

Zebra Dimensioning

Mobile Parcel



ZEBRA

User Guide

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About This Guide

The guide discusses the Zebra non-certified parcel dimensioning solution and the Mobile Dimensioning (MD) client. The MD Client provides dimension capture capabilities, demonstrating a line-of-business (LOB) app calling the dimensioning service using the MD application program interface (API). The MD Client is provided by default on select premium Zebra Android™ mobile computers.

For general information on how to use your Zebra mobile computer, refer to the product reference guide for your device.

Notational Conventions

The following notational conventions make the content of this document easy to navigate.

- **Bold** text is used to highlight the following:
 - Dialog box, window, and screen names
 - Dropdown list and list box names
 - Checkbox and radio button names
 - Icons on a screen
 - Key names on a keypad
 - Button names on a screen
- Bullets (•) indicate:
 - Action items
 - List of alternatives
 - Lists of required steps that are not necessarily sequential.
- Sequential lists (for example, those that describe step-by-step procedures) appear as numbered lists.

Overview

The Zebra non-certified parcel dimensioning solution provides fast and accurate point-and-shoot dimensioning using an integrated time of flight sensor with no external snap-on sensors required.

The non-certified mobile parcel dimensioning solution provides the same performance as the certified versions. However, it does not have the software sealing features required for certification and Weights and Measures requirements. For these reasons, the solution cannot be used as legal-for-trade.

Parcel dimensioning is available for premium mobile computers that feature a time-of-flight (ToF) camera. The following models are supported:

- TC53 (Premium only)
- TC58 (Premium only)
- TC73 (Premium only)
- TC78 (Premium only)

A mobile dimensioning application comes pre-installed on supported models to demonstrate how a line-of-business (LOB) application can use the outputs from the mobile dimensioning framework.

The resolution for dimension results is 0.1 cm for metric and 0.1 in. for imperial units.

Term Definitions

This section describes the terms used in this guide as they relate to the Zebra Parcel Dimensioning solution.

Dimension Capture

The process of aiming the dimensioning device at a parcel and obtaining length, width, and height dimensions.

Mobile Dimensioning (MD) Client

The MD Client is a demonstration of a LOB app calling the dimensioning service using the MD API. The app allows for testing and demonstration of dimension capture.

LOB App

An app developed using the MD API that is customized for a specific business need.

Dimensioning Service

The combination of software that performs the parcel measurement. When the dimensioning service is called by a LOB app, it presents a user interface that is active for the entire dimension capture.

Length

The larger of the horizontal dimensions of the parcel. It is represented in inches or centimeters (user-configurable).

Width

The smaller of the horizontal dimensions of the parcel. It is represented in inches or centimeters (user-configurable).

Height

The vertical dimension of the parcel above the supporting surface. It is represented in inches or centimeters (user-configurable).

Minimum Bounding Box (MBB)

A rectangular cuboidal construct represents the minimum cuboidal volume occupied by the parcel, with the base of the cuboidal construct lying on the platform at a stable position.

Out of Range

For non-certified parcel dimensioning, measurements are out of range when smaller than 10 cm (4 in.) or larger than 120 cm (48 in.).

Dimension Capture

For the optimal dimension capturing experience, the following sections provide information about dimensioning use cases, aiming methods, tips, and limitations of the framework.

Parcel Use Cases

The Zebra parcel dimensioning solution supports cuboidal and non-cuboidal parcels placed on a horizontal flat surface.

Supported Parcels and Environments

Supported parcels and environments include cuboidal and non-cuboidal parcels placed on a horizontal flat surface.

Figure 1 Supported Cuboidal Parcel Use Cases

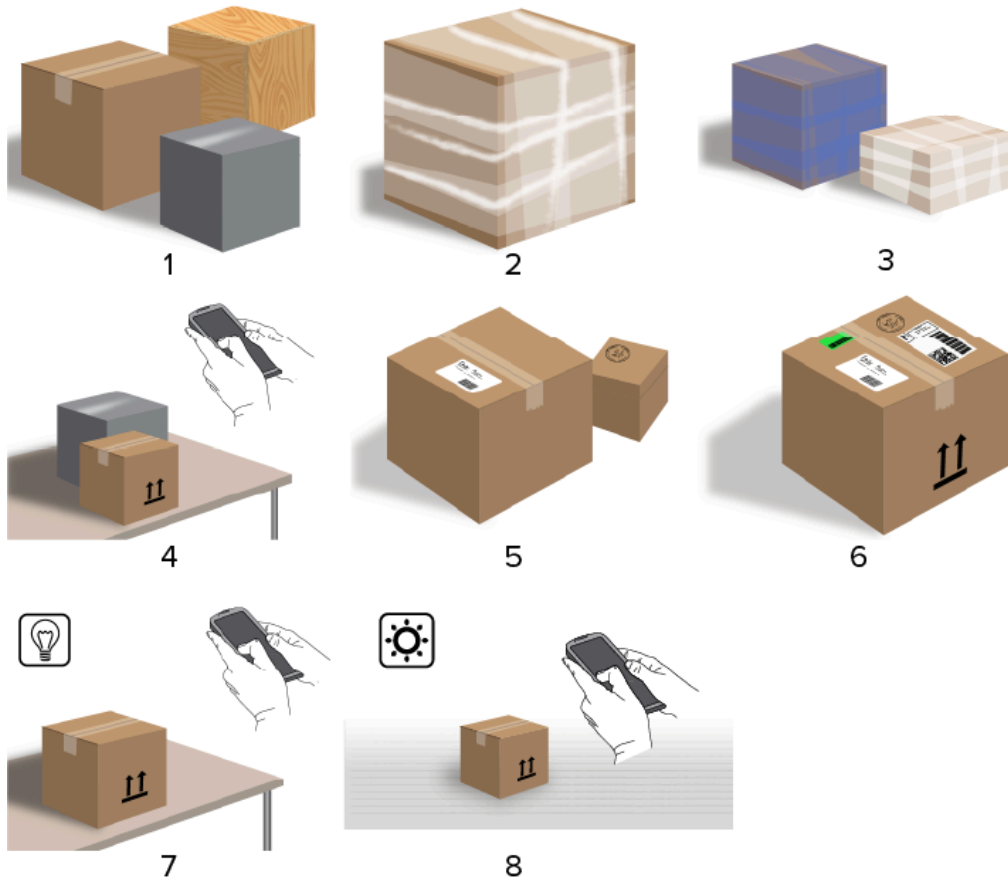
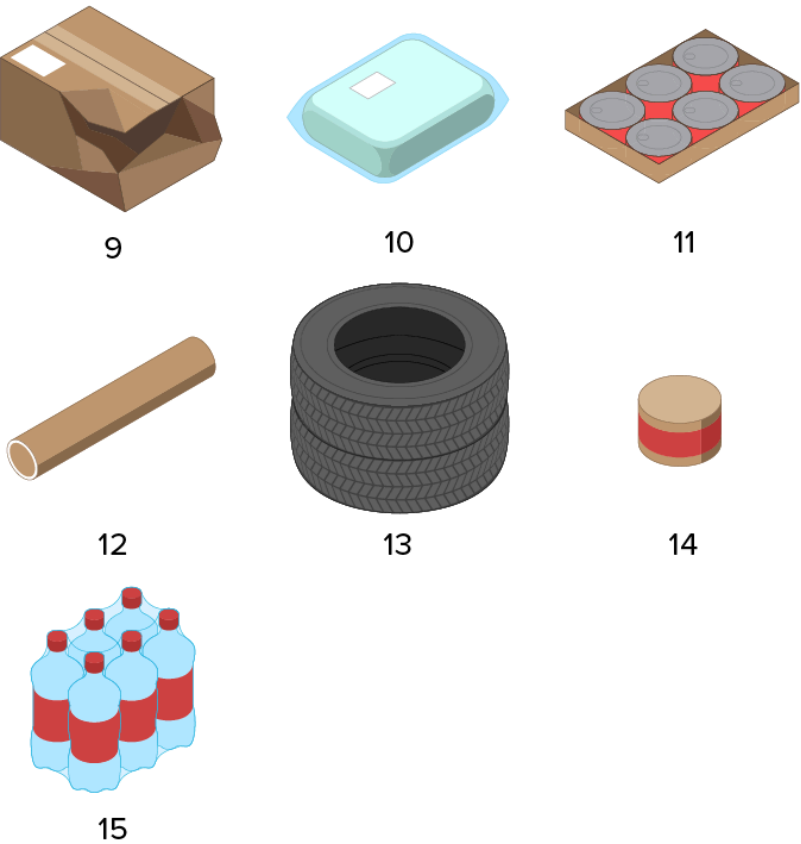


Figure 2 Supported Non-Cuboidal Parcel Use Cases

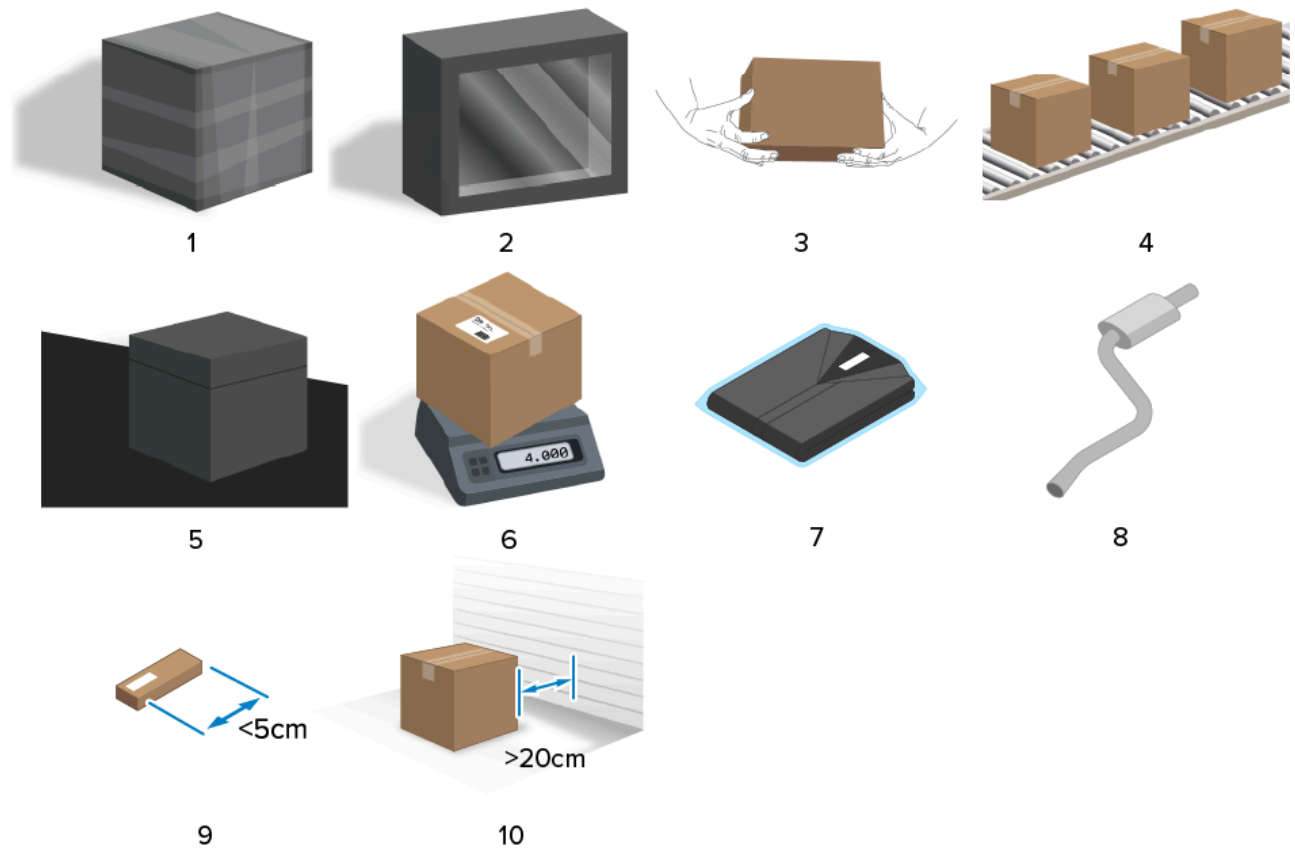


1	Regular cuboid (cardboard, wood, plastic)
2	Clear wrap
3	Non-black wrap
4	Countertop
5	Multiple parcels
6	Label, tape, graphics
7	Indoor lighting
8	Outdoor lighting
9	Crushed boxes
10	Curved opaque or bagged parcels
11	Non-continuous opaque top parcels
12	Cylinder
13	Tires
14	Small round parcels
15	Non-continuous clear top parcels

Unsupported Parcels and Environments

Unsupported parcels and environments as shown.

Figure 3 Unsupported Parcel Use Cases

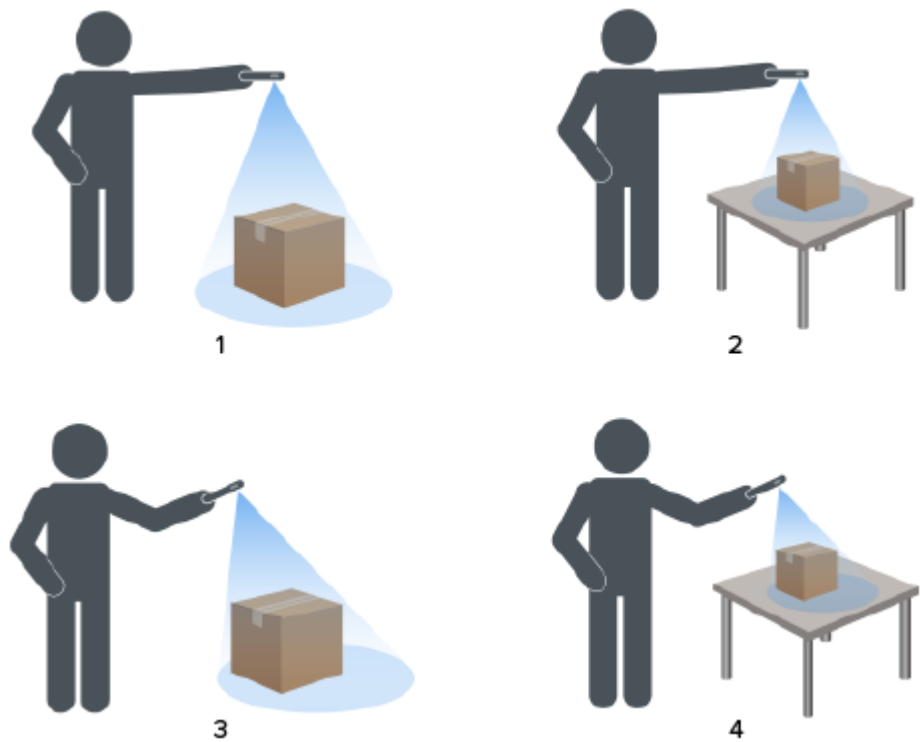


1	Black wrap or parcel Non-reflective surface
2	Transparent
3	Handheld parcels
4	Conveyor belts
5	Black surfaces
6	Weight scale
7	Apparels
8	Elongated muffler
9	Tiny parcels (smaller than 5cm)
10	Non-singulated parcels (less than 20cm of floor clearance to background)

Dimension Aiming Methods

For the optimal dimensioning results, always make sure that the entire parcel is visible in the Viewfinder.

Figure 4 Aiming Methods

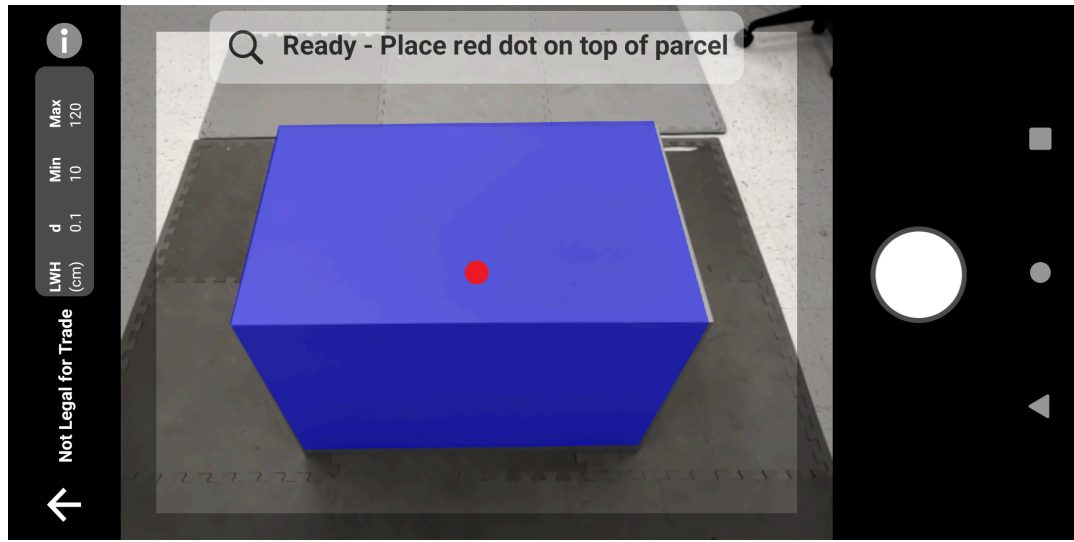


1	Top-down view on floor
2	Top-down view on countertop
3	Angled view on floor
4	Angled view on countertop

Viewfinder Orientation

- Make sure to align the longest edge of the parcel with the longest edge of the Viewfinder.
- Use portrait mode when aiming at the smaller side of the parcel. For example, when dimensioning tall parcels.
- Use landscape mode when facing the larger side of the parcel. For example, when dimensioning wide parcels.

Figure 5 Landscape Orientation



- Change between portrait and landscape orientation by rotating the device. From the portrait orientation, rotate the device counterclockwise to change to landscape orientation. From landscape orientation, rotate the device clockwise to move back to portrait orientation.
- When the device orientation is changed, the user interface automatically rotates to the current orientation even if the auto-rotate setting is disabled on the device. This is required for dimensioning to function properly.

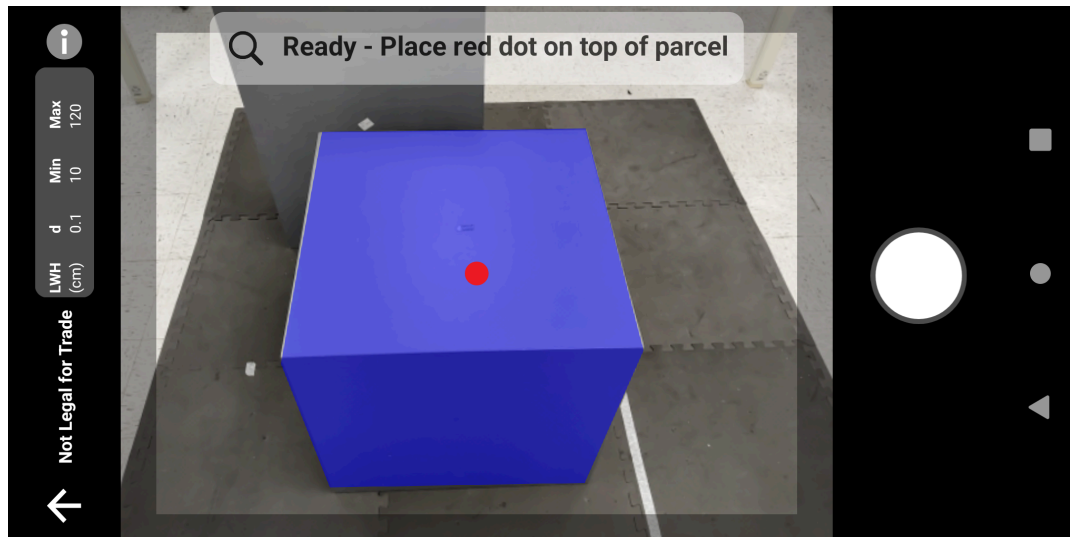
Top-Down Method

The preferred method for parcel dimensioning is to aim straight down from above the parcel.

- Place the on-screen aimer on the middle of the top surface of the parcel.
- Make sure that there is a minimum of 20 cm (7.9 in.) of floor or counter space visible around all sides of the target parcel.

- When multiple parcels are in the Viewfinder, use the on-screen aimer to identify the target parcel.

Figure 6 Multiple Parcels



- Avoid glare from parcel surfaces by tilting the device slightly.

Angled Method

When a top-down view of the parcel is not possible, dimensioning can be performed using an angled method. For this method, it is preferred to aim the Viewfinder at an angle that captures the top and one full side of the parcel.

- Place the on-screen aimer on the top surface of the parcel while keeping the entire parcel visible in the Viewfinder.
- Make sure that there is a minimum of 20 cm (7.9 in.) of floor or counter space around all visible sides of the target parcel.
- When multiple parcels are in the Viewfinder, use the on-screen aimer to identify the target parcel.

Tips for Optimal Dimensioning

To optimize your dimensioning performance, follow these recommended tips.

Minimum Range

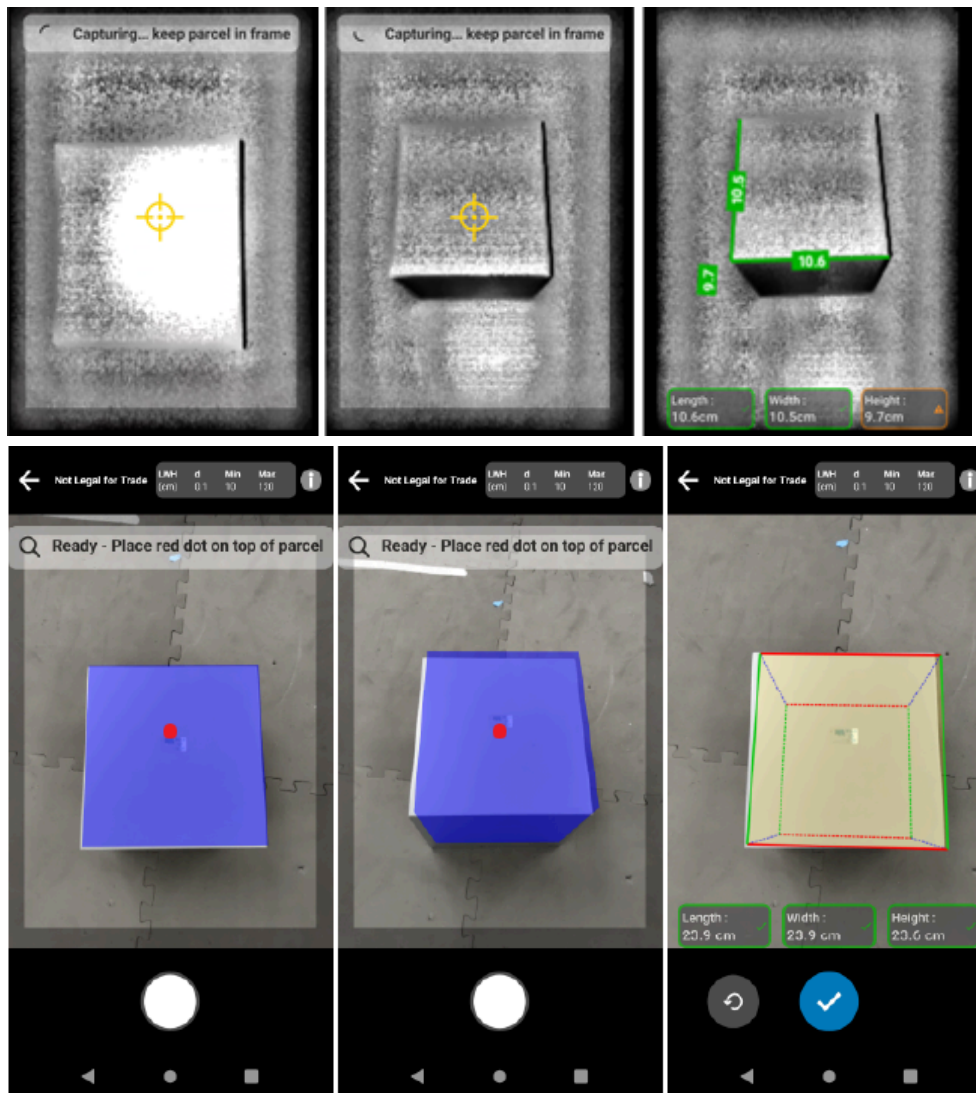
It is recommended that the distance to a parcel be at least 40 cm (16 in.).

This is important when dimensioning small boxes. If aiming top-down at close range there may be too much IR glare directed at the dimensioning device. It is visible on the user interface (UI) advanced feedback as *Please try another angle*.

When this happens, tilt the dimensioning device slightly to move the glare off of the parcel's top surface.

The glare spot is easily visible in the first image below. The second image shows the result of tilting the dimensioning device leading to a successful dimension in the third image.

Figure 7 Adjust for Glare

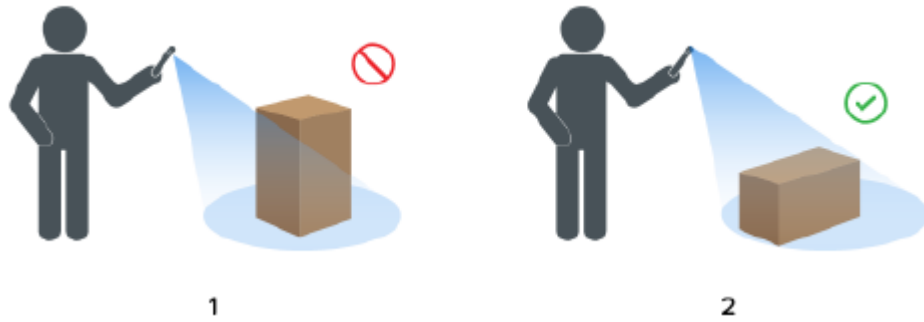


Tall Parcels and Countertop Dimensioning

To successfully dimension a parcel, point the on-screen aimer at the top of the parcel. Aim directly above the parcel as much as possible (within 45° of vertical).

If the parcel is very tall or the counter height makes it difficult for the user to fit the entire parcel within the viewfinder, rotate the parcel so that the smallest dimension is the height.

The following figure illustrates turning a box onto its side, allowing the user a better view of the parcel. The user is able to fit the entire parcel on the screen and point the on-screen aimer at the top of the parcel.

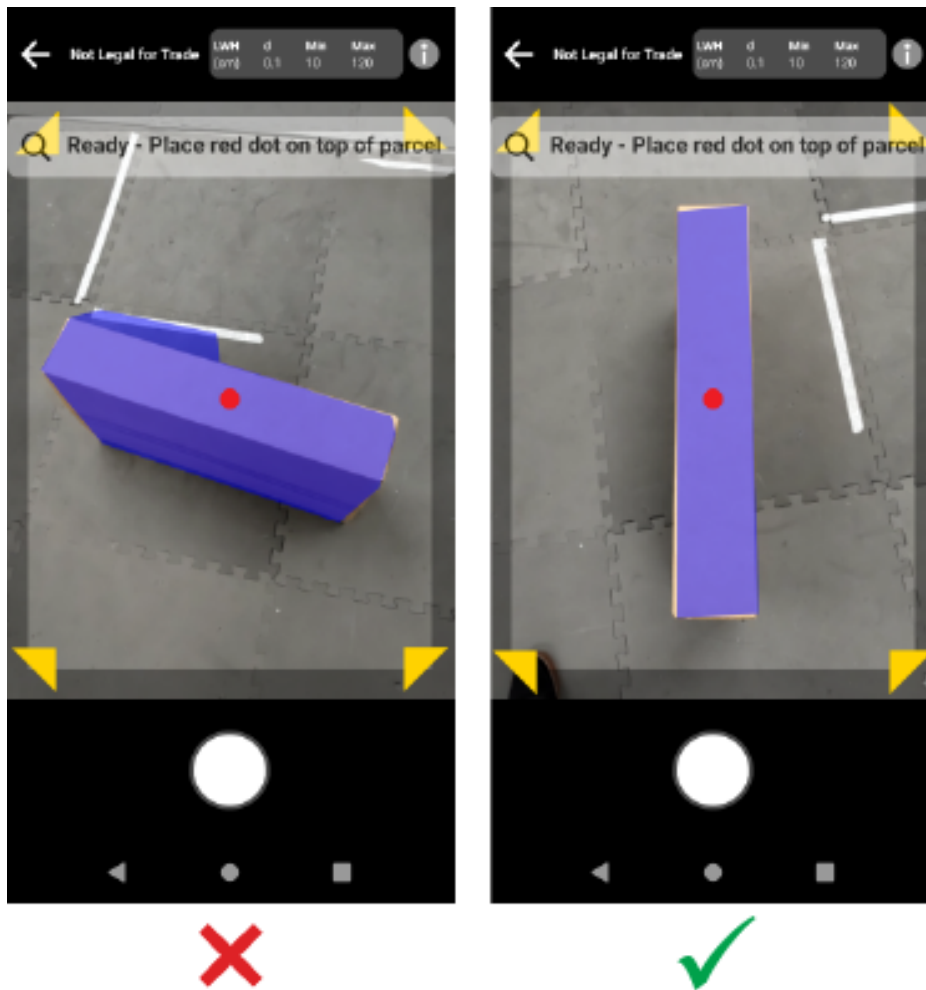
Figure 8 Rotate Parcel to fit in Viewfinder

1	Entire parcel is not in the viewfinder
2	Entire parcel is in the viewfinder

Alignment of Parcels within the Viewfinder

The optimal results are obtained when the largest horizontal edge of the parcel is aligned with the largest dimension of the display. This is achieved by using the portrait device orientation when standing next to the smaller side of the parcel and using the landscape device orientation when standing next to the longer side of the parcel.

Figure 9 Parcel Alignment



Dimensioning with Multiple Devices

When using multiple devices to perform dimensioning in close proximity, make sure not to overlap the field-of-views.

As part of the dimensioning process, the ToF camera uses illumination that is not visible to the naked eye. No dimensions are captured when the illumination coming from two or more nearby devices overlaps.

Figure 10 Dimensioning with Multiple Devices



1	Overlapping field-of-views
2	Separated field-of-views

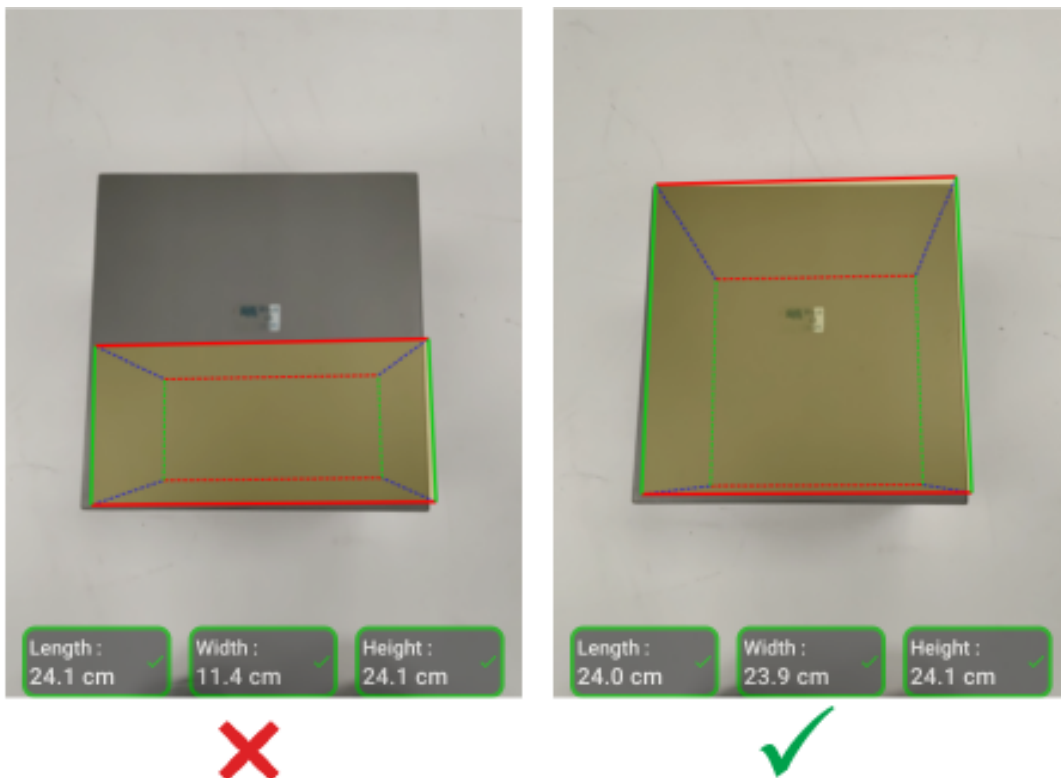
Multiple Parcels in the Field-of-View

When more than one parcel is in the field-of-view, fill the screen as much as possible with the intended target. Ensure that the aimer is centered on top of the intended target during the dimensioning process.

Bounding Lines

Bounding lines that match the edges of the parcel indicate a good result. If bounding lines do not match the edges of the parcel, the user should retry.

Figure 11 Bounding Lines



Operation in Sunlight

Avoid dimensioning a parcel where the sun is directly in front of you. Dimension with the sun at your back, place the parcel in the shade, or use a top-down view.

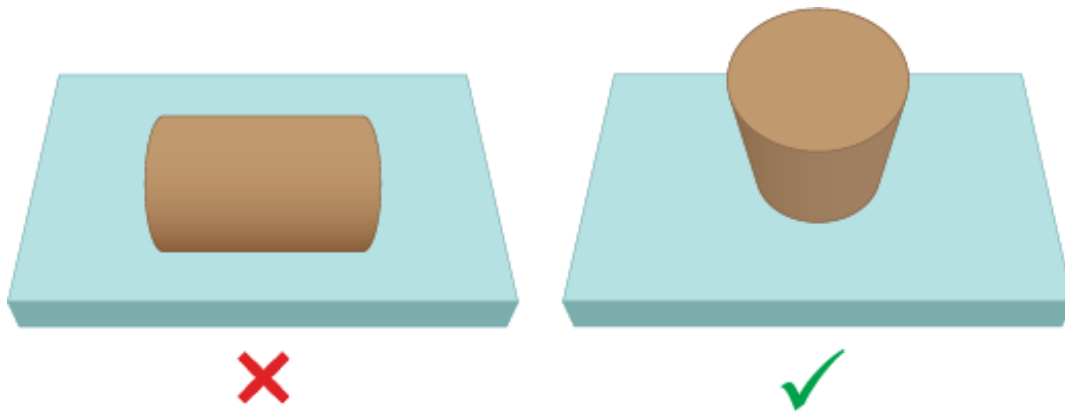
Distance to Other Objects

Make sure there is a minimum of 20 cm (7.9 in.) between the target parcel and walls or objects the same height or taller. For large parcels that require an angled view, the time-of-flight signal may be impacted by an adjacent wall or object that is too close to the target parcel.

Cylinder Dimensioning

Positioning the cylinder upright and vertically will give more accurate results. If it is positioned horizontally on the floor, the depth will be underestimated due to ToF technology limitations.

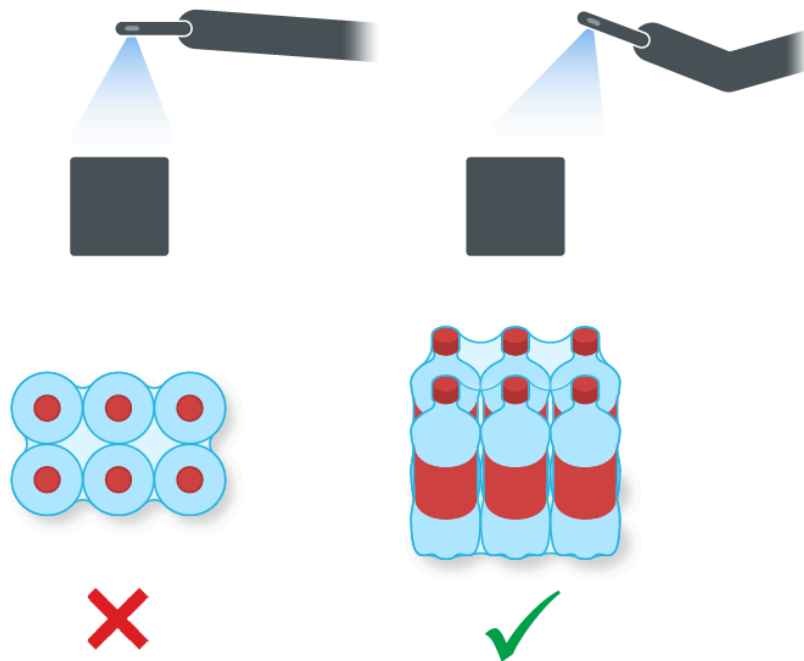
Figure 12 Cylinder Dimensioning



Dimensioning Non-Continuous Top Parcels

When dimensioning parcels such as wrapped bottles or cans, use angled and distance capture and avoid aiming top-down at close range. This is to prevent inaccuracy for the ToF camera due to the wrapping of such targets.

Figure 13 Dimensioning Non-Continuous Top Parcels



Limitations

The dimensioning framework can handle a wide range of parcels, with the following limitations.

Black Surfaces

The 3D sensor cannot reliably detect black surfaces. Under the following conditions, parcel dimensioning attempts timeout to a NoDim (no dimension) result.

- Black parcels - This includes parcels wrapped in black material.
- Black floor - The floor must be recognized for dimensions to be calculated. Dimensioning on grey surfaces, such as asphalt, should be possible even in sunny conditions.
- Black tape - This applies to black tape on the top edges of the parcel. You can dimension parcels with black tape across the middle by making sure the aimer is not on the black tape. If the aimer is on the black tape, the parcel may not be dimensioned.

Highly Reflective Surfaces (Specular Reflection)

The 3D sensor cannot reliably dimension with highly reflective surfaces such as shiny metal walls or mirror-like reflective surfaces that produce a specular reflection. The user must dimension the targeted parcel with these surfaces outside the field-of-view of the camera (i.e., not within the viewfinder display).

- Shiny metal walls and floor – mostly unpainted bare metal that produces a mirror-like reflection
- Shiny containers – metal containers next to the target parcel
- Mirrored walls
- Metal tape – this applies to metal tape on the visible surfaces or edges of the parcel.

Long or Thin Parcels

Parcels where one dimension is near the maximum and one dimension is near the minimum may lead to a NoDim (no dimension) result.

For example, a parcel measuring 100 x 15 x 15 cm may not produce a dimensioning result. However, a parcel measuring 50 x 15 x 15 cm should produce a result.

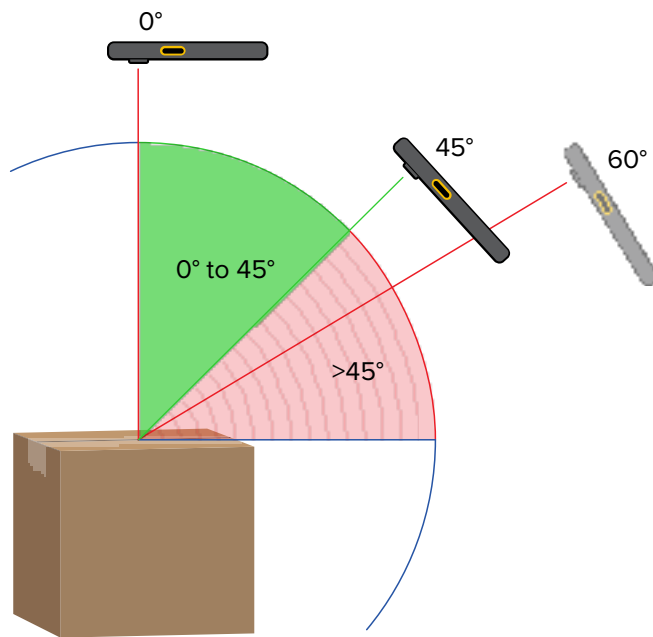
Directional Feedback

To receive directional feedback, the dimensioning service must be able to identify that there is a parcel in the field-of-view.

- If the device is too close to the parcel, move further away or move left, right, up, and down until the entire parcel is visible in the Viewfinder. The ToF camera cannot dimension a parcel closer than the minimum range of the ToF camera. Also, when the device is too close to the parcel, it can cause glare, which can interfere with dimensioning.
- If the device is too far from the parcel, move closer and fill more of the display area with the parcel.

- If the dimensioning angle is too steep, move or tilt the device to keep the angle within 45° of the top-down (0%) position. The device provides tilt feedback when the angle is too steep.

Figure 14 Dimensioning Angles



Application Interactions

- Google Voice Assistant - Google Voice Assistant will not launch when the dimensioning screen is active.
- Repeated Rotations - Repeatedly rotating the dimensioning device may cause the Mobile Dimensioning demonstration client Start Dimensioning button to be grayed out. Restart the application to clear the condition.
- Repeated Open/Close of the Mobile Dimensioning demonstration application - Repeated opening and closing of the application in quick succession may cause the Mobile Dimensioning demonstration client Start Dimensioning button to be grayed out. Restart the application to clear the condition.
- Split screen mode - Android Split Screen mode is not supported.
- Guest mode - Android Guest mode is not supported.

Mobile Dimensioning Client

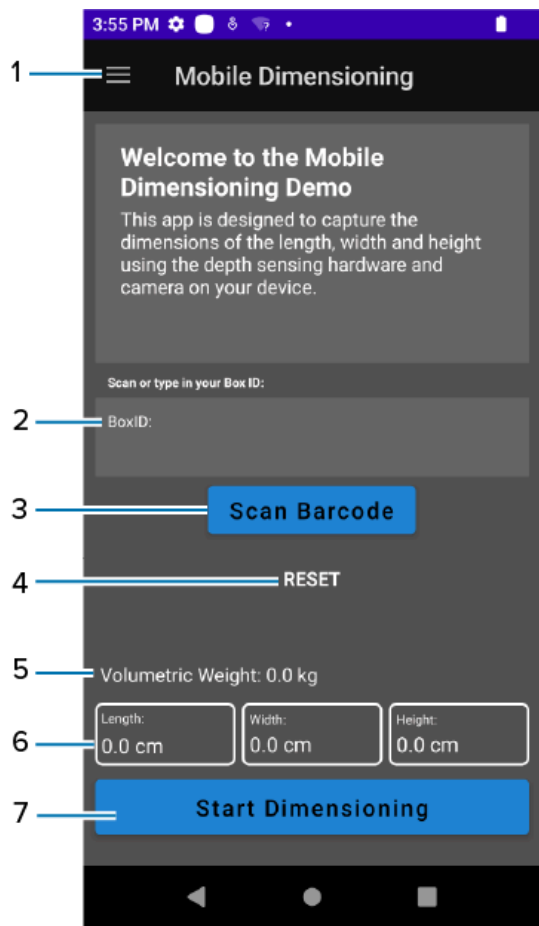
The MD Client demonstrates parcel dimensioning and allows developers to test a sample LOB app that calls the dimensioning service using the MD API.

Mobile Dimensioning Client User Interface

The MD Client provides a sample user interface (UI) that allows end-users to perform dimensioning capture and view the dimension results.

The MD Client is an example of a line-of-business customer app and may only be used for demonstration and testing of the dimensioning solution.

Figure 15 Welcome Screen






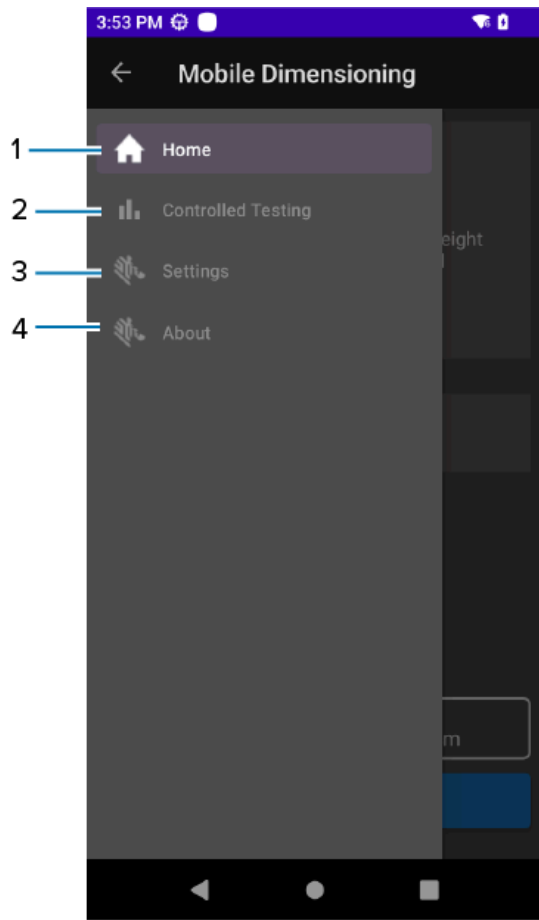
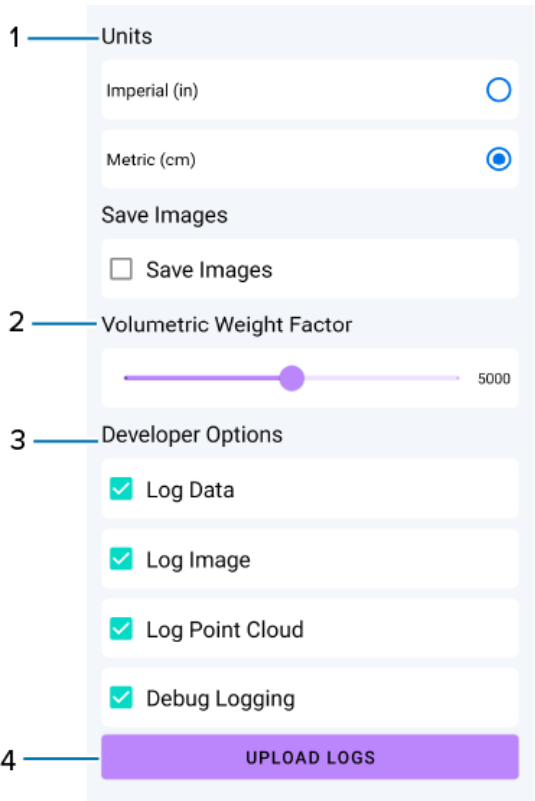
1	Extended Menu - Contains About Screen, Controlled testing, and Setting menu.
2	BoxID - Displays optional box identification.
3	Scan Barcode button - Select to scan a barcode that fills the BoxID field with a barcode value.
4	Reset - Resets dimensioned data on Item 6.
5	Volumetric Weight - Displays volumetric weight based on the dimension of the parcel.
6	Dimensions - Displays the dimension values. <ul style="list-style-type: none"> Zero values - Initial value before dimensioning begins. Green checkmark  - Indicates that dimensioning was successful. Yellow caution symbol  - Indicates that the captured dimensions are out of range. Red caution symbol  - Indicates that the time-out was reached before dimensioning was completed or dimensioning was canceled by the user.
7	Start Dimensioning button - Select to begin dimensioning a parcel.

Figure 16 Extended Menu



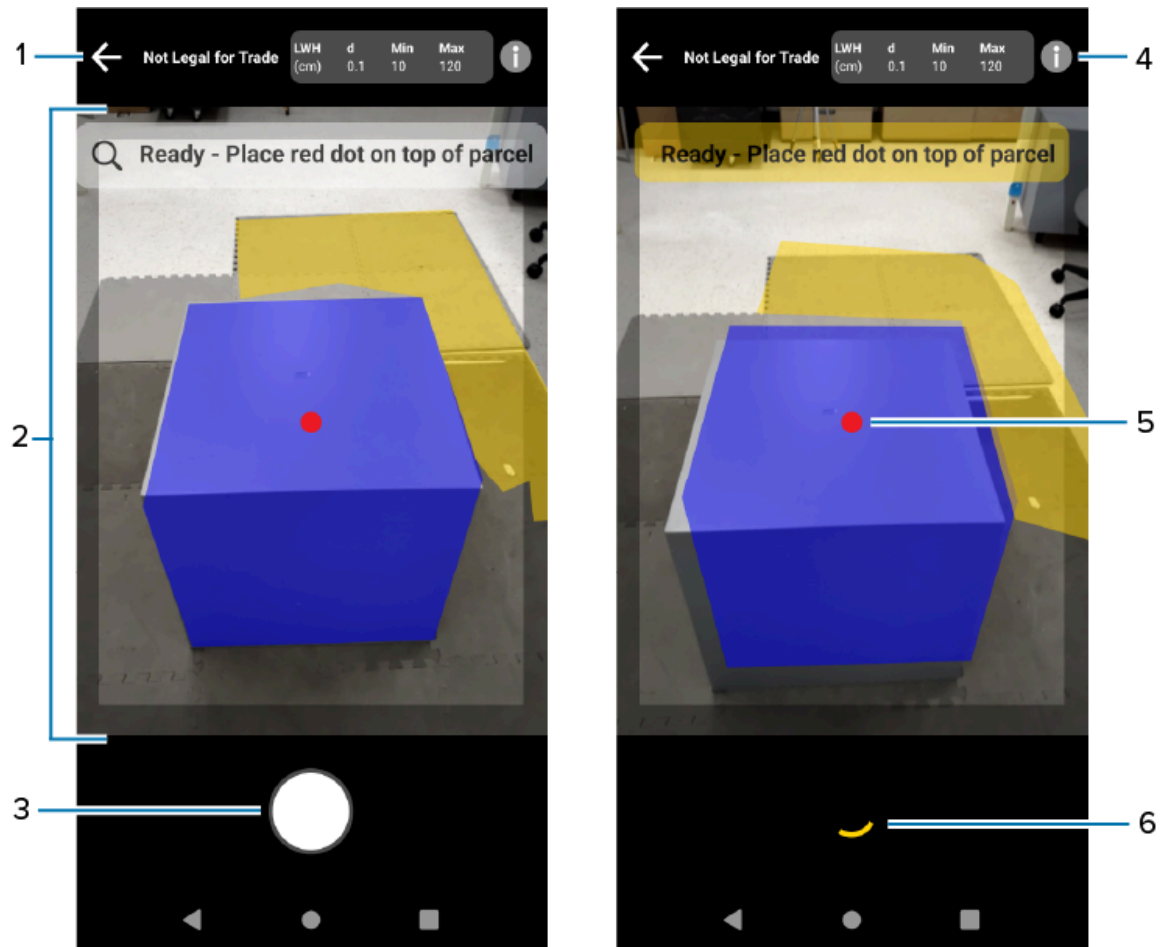
1	Home - Dimensioning Client home page.
2	Controlled Testing - For performing Controlled testing with ground truth captured. Used for reporting Dimensioning issues.
3	Settings - Contains controls for Save Image, Volumetric Weight Factor, and other parameter configurations.
4	About - Version information of Client and Dimensioning software.

Figure 17 Extended Menu



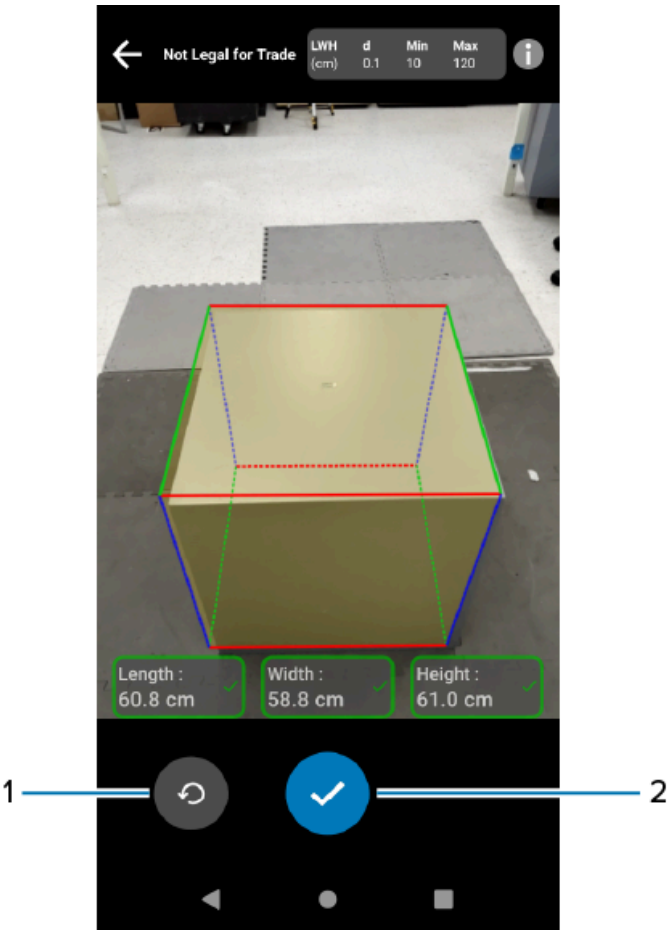
1	Measurement units - Select to display dimensions in inches or centimeters. The default is based on the current location of the device and may not be available in all locations.
2	Volumetric Weight Factor - Based on customer requirements, this will determine the volumetric weight.
3	Developer Options: <ul style="list-style-type: none">• Log Data - Saves dimension data• Log Image - Saves camera images• Log Point Cloud - Saves point cloud• Debug Logging - Enables Android Logcat for debug purposes.
4	Upload Logs - Uploads all the logging data to Zebra Cloud BackEnd for analysis. This requires network connectivity.

Figure 18 Active Viewfinder Screens



1	Back - Cancels the dimensioning capture.
2	Viewfinder - Use to aim at a parcel and navigate through the dimensioning process. Dimensioning tips display at the top of the Viewfinder.
3	Start button - Starts the dimensioning process.
4	Information - Select to display legal, configuration, and other relevant information.
5	On-screen aimer - Use to identify the target parcel.
6	Progress arc - Indicates that dimensioning is in progress.

Figure 19 Confirmation Screen



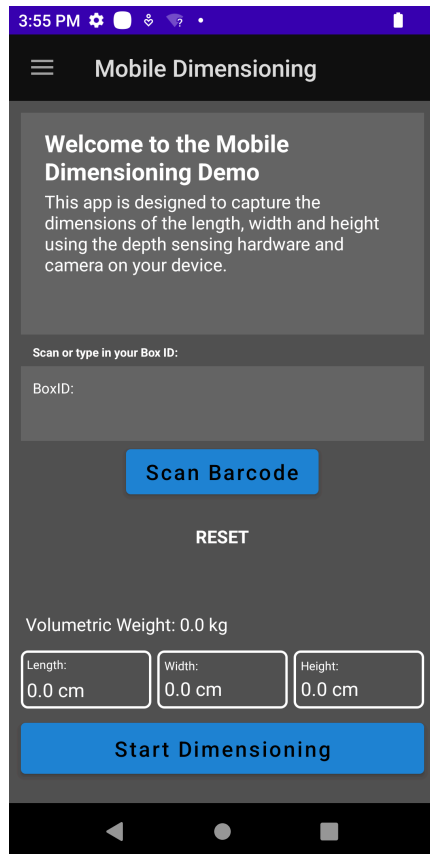
1	Retry - Restarts the dimensioning process.
2	Confirm - Ends the dimensioning process and displays dimension results on the Welcome screen.

Performing a Parcel Dimension

Use the MD Client to test the dimensioning service and understand the sample user interface (UI) of the app.

1. Open the MD Client app.

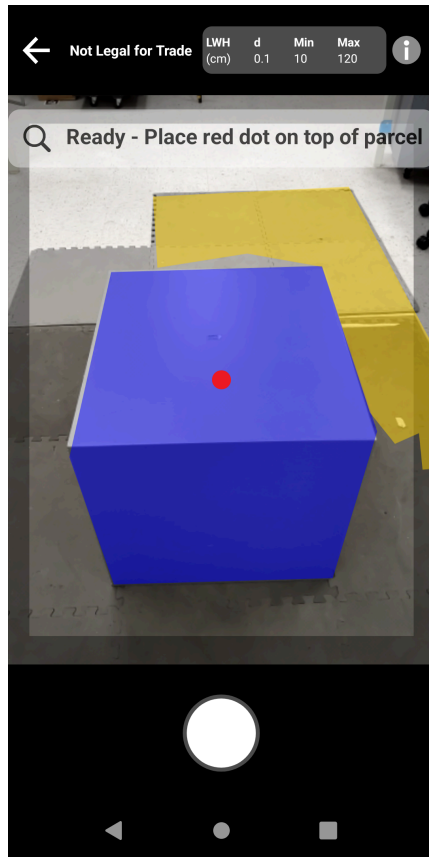
The Welcome screen displays. Dimension values begin in a ready state as zeros.



2. Scan a barcode, if required.
3. To update the unit measurement (IN or CM), tap the main menu icon (located on the top left), then **Settings**. Under **Units**, select either **Imperial (in)** or **Metric (cm)**.

4. Select **Start Dimensioning**.

A request is sent to the dimensioning service. The Viewfinder becomes active, but dimensioning has not started.



5. Select the Start icon.

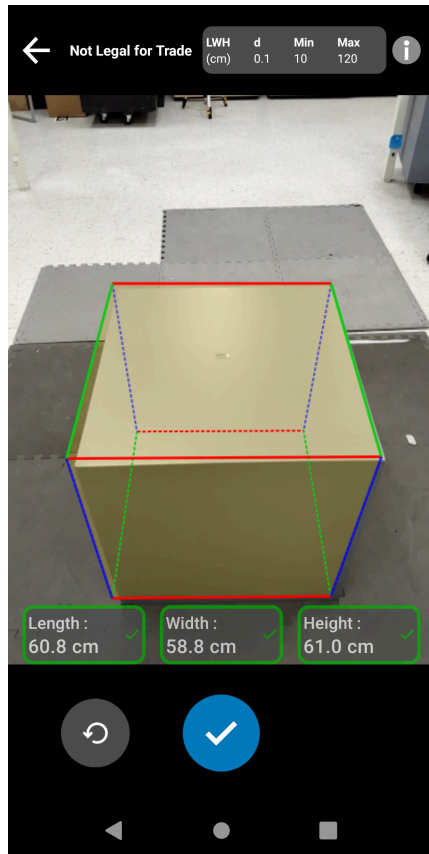
The Viewfinder remains active, and dimensions display as dashes. A progress arc rotates in place of the Start icon, indicating that dimensioning is active.

6. Use the Viewfinder to place the red on-screen aimer dot on the top surface of the parcel.

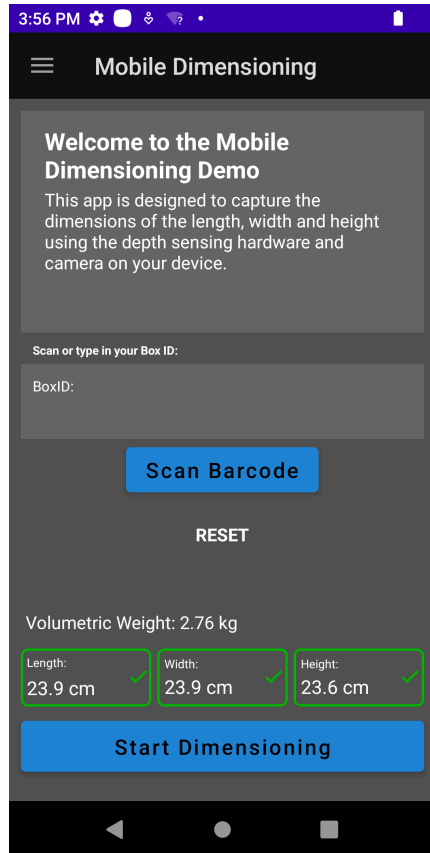
When dimensioning results are obtained, the length, width, and height dimensions replace the dashes, and then the Confirmation screen displays. On the Confirmation screen, the Viewfinder displays a static image of the parcel with the captured dimensions indicated on the parcel axes. The length and width dimensions are drawn on the top edges and the height dimension is drawn to the side.

7. Select an option on the Confirmation screen.

- Select the Retry button to return to the active Viewfinder screen and retry dimension capturing.
- Select **Confirm** to confirm and accept the current results.
- If dimensioning is not captured, the **Confirm** does not display. Select the Retry button to retry dimension capturing.



When the results are confirmed they display on the Welcome screen.



To begin a new dimensioning capture, select **RESET**. The dimensioning results are cleared.

Sample Feedback

The Framework provides helpful feedback to users during dimensioning and if dimensioning fails.

Positional Feedback

During dimensioning, the Framework provides positional feedback as arrows in the corners of the Viewfinder. Text feedback can be added to the LOB app.

The MD Client uses the following sample prompts and feedback during dimensioning.

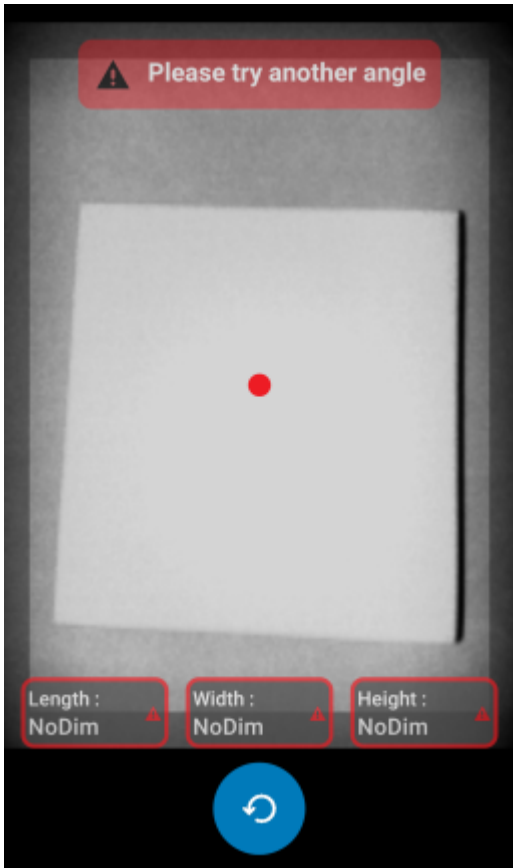
Text	Description
Move Closer	Move the device closer. The parcel is too small in the Viewfinder's Field-of-View (FOV).
Move Farther Away	Move the device away. The parcel is overflowing the FOV.
Tilt upwards	Tilt the device up. The parcel is out-of-bounds of the FOV.
Tilt downwards	Tilt the device down. The parcel is out-of-bounds of the FOV.
Move Left	Move to the left. The parcel is out-of-bounds of the FOV.

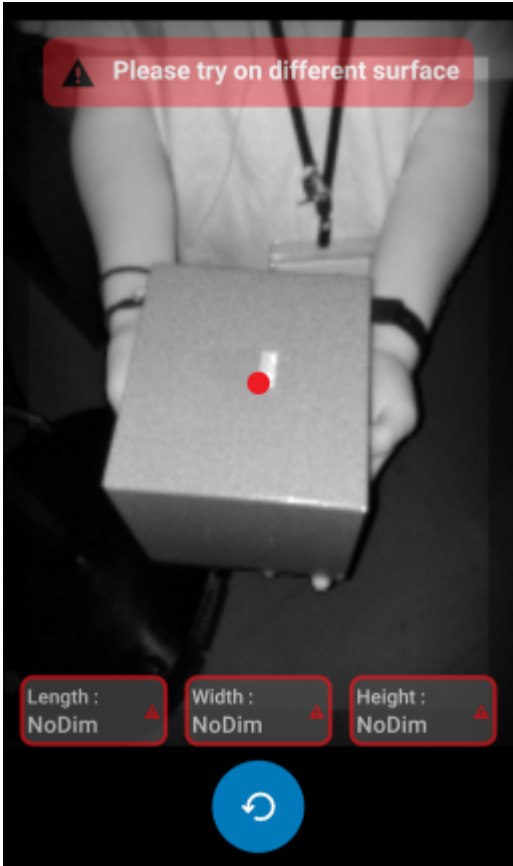
Text	Description
Move Right	Move to the right. The parcel is out-of-bounds of the FOV.
Timeout – Please retry or cancel	Retry or cancel the dimension capture. The parcel could not be dimensioned in the given timeframe.
Capturing... keep parcel in frame	Keep the parcel within the FOV while dimensioning is in progress.

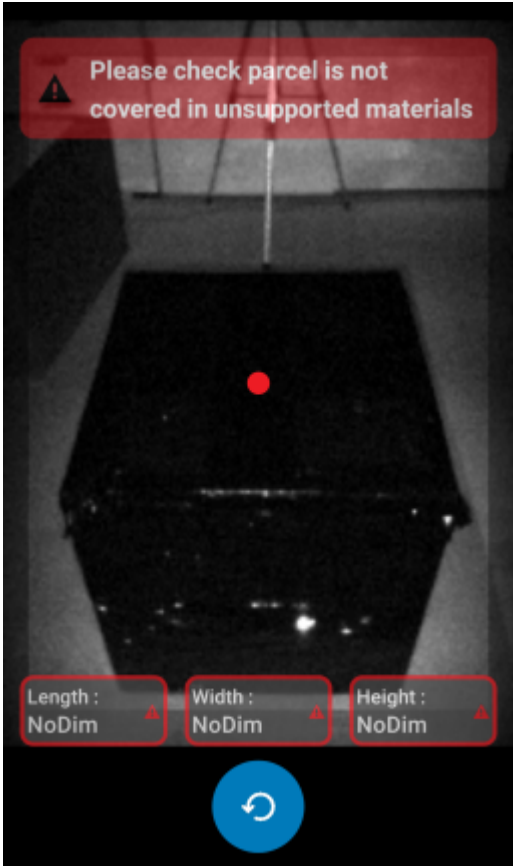
Advanced Feedback

When NoDim indicators are returned to the app, the Framework provides advanced feedback at the top of the screen.

For unsuccessful dimensioning attempts, the MD Client uses the following feedback after dimensioning.

Feedback	Description
	<p>Tilt the dimensioning device slightly. There is too much glare reflected back at the dimensioning device. For more information, see Minimum Range.</p>

Feedback	Description
 A screenshot of the Mobile Dimensioning Client interface. At the top, a red banner with a warning icon and the text "Please try on different surface" is displayed. Below this, a grayscale image shows a person's hands holding a rectangular parcel. A red dot is visible on the top surface of the parcel. At the bottom of the interface, three boxes show dimension status: "Length : NoDim", "Width : NoDim", and "Height : NoDim", each with a small red triangle icon. A blue circular button with a white refresh icon is located at the bottom center.	<p>Place the parcel on a flat surface. The parcel is currently located in an unsupported environment. For more information, see Unsupported Parcels and Environments.</p>

Feedback	Description
 A screenshot of the Mobile Dimensioning Client interface. At the top, a red warning banner with a triangle icon contains the text "Please check parcel is not covered in unsupported materials". Below this is a dark image of a parcel with a red dot in the center. At the bottom, there are three input fields for "Length :", "Width :", and "Height :", each containing the text "NoDim" and a small red triangle icon. A blue circular button with a white refresh icon is located at the very bottom.	<p>Make sure that is parcel is not covered in an unsupported material. For more information, see Unsupported Parcels and Environments.</p>

Dimensioning Flow

The MD Client demonstrates typical dimensioning flows.

Successful Dimension In Range

In this scenario, dimensioning is successful while the parcel is in range.

1. Dimension values are all zeros. The user selects **Start Dimensioning** and the Viewfinder becomes active.
2. The user successfully captures the parcel in the Viewfinder. Dimensions and indicators display on the screen.
3. The user selects **Confirm**. Dimensions, indicators, and control return to the calling app.
4. The user selects the Refresh button to set the dimension values back to all zeros.

Successful Dimension Out of Range

In this scenario, dimensioning is successful while the parcel dimension is out of range. The parcel is out of range when the captured dimensions are either below the minimum specification or above the maximum specification.

1. Dimension values are all zeros. The user selects the **Start Dimensioning** button and the Viewfinder becomes active.
2. Dimensions are captured. Dimensions and indicators return to the calling app indicating that one or more measurements are out of range.
3. The user presses Retry to try again or selects the Confirm button to continue.
4. After measurements are confirmed, control returns to the calling app.
5. The user selects the Refresh button to return to the Welcome screen and set dimension values back to all zeros.

Unsuccessful Dimension Time-Out

In this scenario, dimensioning is unsuccessful because a time-out occurs before dimensions are captured.

1. Dimension values are all zeros. The user selects the **Start Dimensioning** button and the Viewfinder becomes active.
2. Dimensioning time-out occurs. The dimensions are indicated as NoDim.

3. The user selects Retry to try again or touches the Android Back button again to cancel dimensioning.
 - If the user selects Retry, the Viewfinder becomes active, and dimensioning starts.
 - If the user stops dimensioning by touching the Android Back button, the Welcome screen displays. NoDim indicators are returned to the app, indicating that no dimensions were captured.

Canceled Dimension

In this scenario, dimensioning is canceled by the user.

1. Dimension values are all zeros. The user selects the **Start Dimensioning** button and the Viewfinder becomes active.
2. The user stops dimensioning by touching the Android back button.
3. The user selects Retry to try again or touches the Android Back button again to cancel dimensioning.
4. Control returns to the calling app and the Welcome screen displays with all dimension values set to NoDim.
5. NoDim indicators are returned to the app, indicating that no dimensions were captured. The app is notified that dimensioning was canceled.

Positional Feedback

In this scenario, the user is too close to the parcel.

1. Dimension values are all zeros. The user selects the **Start Dimensioning** button and the Viewfinder becomes active.
2. The user receives a notification indicating that they should move the device farther away from the parcel.
3. The user successfully captures the parcel in the Viewfinder.
4. The user selects the Confirm button. Dimensions and indicators return to the calling app.
5. Control returns to the calling app and the results screen displays.
6. The user selects the Retry button to set the dimension values back to all zeros.

