Purpose

The function of this application is to display the push-rod and timing measurements to the user by receiving the data over Bluetooth, at the end of a brake event.

Once connected, and the brakes are applied and released, the measurements of the brake push rod travel and timing will be captured and sent to the phone.

The SeeBrake app will collect all brake data, display the results and make a determination of the overall condition of the vehicle brakes.

Each brake is calibrated for the size of the air canister and taking initial readings. Each controller in the SeeBrake system will read all of its brakes and determine if each brake is within limits or if not, by how much.

SeeBrake also records the time it takes for each brake to reach its full position. From that data, one can see if a brake is dragging or stuck. It is also important to know that the trailer brakes are engaging before the tractor brakes.

**** SeeBrake reporting platform is developed for Android, so a phone or tablet that runs Android and has Bluetooth will work.

Typical Setup

SeeBrake's configuration can be for the tractor or trailer or in combination.

The tractor and trailer systems are independent of each other consequently no wired connection is required between them.

When using only the trailer reporting system there is no equipment requirement for the tractor.

The tractor system will have the Bluetooth transmitter located inside the cab, around the driver's position. The Bluetooth adapter for the unit should have been configured, during installation, to contain the asset number of the unit. Scanning the Bluetooth devices should show the identifiers as will show in the screens of the application. The names are limited to 23 characters, of upper-case letters, digits and the underscore character.

The trailer will have its Bluetooth transmitter located at the front of the trailer closest to the driver. This transmitter can be located under the lip of the trailer for protection

Connections will then be made to the unit [tractor or trailer or both]. Once the brakes have reached their required air pressure, then depress and release your brake pedal. This unit's brake data will then be displayed on your phone's screen.

Installation

The SeeBrake application is located on the www.SeeBrake.com/apps page. Select SeeBrake Version 1.0 to be installed. Your phone may be set to block installation from Unknown Sources, so you will have to turn this off, or allow the app to be installed anyway.

The SeeBrake System

The system as installed in each unit will include one or more controllers with at most four brake sensors per controller.

As part of the installation of the SeeBrake system, the controllers will be configured for the brake limits and calibrated for initial sensor readings.

The SeeBrake controller will read the sensors and perform the calculation to see if the brake is within adjustment. The data sent to the SeeBrake app, includes the following information for each brake.

- Axle number
- Brake side (left or right)
- Brake status
  - In limits
  - Out by 1/8
  - Out by ¼
  - Stuck
- Brake push rod measurement
- Timing of brake
- If steer axle

First Time Start Up

Once installed, the system will not know anything about what tractor or trailer to use.

The application must be instructed on what unit(s) to connect to prior to installation.

Adding Units

From the main screen, press the Menu (set of three dots in the upper right corner). From the Menu, choose Select Units.

Daily Use

Once the SeeBrake application is installed and configured to a tractor and or trailer, then allowing the application to run will constantly monitor the brakes at the end of a brake event. If there is any change in the brake status, the user will be notified.

At the end of the day or during meal breaks, it is best to exit the application and start it up again the next time.

Normal Start Up

After the SeeBrake has been configured, then each time it is started, it will display the unit name(s) and any previous brake data that was captured.

At the top of the screen, just below the screen name is a banner that will give an indication of the overall brake status.

This banner will be at the top of each of the four screens.

Hidden Screen

If the SeeBrake app is not active, because of switching to another app, the SeeBrake app can be brought back up by pulling down the notifications from the top and touching the SeeBrake notification.

Brake activity will continue to be monitored while the SeeBrake app is in the background. The Notification will be updated as the brake status changes.

Measured versus Detected

This application can satisfy measurement needs and detection needs.

If all that is needed is to perform the brake measurements once a day, then the app can be used and then put away.

For proper detection to work, the app must remain running during the use of the vehicle.

Detection involves monitoring the brakes at each use and during the times between brake usage.

With each brake event, the system will detect a changing condition and report when a brake has fallen out of adjustment. The operator can correct the issue, if trained, or take it to an authorized technician.

The controller can be instructed at installation time, to periodically check the brakes to see if any are not at rest. This permits the controller to continually look at the brakes to see if any are stuck high. In finding a stuck brake, messages will be sent to the app to convey the condition.

Brakes that do not respond during a brake application can only be detected if the SeeBrake app is running while the brakes are applied.

Brakes that fail to return to rest can only be detected after the brakes are released. Brakes that are stuck high will remain reported as stuck by the SeeBrake app until the problem is corrected and the brakes retested by reapplying the brakes with the SeeBrake app running.

No Units Have Been Selected

This indicates that the application has not been set up with any units. It will be necessary to go into the Select Units and add one or more units. This is what it looks like after installation.

See Figure 1.

The SeeBrake application must be told which units to expect brake data from. In this mode, there is no knowledge of any units.

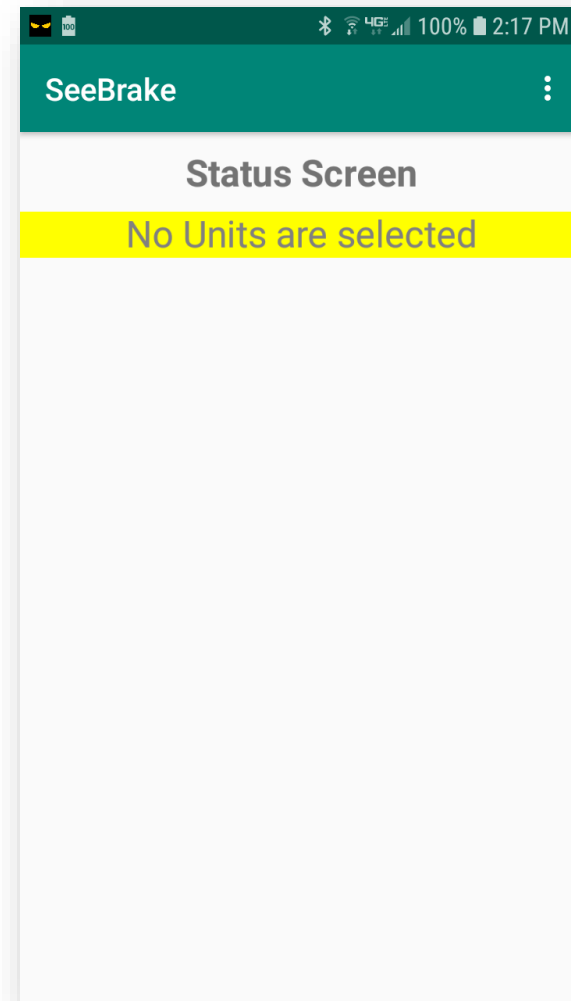If the brakes are tested in this mode, no brake data will be received.

Figure 1 - No Units Selected

Select Units

One or more units need to be selected from available vehicles.

The Available Units list will show all known units that the phone has connected with in prior sessions. See Figure 2.

If the Available Units list is empty, then press the SCAN button to detect new units. Power should be applied to the vehicle, for the Bluetooth adapter of the unit to be detected.

The Available Units list may contain several entries and scrolling the list may show additional units.

Any units found will need to be paired, the app will ask for the pairing number, which is '000000'.

The Selected Units show what units are to be monitored. If this list is empty, then pick units from the Available Unit list by touching and holding the entry to select.

When the Selected Units list shows the units to connect to, then press the DONE button.
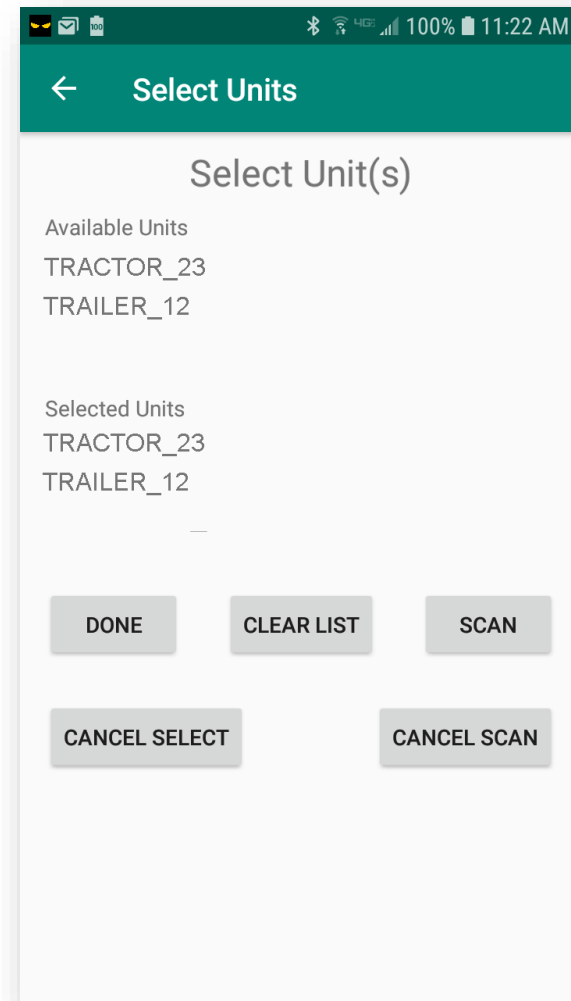

Figure 2 Select One or More Units

Brakes Not Checked

If the brakes have not been applied since the SeeBrake app was started, the banner will display the message "Brakes not Checked". To clear this message, press the brakes.

This will show up if new units are involved and the brakes have not been tested yet.

If there is data from a previous session, then the condition of the brakes will be displayed here.
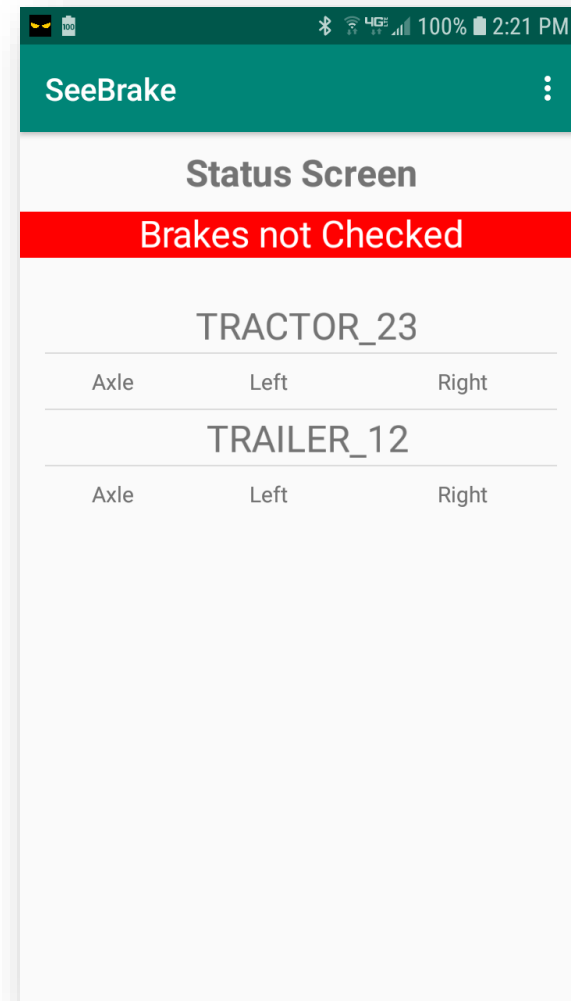
See Figure 3.

Figure 3 - Brake Not Checked

Normal Status

If all of the brakes are within limits, then the overall status is normal. The banner will display the message "Normal Status".

See Figure 4.

When all brakes are within the proper limits, all of the boxes will be Green, and the status will be displayed as "Normal Status".

Each unit that is connected will show up in the Status Screen in the order in which they are scanned.

The information is shown as a table of axle numbers and a colored box for left and right side brakes.

The table will accommodate the number of axles as reported by the SeeBrake system on that unit.

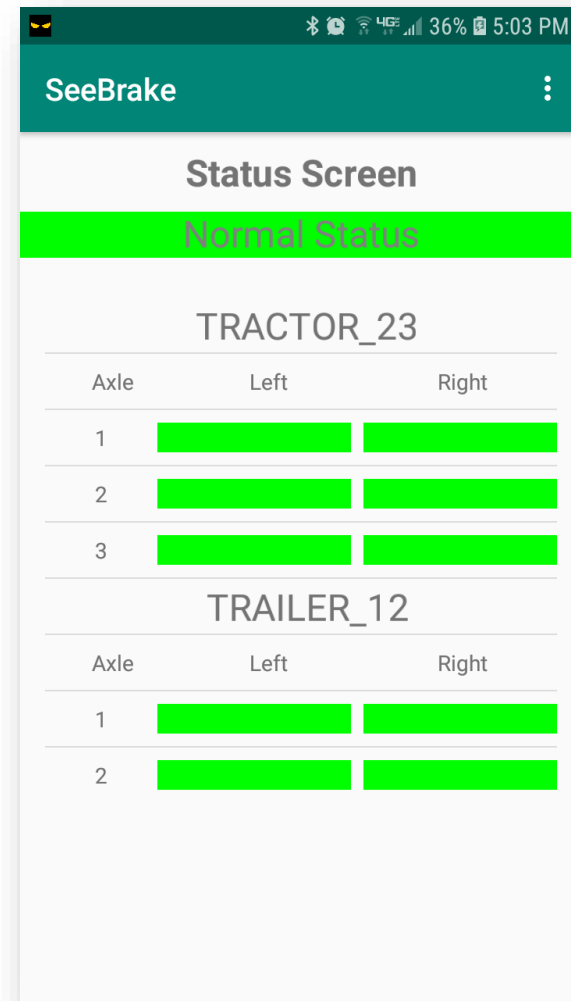The screen can be scrolled vertically to view all axles if there is not enough room on the screen for all axles.

Figure 4 - Normal Status

Out of Adjustment

If one or brakes are out of adjustment, but not enough of them to reach the 20% threshold, then the banner will display the message "Out of Adjustment".

See Figure 5. The brake is shown in Yellow, to indicate it is out of adjustment by 1/8".

If the brake is shown in Red, then it is out of adjustment by ¼". At least one brake status can be either yellow or red, depending on how far out of adjustment it is, to show this message.

When this message is displayed, it is time to confirm that a brake is out of adjustment. The brake should be adjusted by a trained technician. Once adjusted, test the brakes again. It should clear the message and go back to "Normal Status" and all Green.
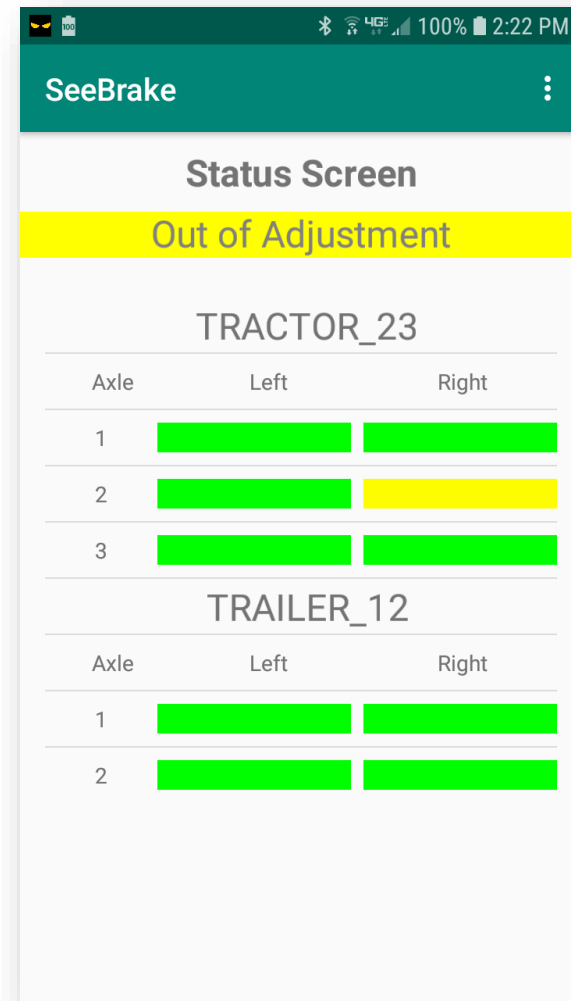

Figure 5 - Out of Adjustment

Out of Service

If 20% or more of the brakes are out of adjustment, then the banner will display the message "Out Of Service". See Figure 6.

This screen shot shows two brakes that are out of adjustment by ¼". That is 2 brakes out of 10 that are out. This is equal to 20%.

This can also occur if one of the steer brakes is out of adjustment. It does not matter if it is out by 1/8" or by ¼". If it is out, then the vehicle is Out of Service.

Each Red brake counts as 1. Each Yellow brake counts as 0.5. Two Yellows count as a Red. If the number of Red divided by the number of brakes is less than 20%, then vehicle is NOT in Out of Service.

The number of Yellow brakes is rounded down to an integer value. If three brakes were at Yellow, then it would be 1.5 Red brakes, or 1 Red brake. Four Yellow brakes would be 2 Red brakes.

The SeeBrake application does the determination of OOS.

This is critical as the vehicle should not be operated with the brakes at this level of limit violation.

This would be the time to visually verify that indeed the brakes are as indicated by SeeBrake.

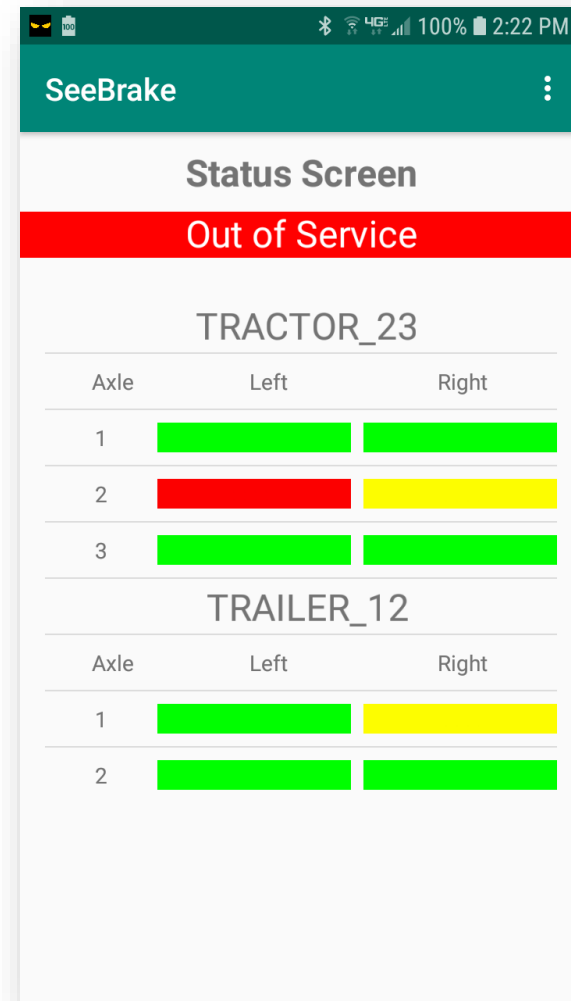Repairs and adjustments should be made by professionally trained technicians.

Figure 6 - Out of Service

Stuck Brake

In the Status Screen, a brake that is stuck high after the brakes are released will be shown in Orange. See Figure 7.

This status color is also used if during a brake event if a brake does not move.

Brakes that are stuck low are detected during brake measurement. A brake that is stuck high will be detected after the brakes are released.

The notification will be visible

This is a critical condition that requires immediate attention. The vehicle should be pulled over and the brake inspected, particularly if the vehicle is moving.

If the vehicle is traveling with a stuck brake, the SeeBrake app can send a text message to designated cell phones to alert others of a dangerous condition, who in turn can contact the operator by other means.

Once the situation has been resolved, get a new reading by applying the brakes. The indication of a stuck brake will not clear without a brake test.

If the parking brakes are active during this time, all engaged parking brakes will show as stuck. Again, not critical if the vehicle is not moving.
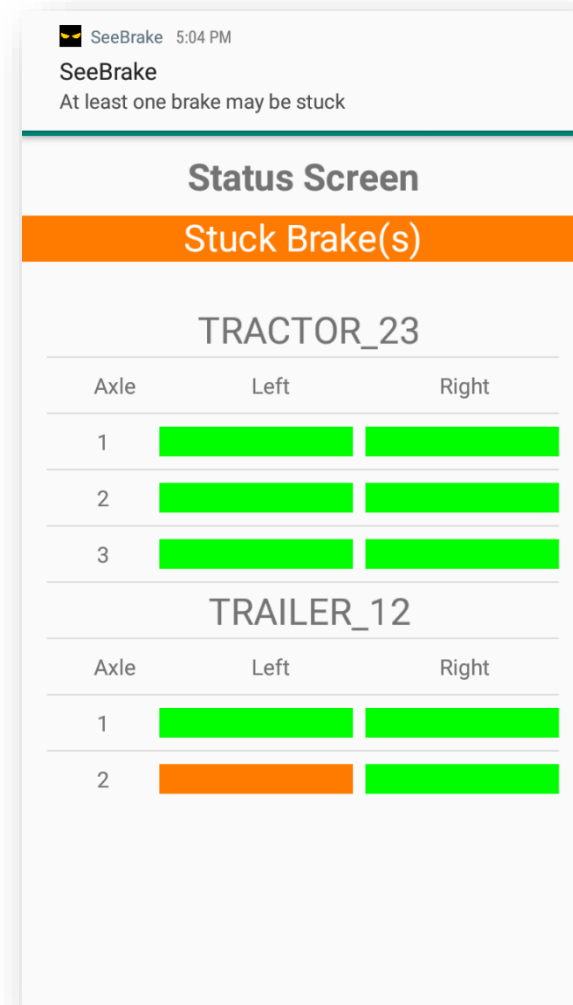
Figure 7 A Brake is Stuck

Critical Notification

If the condition of a stuck brake occurs, the SeeBrake app will check the speed of the vehicle. If it is greater than 15 MPH, then it will send a text message to designated contacts.

These contacts should be personnel that would have the ability to contact the operator in an alternate means, such as through the ELD.

The phone number or numbers can be entered into the Settings screen. See Figure 8 Text Message Setting Figure 8.

The feature should be enabled using the check box.

One or more phone numbers can be entered under the Text Message Numbers entry. They need to adhere to the format of

nnn ppp-pppp

Use a 3 digit area code, followed by a space, and then the 7 digit phone number with a dash. More than one number can be added by following each with a semicolon.
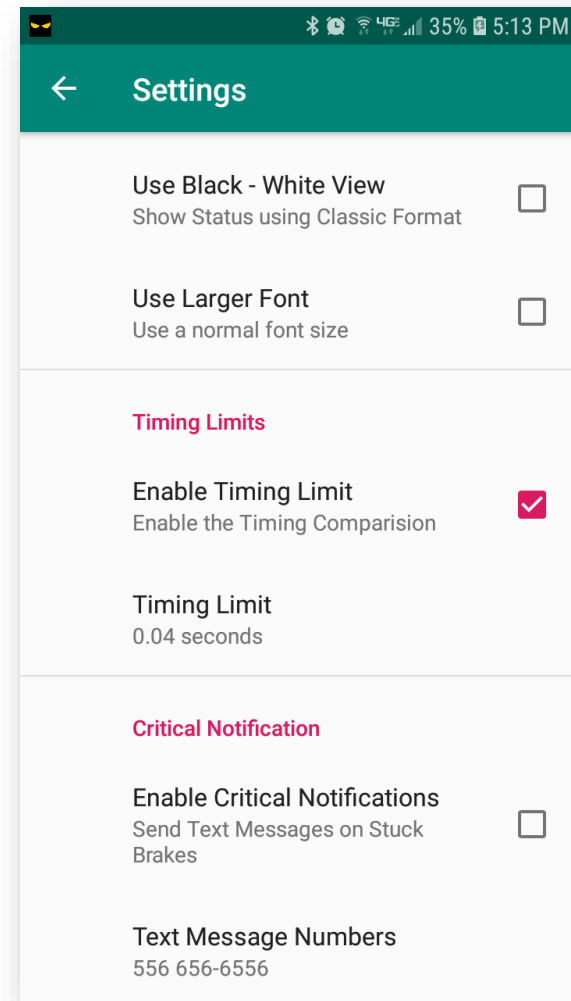
Figure 8 Text Message Setting

Screens

These are the different screens that are available in SeeBrake that show the conditions of the brake push rods.

Status Screen

This is the first screen that is displayed. It shows the status of each brake. See Figure 9.

The first line is the title of the screen, Status Screen.

The second line is the overall status of the vehicle, Normal Status.

The next line will be the name of the unit as entered in the Scanner Screen.

Following the name will be the table of axles and the brake status of the left and right brake of each axle.

If the brake is within adjustment, then the color is shown in Green.

Following this table will be the brake status of the trailer, showing its name and the status of the brakes.
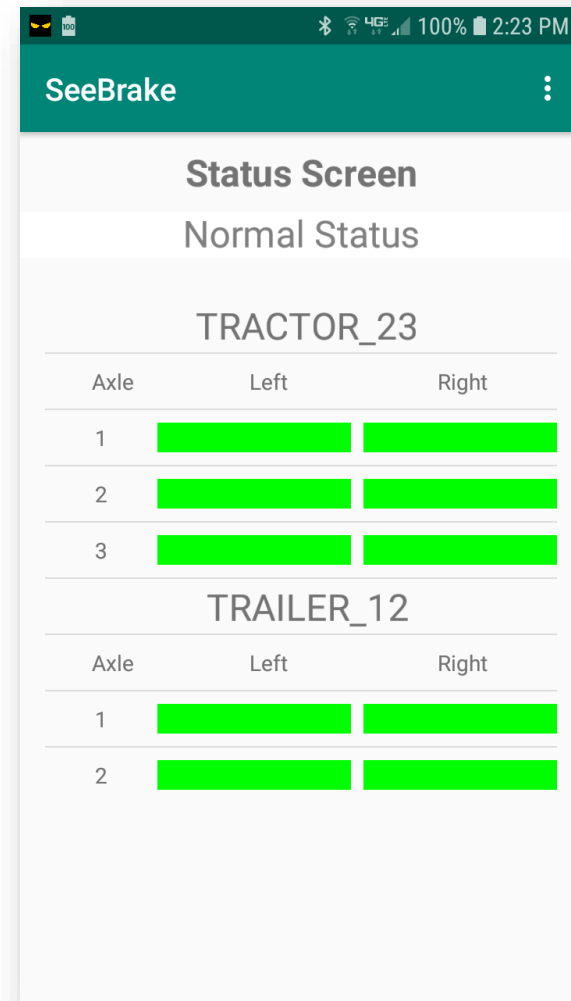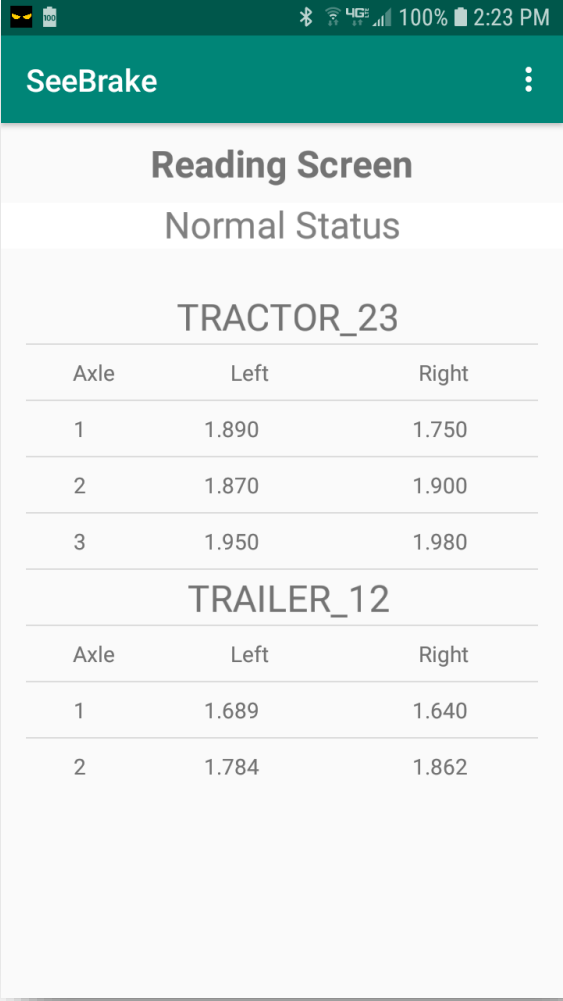

Figure 9 - Status Screen with Good Brakes

Reading Screen

The Reading Screen shows the brake data in a numeric form. Each value shown is the actual measurement, in inches. See Figure 10.

Each unit is shown with the name at the top of the table and each axle shows the Left and Right values.

This screen only shows the measurements. It does not provide an indication of limit violation, as that is shown on the Status Screen.
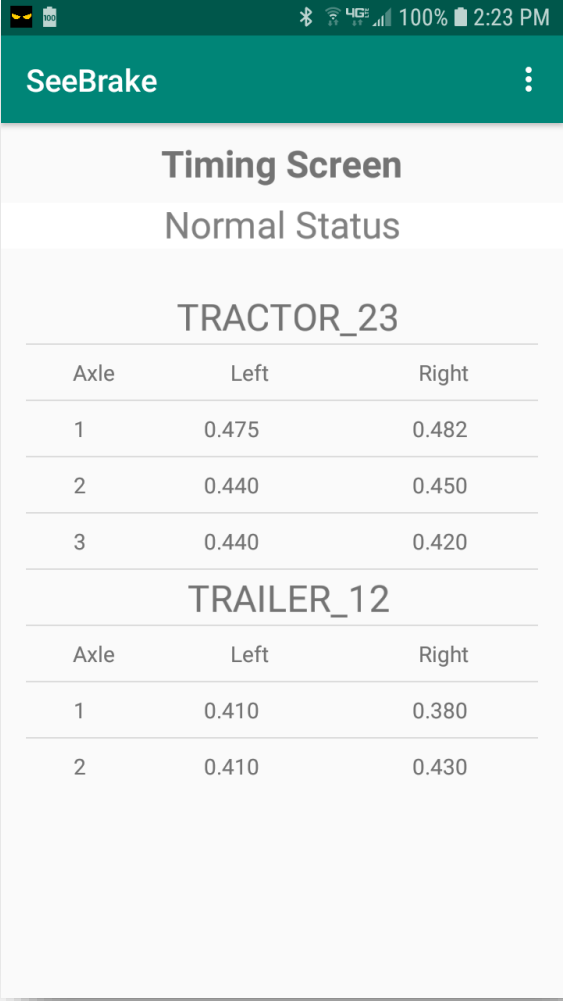

Figure 10 - Reading Screen

Timing Screen

The information shown on this screen is a measure of the brake response time. It is a measure of how long it took for the brake to reach its full position. See Figure 11.

In general, there is no means of knowing what the limits are in time to travel. What can be determined is a relative comparison between brakes per axle and brakes from the trailer forward.

Once results are obtained on a properly functioning brake system, then the technician can look at these numbers to see if a brake is taking way too long to engage on the right side versus the left side.

The SeeBrake application can be set up to look at the differences per axle and mark a slow brake with a cautionary color of yellow.

If the value is awfully close to zero, it may be an indication of a brake that is not moving. Either it is stuck at the rest position or at its maximum position. In either case, the push rod measurement may be within adjustment limits, but there is still a mechanical issue to attend to.

Timing Screen

Normal Status

TRACTOR_23

Axle	Left	Right
1	0.475	0.482
2	0.440	0.450
3	0.440	0.420

TRAILER_12

Axle	Left	Right
1	0.410	0.380
2	0.410	0.430

Figure 11 - Timing Screen

Summary Screen

The Summary screen does not relate to brake measurements as it more gives information about each units name, notes, MAC address (Bluetooth address), how many times the brakes have been applied, the timestamp of the last brake event and how many operational hours the unit has been in operation since the SeeBrake system has been installed.

As shown in Figure 12, this would be the summary for a newly installed system for both the tractor and trailer.
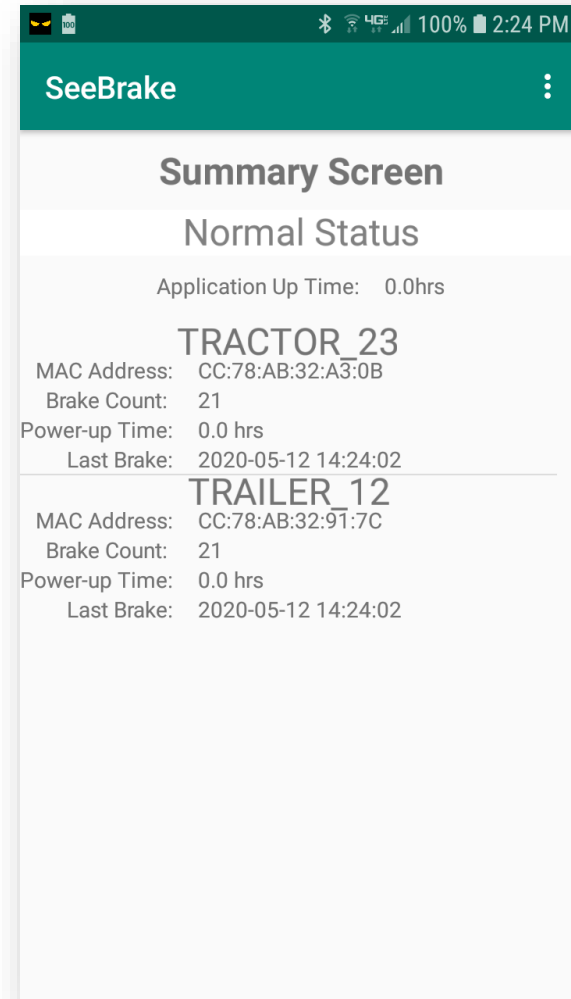

Figure 12 - Summary Screen

On Line or Off Line

A properly configured setup will allow the application to connect to the units. The units must be powered on, for a connection to complete.

For each unit that is on-line, it will provide brake data each time the brakes are applied and released. In the status screens, any unit that is on-line and responding is shown by name only.

If the vehicle is turned off, the trailer disconnected, or the phone is moved too far away, the SeeBrake application will send a notification of loss of connection, and the name of the unit will include the phrase ' – Off Line'.

The SeeBrake application does not reconnect, on its own. If the units are turned back on or the phone is moved closer, the user must re-establish the connection by opening the Scanner Screen from the Menu and verify the units are listed in the Active List and press the DONE button.

When the Scanner Screen closes, the application should re-connect to the units.

Settings Screen

The settings of the application can be controlled from this screen. There are switches that control the way the brake status is shown. See Figure 13.

Display Settings

This is the group of controls that affect mainly the Status Screen, unless otherwise noted.

Show Status Text

The switch for Show Status Text allows for a phrase to show up in the colored boxes of the Status Screen. This only applies to the Status Screen, while not in the Use Black – White View mode.

See Figure 14.

If the brake adjustment is within limits, it will be shown with a green background, with the word 'Normal' in the box.

If the brake is out by 1/8", then the phrase '1/8 Out' is shown, on a yellow background.

If the brake is out of adjustment by ¼", then the phrase '1/4 Out' is shown on a red background.

Use Black – White View

When this is turned on, the colors of the Status Screen of green, yellow and red are replaced with a black and white graphical box. This only applies to the Status Screen. See Figure 16.

If the box is empty, then the brake is within the proper adjustment.

If the left side of the box is filled in, then the brake is out by 1/8"

If the box is fully filled in, then the brake is out be ¼"

Use Larger Font

There are two sizes of text available. The normal size is the default when the SeeBrake first starts up. The larger font size will be applied to all brake screens of Status, Reading, Timing and Summary Screens. See Figure 15.

Timing Limits

This group deals with setting the timing difference as an upper limit of how different two brakes can be on one axle.

The Timing Screen will highlight any brake that takes longer than brake of the same axle, by the amount of time given here.

If there is a timing issue, and the timing test is enabled, then a notification is sent to the user.

Disable Timing Limit

Turn off the timing limit check by checking this box. The user must opt out of checking for timing issues, specifically.

The default state is to do the timing tests.

Timing Limit

This field allows the user to set the time difference. The default is 0.04 seconds. This means that if the left brake takes 0.039 seconds to engage and the right brake takes 0.082 seconds that is a difference that is greater than 0.04 seconds. The right brake will be shown on a yellow background.
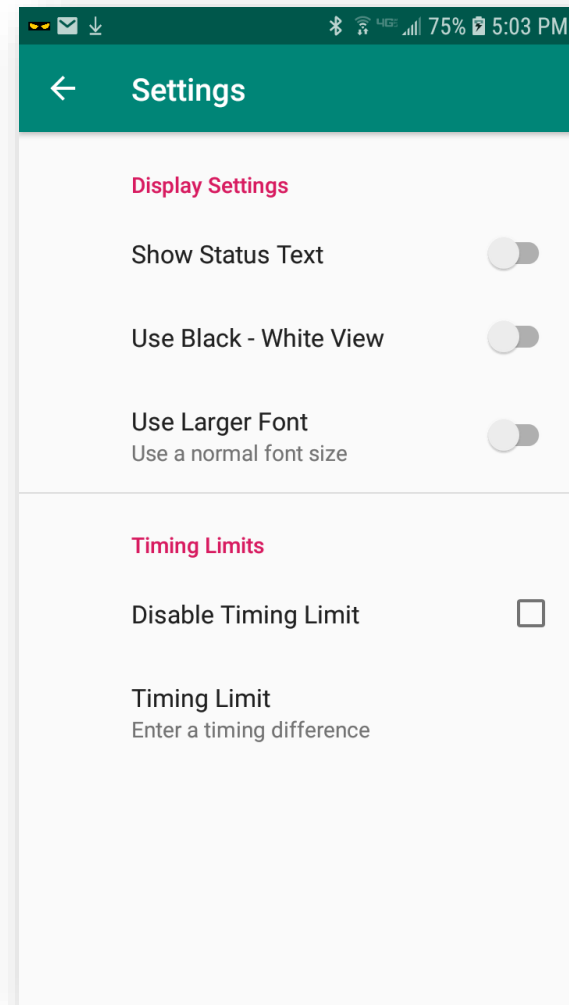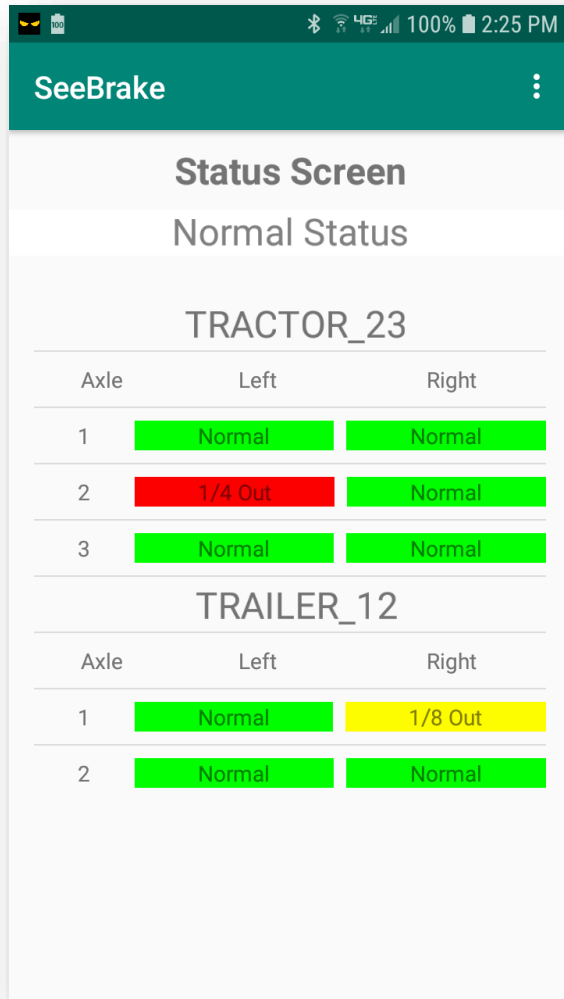

Figure 13 - Setting Screen
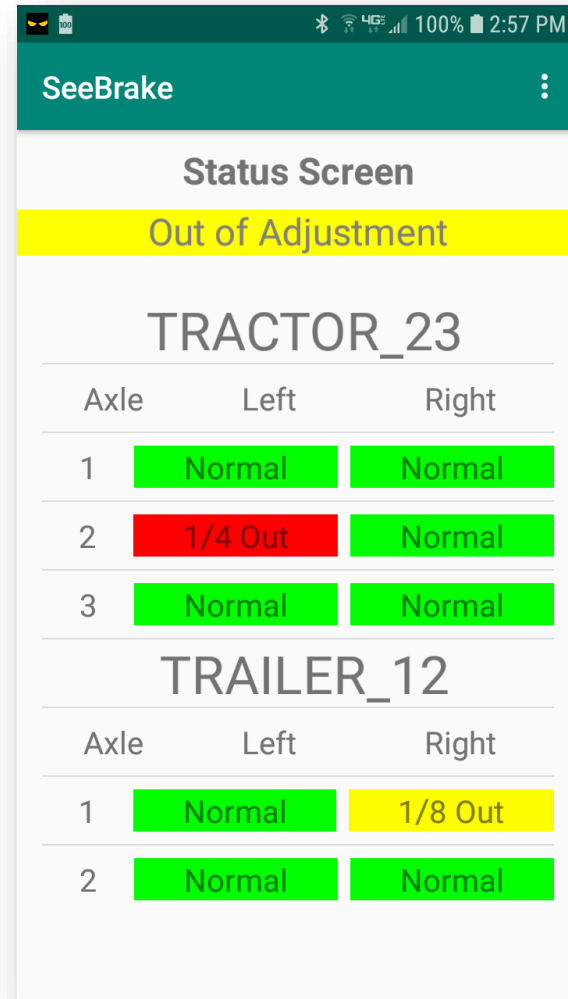
Figure 14 - Status Screen with Text

Figure 15 - Status Screen with Text and Larger Font

Figure 16 - Status Screen in Black and White

About Screen

The About Screen shows the name of the SeeBrake application, copyright, company name, and version.

Brake Conditions

Normal Status

For the vehicle to be in Normal Status, all brakes must be properly adjusted.

Out of Adjustment

This is an indication that there is at least one brake that is out of adjustment by 1/8" or ¼". But there are not enough brakes in this state that would put the vehicle into Out of Service.

Out of Service

This is a critical condition in that there are enough brakes out of adjustment, to put the vehicle in Out of Service (OOS).

This can also happen if either of the steer brakes is, at all, out of adjustment. It could be the only brake out of adjustment.

The following table gives some examples for a 5 axle tractor/trailer combination. This would be 10 brakes. At least two brakes have to be out by ¼"

Table 1- Summary of Brakes and Status

No brakes out of adjustment	Normal
One brake out by 1/8" (yellow)	Out of Adjustment
Two brakes out by 1/8" (yellow)	Out of Adjustment
One brake out by 1/4" (red)	Out of Adjustment

One brake out by 1/4" (red) and one yellow	Out of Adjustment
One red and two yellows	Out of Service
Two reds	Out of Service
Orange	Brake stuck high **Critical**

Timing Issues

Any brake can be properly adjusted, but not respond in a timely fashion. A brake may longer to engage because of an air leak. It could be stuck in the off position or the on position.

If the brakes are all in adjustment, but there is a timing difference between brakes on an axle, then a notification will be sent to the phone.

Notifications

Notifications are a means to convey different conditions to the user. The brakes are checked and analyzed even if the SeeBrake application is not the top application.

The SeeBrake application could be in the background while the phone in a map mode, giving directions. If the brakes are applied during this time, the application will receive the data, analyze the data for brake status and if there is an issue, a notification is sent to the phone.

The user can see the notification by dragging a finger down from the top. Touching the SeeBrake notification will bring the application to the forefront, and the brake results are now visible.

If the SeeBrake notification is visible, slide it to the right to expose the notification settings. Open the settings to change the ring tone used to alert the user.

The app will run in the background if it is not visible. This permits the app to continually monitor the brakes and notify the user if there are any changes.

The app when hidden is not included in the list of running apps. To bring the SeeBrake app back to the forefront, open the notifications and touch the SeeBrake notification.

Connecting to a Different Unit

After the SeeBrake app has been configured for which units to use, it will remember the units as the SeeBrake app starts up.

If a different trailer is to be used, then it needs to be selected.

Different Trailer

If the SeeBrake is connected to one trailer, then:

1. Bring up the Select Unit screen
2. Touch and hold the name of the unit to remove from the Selected Units list or press the Clear List button
3. Touch and hold the name of the new unit from the Available Units list
4. Press the DONE button

New data will not show until the brakes are pressed and released.

Tractor and Different Trailer

If the SeeBrake is connected to a tractor as well as a trailer, and the trailer is to be changed out with a different trailer, then:

1. Bring up the Select Unit screen
2. In the Selected List, touch and hold the unit to remove
3. Touch and hold the name of the unit to add from the Available Units list
4. If the desired unit is not available, press the SCAN button, while power is applied to the unit
5. Repeat for each unit to add
6. Press the DONE button

New data from the units will not be seen until the brakes are pressed and released.

Data Storage

Each phone will create its own database of information about the current setup. It stores what units were involved, and what the last brake measurements were.

Units

Anytime a unit such as a tractor or trailer is used, information about that unit is stored in the phone.

If it is a new unit, not seen before, the user will need to supply a name for the unit, and optional additional information.

The name used should be a name that is agreed upon within the organization. It may be a single letter followed by some digits. It

might be a more generic name. It could be an asset identifier. This name will show up in the results, followed by the brake information.

The optional information may be an asset tag, VIN or license plate. This information will show up only in the Summary Screen.

If the unit has been seen before and entered the database, then the next time it is scanned, the name and optional information will be displayed as read only text.

Brake Data

Each unit will have one or more axles. As the brake data is received, it is displayed on the different screens under the name of the unit.

The database stores the current reading. If the app is shut down and restarted, then this last set of readings will be displayed.

Changing units to a different trailer will change what brake data is shown. If it is a new unit, no data is yet available. If it is a unit that was previously used, the last known brake readings will be shown.

Terminology

Brake Event	The brakes are pressed and released
OOS	20% or more of the vehicle brakes are out of adjustment
Bluetooth	A wireless interface for sending data from the units to the SeeBrake app
MAC Address	A unique 12-digit value that is for a particular Bluetooth device
Unit	Refers to a tractor or trailer
Notification	A high priority message displayed on the phone when an application

	requires the user's attention
Adjustment	A condition of how the push rod travel relates to the limit of the air canister that drives the brake

Configuration and Calibration

During installation, the SeeBrake controller is configured for the active axles and the size of the air cans on each axle. This determines the limit for adjustment.

The calibration is required to record into the controller each physical measurement and then capture the sensor readings while the brakes are released and while the brakes are engaged.

This frees the SeeBrake app from having to know what the limits are for each brake. That information remains with the tractor or trailer.