



# CITY TECH COLLABORATIVE

WE REINVENT CITIES

Microsoft Research Air Quality  
Usability Test Results  
February 2021

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# PROJECT BACKGROUND AND TESTING OVERVIEW



# PROJECT BACKGROUND



**Wireframe Testing** gathers feedback on a simple visual representation of an interface, early in the design and development process

## Context

Microsoft Research is rolling out Air Quality sensors in bus stops in the Chicagoland area. The sensors will be accompanied by a website that will both report the collected quantitative sensor data and crowdsource qualitative data from users

City Tech is working with the Microsoft Research team to conduct a usability test on this air quality wireframe. The primary goal of this test is to get feedback on the website. Additionally, the test will ask users for preliminary feedback on the sensor setup and website access.

## Goals and Outcomes

Facilitate moderated remote tests of the air quality wireframe and gather content and usability feedback from testers. These data will help define recommendations for development.

## User Profile

*Testing group will match this profile*

- Chicagoland residents
- Majority of testers should have some experience with public transit
- No specific environmental or air quality requirements
- No digital skills requirement, but had to be able to participate on a video call while navigating the site on a mobile device



# TEST PLAN AND TESTING

Testers were paired with proctors and had 1 hour to review sensor mockups and the website, as well as complete tasks

## TEST PLAN

### Recruitment

- Testers were recruited from the pool of CUTgroup members.

### Testing

- **Introduction and background:** Collect profile information, understand participant's current concern level and involvement in environmental and air quality work.
- **Station review:** Tester gives feedback on the bus stop mockups of the sensor and QR code
- **Homepage review:** Tester gives initial impressions of the website home page
- **Data Page review:** Tester gives initial impressions of the data page
- **Navigation and tasks:** Completion of key tasks to assess how well the tester can navigate the website and find and understand information
- **Wrap-up and final thoughts:** Tester will comment on overall user experience



**Tester Experience:** Tests were conducted remotely over Zoom. Testers were paired 1:1 with proctors for the duration of the 1hr test. Proctors were able to see the tester actions via share screen.



**Test Platform:** Testers viewed station mockups shared by the project team and viewed the latest version of the air quality wireframe to complete the testing. Mockups were shared over Zoom and website was accessed via QR code



**Testing Medium:** The testers viewed station mockups on a laptop or tablet and the website on a mobile device



**Test Data:** Proctors kept detailed records of testers' actions, as well as directly asked testers to describe their experiences. Full Zoom calls were recorded for reference.



## TESTER DEMOGRAPHICS

Testers were recruited from within CUTgroup

**Location:** 21 testers within the Chicago Area\*

### Familiarity With Material:

- » It was important to all testers to be environmentally active, and 14 of the 21 testers said it was very important
- » 20 of the 21 testers were concerned about air quality in their environment, though not all seek information about it. Those that do generally find air quality using a weather app.
- » The testers were split between thinking of air quality as air within their houses and the air around them
- » All testers rode public transit at least 1x a month and 57% rode it greater than 3x a week. 20 of the 21 testers choose CTA bus as one of the modes that they used

**Digital Skills Experience:** All testers self assessed that they were comfortable using technology for their daily tasks, with 90% stating they were very comfortable

*\* 1 tester had recently moved out of state, but had lived in Chicago prior to the move*



# EXECUTIVE SUMMARY



# EXECUTIVE SUMMARY

Testers found the website generally easy to use, but wanted more context around the purpose and what to do with the information



## Station Experience

- » Many testers identified the leaf shape as denoting something environmental, but testers had a hard time pinpointing that it was a sensor, its purpose and connecting it to the website.
- » While most noticed the QR code, they wanted more instructions on how to use it and details on the where it would take them, the purpose of the site, and who ran it.



## Usability and Aesthetics

- » On a 1-5 scale with 1 being “Very Difficult” and 5 being “Very Easy”, testers rated the website an average of 4.43 for ease of use.
- » The colors were both reported as helpful in orienting the tester to the data and but also as jarring and busy. Some testers were concerned about accessibility issues.
- » Due to a lack of branding and some of design inconsistencies, testers were concerned that the website may be a scam



## Website Purpose and Context

- » All of the testers expressed confusion about the purpose of the website. They weren’t sure whether it was collecting data or sharing data and how the datasets related.
- » Some testers noticed the Microsoft logo on the QR code, but once they were on the website, did not know who was running it or where their data was going.



## Data Interpretation and Application

- » Testers were interested in the prospect of both the crowdsourced and sensor-reported data but they were confused which data was being shown on which part of the site
- » While testers appreciated the simplicity of the data presentation, they wanted better defined axes and terminology, as well as the potential to see larger trends and comparisons
- » Testers repeatedly expressed that they did not know what to do with the data that was presented on this site. They wanted better recommendations on how to interpret the data and determine the best course of action.



# TESTING DETAIL



# STATION EXPERIENCE REVIEW

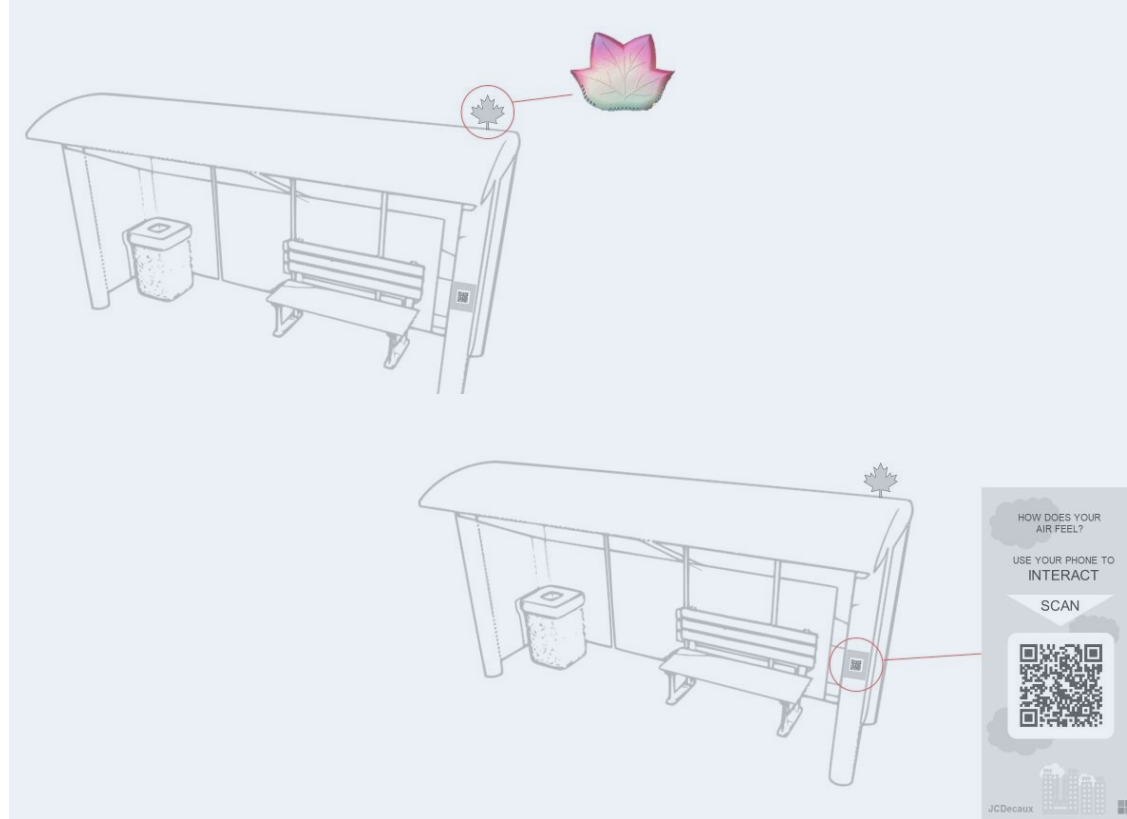
Testers responded to mockups of the sensor and QR code

## Air Quality Sensor

- » Testers said they may notice the leaf but were not sure what it was
- » While many testers thought the leaf may indicate something related with environmental bus stop design, only 3 testers guessed it was air quality related and it was due to the context of the study
- » Once testers were told that the leaf was an AQ sensor, they wished the sensor were dynamic and displayed air quality information through numbers or colors
- » A few testers expressed concern that the visibility of the sensor may be cause it to be vandalized. They did not feel it needed to be visible if it was not displaying information.

## QR Code

- » 7 testers said they would be very likely to scan the QR code and another 11 would be somewhat likely – they anticipated that the likelihood of scanning would depend on how long they spent at the bus stop and what else they had to do
- » All but 1 tester was able to scan the code and reach the website with no problem, but 1/3 of the testers did need some coaching on how to scan a QR code, suggesting there may be a need for more instructions at the bus stop
- » The “How Does Your Air Feel” prompt did not resonate with testers. They weren’t sure what it meant and did not know what type of site they would be taken to.
- » Testers expressed concern the QR code would go to a site that would harm their phone. Better branding or more information about the site it was going to would alleviate those concerns.



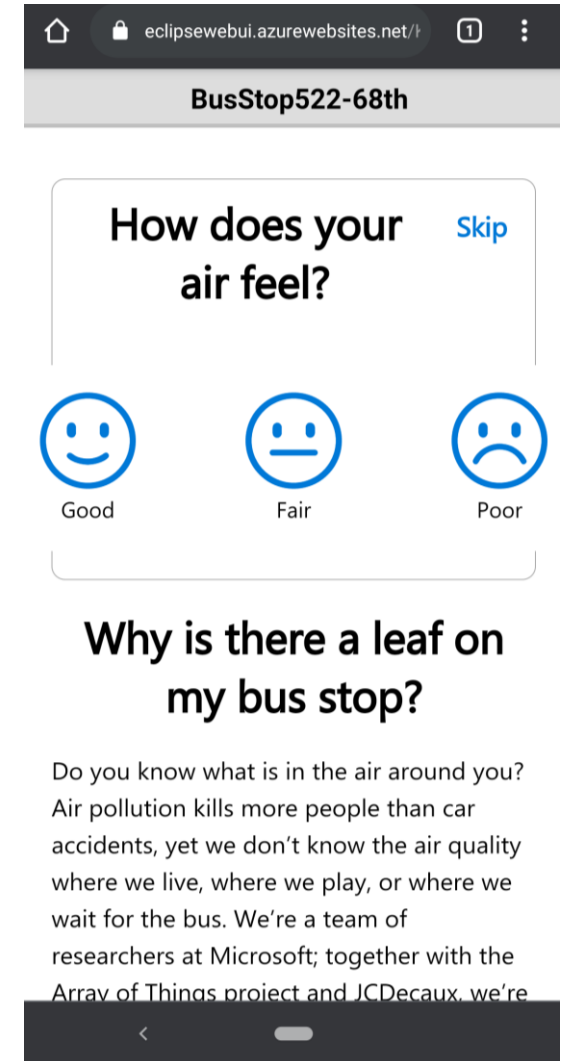
My first impression is why is the symbol of Canada on top of the bus stop? - RobertS

If it's a display, then people don't have to ask “what is that thing?” If it's a sensor, it would be better if it blended in and became invisible. - ErikD

# TESTERS WERE ASKED TO REVIEW THE HOME PAGE

Testers could scroll, but were asked not to click anything

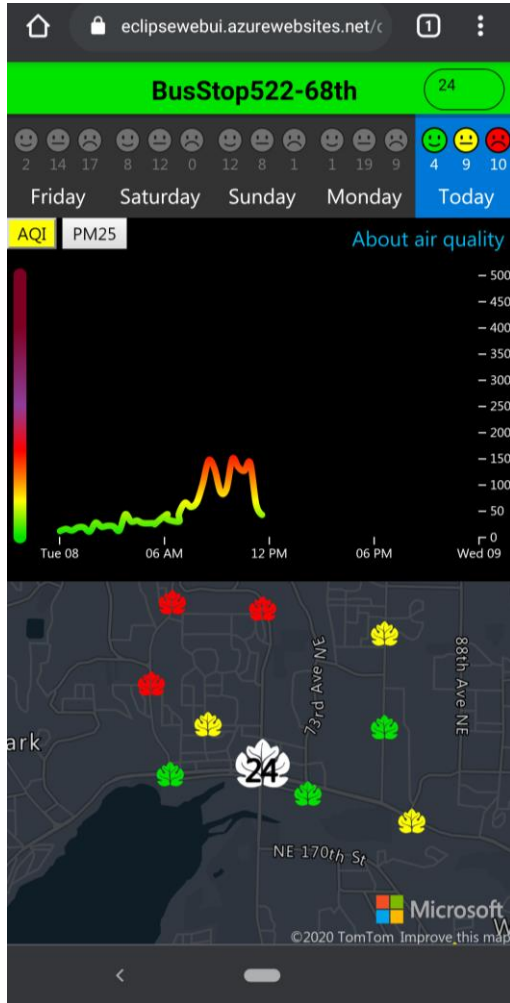
- Overall, **testers appreciated the additional information shown on this page, but it still left them with questions** about who was running the site and exact purpose of it.
  - » Most testers guessed that the **site had to do with collecting air quality information**, based on the previous background they had. They were not sure if it would also share information with them.
- While testers recognized this was still a wireframe, it felt barebones to them. **More than one tester said the site felt “scammy”**.
- Testers were mixed on aesthetics. **Some liked the simplicity** and thought it would help with accessibility, while **others wished for more color and visual callbacks to the leaf sensor**.
- Without branding, it was **difficult for testers to understand whether it was an official site**. City of Chicago, CTA, and MSFT logos were all suggested.
- All testers noticed the smiley faces first. Multiple testers said the smiley faces reminded them of the quick surveys you find at airports, but **they were not sure what would be done with their answers**
- Testers noticed that the **emojis were not scaling down and broke the sides of the box**. This added to the thought that the site might be a scam.
- Testers were split between the formatting of the text – they **appreciated the information and found it helpful, but some thought that it could be more bulleted or easier to read**. Additionally, a few testers noticed the lack of sources.
- “How does your air feel” continues to be a confusing prompt – some testers wanted to skip this question due to not knowing how to answer





# TESTERS WERE ASKED TO REVIEW THE DATA PAGE

Testers could scroll, but were asked not to click anything



- Most testers first **noticed the crowdsourced data emojis, sensor data graph, and maps**, and almost half wanted to explore the map first
- Testers found **the aesthetic of the site busy and the colors a little jarring**. Some testers with software and website development experience thought the colors may lead to accessibility concerns.
- Testers liked being able to see the quantitative data, but not all understood where it was coming from or what it meant. There was a **desire to better connect the data with the sensor**.
- More testers focused on the quantitative sensor data graph, but **most noticed the crowdsourced qualitative data also**. They were concerned about whether the data was representative.
- The bus stop naming convention was mentioned by many testers. **Many thought that something more easily recognized, like bust stop intersections, should be used**.
- Many **testers noticed the numbered pill at the top right of the screen** but no one knew what it stood for and found it distracting
- Understanding **air quality at other stops** was very interesting to testers; testers also wanted a zoom out to a neighborhood or city-level and be able to compare
- Testers thought it would be useful to **include more context about the data being presented**. While they could see the numbers and the colors were helpful, it was **hard for testers to understand what action they should take** based on what they saw.

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## TESTERS WERE OBSERVED COMPLETING 5 TASKS

For each task, we recorded how the tester navigated the task, as well as the user search experience

**Task 1:** What is the approximate PM25 measurement at this station at the end of Sunday?

**Task 2:** Where would you go to understand the definition of AQI

**Task 3:** How would you find how people feel about air quality at this station today?

**Task 4:** How did AQI change at this station throughout Friday?

**Task 5:** How would you find Air Quality measurements at other stations?

# TASK 1: STATION PM25 MEASUREMENT AT SUNDAY END



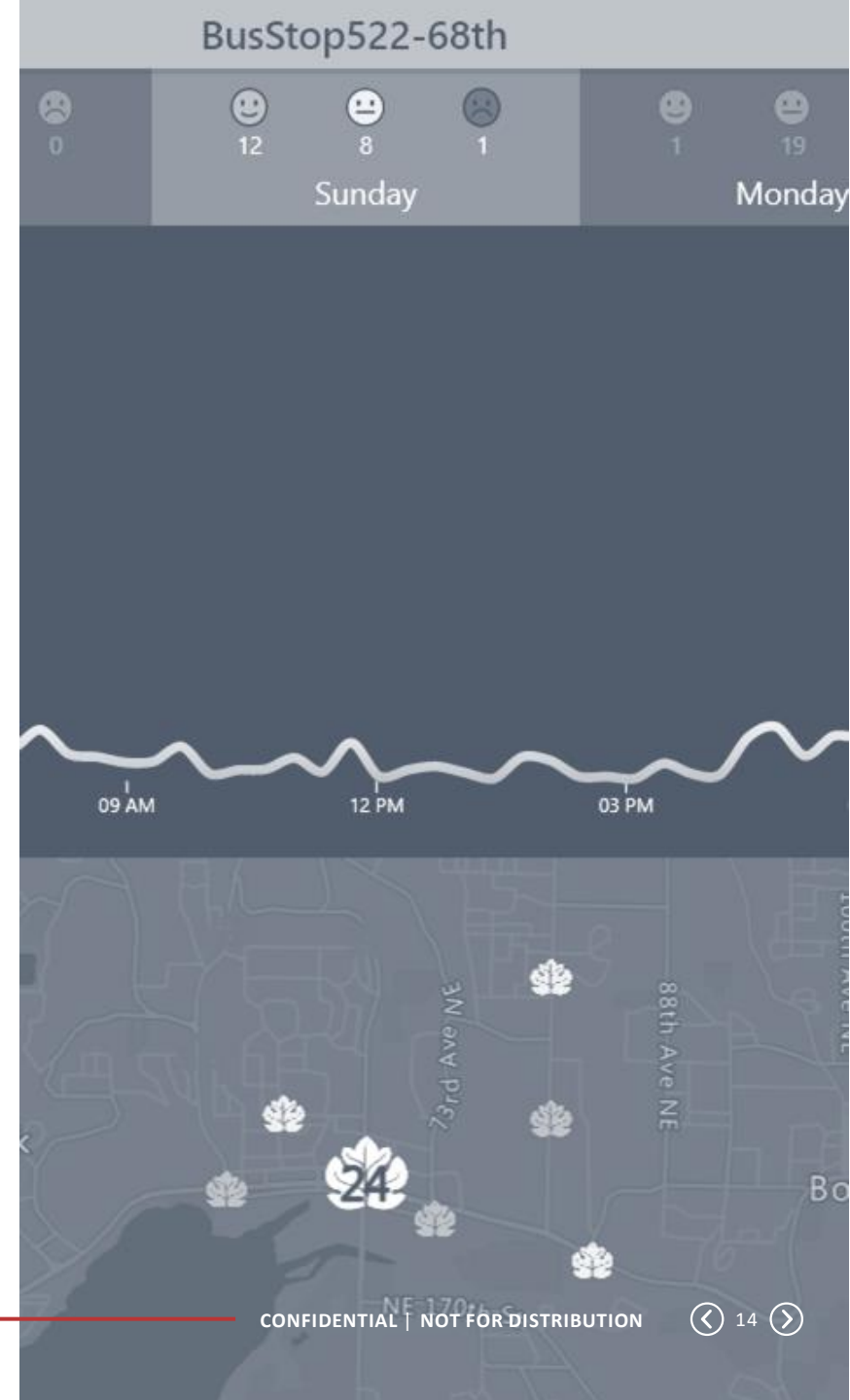
## NAVIGATION

- 12 of 21 testers navigated by first choosing Sunday, then clicking on PM25, while most others first switched the graph to PM25 and then chose the date
- 71% of testers were able to find this on the first try. Many of those that had trouble found AQI and did not switch to PM25. Others thought the answer might come from the numbers under the emojis and got stuck there.



## KEY FEEDBACK

- Most testers did not know what PM25 was: 1 tester knew the definition and 3 assumed it had to something to do with pollution or particles. All testers wished there was more up-front explanation and definition of terminology.
- Testers wanted better labels and more specific information on the graphs:
  - » Labeled axes that scaled would be helpful to better understand the range of what was being graphed
  - » The colors on the graphs were helpful to understand what the number ranges may mean, but testers wanted a key and additional context
  - » A number of testers expressed interest in zooming in to see specific values along the curve, potentially through a popout
- Testers wanted additional context as to what the numbers mean, how they compared to previous trends, and how/when they should take action





## TASK 2: DEFINITION OF AQI



### NAVIGATION

- All but 3 testers found the information on the first try by clicking on “About Air Quality”. 2 of the other 3 initially clicked on the AQI button and the other 1 said they would check Google.
- Most testers reported that they found this task to be easy, and some had already encountered this on the previous task



### KEY FEEDBACK

- While testers found this task easy, they wished there was a more straightforward display or way to find the information
- Once the testers found and read the text under “About Air Quality”, they overwhelmingly stated that the information was very helpful and clear, though some were confused as to why PM25 was labeled PM2.5. Only 5 of the 21 testers knew the definition of AQI before reading this content, though a few had guessed what it might be.
- After learning about AQI and PM2.5, testers agreed that it was important to have both sets of information available as there would be different actions taken for each. Some testers thought it would be nice to see them on the same graph.
- Multiple testers also asked whether the site could help them better understand how to use AQI and PM2.5 in their daily lives

“

I’d have to go to  
Google, since there is  
no legend or  
hamburger menu  
- LaToya R.

Is there an opportunity  
within this to click a  
thing and see how you  
or the city could  
personally take action  
against this?  
- MKW

”

## TASK 3: PEOPLE'S FEELINGS ABOUT STATION AIR QUALITY



### NAVIGATION

- All but 1 tester was able find this answer and 85% were able to find it on the first try. The tester who did not find the correct answer stated that they did not notice the smiley face emojis at all
- Testers who were able to find this did so by choosing “Today” across the top bar
- 2 testers got stuck on the 24 pill at the top right. They did not know what it meant but felt like it may have something to do with the answer.



### KEY FEEDBACK

- The emoji representations were helpful to many testers, but there was also some concern that the small number of ratings may not be meaningful
- Multiple testers expressed that they were not sure how to interpret others' ratings.
  - » They weren't sure what made the user click a value and wanted to know what they may have been experiencing.
  - » Similarly, it would be useful to understand what was happening at the site/with the sensor at that time, to see if there was an incident that may have accompanied multiple bad ratings
  - » They also wanted to see how these values were trending over a longer period
- Visually, it may be helpful to highlight the highest rating for the day to help users quickly see what the majority feedback was for a day.



**“I like how these are represented. It makes the direct connection because I clicked on the smiley face before.”**

**- Lakeshore Runner**

## TASK 4: FRIDAY AQI CHANGE AT THIS STATION



### NAVIGATION

- All testers found this straightforward and were able to find this information on the first try
- 20 of the 21 testers navigated to Friday first and then toggled to AQI to find the answer. One tester toggled AQI before choosing Friday.



### KEY FEEDBACK

- Friday's data did not start at the beginning of the day. Some testers speculated that the sensor may have been down, but others were not sure why there wouldn't be a full day of data and whether they were maybe looking at people's ratings
- Within their answers, testers were able to correlate that higher AQI value meant worse quality of air
  - » This was confirmed when directly asked about the relationship between air quality and AQI
  - » The colors were helpful for the testers when interpreting the data, though one tester suggested a greater range of color might help highlight nuances or danger zones
- There was still a desire to better understand why the data was changing and whether there was an event that resulted in the air quality worsening. Given the changing air quality, there was some concern that busses going by may be skewing the data.
- Multiple testers were still confused whether the graphs were showing data collected by people or sensors

“

Easy to search and find the information but I would like to have a menu to get more information...

Who's collecting the info? What will they do with it? Any plans to improve AQ? Tips to protect yourself?

- LaToya R.

”



## TASK 5: AQ MEASUREMENTS AT OTHER STATIONS



### NAVIGATION

- The 19 testers who had time to respond to this question knew that the leaves in the map would allow them to navigate to AQ measurements at other stations
- The size of the leaf was helpful in orienting the tester to the current station but they did not understand what the 24 on the current leaf meant and thought that the extra information might make be distracting and make navigation difficult. Some connected this to the 24 pill on the top right, but still did not know what it meant.
- 1 tester thought that clicking on the bus stop name might be another way to navigate between stops



### KEY FEEDBACK

- Testers were not sure what the leaf numbers or colors meant. They assumed that color may have to do with the average rating at that stop, but weren't sure if it was the current rating or average rating
- As with the previous task, multiple testers mentioned that they were not sure if the data they would be seeing would be from sensors or testers and what the time period would be
- This might be difficult for those who have trouble with maps. One tester suggested that having an alternative list view might be a good option.



**Part of me wants to see some interpretation between the stops, but I think that's unreasonable**  
- Environmental whiz kid

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# FINAL TESTER IMPRESSIONS

Overall, testers found the website easy to use and were more likely view it once they knew the details, but also wanted more context

## Ease of Use:

**On a 1-5 scale with 1 being “Very Difficult” and 5 being “Very Easy”, testers rated the website an average of 4.43 for ease of use.** Testers liked the simplicity of the site, but wanted a little bit more detail. While testers thought the quantitative and qualitative data visualizations had helpful components, they did not understand where the data was coming from and the reliability of it. Testers gave a variety of answers for the easiest information on the is but agreed that the most challenging piece was understanding the technical data and terminology and how to use that information

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## Likeliness to View ,Use, and Recommend the Site:

**Upon initially viewing the QR code, 85% of testers said they were Very Likely or Somewhat Likely to scan the QR code and enter the site. After understanding the site’s contents, 6 testers increased their likelihood of scanning the QR code and viewing the site.** However, only 85% were still likely to use the site with some modifications. 19 of the 21 testers were likely to recommend the site as a resource; the 2 who would not though there may be other products or resources on the market that give this same information.

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## Additional Sensor Locations:

**Parks were chosen by most of the testers as another ideal location to submit and view data.** Generally, testers, suggested that any location where there might be environmentally-minded people or that people might be bored would be a good candidate for collecting and disseminating data

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## Overall Impressions:

**Testers were interested in the air quality information that the website was presenting, but wanted more details about the purpose and needed more information about how their data was being used and how they should interpret the data presented.** The testers repeatedly noted that they thought air quality was important but did not know what to do with the data that was presented on this site. They wanted better recommendations on how to interpret the data and determine the best course of action. Additionally, they were questions about where their data was going.

# RECOMMENDATIONS





# KEY RECOMMENDATIONS

Overall, testers liked the website, but adding data detail and context would make the site a more unique and valuable resource

- 1. Call out the connection between the air sensor and the website:** Testers did not always know what the sensor was for and how it was related to the data on the website
- 2. Include QR Code instructions and up-front website description:** While most noticed the QR code, they wanted more instructions on how to use it and details on the where it would take them
- 3. Add City of Chicago, MSFT, and/or CTA branding to ensure that people know who is running the site:** Testers were worried about scanning a random QR and were not comfortable sharing data on a site that may not be official.
- 4. Update User Prompt from “How does your air feel?” to something more concretely related to Air Quality:** Testers thought this could mean a variety of things, including temperature, and were not sure how to answer. This confusion also caused them to question the data that had been collected
- 5. Call out the purpose of the site, why it is unique, how users should be interacting with it, and how the collected data will be used:** There was confusion on the purpose of the site and how to best use this as a resource. Testers were sometimes hesitant to contribute their air quality feedback because they didn’t understand how it would be used and would be more likely to share their data if they knew it was being kept safely
- 6. Add clarity to the graphs and charts by including the data source, adding terminology definitions, labeling axes, and allowing users to see an exact value:** While simplicity is important in a mobile site, adding a few details can help users better understand and interpret the data that is being presented
- 7. Provide additional information to help users understand how to use the data to take action.** Testers felt like the website provided a lot of data, but were unclear as to what it meant and how they should use it. Including more information on what ranges of values mean, how the air quality at their location compares to others, and how a user should respond and take action air quality values, making this site a more valuable resource and differentiating it from existing resources. Given limited space, some of this information could be provided through links to external organizations working on air quality.





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