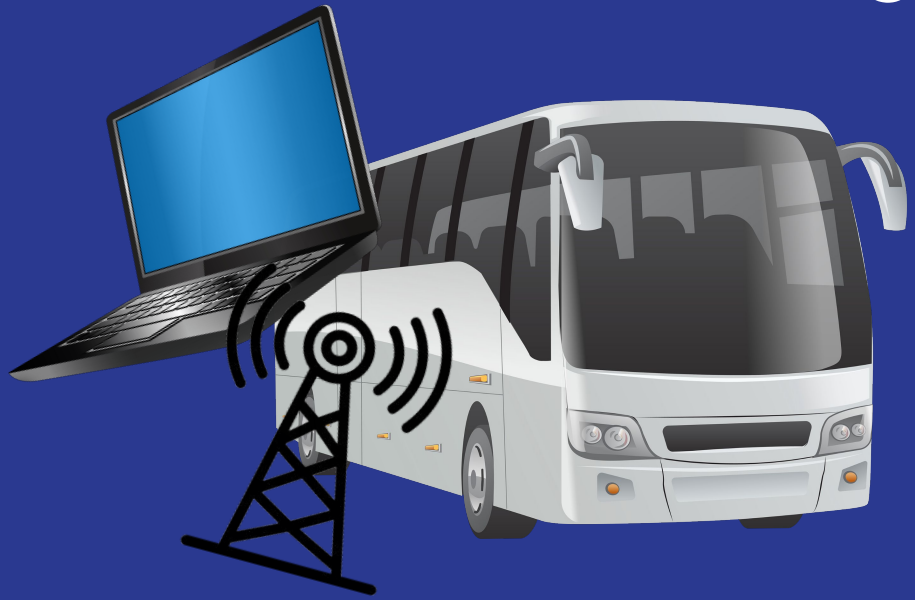
Bus Division Cellular Coverage Study



Megan Leitz, Talley Applewhite, and Anna Gotterup

The Problem

Company

GL Communications Inc.

- Telecommunications consulting company
- Developed a package to test network performance

Context

A transit company is evaluating the reliability and strength of a cellular communication link at one of it's indoor bus maintenance facilities with three different cellular service providers.

Problem statement

Buses collect data on their daily route and need to be able to upload it with efficiency upon return to the maintenance facility.

The Objectives

Objective 1

Compare carrier performance in maintenance facility

- Represented with data graphics

Objective 2

Verify cellular coverage & identify coverage gaps

- Verified by Heat Maps

Objective 3

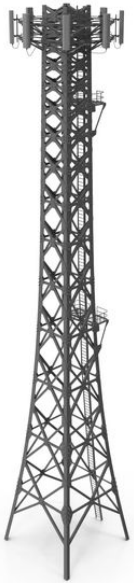
Recommend locations to add cellular repeaters

- Contemplate costs
- Evaluate pros and cons for data transfer

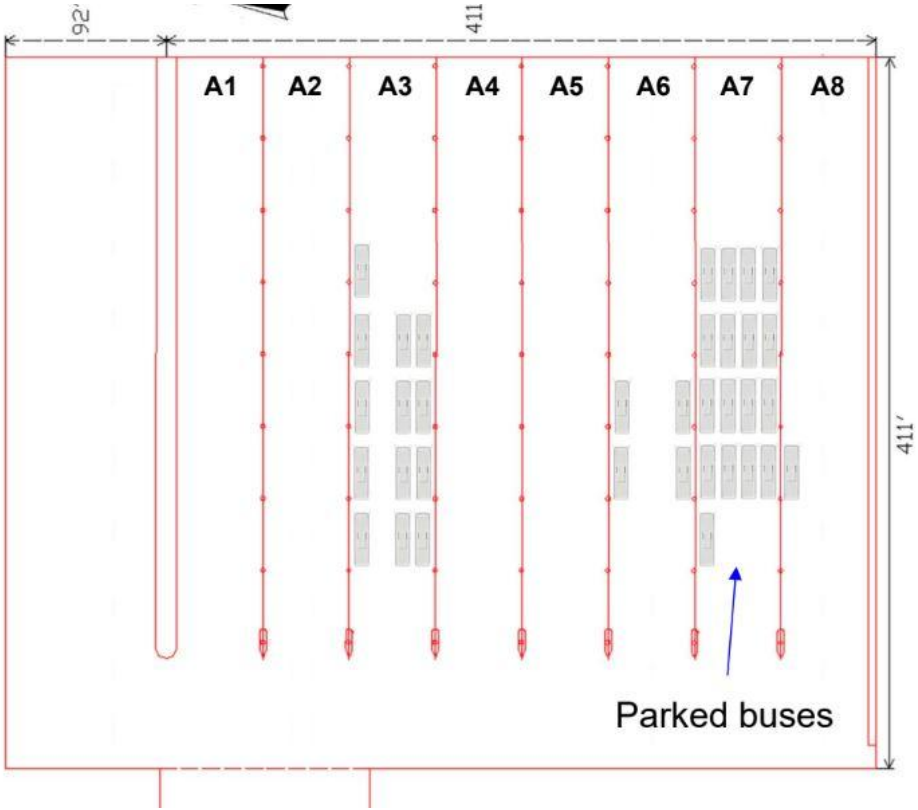
The Variables

4 variables are being measures:

- Received Signal Strength Indicator (RSSI)
  - Measured in decibels
  - Higher the number the stronger the signal
- TCP Upload Speed
  - Speed of the data transfer
  - Measured in megabits per second
- TCP Upload Quality of Service
  - Consistency of throughput
  - Measured as a percentage
- TCP Round Trip Time
  - Time for data to move across the network
  - Measured in milliseconds

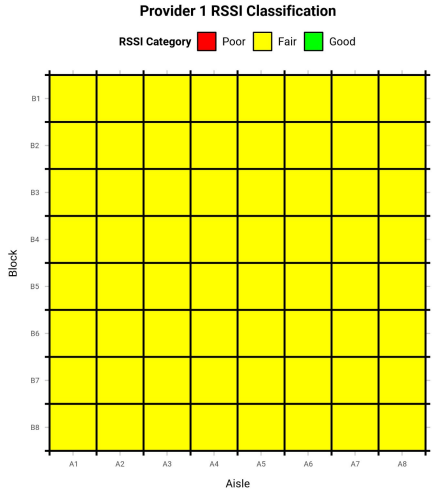


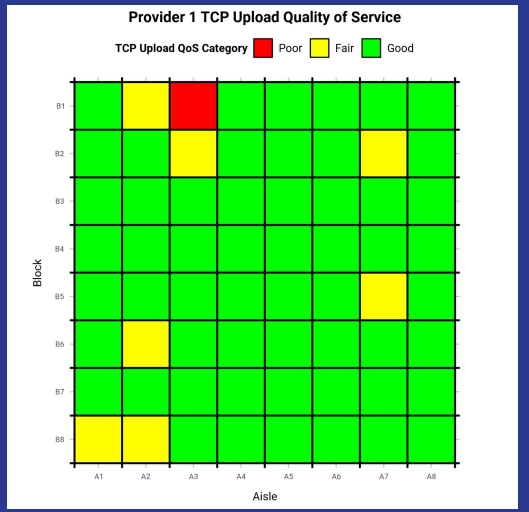
The Facility

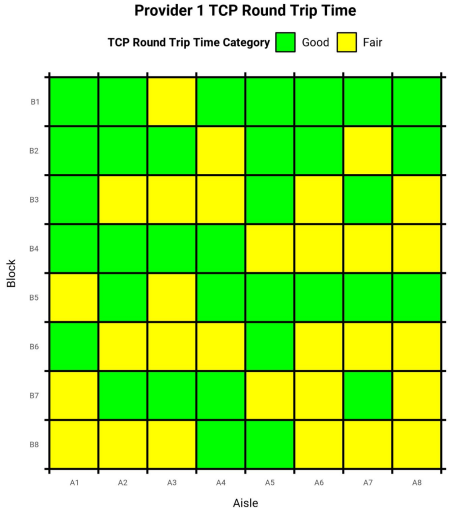


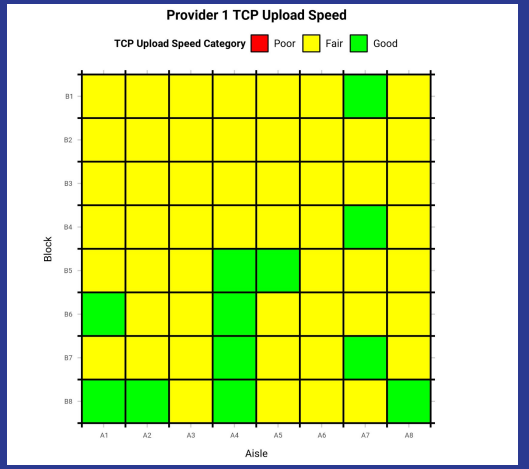
- Facility broken into 8x8 grid
- 36 quads
- A represents the aisle
- B represents the block
- Each quad holds roughly 4 buses

Carrier 1

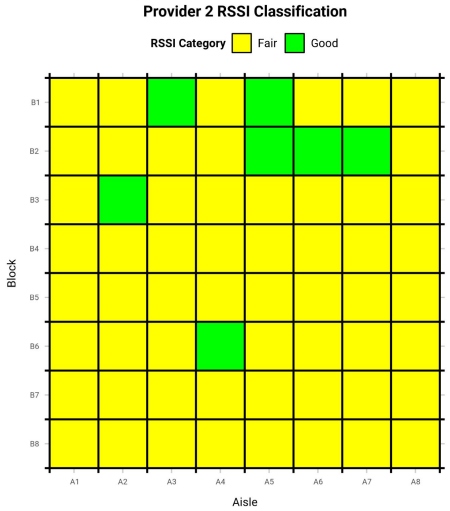

Provider 1 RSSI Classification
RSSI Category
Poor
Fair
Good
Block
B1
B2
B3
B4
B5
B6
B7
B8
A1
A2
A3
A4
A5
A6
A7
A8
Aisle


Provider 1 TCP Upload Quality of Service
TCP Upload QoS Category
Poor
Fair
Good
Block
B1
B2
B3
B4
B5
B6
B7
B8
A1
A2
A3
A4
A5
A6
A7
A8
Aisle


Provider 1 TCP Round Trip Time
TCP Round Trip Time Category
Good
Fair
Block
B1
B2
B3
B4
B5
B6
B7
B8
A1
A2
A3
A4
A5
A6
A7
A8
Aisle


Provider 1 TCP Upload Speed
TCP Upload Speed Category
Poor
Fair
Good
Block
B1
B2
B3
B4
B5
B6
B7
B8
A1
A2
A3
A4
A5
A6
A7
A8
Aisle

Carrier 2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RSSI Category
Fair
Good
Block
B1
B2
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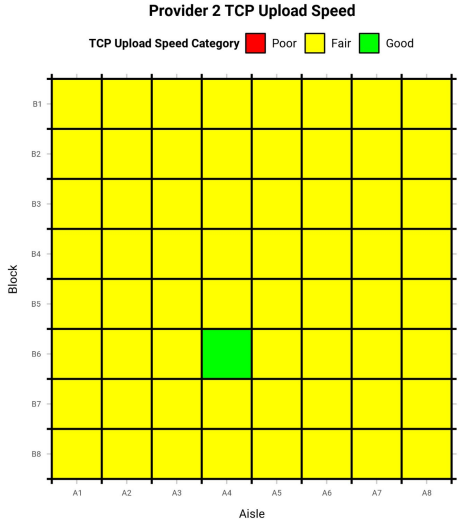
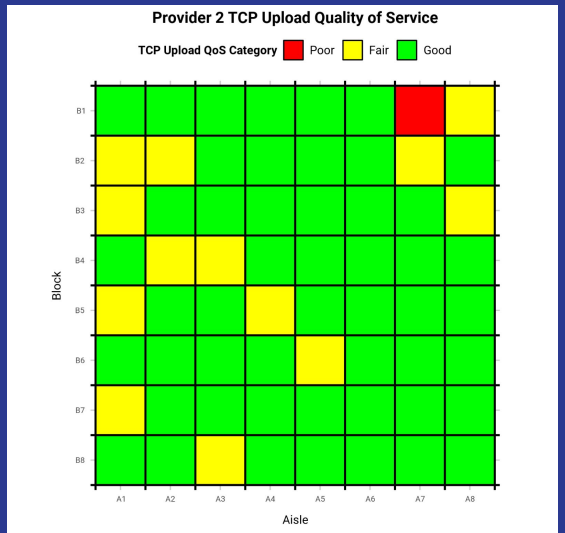
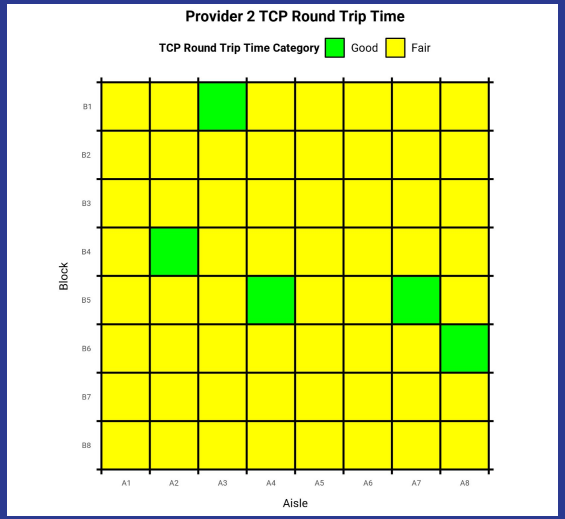
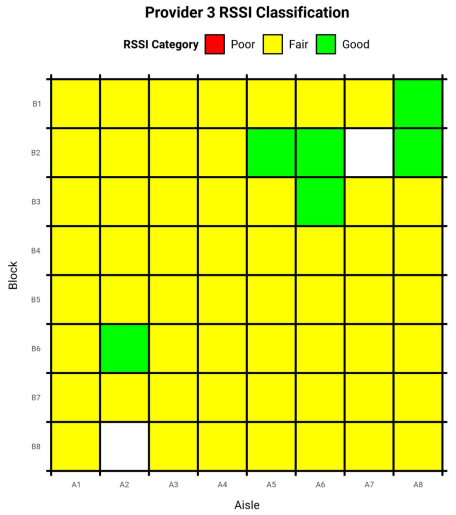
B4
B5
B6
B7
B8
A1
A2
A3
A4
A5
A6
A7
A8
Aisle

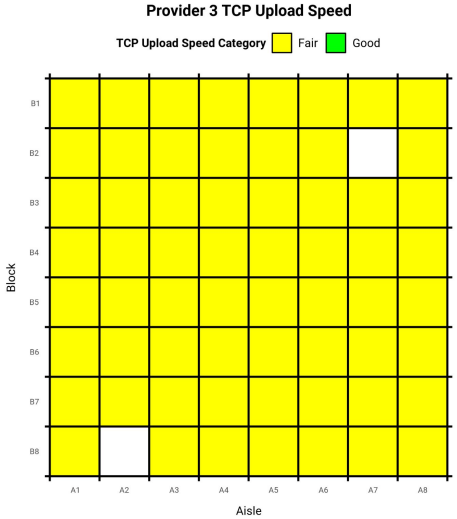

Provider 2 TCP Upload Speed
TCP Upload Speed Category
Poor
Fair
Good
Block
B1
B2
B3
B4
B5
B6
B7
B8
A1
A2
A3
A4
A5
A6
A7
A8
Aisle

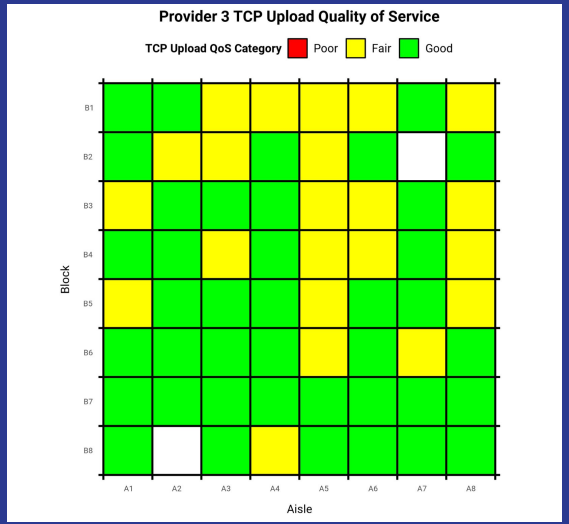

Provider 2 TCP Upload Quality of Service
TCP Upload QoS Category
Poor
Fair
Good
Block
B1
B2
B3
B4
B5
B6
B7
B8
A1
A2
A3
A4
A5
A6
A7
A8
Aisle

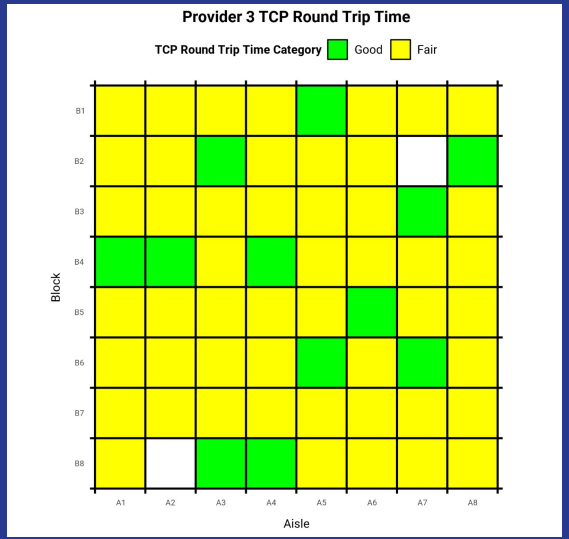

Provider 2 TCP Round Trip Time
TCP Round Trip Time Category
Good
Fair
Block
B1
B2
B3
B4
B5
B6
B7
B8
A1
A2
A3
A4
A5
A6
A7
A8
Aisle

Carrier 3

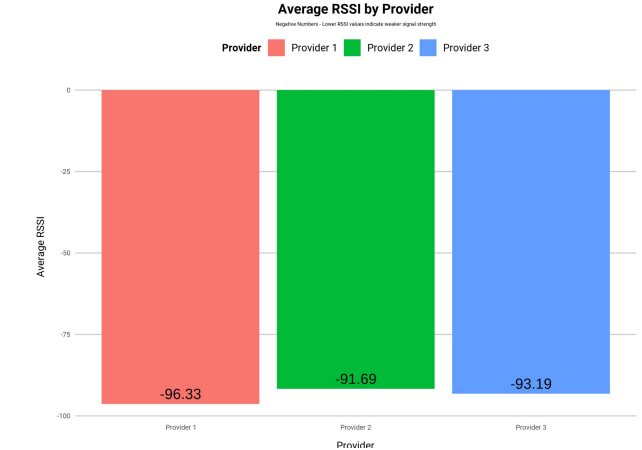

Provider 3 RSSI Classification
RSSI Category
Poor
Fair
Good
Block
B1
B2
B3
B4
B5
B6
B7
B8
A1
A2
A3
A4
A5
A6
A7
A8
Aisle

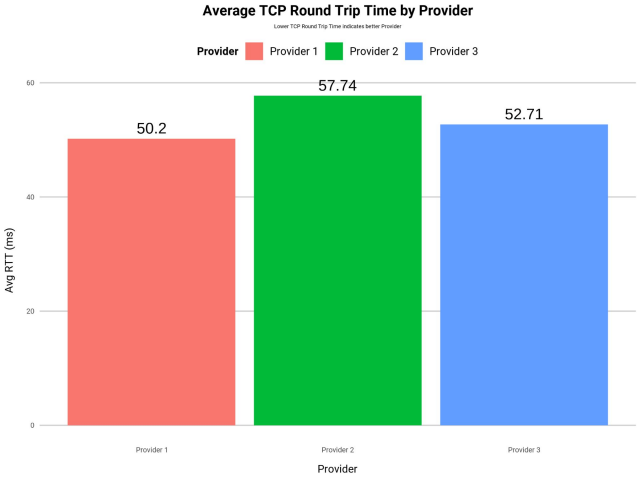

Provider 3 TCP Upload Speed
TCP Upload Speed Category
Fair
Good
Block
B1
B2
B3
B4
B5
B6
B7
B8
A1
A2
A3
A4
A5
A6
A7
A8
Aisle

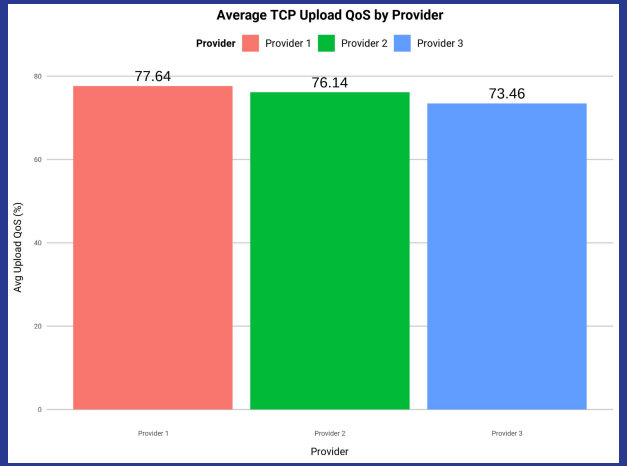

Provider 3 TCP Upload Quality of Service
TCP Upload QoS Category
Poor
Fair
Good
Block
B1
B2
B3
B4
B5
B6
B7
B8
A1
A2
A3
A4
A5
A6
A7
A8
Aisle

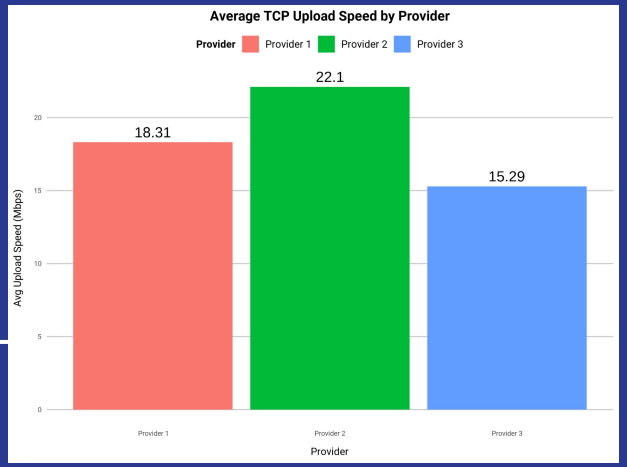

Provider 3 TCP Round Trip Time
TCP Round Trip Time Category
Good
Fair
Block
B1
B2
B3
B4
B5
B6
B7
B8
A1
A2
A3
A4
A5
A6
A7
A8
Aisle

Average Comparisons







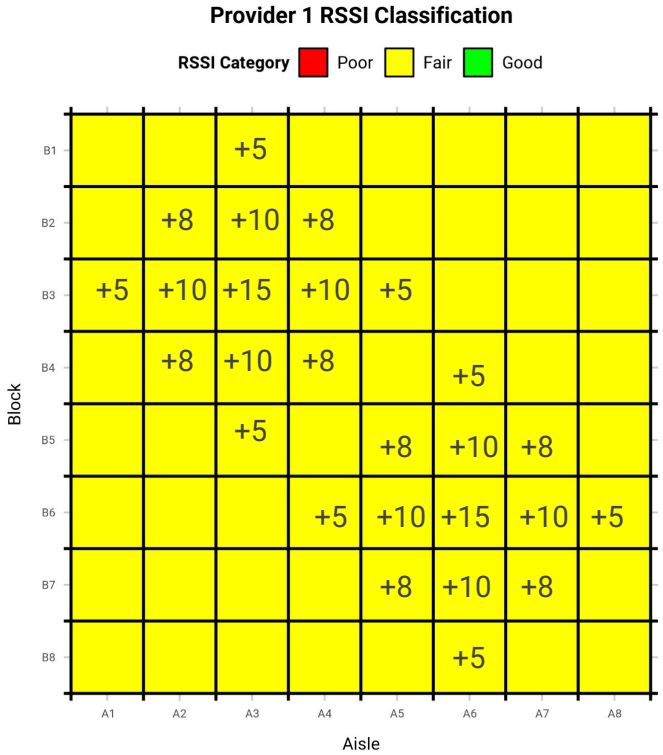


Best Overall Carrier

Carrier 1

- *Best overall performance across facility in terms of RSSI, TCP upload speed, TCP upload quality of service, and TCP round trip time*
- *B1, A3 is the only quad with a poor performance score*
- *Received Signal Strength Indicator (RSSI) is the carriers worst performing indicator and the worst performing indicator overall but metrics can be improved by adding signal repeaters.*

Repeater Recommendations



- *Received Signal Strength Indicator (RSSI) is the worst performing indicator for Provider 1.*
- ***If cost is not a concern:** Recommend two repeaters placed at quads B3,A3 and B6,A6.*
- ***If cost is a concern:** Recommend one repeater placed at B3,A3.*
- *This will increase overall performance of RSSI by boosting signal strength in the indicated areas.*
- *Adding repeaters in these two spots will also boost the performance of the providers only poor value in B1,A3 of the TCP upload quality of service graph.*

Overall Recommendations

- **Carrier 1** is the best choice based on coverage gaps and overall performance
- Two signal repeaters added to the warehouse will boost poor performance areas.