Making Digital Geographic Maps ADA Compliant and Inclusive

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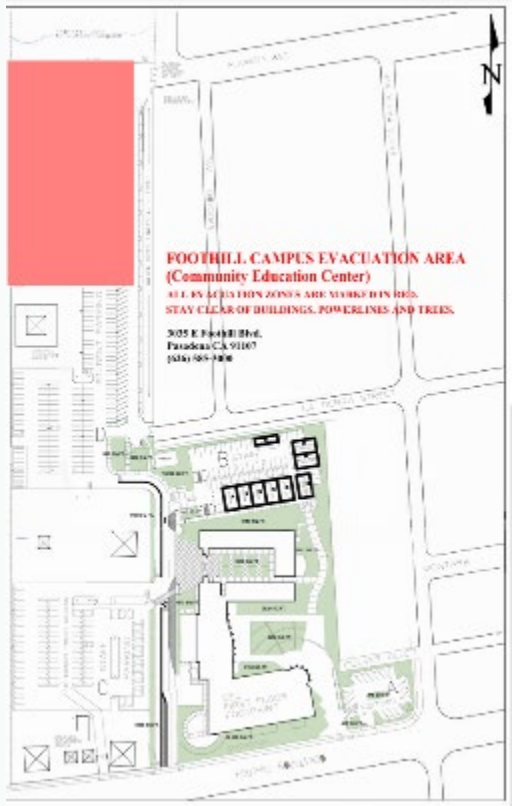
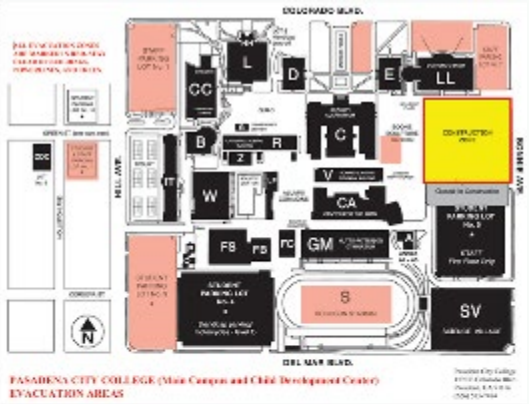
In partnership with:

What a sighted person can see

Maps Are Inaccessible

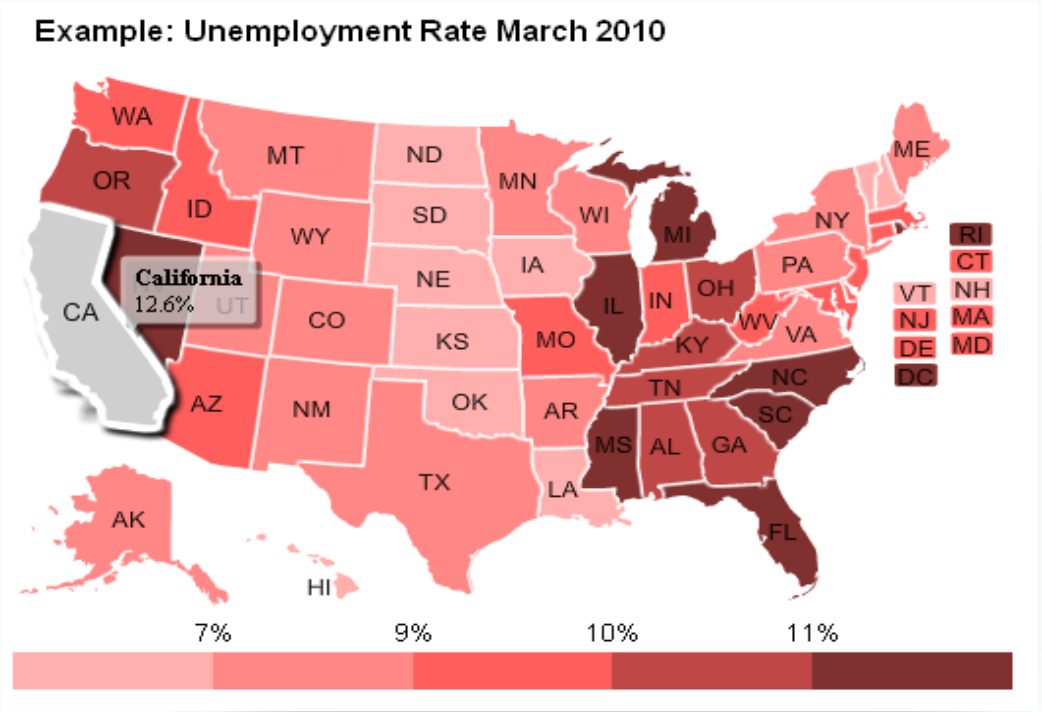




What a screen reader will say

Maps

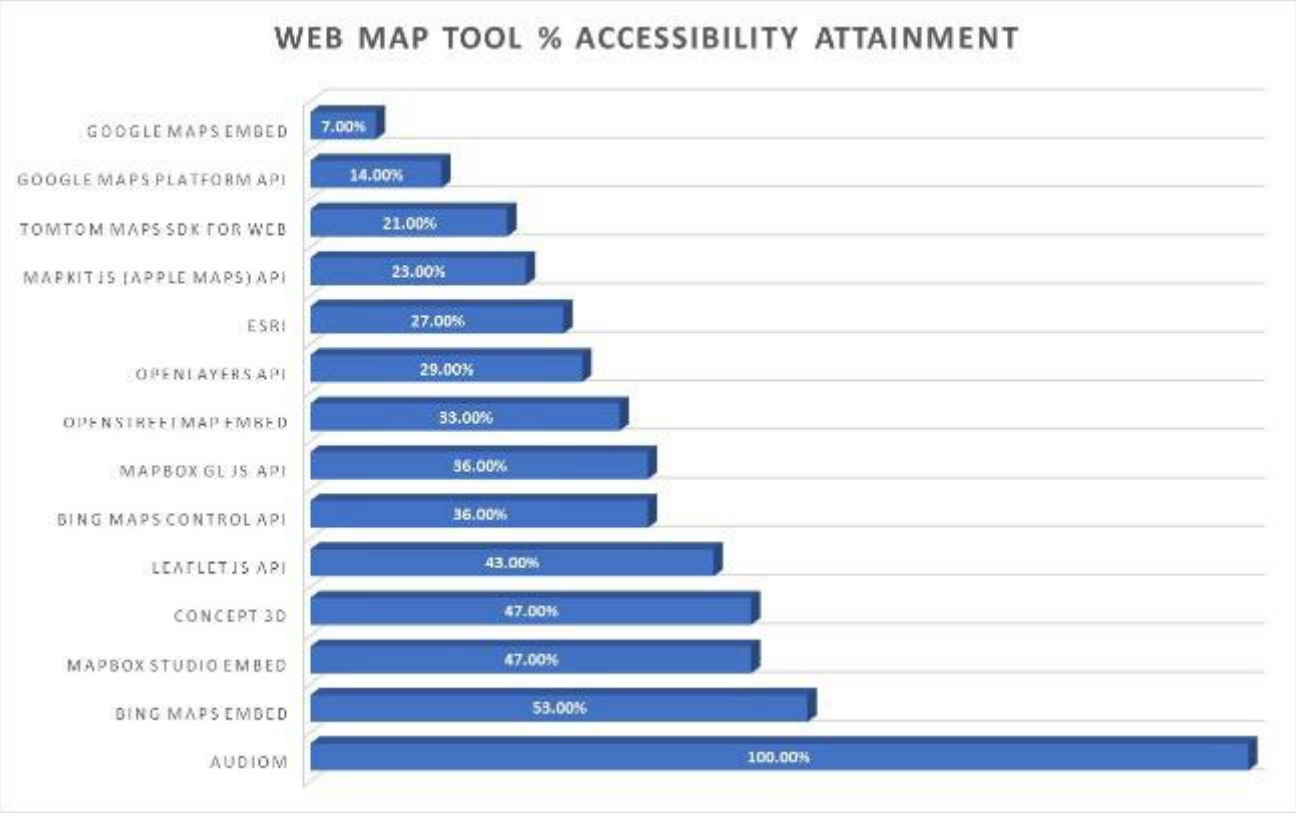

WORLD TRAVEL MAP
ARCTIC OCEAN
Arctic Circle
Tropic of Cancer
Tropic of Capricorn
Equator
NORTH ATLANTIC OCEAN
PACIFIC OCEAN
SOUTH ATLANTIC OCEAN
INDIAN OCEAN
Antarctic Circle
Places to See
The Great Wall of China


Example: Unemployment Rate March 2010
California
12.6%
WA
OR
CA
ID
NV
MT
WY
UT
AZ
CO
NM
ND
SD
NE
KS
OK
TX
MN
IA
MO
AR
LA
WI
IL
MS
MI
IN
KY
TN
AL
OH
WV
GA
FL
SC
NC
VA
PA
NY
ME
VT
NJ
DE
DC
RI
CT
NH
MA
MD
AK
HI
7%
9%
10%
11%

ADA and the WCAG

- Testable criteria that make sure web content is usable
- Used by the ADA, section 504, and other laws
- Are not perfect, but are the best

Most digital map tools are NOT accessible by default



Biggs, B., Coughlan, J., & Bruce, W. (2025). Systematically Evaluating Digital Map Tools Based on the WCAG. Journal on Technology and Persons with Disabilities, 13.

National Federation of the Blind Calls for Inclusive Digital Maps (Resolution 2024.11)

- All Federal Agencies and higher education institutions need to adopt inclusive digital maps in 3 years.
- Inclusive digital maps mean WCAG compliant
- We use their definition in this presentation

Paper tactile maps are not digital

- Not WCAG compliant
- Static
- No standard
- Simplified
- Need years of braille training
- Need years of tactile graphics training

Full-page Tactile displays are exclusionary

- Cost $15-20K
- Are not text
- Not WCAG compliant
- Require years of braille training
- Require years of tactile graphics training

Three Most Complex WCAG Criteria for Maps

- Text alternatives (SC 1.1.1)
- Non-text color contrast (SC 1.4.11)
- Keyboard accessibility (SC 2.1.1)

Non-Text Content (SC 1.1.1)

“All non-text content that is presented to the user has a text alternative that serves the equivalent purpose”

Landmark Knowledge (Includes all features)

- Sensory characteristics
- name
- type
- shape
- orientation
- size
- if applicable: numeric or categorical variables of features

Route Knowledge (Connections between all landmarks)

- distance
- direction
- legs of the route
- shape of the route

Survey knowledge (Overall understanding of spatial relationships between all landmarks)

- distance
- direction
- shape
- size
- orientation
- general layout

Traditional alternate text loses most spatial knowledge

- Lack most spatial information
- Lack standard
- Long
- Can’t handle thousands of features
- Can’t allow map creation
- Not dynamic
- Turn-by-turn directions
- Nearby address search lists
- Tables
- Simple alternate text descriptions

Example 1: map alt-text

Landmark, Route, and Survey Knowledge for all points, polygons, and lines:

- Distance
- Direction
- Orientation
- Shape
- Size
- General layout

A neighborhood in San Francisco centered at 2318 Fillmore St.

Example 2: Turn-by-turn directions

Landmark, Route, and Survey Knowledge for

all points, polygons, and lines:

- **Distance**
- **Direction**
- **Orientation**
- **Shape**
- **Size**
- **General layout**

- Walk 10 meters along Fillmore St. and turn right on Washington St.
- Walk 25 meters along Washington St. and turn right on Webster St.
- Walk 52 meters along Webster St. and turn right on California St.

Example 3: Table

Landmark, Route, and Survey Knowledge for all points, polygons, and lines:

- Distance
- Direction
- Orientation
- Shape
- Size
- General layout

Name	Total Cases
Washington	1975382
Minnesota	1817565
Oregon	974924
Nevada	904558
Idaho	525825
Wyoming	187858
Virginia	2315784
Massachusetts	2257300
Utah	1101767

Types of Equivalent Digital Maps

- Detailed text descriptions (Audio descriptions)
- Interactive alt-text

Detailed Text Descriptions

- Start with a map summary
- Have clear headings and table of contents
- Landmark section describes all map features independently
- Route section describes how to get between all map features, and highlights important routes
- Survey section describes overall layout in reference to a major landmark (e.g., entrance)

- Example and more detailed instructions at:

https://xrnavigation.io/how-to-make-detailed-map-text-descriptions/

Pros and Cons of Detailed Text Descriptions

Cons:

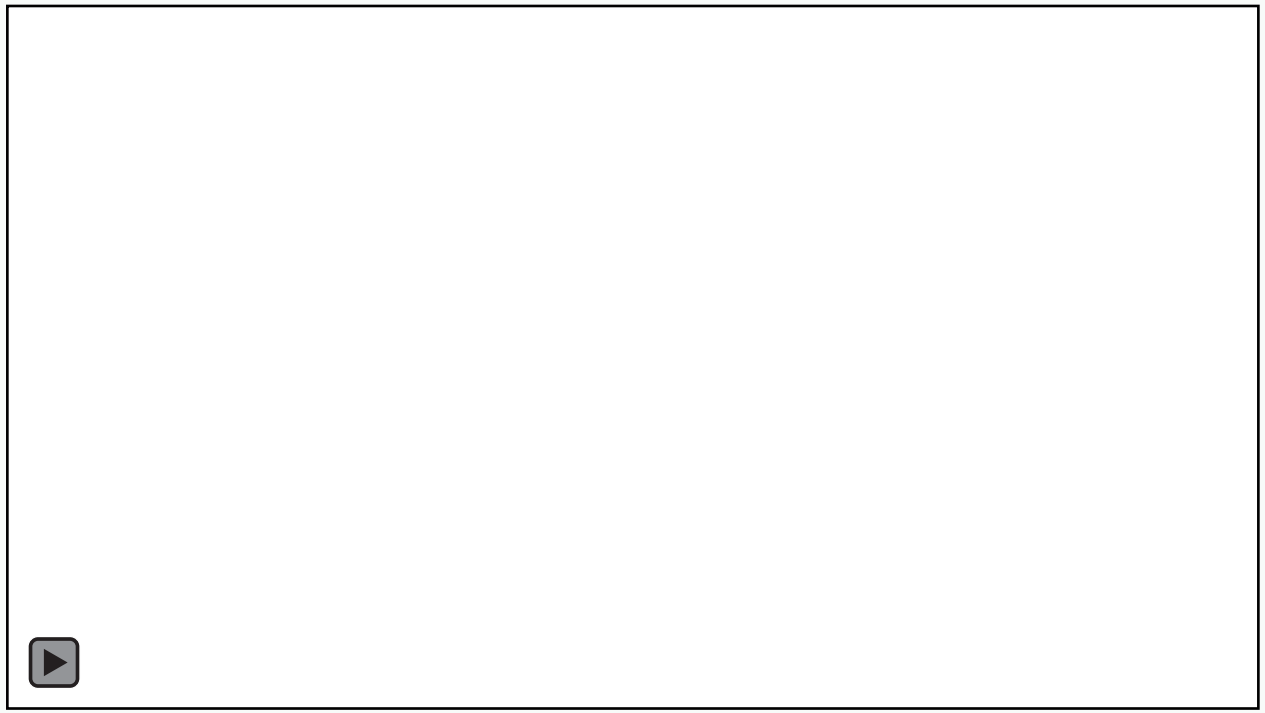
- Take significant time and money
- Are only static
- Difficult to index
- Are separate but equal
- Need to be easy to read
- Hard to provide the same resolution as a visual map
- Difficult and costly to maintain
- Not inclusive
- Difficult to find

Pros:

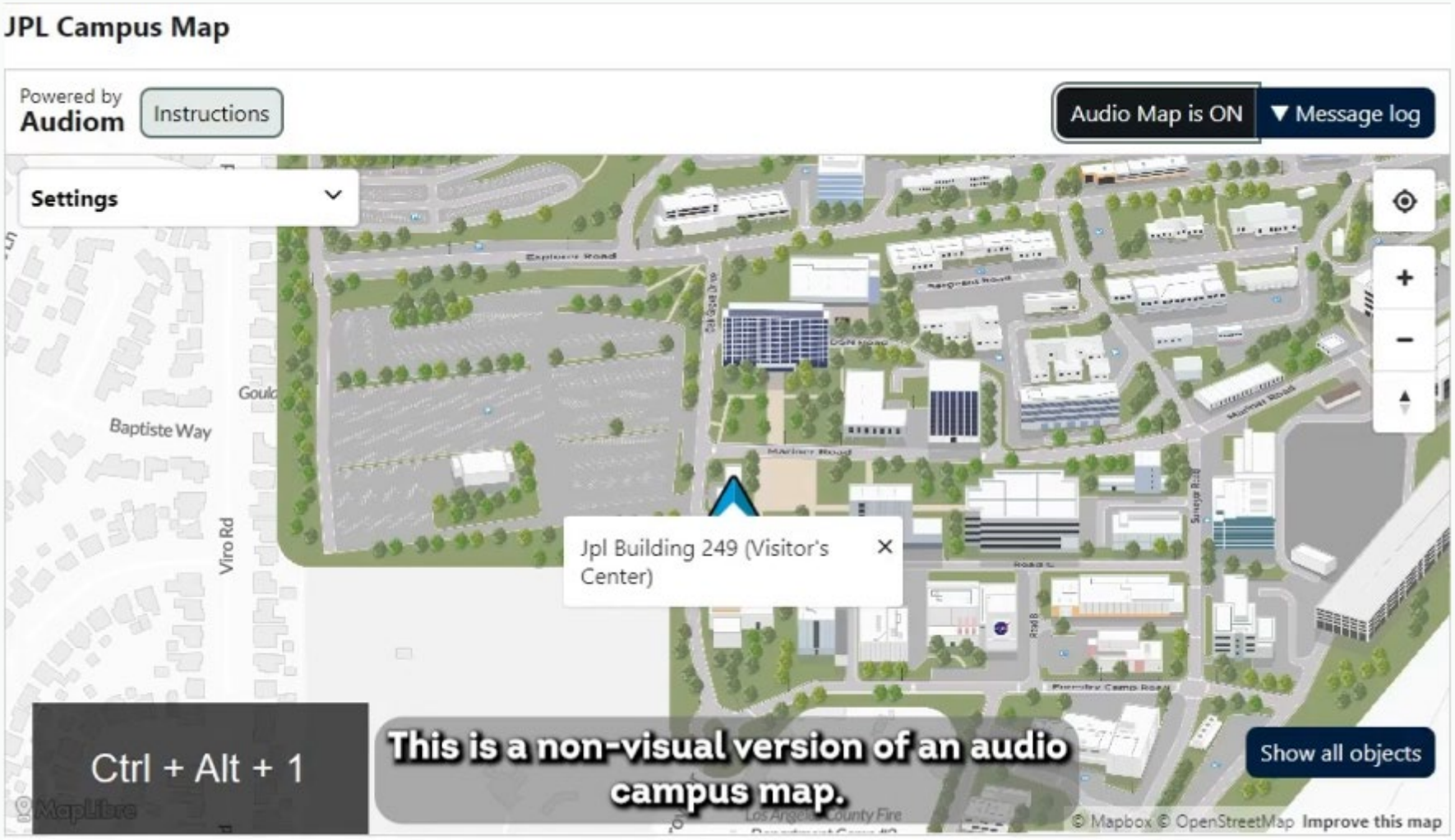
- Least technical option
- Viewable on any device
- Simple concept

Interactive Alt-Text with Audiom

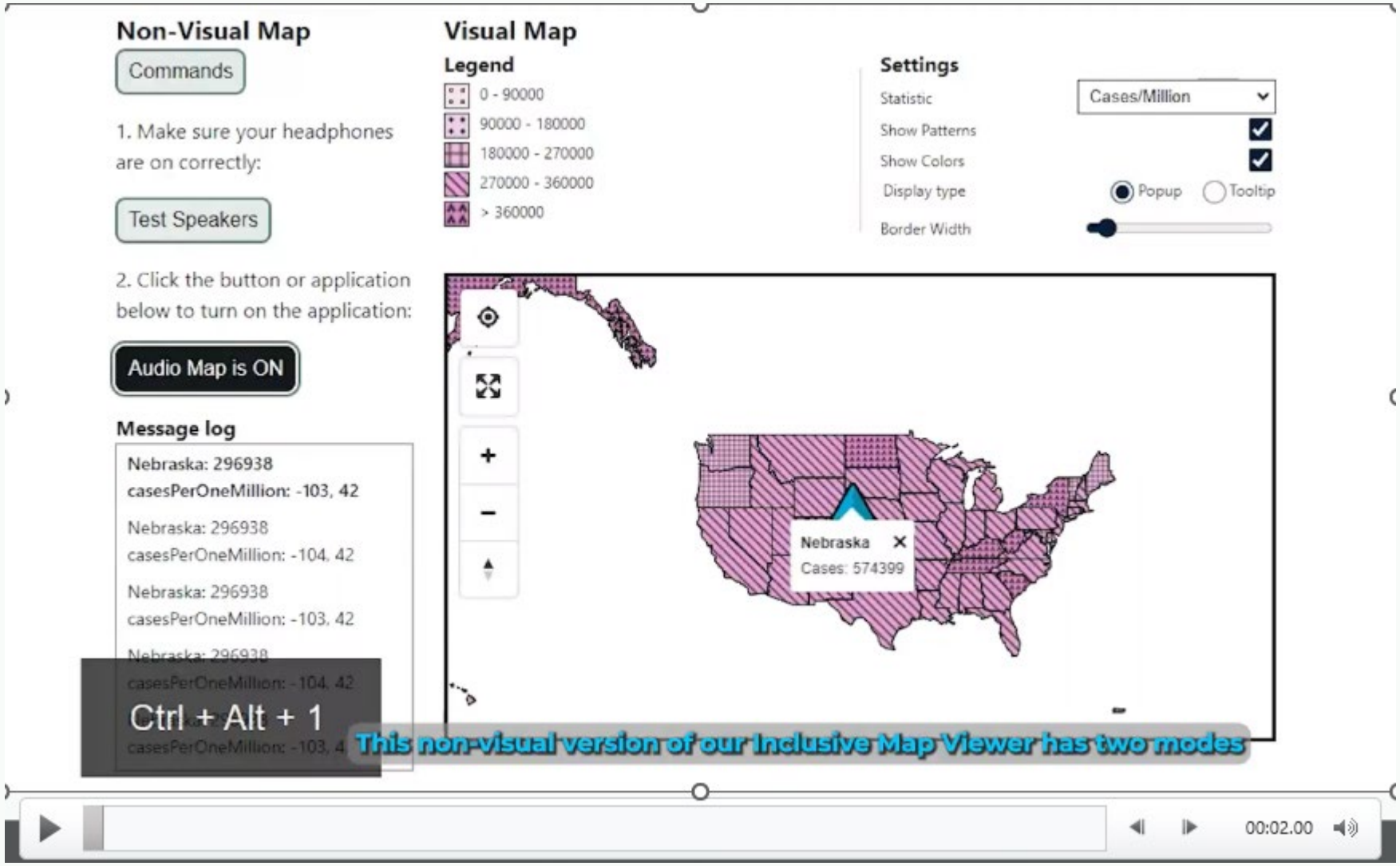
- Like a video game
- Move a character
- Hear names and sounds of features
- Change step size



Audiom Campus Map Example



Audiom Heatmap Demo



Pros and Cons of Interactive Alt-Text

Cons:

- Has a 5-10 minute learning curve
- Requires 3rd-party tools

Pros:

- WCAG compliant from LevelAccess
- Research-backed
- Combined visual/text solution
- Runs on same data as other maps (ESRI and GeoJSON)
- Supports thousands of features
- Easy to get data of interest
- Supports multiple layers

Non-text Contrast (SC 1.4.11)

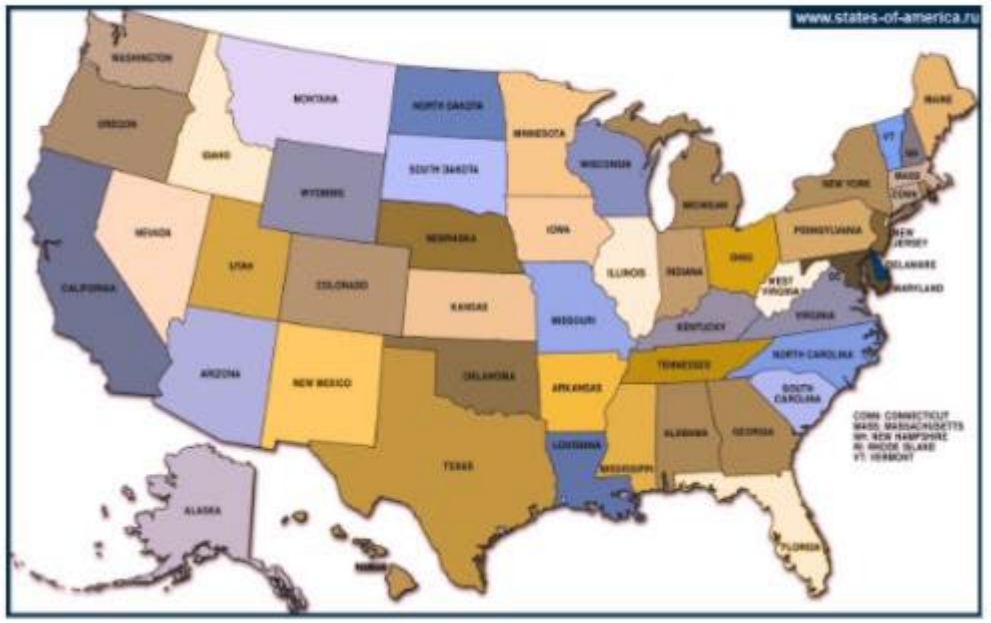
The visual presentation of the following have a contrast ratio of at least 3:1 against adjacent color(s):

- User Interface Components
- Graphical Objects

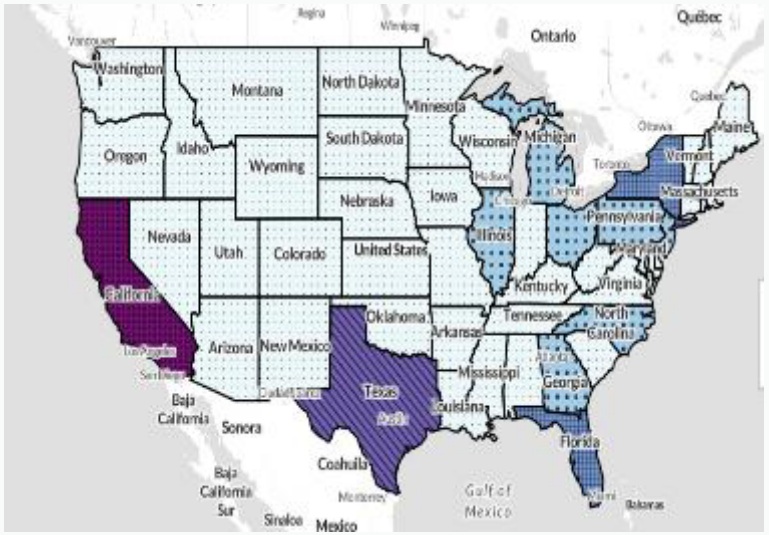
Colors are not always accessible

Original

Simulated



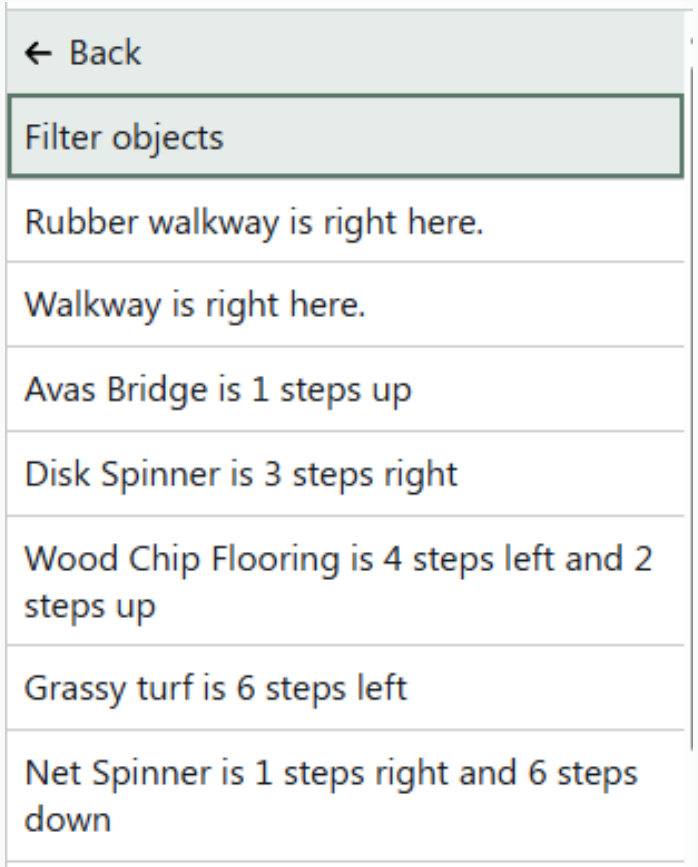
Use high contrast, patterns, and or Orio boarders



Keyboard Accessibility (SC 2.1.1)

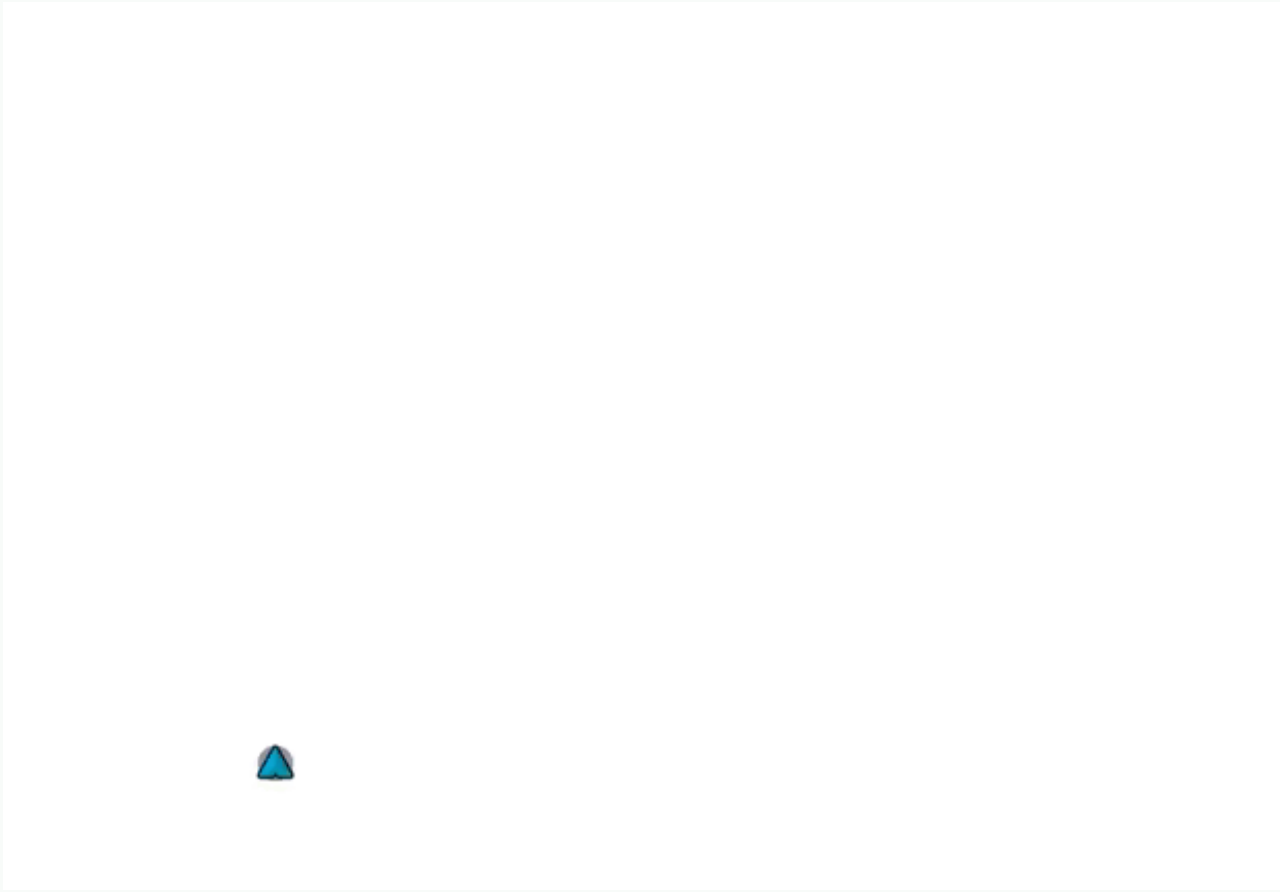
All functionality of the content is operable through a keyboard interface without requiring specific timings for individual keystrokes, except where the underlying function requires input that depends on the path of the user's movement and not just the endpoints. (This exception relates to the underlying function, not the input technique.)

Features can be presented through lists, tables, or menus



Use keyboard to draw

- Drop points at vertices



There’s a 99% chance these maps are unusable from your department

- Zoning
- Parcel
- Utility
- Land Use
- Transportation
- Demographic
- Park
- University
- Environmental
- Emergency
- Proposed maps

Usable Digital Maps Should Be Expected

- Systematically evaluate landmark, route, and survey knowledge for text alternatives.
- Full keyboard accessibility
- High contrast and patterns

Free Map Evaluation Tool Based on WCAG

- Guide for novices
- Includes 15 WCAG criteria
- Has links for color and screen reader testing

https://xrnavigation.io/map-evaluation-tool/

Our vision is that everyone can use spatial information.

What questions do you have?

Let’s talk to make your maps usable:

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