trade |
| | Maintenance | ▪ Generalists<br>▪ Plumbers<br>▪ Electricians<br>▪ Tilers<br>▪ Painters | Jobs often involve collecting items that are difficult to predict in advance | ~1 trip for every three jobs |
| Non-residential | Small/medium | ▪ Schools<br>▪ Public housing<br>▪ Other educational facilities<br>▪ Recreational facilities<br>▪ Healthcare facilities | Quantity surveyors and purchasers are not able to account for all circumstances and unplanned trips still occur | ~1 trip every two days per trade |
| | Large | ▪ Highways<br>▪ Bridges<br>▪ Railways<br>▪ Utilities<br>▪ Office towers<br>▪ Industrial facilities | Large projects have more rigorous inventory and supply management, and typically order in large quantities | ~1 trip (or fewer) per week per trade |

## Step 2 – Estimating the impact of delivery drones

Using the estimated number of replaced trips, it is possible to calculate the total cost savings from drone deliveries. This can be done by subtracting the total cost of unplanned pickups by the total cost of drone deliveries (Exhibits 4 & 5).

# Exhibit 4

## Estimating the cost savings from drone delivery




# Exhibit 5

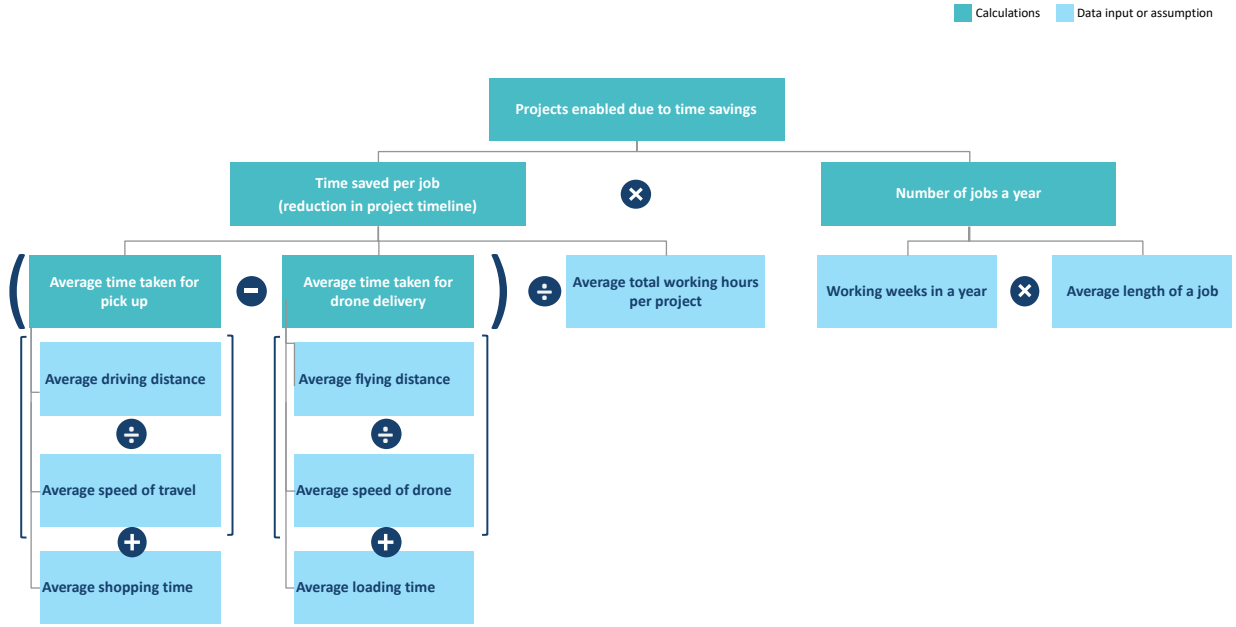
## Inputs and sources for calculating cost savings from drone delivery

| Area | Metric | Source |
|---|---|---|
| Total cost of unplanned pickups | ▪ Labour ($/km) | ▪ ABS (2019) Average Weekly Earnings<br>▪ Interviews with construction workers and experts to sense-check time saved per trade team |
| | ▪ Fuel ($/km) | ▪ Australian Institute of Petroleum (2018) |
| | ▪ Depreciation ($/km) | ▪ Carsguide: Toyota HiLux (2014) |
| Average cost per trip based on distance | ▪ Electricity ($/km) | ▪ Consistent with modelling undertaken by AlphaBeta (2019), 'Faster, Greener and Less Expensive: The Potential Impact of Delivery Drones in Queensland' |
| | ▪ Motors ($/km) | |
| | ▪ Depreciation ($/km) | |
| | ▪ Rotors ($/km) | |
| | ▪ Labour ($/km) | |
| | ▪ Hovering time | |
| | ▪ Hovering cost ($/time) | |

Additional new projects and project timeline savings were calculated in a similar way to cost savings. Time savings were calculated per project, expressed as share of total working hours and multiplied by total number of jobs in a year (Exhibits 6 & 7).

# Exhibit 6

## Estimating additional projects enabled due to time savings




# Exhibit 7

## Inputs and sources for calculating additional projects enabled due to time savings

| Area | Metric | Source |
|---|---|---|
| Time saving per job | ▪ Average driving distance | ▪ Interviews with construction and maintenance professionals |
| | ▪ Average speed of travel | |
| | ▪ Average shopping time | |
| | ▪ Average total working hours per project | |
| | ▪ Average flying distance | ▪ Consistent with modelling undertaken by AlphaBeta (2019), 'Faster, Greener and Less Expensive: The Potential Impact of Delivery Drones in Queensland |
| | ▪ Average speed of drone | |
| | ▪ Average loading time | |
| Number of jobs a year | ▪ Working weeks in a year | ▪ Interviews with construction and maintenance professionals |
| | ▪ Average length of a job | |

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