

## PEBBLE™ INSTALLATION GUIDE

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## Revision History

| Revision | Date       | Description                                 |
|----------|------------|---------------------------------------------|
| -        | 03/03/2020 | Initial Draft (shared with REWS and Arrive) |
| v1       | 09/09/2020 | Final v1 release for REWS installs          |
|          |            |                                             |
|          |            |                                             |
|          |            |                                             |

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# I. Introduction to Pebble

A robust understanding of real-time and historical conditions is key to improving the management of urban infrastructure. While many cities and parking operators wish to have accurate, low-latency parking data, existing market solutions have been too expensive to implement widely.

**Pebble™** is a high-accuracy, low-cost, low-power, privacy-conscious occupancy sensor that is easy and inexpensive to install and maintain. Pebble™ greatly reduces the costs of deploying high-accuracy occupancy sensing in the urban realm.

**Pebble™** consists of two key hardware components: a fully wireless, solar-powered gateway and a network of sensors that are installed on a street surface with adhesive or epoxy.



## II. Regulatory Notice

### FCC COMPLIANCE STATEMENT

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

This device complies with Part 15 of the FCC Rules. Operation to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

CAUTION: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

This equipment should be installed and operated with a minimum distance of 20cm between the radiator and your body. This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.

### CANADA - ISED COMPLIANCE STATEMENT

This device complies with Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage

radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

This equipment should be installed and operated with a minimum distance of 20cm between the radiator and your body. This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.

Cet équipement doit être installé et utilisé avec une distance minimale de 20 cm entre le radiateur et votre corps. Cet appareil et son (ses) antenne (s) ne doivent pas être co-localisés ou utilisés conjointement avec une autre antenne ou un autre émetteur.

### III. What comes in the box?

#### Hardware:

- **Pebbles:** Puck-sized vehicle occupancy sensors (72mm diameter x 13.4mm thick)
- **Gateways:** Manage the transmission of data between Pebbles and the cloud database. Communicates with Pebbles over a proprietary radio signal, and backhauls data to the cloud using a cellular connection. Solar powered, with optional wired power for low light / underground conditions.

#### Software:

- **Installer:** A web application that is provided to assign Pebbles to digital spaces. This application should be used to record the Pebble IDs in each space as they are deployed.
- **Reporting:** A web application that is provided to view real time Pebble data and run analyses.

### IV. Materials and tools required

#### Gateway installation tools

- Hose clamp (included)
- Banding straps (included)
- **Tools not included:**
  - Ladder and/or lift for elevated mounting of gateways
  - Pliers (for tightening hose clamp)
  - Clippers (for trimming hose clamp)
  - If mounting to a building facade, may require additional tools

## Pebble installation tools (1 kit included per 1000 sensors)

*Note: one kit is required for each two-person installation team*

- [100' chalk line](#)
- [Measuring tape](#)
- [11 x 17" clipboard](#)
- Pencils
- [Playground chalk](#)
- [Magnet](#)
- Adhesive pads for removable installations (included) or road epoxy for permanent installations ([Epoplex MA-50](#))

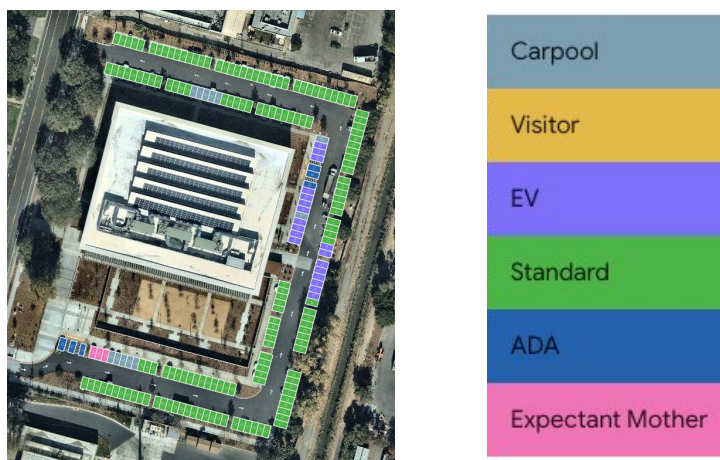
## Recommended additional items

- A broom for sweeping leaves and/or other debris

# V. Preparing an installation

## Setting up your lots in Planner

All digital lots will be created in advance of installation. The lots will show the location of each parking space, as well as a parking space type (indicated by color). Example:



A unique URL for each deployment location will be provided, and can be accessed on any mobile device using Google login (GAIA).

*Note: we require a list of the names / email addresses of each member of the installation team one week in advance of deployment to grant access to the tool*

## Selecting locations for gateways

We will provide a map with a recommended placement for each gateway (example below). You will need to identify a suitable pole or other piece of infrastructure that is appropriate for gateway mounting, as close to the recommended location as possible.



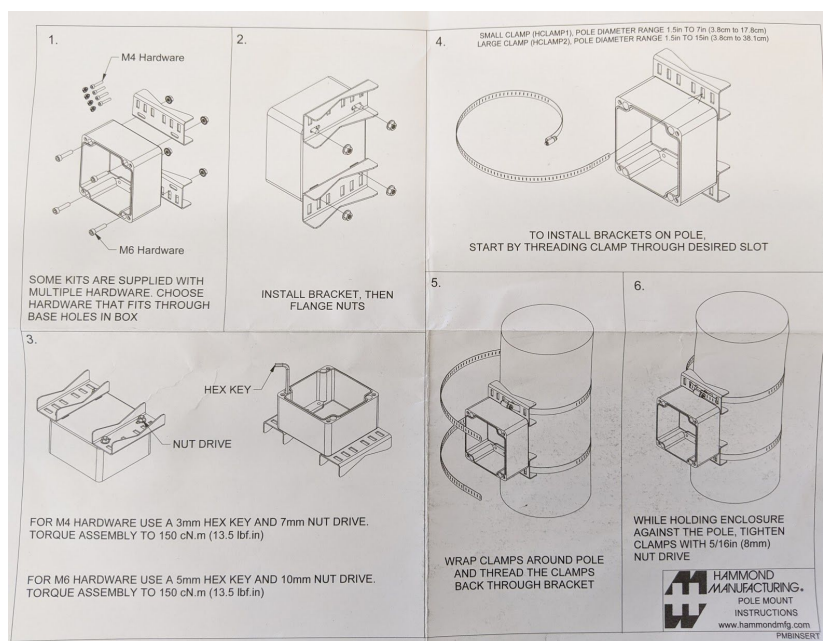
## VI. Installing gateways

First, you will be installing gateways that manage communications between Pebbles and the server. It is important to install the gateways first because Pebbles that are activated out of range of a gateway will drain battery faster than normal while searching for a gateway pairing. We estimate that installing gateways should not take longer than 45 minutes per gateway, but will depend heavily on the installation location and equipment required to access it.

Below are the steps for installing gateways:

1. Mount the gateway
  - a. Select a mounting location and orientation. If possible, the gateway should be mounted with the solar panel facing south (orientation does not need to be exact, but effort should be made to expose the panel to as much light as possible)
  - b. [Using the pole mounting kit](#), attach the metal brackets to the outer flange on the top and bottom of the enclosure using a nut/bolt assembly
  - c. Attach the gateway to a pole (with the two longer antennas pointing      ), by running the hose clamp through the slots on each metal bracket, wrap around pole, and thread back through a slot on the bracket
  - d. While holding the enclosure tight against the pole, tighten the clamp with 5/16in (8mm) nut drive

*Note: if mounting to a pole is not possible, the gateway may be mounted to a building facade using the same mounting holes. Mounting instructions will depend on your building.*

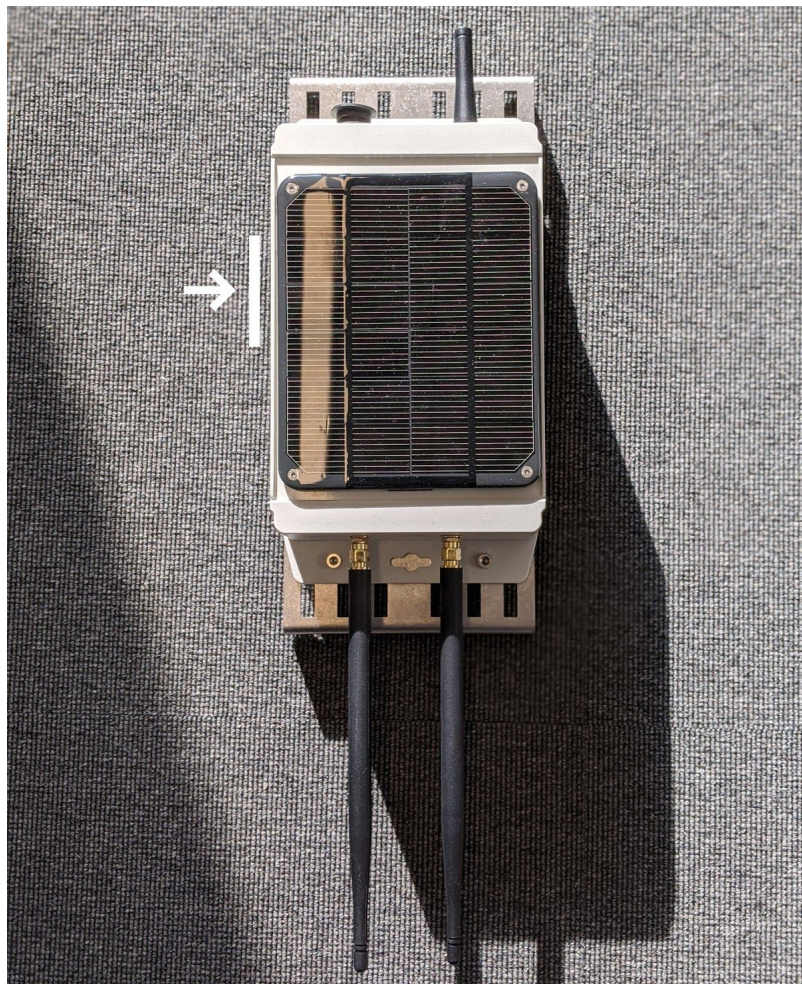


## 2. (Optional: connect to a power source)

If the gateway is placed in a location that does not get consistent sunlight, you may need to connect it to a power source. There is an exposed Micro-USB port on the enclosure which can be connected to a 0.5A 5V DC power source with a Micro-USB cable/connector (the port is waterproof (IP67) when the cap is secured).

## 3. Activate the gateway

- a. Activate the gateway by pressing the magnetic wand against the surface of the case at the below position for 5 seconds to activate it:



*Tip: there is currently no indicator light that signals when a Gateway has been activated. After installing an entire lot, we recommend checking that each Pebble is online - see section [VII. Testing Pebbles](#).*

4. Repeat steps 1-4 for all gateways in your deployment

## VII. Installing Pebbles

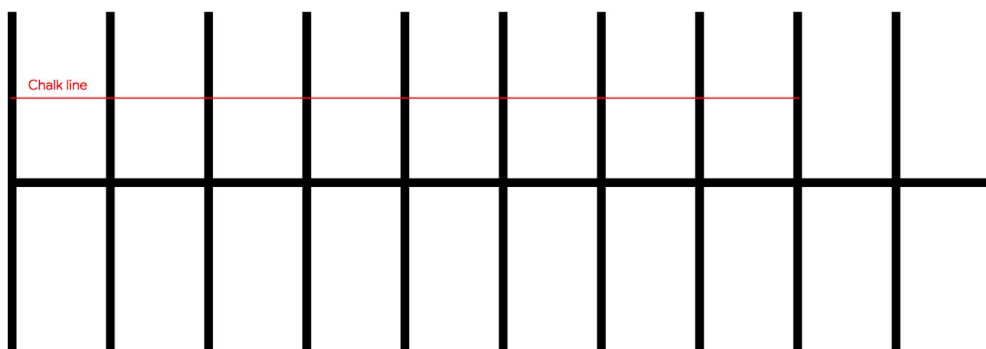
Next, you will be installing Pebbles in each parking space at your deployment. We estimate that installing Pebbles will take 2-3 minutes per space. When installing Pebbles, we recommend you start with the parking spaces closest to the gateway, and work your way away from the gateway.

Below are the steps for installing Pebbles:

1. Create a straight chalk line

- a. Unwind a chalk line approximately 100 feet.
- b. Have two people extend the chalk line through the middle of 6-8 parking spaces.
- c. Snap the chalk line, leaving a straight line of chalk through the parking spaces.

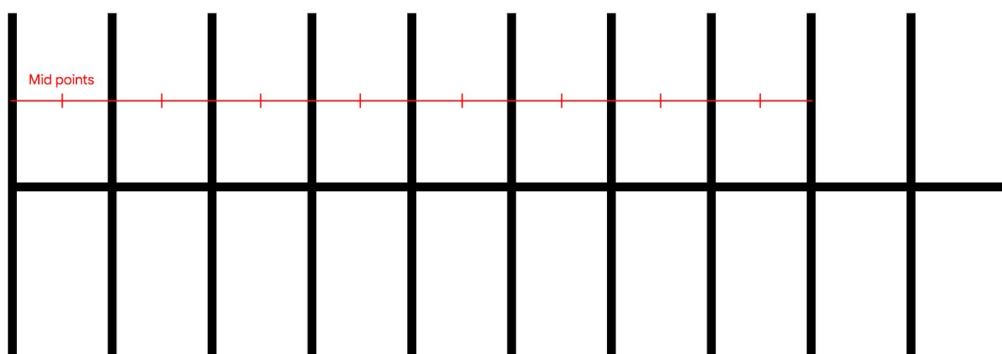
*Tip: you may have to snap the chalk line multiple times to leave a clear chalk mark.*



2. Mark midpoints

- a. Start at one end of the chalk line
- b. Use a measuring tape to find the midpoint of each parking space
- c. Mark the midpoint of each spacing using chalk

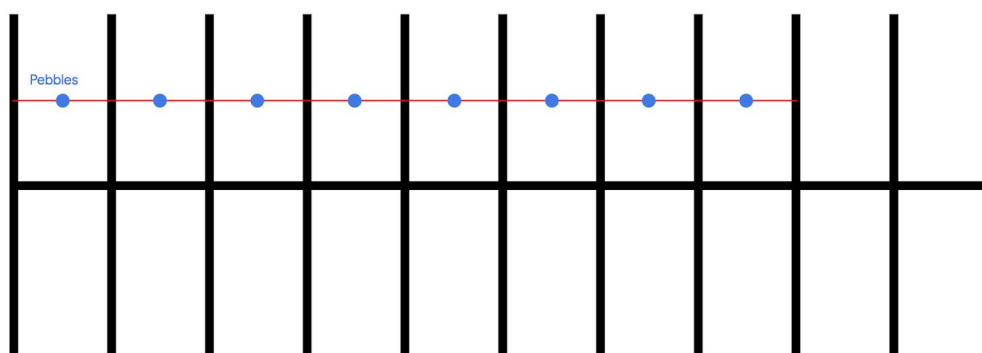
*Tip: if your parking spaces are all the same width, you can lock the measuring tape to half the width of a parking space and measure from one end.*



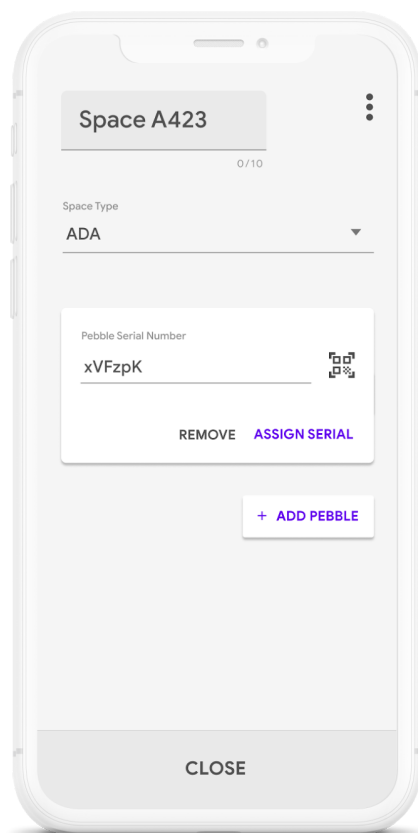
3. Place Pebbles

- a. Start at one end of the chalk line

- b. Adhering Pebbles (currently only Butyl Pad installation is available. Epoxy installation coming in 2021):
- Option 1, Butyl Pad installation: At each midpoint, unpeel the protective backing of a Pebble, exposing the adhesive, and place it on the chalk mark.
  - Option 2 (available starting in 2021), epoxy installation: At each midpoint, deposit a small amount of epoxy and press the Pebble onto the glue. For more detail, see manufacturer instructions ([link](#))



- c. Capture the Pebble ID number associated with each parking space using the mobile installer interface (URL will be provided):
- Step 1: click into the relevant location / lot
  - Step 2: click the relevant parking space
  - Step 3: scan the QR code or type the ID number printed on the Pebble label into the textbox and press "Assign Serial" and then "Save"



*Note: in the event of any issue with the mobile installer app, physical print outs of each lot will be provided, and Pebble IDs can be manually recorded on the printouts.*

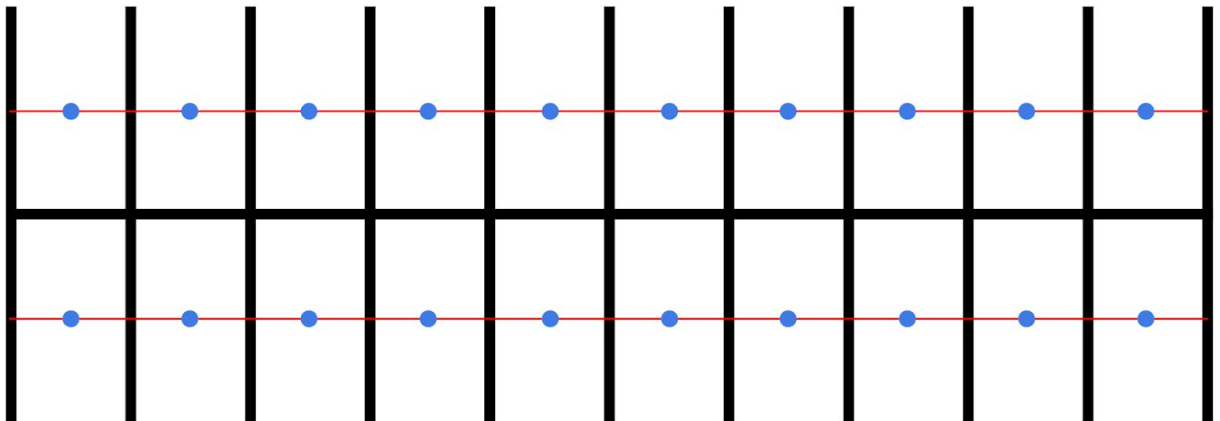
#### 4. Activate Pebbles

- a. After placing each Pebble, use the Pebble wake-up tool to place it over the Pebble for 5 seconds to activate it. If you don't have the wake-up tool and just have the magnet, press the magnet against the surface of the Pebble at the below position for 5 seconds to activate it.

*Tip: there is currently no indicator light that signals when a Pebble has been activated. After installing an entire lot, we recommend checking that each Pebble is online - see section [VII. Testing Pebbles](#).*



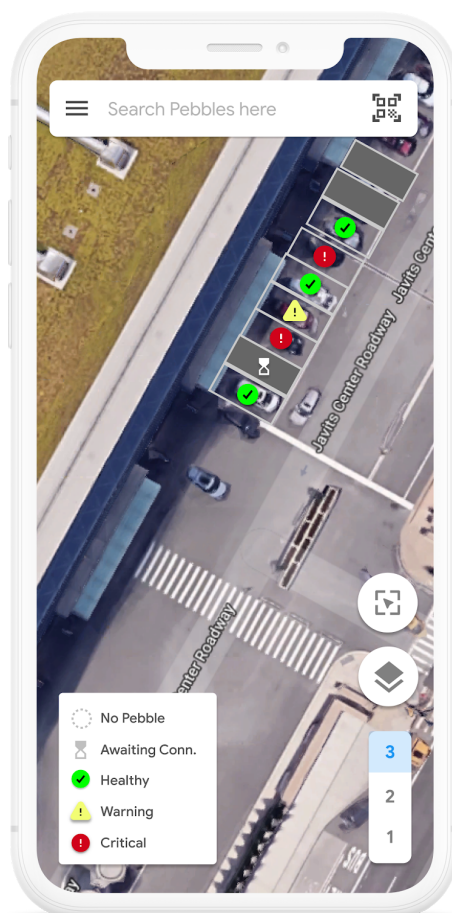
5. Repeat steps 1-4 for every parking space



## VIII. Testing Gateways & Pebbles

The final step is reviewing the live data maps to ensure that all Gateways & Pebbles are correctly sending in data. It may take up to 5 minutes for Pebble data to start appearing in the maps. Using the mobile web view (URL will be provided) complete the following steps:

1. On the real time data map, review all lots and identify any spots that show as offline (“Awaiting Conn.” or “Critical” in the legend below):



2. For any spots that show as offline, follow the procedure outlined in the [FAQs and Troubleshooting](#) section below until the space shows as online.
3. If there are a large number of Pebbles in close proximity that are not online, there may be an issue with the gateway (a gateway may be offline, or there may be insufficient gateway density). In this case, follow the procedure outlined in the [FAQs and Troubleshooting](#) section below until the spaces show as online

## IX. FAQs and Troubleshooting

**Q: What should I do if I encounter issues saving a Pebble ID in the mobile app?**

A: First, try logging out and logging back into the mobile app. If this doesn't fix the issue, please default to recording the Pebble ID on the paper maps / layouts that will be provided.

**Q: What should I do if a Pebble isn't showing up online after installation?**

A: First, repeat the [Pebble activation](#) step of placing the magnet against the Pebble. Wait 5 minutes, and check if that has resolved the issue. If the Pebble is still not online, remove the non-functional Pebble, return it to Sidewalk Labs for debugging, and replace it with a new device.

*Note: if there are a large number of Pebbles in close proximity that are not online, there may be an issue with the gateway (a gateway may be offline, or there may be insufficient gateway density. In this case, please refer to the gateway troubleshooting FAQ below).*

**Q: What should I do if a Gateway isn't transmitting data after installation?**

A: First, repeat the [gateway activation](#) step of placing the magnet against the gateway. Wait 5 minutes, and check if that has resolved the issue. Second, try tightening the antennas that are screwed on the outside of the box. Finally, if this gateway is still not online, remove the non-functional gateway, return it to Sidewalk Labs for debugging, and replace it with a new device.

## X. Support

For questions or support, please contact [pebble@sidewalklabs.com](mailto:pebble@sidewalklabs.com).