BRIDGING MONTANA'S HISTORY INTO THE FUTURE: MODERNIZING MDT'S INTERPRETIVE MARKER SYSTEM

Task 1 Report – Literature Review, Information Gathering, & Survey of Other States & Federal Lands

Prepared by

Natalie Villwock-Witte, PhD, PE
Associate Research Professor/Research Engineer

and

Karalyn Clouser
Research Associate

of the

Western Transportation Institute
at Montana State University – Bozeman

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Acronym List

Apps	Smartphone applications/mobile applications
BLE	Bluetooth Low Energy
CSV	Comma-Separated Values
DOT	Department of Transportation
FHWA	Federal Highway Administration
FTC	Federal Trade Commission
GIS	Geographic Information Systems
GPS	Global Positioning System
KML	Keyhole Markup Language
MDT	Montana Department of Transportation
NPR	National Public Radio
NPS	National Park Service
PDF	Portable Document Format
QR	Quick Response
SHPO	State Historic Preservation Office
SOW	Scope of Work
SWHC	Spanish World Heritage Cities
WTI	Western Transportation Institute

Project Background

The Montana Department of Transportation (MDT) currently administers 295 historic and geological interpretive markers (Figure 1) along the state's primary and secondary roads and in rest areas along interstates. The markers have been an important part of the Montana transportation landscape since 1935. Traditionally, one would access the information they convey by reading the sign itself, or a traveler may review the content in a booklet in cooperation with a static map about each sign's location. However, in modern times there is a need to consider contemporary approaches to disseminating this information to Montanans and visitors to the state. One potential approach is to leverage interactive electronic maps on the MDT website, and there may be other methods available to better disseminate the history and geology of Montana described in the interpretive markers. For example, smartphone applications (a.k.a. apps) have been a commonly used technological approach. An app could provide the text of the markers without the user stopping to read them. However, if this is the intent, the tool should not encourage unsafe or distracted driving. Therefore, there is a need to better understand how other states, and potentially federal agencies (e.g., the National Park Service) are trying to use more contemporary media for better dissemination of their history.

Figure 1: Example of a Geologic Interpretive Marker in Billings, Montana.

Literature Review & Information Gathering

Interpretive markers provide information that enable the reader to connect to a place. However, ensuring that the information is disseminated to readers is becoming more challenging as vehicles can travel at faster speeds and people's lives have more and more activities crammed into a finite amount of time. Therefore, while the markers remain in place ready to share information, it is unclear if that information is received by travelers. This literature review and gathering of information examines: 1) the purpose of interpretive markers, 2) the number of interpretive makers, 3) the history of interpretive markers, and 4) innovative methods for dissemination. Resources that focus on the content displayed on the historic markers was abundant but not sought for this effort. A more recent feature within National Public Radio (NPR) (Sullivan & McMillan, 2024), highlighting the on-going conversation about who is and is not included as subjects in interpretive markers suggests that they remain relevant. However, the priority of this research is the *dissemination* of the markers. The discussion of the content displayed on markers should be left to historians and other experts in this field.

The Purpose of Interpretive Markers

Interpretive marker programs have been described as having four purposes: 1) convey pride of place, 2) support cultural tourism, 3) educate the public, and 4) preserve historic resources (Bluestone, 2011) and (Schultz & Kelly, 2007). An interpretive marker suggests that a "certain person or story matters," and have the "potential of increasing residents' pride of and attachment to the places in which they lived" ((Bluestone, 2011), (Marks, 2023)). Interpretive markers are said to "promote history-related tourism and research" ((Bluestone, 2011), (Daniels, Meinkoth, & Loux, 2023)). Some have touted the ease with which they can be used to educate the public, potentially serving as a starting point to encourage the reader to learn more ((Bluestone, 2011), (Lapshan & Voigt, 2017), and (Robinson & Galle, 2014)). Yet, with often only a hundred or so words able to be included on each marker, "…the history captured on the markers did little to get across the meaning or importance that places should hold for people" (Bluestone, 2011). Interpretive markers have also been suggested as bringing economic benefits (Bluestone, 2011), particularly related to the introduction of the automobile as it became more accessible to the broader public (Daniels, Meinkoth, & Loux, 2023).

Number of Interpretive Markers

The number of markers that each state reports varies widely from as few as 120 in Kansas to as many as 13,000 in Texas (Table 1) ((Idaho Historical Society, n.d.), (KJZZ Phoenix, 2024), (Lapshan & Voigt, 2017), (Maryland Department of Transportation, n.d.), (Schultz & Kelly, 2007), (South Carolina Department of Archives & History, 2019), & (State Historical Society of Iowa, n.d.)).

Table 1. Estimated Number of Interpretive Markers

State	Estimated Number of Interpretive Markers
Arizona	2,000+
Colorado	220
Delaware	~630
Idaho	500
Illinois	400+
Indiana	425+
Iowa	3,500
Georgia	2,600
Kansas	120+
Kentucky	2,000+
Maryland	780
Michigan	1,700
Montana	295
Nevada	266
New Mexico	500+
New York	2,800
North Carolina	1,400
Ohio	1204
Pennsylvania	2,000+
South Carolina	1,700
Texas	13,000
Virginia	2,200
West Virginia	1,000
Wisconsin	470
Wyoming	400

History of Interpretive Markers

In 2007, a review of state-level historic marker programs concluded that thirty-four states had some type of program (Schultz & Kelly, 2007). While many suggest Virginia may have "the oldest" program with roadside markers placed as early as 1927, ((Marks, 2023), (Daniels, Meinkoth, & Loux, 2023), (Barni, 2018)), South Carolina reported having a program since 1905, which would make it the oldest (Schultz & Kelly, 2007). Colorado has had one since 1907 (Schultz & Kelly, 2007), Missouri since 1913 (Daniels, Meinkoth, & Loux, 2023), and Pennsylvania since 1914 (Robinson & Galle, 2014), with more recent programs like Michigan starting in 1955. However, what constitutes a formal definition of a historic marker program and whether or not it is consistent in what each program looked like at various points in time could likely be debated.

From the onset, historical markers have been seen as bringing economic benefits ((Bluestone, 2011), (Daniels, Meinkoth, & Loux, 2023), (Marks, 2023), & (Robinson & Galle, 2014)). Virginia's highway marker program was intended to promote tourism and economic development, as suggested by the $50,000 seed funding provided by Virginia's state advertising fund (Bluestone,

2011). Early on, the interpretive markers of Virginia's program were installed only on the main road so they could be seen by tourists (Bluestone, 2011). Later, "The association likely established a 700-mile historic circuit in order to guide tourists from eastern Virginia to more remote parts of the state using history as an attraction. The Conservation Commission continued this role of juxtaposing history and highways in the interest of economic development" (Bluestone, 2011). Most notably, historic markers did not require purchasing historic buildings or sites, an often costly endeavor (Bluestone, 2011). The belief of their economic influence continues today, although research does not suggest a direct connection or a specific dollar amount that may be associated with the presence of a historical marker ((Marks, 2023), (Daniels, Meinkoth, & Loux, 2023)).

As recently as 2007, New Jersey asked a consultant to provide recommendations for what a statewide program would look like (Schultz & Kelly, 2007). While some markers exist and have been in place in New Jersey as early as the 1930s, there had never been "an organized state historical marker program." However, four counties within New Jersey had their own programs: Bergen, Middlesex, Morris, and Sussex.

Late in the 1920's, Virginians conveyed history via cast-metal signs installed along the state's primary highways (Bluestone, 2011). These signs were preferred to granite markers installed by historic societies elsewhere so that they were, "highly legible and designed to be read in part from a moving car." In fact, this style of marker is often viewed as "the iconic interpretive marker," often constructed of aluminum and painted with raised lettering. Many have used such a design since the 1930s (Schultz & Kelly, 2007). The Walton East Branch Foundry cast the markers for New York. To replace a marker today, an aluminum cast is made and can cost about $500 each (Lord, Jr., 2024).

The physical condition of interpretive markers over time varies. In some cases, the wording has deteriorated. In others, like Virginia, the markers remain in place (Daniels, Meinkoth, & Loux, 2023). Some have been hit when vehicles leave the roadway or by snowplows ((Marks, 2023), (Barni, 2018)). One state reported changing to a "honeycombed constructed post," reporting that they were fairly frequently hit by vehicles leaving the roadway (Schultz & Kelly, 2007).

Early speed limits of 25 miles per hour more easily allowed motorists to pull over and read the historical markers (Robinson & Galle, 2014), although some have suggested that markers were originally intended to be read as the vehicle was moving ((Bluestone, 2011), (Schultz & Kelly, 2007)). As roads improved, vehicles were able to travel at faster speeds. By 1929, speed limits rose to 40 mph, and motorists were less likely to stop and read the markers (Robinson & Galle, 2014). Even so, some felt that the presence of interpretive markers could compel motorists to slow down (Barni, 2018).

Many of New York's interpretive markers were installed between 1926 and 1936, spurred by an interest in celebrating the 150th Anniversary of the American Revolution (Lord, Jr., 2024). However, in the 1960's, after formal legislation officially re-established a program, larger markers were installed moving forward, to identify historic sites for educational purposes. Therefore, while the original purpose of the markers was commemorative, it shifted to an educational purpose. New York State does not manage a historical marker program; instead, local officials were given the responsibility. New York reports leveraging funding from the William G. Pomeroy Foundation to repair or install a marker.

Maryland has been installing historic markers since 1930 (Maryland Department of Transportation, n.d.). The Maryland Department of Transportation State Highway Administration "funds, installs, and maintains markers along state roads and property." Similar to New York,

Maryland supported George Washington commemoration activities by installing markers along state routes that Washington had traveled. Around 800 markers had been installed, with around 780 markers remaining today. Applications are still being submitted.

Innovative Dissemination Methods

While acknowledging that "augmented reality, virtual tours and online programing" are more contemporary than the "old-school vibe" of historical markers, interpretive markers still possess "the power…to shape the public's ideas about history" (Marks, 2023). Some states have taken innovative approaches to disseminate the information on interpretive markers. In this section, the more traditional printed materials approach is highlighted, followed by web pages, mobile apps, and augmented reality (AR) and virtual reality (VR). Technology can be a "powerful avenue for storytelling" (Cuseum, Inc., 2018). Audio guides, apps, AR, and VR are some modern technological approaches that can be used to "bring preservation narrative into the digital age" (Cuseum, Inc., 2018).

Printed Materials

A previously popular approach for disseminating information about interpretive marker programs was the production of interpretive marker guides. In fact, until more recently, the provision of such guides, where a number may be associated with a marker and contain the relevant information, was seen as innovative.

The Virginia Conservation Commission "grappled with the incompatibilities between driving an automobile and reading historic markers," (Bluestone, 2011) suggesting that the idea of having people read markers while moving was short-lived (Schultz & Kelly, 2007). Furthermore, Virginia's Conservation Commission, "worried that the markers might prove a hazard if people stopped to read them while still on the roadway itself" (Bluestone, 2011); the Conservation Commission's concerns are well-founded, as modern traffic safety engineering practices remove fixed objects, like signs, from the shoulder where errant vehicles may travel when they leave the roadway. Consequently, as early as 1929, a guidebook associated with the markers in Virginia stated, "It is difficult to read anything when going at speed [25 to 40 mph], and so the commission decided to supplement the inscriptions on the markers with a book giving the inscriptions and keyed to the road markers by means of their numbers. Thus, the traveler supplied with this booklet has only to catch the number of a marker and to turn to that number in the booklet to find the inscription, which may be read without checking the speed of the car…it is possible to get a good idea of the topography of Virginia history with an absolute minimum of reading. And in a busy age this is deemed to be a much-desired convenience" (Bluestone, 2011). It seems that even in the 1930's, life was at a fast pace. It was argued that by allowing motorists to pass by without stopping for the site, "the commission's work made the awareness of history more pervasive even as the historical power of any particular places seemingly diminished" (Bluestone, 2011). This again speaks to an interest in ensuring that the educational content is delivered to the passerby, as previously discussed as a purpose of interpretive markers.

Delaware, as early as 1933 ((Barni, 2018), (Schultz & Kelly, 2007)) produced a guidebook for their historic sites. The book contained a small map of the sites and inscriptions of each site. The aim of the guidebook was to attract visitors to the state, again harking back to an interest in promoting economic development via tourism.

The Idaho Transportation Department publishes the *Idaho Highway Historical Marker Guide*

which provides information on the over 500 state markers along Idaho's highways (Idaho Historical Society, n.d.). The intent of the guidebook was to allow travelers to plan interesting stops along their journey or to pass a marker without stopping and still read the text. The guidebook is organized by highway number. For each marker, information is provided on the sign number, highway, milepost, marker title, and a short description.

Nevada State Historic Preservation Office (SHPO) offers a booklet entitled *A Guide to Nevada's Historical Markers* (Martin, 2021). This guidebook provides basic information on Nevada's roadside markers including the marker name, marker number, primary topic (i.e., mining, railroad), location coordinates, a short description, marker type (i.e., stone, on building) and a quick-response (QR) code which readers can use to find more information, again encouraging the viewer to learn more. The guide is organized by county including a map of marker locations for each county and a list of markers.

South Carolina offers a similar booklet which lists the state's more than 1,700 historical markers by county (South Carolina Department of Archives & History, 2019). Each marker has its name, location description, a short description, and global positioning system (GPS) coordinates. The booklet also provides a list of marker names based on select subject matter (i.e., Colonial Era, American Revolution), as well as information on how to apply for a new historical marker.

The West Viginia Department of Arts, Culture and History updated their *Signs of the Times: West Virginia's Highway Historical Marker Program* guidebook in 2021 (West Virginia Office of the Governor, 2021). Published since 2002, the guide contains descriptions of the state's historic markers along highways organized by county.

While guidebooks were only recently offered by some states, other states have chosen to no longer produce theirs. The main motivation behind this change is often as soon as the guide is published, the information is "obsolete," as new markers were already being installed ((Robinson & Galle, 2014), (Schultz & Kelly, 2007)). For example, in 2000, Pennsylvania stopped offering its guide which had provided the text and locations of the state's historical markers (Robinson & Galle, 2014).

Web Pages

As access to the internet became more commonplace, it provided opportunities to use websites where a user can obtain information on interpretive markers in a format that can easily be updated when compared with a printed guidebook.

Pennsylvania's database was provided via a website, where a user could access the information from a variety of searches. Now, GPS coordinates are provided for each marker in Pennsylvania. In 2001, in an effort to better disseminate the information from the markers, the Pennsylvania's marker program partnered with WITF, a "trusted, valued supplier of programs and services that both satisfy and stimulate curiosity for residents in every community in the central Pennsylvania region" (WITF, n.d.). This collaboration really highlighted the desire of educating the public based on the interpretive markers. A review of all statewide programs indicated that this effort was "unique and extraordinary" (Schultz & Kelly, 2007). The collaboration between these two entities and others resulted in the development of the website, ExplorePAhistory.com. In addition to providing general information about the markers, the website also provides lesson plans that can be used by teachers that align with the state's teaching standards. WITF then went on to create the PA Markers app. The creation of the lesson plans and other associated tasks were said to have cost

about $6 million (Schultz & Kelly, 2007).

Michigan has created their own "web-based tool" (Lapshan & Voigt, 2017) in an attempt to disseminate the information contained on their historic markers. Their website is described as "interactive," and they tout the fact that there is "no special app required." Information provided by the tool includes the title, address of the marker, links that enable someone to learn more about the marker, driving directions in Google maps, installation dates, an image, and marker text. The user is also able to download a portable document file (PDF) copy of the marker. Furthermore, the website provided a "contact form link" to notify administrators when a marker is missing. It is essentially leveraging crowdsourcing. In addition, the tool allows the user to filter the markers by county, theme, or time period. The map can be viewed in a road or topographical format. Information about state parks, campgrounds, and the state's network of rail trails can also be incorporated onto the map, allowing for someone using the tool to coordinate traveling to marker locations with places to stay and other destinations. The database can be downloaded in the keyhole markup language (KML) or comma-separated values (CSV) file format.

The Virginia Department of Historic Resources is working with the Virginia Department of Transportation to develop a "more flexible ArcGIS app" (Daniels, Meinkoth, & Loux, 2023).

Recommendations for developing a marker program for New Jersey suggested that the website should be "dynamic and innovative;" they also recommended that an online geographic information system (GIS)-based database be "interactive" and "searchable" (Schultz & Kelly, 2007). Indiana, Kentucky, Michigan, North Carolina, and Pennsylvania were identified as states that had the most "comprehensive user-friendly websites" (Schultz & Kelly, 2007).

There are other websites that may feature some markers, including Waymarking.com, Historical Marker Database (www.hmdb.org), and Markeroni.com ((Robinson & Galle, 2014), (Schultz & Kelly, 2007)). Data from the Historical Marker Database was used as the source for the "Explore Here" application (Guld, 2021).

Sterling Eureka and Laketown Historical Society leveraged a volunteer with geospatial analysis expertise to digitally map 373 historical markers within Polk County, Wisconsin (Anderson, 2024). Little information besides the location of the marker and a name for the feature were provided.

Finally, one more contemporary suggestion for the dissemination of interpretive marker information was "self-guided public tour opportunities" (Schultz & Kelly, 2007). Such an opportunity is believed to involve things like a self-guided audio tour or tour options where an agency may provide a suggested list of places to visit based on a locality or a historic topic of interest.

Mobile Apps

Mobile guide apps have a growing presence in the tourism industry, since first introduced in 2007, and may have a role to play in interpretation as they can provide current multimedia content in a format that is accessible at your fingertips (Purcell, 2011). Apps can aim to educate and engage users, a stated purpose of interpretive markers. Apps are "an end-user software application designed for a mobile device operating system, which extends that device's capabilities," although a "standard, industry-wide definition of what is-and is not- an 'app' is difficult to pinpoint" (Purcell, 2011). A mobile app can pull data from an online database, like those mentioned in the previous section, or be more interactive (i.e., provide users with video, photos, and other

multimedia content, allow users to share information, or notify a user when they are near an interpretive marker). In addition, an app can provide options like both audio and visuals for people with disabilities, ensuring that interpretive marker materials are accessible to all visitors.

The Georgia Historical Society (GHS) developed a mobile app to reduce the number of people who just "drive-by" roadside historical markers (American Association for State and Local History (AASLH), n.d.). The mobile app allows users to search the GHS marker database by county, region, marker subject, time period, and by marker program (American Association for State and Local History (AASLH), n.d.). Additionally, the mobile app displays makers which are near the user (Meagher, 2011). Users can click on a marker to read it and find photos and additional details.

University of Nebraska - Lincoln NPS App Development

A project completed at the University of Nebraska – Lincoln explored modern methods for visitor interpretation in the National Park Service (NPS), to help prepare for the development of an interpretive mobile app for the Oregon National Historical Trail (Blaser, 2015). As a part of this effort, a market analysis was conducted where both official NPS and unofficial national park mobile apps identified in the following list were examined to understand available features and what types of information were provided:

- Chesapeake Explorer
- Canyon Country National Parks,
- Black Hills & Badlands of South Dakota,
- NPS National Mall and Memorial Parks,
- NPS Boston,
- Visit Harpers Ferry,
- NPS Independence National Historical Park,
- Mount Rushmore Virtual Tour,
- Chimani Yellowstone NP,
- NPS Yosemite,
- Fort Vancouver Mobile,
- Yellowstone National Park - The Official Guide,
- Passport to Your National Parks,
- National Parks by National Geographic,
- Parkopolo

The researchers found that the biggest difference between official and unofficial apps was that NPS official apps were free to use and did not have advertisements, whereas unofficial apps were generally ad-supported or had a paywall to unlock features. Information provided in these mobile apps included maps, driving directions, hours of operation, guided tours, nearby amenities, and interpretive site information. In addition to reviewing the mobile app features, customer ratings were reviewed to understand user opinions. App users liked in-depth information (e.g., hours of operation, wayfinding including maps and directions, admission costs, guided tours, current events, and current park alerts) over basic overview information. App users also wanted the ability to download maps so that they could be used offline.

The University of Nebraska – Lincoln researchers then distributed a survey through social media and outdoor focused websites like the Wilderness Medicine Institute and John Day Fossil Beds National Monument to obtain feedback on what app features were most desired for an NPS tourism app. Survey respondents ranged from age 19 to 63 with an average age of 28 years old, suggesting

a slightly youthful sample (Blaser, 2015). Just over 30% of respondents were female, 53.7% were male, and 14.9% did not provide their gender. Most respondents (74.1% were Caucasian). Most respondents (89.45%) had never used a NPS mobile app and were unaware one existed or did not feel the need to use an app. This could indicate a need to better market the app and make it seem like a viable option for interpretive services at NPS sites, particularly since 60% of Americans aged 18-29 had downloaded apps (compared with 46% for 30-49 and 15% for 50+) (Purcell, 2011). Participants were asked to share features of NPS or other travel mobile apps that they found to be most helpful. Commonly chosen features included: maps (79.6%), destination information (76.6%), visitor notifications (68.2%), and personalized tours (24.88%) (Blaser, 2015). Nearly all respondents (96.6%) believed that an NPS or other tourist app should be capable of running offline (Blaser, 2015).

Blaser (Blaser, 2015) described one method to address spotty cellular/internet reception. The app downloads all the information to the smartphone so that it can operate without cellular connection. The challenge with this solution is that the download size of the app can become quite large.

Fort Vancouver National Historic Site App Development

In an article for *Federal History*, Oppegaard & Shine (Oppegaard & Shine, 2014) describe the development of a National Endowment for the Humanities-funded interpretive mobile app for the NPS Fort Vancouver National Historic Site in Washington State. The app arose from an independent examination of NPS by the Organization of American Historians which found that NPS could better utilize technologies to advance "historical research, interpretation, and connections between staff and the larger historical profession, as well as public engagement with the past" (Oppegaard & Shine, 2014). When the app was first offered in 2012, few apps existed for heritage sites and most of the apps that did exist were not interpretive. NPS attracted 280 million visitors in 2010, and an estimated 78 percent of those visitors had no interaction with an NPS staff member for site interpretation; instead NPS largely relies on wayside signs, brochures, and audio tours, suggesting the implications that such an app could assist NPS with better achieving its mission of "preserving unimpaired the natural and cultural resources and values of the National Park System for the enjoyment, education, and inspiration of this and future generations" ((Oppegaard & Shine, 2014), (National Park Service, 2024)).

The intent of the app was to bring interpretive options to the Fort Vancouver National Historic Site's "The Village" area, which had recently opened. This area was chosen because its location was more than a quarter mile from the nearest parking area or staffed facility as well as being in relative proximity to rail, road, and airport noise which would make ranger-led activities difficult. However, with a mobile app, a user could read the text or utilize headphones to block out background noise. The goals of developing the app included creating connections to the community and to "access information and interpretation for The Village through a variety of means" (Oppegaard & Shine, 2014). These documented goals helped to keep the app project moving forward even when staff and resources were limited during the development process.

The free app officially launched June 2012 and by September 2013 had been downloaded more than 1,500 times. The app was considered a national model for the NPS and was included in a service-wide webinar on increasing technological innovation. Oppegaard and Shine noted that during the development, the partnerships that were built both within and outside of the NPS were extremely valuable and that building the app was a labor intensive and difficult process (Oppegaard & Shine, 2014). Without defined end goals, regular meetings, and partnerships, the app would not

have been so successful. The benefit of the app over interpretive items like brochures and signs is that they are easy to update and expand as needed. Yet, a challenge with the app was a lack of stable wireless connection at the historic site. This meant that some visitors struggled to download the app on site. An important conclusion by the experience is marketing the app is key to getting new users.

Flyover Country

Loeffler et al. examined updates centered around two user scenarios for the Flyover Country mobile app (https://flyovercountry.io/) (Loeffler, Roth, Goring, & Myrbo, 2021). Flyover Country is a free mobile app which provides a map displaying geological and historical information for users to save and access offline while traveling. This app uses the mobile device's GPS location (which can function in airplane mode) to keep the map centered on the user's location, following a pre-downloaded pathway.

Version 1 of the app was developed and shared with University of Minnesota students and faculty who participated in a talk aloud study and focus groups providing feedback on the app by walking through two scenarios: 1) a traveler using the app to examine geologic information on their flight pathway, and 2) a student using one of the app's educational self-guided field trips. Feedback from these activities was used to develop Version 2 of the app.

Changes from Version 1 to Version 2 of the app included centering the map based on the user's context. For example, users in "flight" mode will have a map that shows the user's flight path and a 200-mile buffer around that path, whereas those in "drive" mode will have a map that shows the user's driving path and a 20-mile buffer around that path. The app will enlarge symbols for nearby points of interest and reduce the symbols that are further away to reduce visual clutter.

Additionally, the app focused on "thumb-based" interactions. The app navigation style contains tabs at the bottom of the screen where a user's thumb is located. Information on points of interest can be viewed by pulling upwards on an information panel.

Corallo et al. (Corallo, et al., 2017) examined the use of a mobile app developed to encourage people attending a local folk music festival called "La Notte della Taranta" in the Salento Region of Italy to visit and learn about nearby historic and cultural sites. The app, called "FolkTure" was developed for the 2015 folk music festival. The app provided users with information on nearby historical and cultural points of interest including photos, videos, and recorded commentary about each site. In addition to this information, the app included gamification strategies, or rewarded certain behaviors with points, badges, and a leaderboard where users could compete to win a very important person pass for a concert. In order to gain points, users had to visit points of interest and/or engage with a public thread in the app. A total of 2,123 user posts and 475 user geographical locations were analyzed. Findings showed that the app increased knowledge of the territory and encouraged users to explore nearby historic and cultural sites in areas that were not generally tourist destinations.

In an article for *Sustainability*, Ramos-Soler et al. (Ramos-Soler, Martinez-Sala, & Campillo-Alhama, 2019) examined perspectives of senior citizens (aged 60 and over) in Spain on their use of tourism mobile apps for the Spanish World Heritage Cities (SWHC). According to a census conducted in Spain, 78.6 percent of people aged between 65 and 74 claim to use a smartphone (Ramos-Soler, Martinez-Sala, & Campillo-Alhama, 2019). For this research effort a total of 25 senior participants took part in a focus group where they discussed resources used on different

phases of the tourist journey (e.g., pre-trip, during, and post-trip). Most participants had visited a SWHC site and expressed an interest in cultural and nature tourism. While every SWHC has a tourism mobile app, none of the participants had used these apps. This was primarily due to being unaware that they existed or that they had little interest in trying them out because their typical travel habits included making decisions about sightseeing and other local stops based on printed information and interactions with locals (Ramos-Soler, Martinez-Sala, & Campillo-Alhama, 2019). The participants noted that they value information and guides that include places to visit, culture and traditions, and information that can facilitate planning and enjoyment of a trip including nearby accommodations, restaurants, and transportation. A primary disadvantage noted for mobile apps is that the small screen size can lead to reading difficulties and options like audio guides would be useful for older individuals and people with visual disabilities.

Considering younger generations, in an article for the *International Journal of Social and Business Sciences*, Hiramatsu et al. (Hiramatsu, et al., 2017) discussed a mobile app developed to encourage young people to engage with a cultural heritage site in Nikko, Japan. The mobile app utilized a series of Bluetooth low energy (BLE) beacons which would push information to the mobile app as a user walked nearby. The app allowed users to choose between Japanese, English, Chinese, and Thai for language settings. Information displayed in the app included cultural and historical information about the site, a map, information about the area, nearby shops, and the local bus timetable. BLE beacons were chosen as: 1) this would reduce the need for signboards at the various sites, 2) they do not require use of a smartphone GPS which can utilize a lot of battery power, and 3) they do not require access to the internet which is often limited in rural areas. Tourists were encouraged to install the app at the Tobu Nikko Train Station for various mobile app tests throughout the fall of 2015. Users were then asked to complete an online survey; a total 57 responses were received (15 English speakers and 42 Japanese speakers). Users found the app to be convenient, interesting, and helpful. Positive evaluation of the app was higher for the English speakers than the Japanese respondents.

Clio is a free GPS-enabled "educational website and mobile application created by historians at Marshall University" (American Association for State and Local History (AASLH), n.d.). In addition to the surface information, Clio also provides links to relevant books, articles and websites. Additional media, like oral histories, videos, and photos can also be integrated into a relevant location. Public historians are encouraged to use the app to get people to visit museums or access their websites. Walking tours can be created and users are able to provide feedback, including additional information and sites that might be added to existing trails.

AR & VR

AR can "overlay information through visual layers," "bringing history to life" (Cuseum, Inc., 2018). The link to a 3-D portal was broken, and a search of the website for the Fair Lane Estate did not seem to have it located elsewhere.

Google signed a licensing agreement with The Historical Marker Database, a volunteer-based historical markers website that has geographic coordinates of more than 80,000 historical markers around the world, many of which are in the United States, which enabled the base data for Niantic Lab's (a spin-off of Google) PokémonGo (The Sentinel, 2016). The game is a GPS-powered AR experience. A middle school teacher reportedly incorporated "Pokéstops" into his curriculum,

intending to discuss the historical significance behind some (an example of one can be found in Figure 2). PokémonGo is an evolution of an early game, Ingress. Users of this game were able to submit locations "with a cool story, a place in history or educational value." It also welcomed submissions related to art, architecture, libraries, "little-known gems," and places of worship (because they were "a nod to the otherworldly").

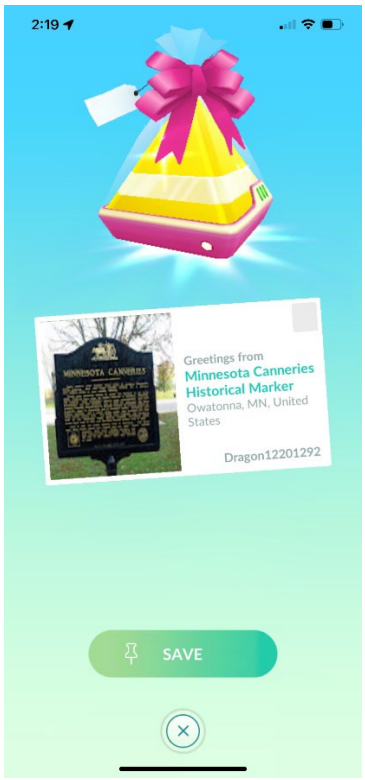

Figure 2: Historic Marker Pokéstop.

If you reach a certain level within PokémonGo, Pokéstops can be nominated which are reportedly vetted by the community. Furthermore, the game "checks" on changes that may be seen to a Pokéstop by asking users to scan an image of them, offering a reward for doing so. It is essentially a means of crowdsourcing, similar to the aforementioned example where a form can be submitted when a user finds an interpretive marker in need of repair or not present. In PokémonGo, AR can be enabled or disabled, particularly when users younger than a certain age are playing.

Summary of Literature Review & Information Gathering

Interpretive markers, whether historic, geologic, cultural, or otherwise, have been around for more than a century. However, even though they have existed for quite some time, there are few peer-reviewed, published papers covering innovative dissemination methods. There is, on the other hand, extensive literature concerning the content of the markers. Most information on the topic of dissemination is found in blog and newspaper articles, websites, and other informal literature sources. However, this may in part, reflect how quickly technology changes, which often does not lend well to peer-reviewed papers and the like, sometimes taking years to be published.

The driving force behind the original roadside interpretive makers seems to have been for commemoration, whereas today, the focus is more for an educational purpose. Early on, with slower vehicle speeds, the markers, with few words, may have been able to be read by passing

vehicles. Yet, the content is like the cliff notes of the interpretive marker. As such, today there is an interest in compelling the reader to seek more educational content, potentially with printed materials but also with PDFs diving deeper into the topic.

Additionally, while it seems that early markers were designed to be read from a moving vehicle, at maximum speeds of twenty-five miles an hour, today, with substantially greater speeds (often times fifty-five miles an hour or more) and a better understanding of a driver's cognitive load, this is no longer a desire or expectation. This may provide an opportunity for new dissemination methods to play a role in how interpretive marker programs are developed.

The implication that interpretive markers were tied to tourism has been suggested. Virginia's experience suggests encouraging travelers to be lured into the rural areas of the state. From the literature available, quantifying what this economic benefit may have been or currently is does not seem to be well-quantified.

States are at varying levels of "innovation" with respect to disseminating the information on their markers – Pennsylvania stopped printing guides in 2000 whereas West Virgnia only started offering such guides in 2002. Now, as technology has changed and become more accessible, agencies are generally moving towards both interactive and static webpages. In some cases, agencies have offered mobile apps. The literature notes several mobile apps have been developed in the recreation and tourism industry to serve as interpretive materials. Some see apps as innovative; others seem to bristle at their offering (Lapshan & Voigt, 2017). Mobile apps are appealing because they are easy to update and expand. However, the literature notes that developing an app can be a labor of love and even with defined end goals and regular meetings to keep momentum going forward, app development can be a difficult process (Oppegaard & Shine, 2014). Some agencies have moved beyond the mobile app offering, coupling them with one or both of AR and VR. In addition, gamification has proven to engage app users in digesting more content (Corallo, et al., 2017).

Getting into more details with respect to mobile apps, there are challenges and features to consider.

Challenges for apps can include spotty cellular or internet connection (particularly in rural areas, which is significantly relevant to Montana) and a lack of end-user knowledge that such apps exist, highlighting the need for a marketing plan to be coupled with the development of an app ((Blaser, 2015), (Oppegaard & Shine, 2014)). For information to be available in more rural and remote areas which tend to have spottier cellular or internet connection, an app must be able to operate offline. Yet, the data that one has to download can be substantial, potentially creating a barrier to use. There are potential alternatives, some of which would not even require a physical marker, like BLE.

In addition, the features of the app itself can require an abundance of decisions (e.g., screen orientation, font types and size, map scale, site information) ((Oppegaard & Shine, 2014), (Corallo, et al., 2017)). While there are several challenges to developing an app, several note that users did value the information that was provided in these apps ((Ramos-Soler, Martinez-Sala, & Campillo-Alhama, 2019), (Blaser, 2015)). Apps have the potential to expand inclusion in who can access information. In particular, with the ability to convey information audibly, people with disabilities or older individuals can potentially have the information read to them.

Survey of Other States & Federal Lands

As a result of the literature review and information gathering for this research, a survey was developed to learn more about agencies' innovative methods of disseminating information about historic, geologic, and cultural markers. The survey was shared with MDT prior to the July 25, 2024 check-in and approved. It was also shared with MSU's Institutional Review Board and approved for dissemination on August 19, 2024. Consequently, on August 21, 2024, the Qualtrics online survey was individually emailed to potential survey respondents across the fifty states and territories of the United States of America. Survey contacts included contacts from state historic preservation offices (SHPO), historical societies, state departments of transportation (DOTs), state parks, and those identified in the literature and information reviewed. Mid-way through September, a follow-up email was sent to each original survey recipient from which a completed survey had not been received, asking them if they would be willing to provide input for their agency. In addition, for states where a generic office email address had been identified, an additional email address was sought out and an invite sent. Furthermore, the researchers engaged contacts at the NPS, leadership within state parks, and specific contacts whom they knew at state agencies across the United States for which a survey had yet to be provided, asking them if they could assist with identifying a contact who could speak to the topic of the survey. Responses were received from entities within 38 states, although a response was only at the local level (not state) in Massachusetts (Figure 3).

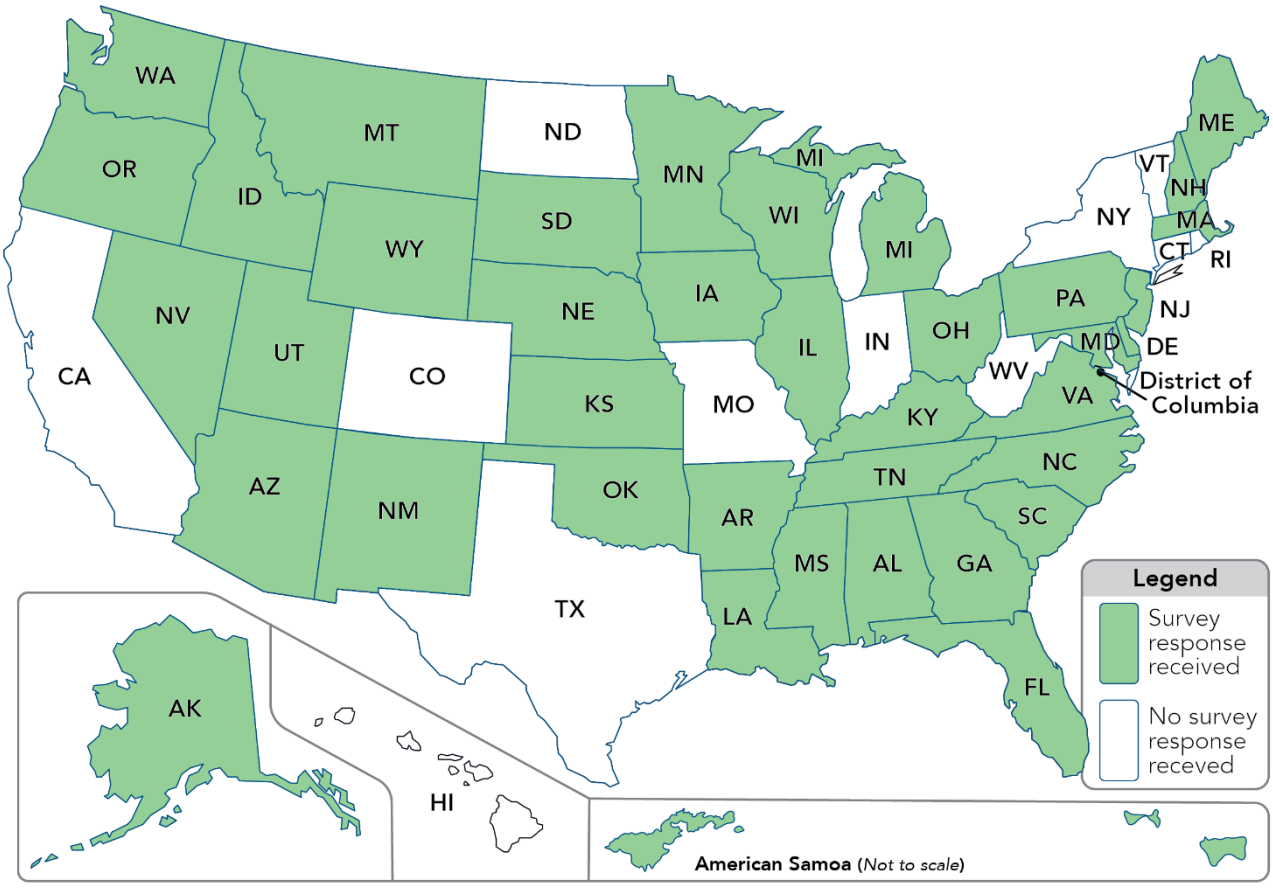

Figure 3: States from which surveys were received.

Ultimately, seventy-four impressions were found within the survey. After removing surveys without any information about the agency or answers to subsequent questions, a total of forty-nine survey responses were received, some more complete than others.

All forty-nine survey respondents provided information about their agency, details of which can be found in Appendix B: Agency Listing. The information provided can have a bias based on the agency of the respondent, so it must be considered. The majority of the survey respondents were classified as historic offices (19 survey respondents). The next most frequently represented entity are state parks (13 survey respondents). Historic societies (6 survey respondents), natural resources (3 survey respondents), state DOTs (3 survey respondents), tourism agencies (2 survey respondents), local agencies (2 survey respondents), and historic marker program (1 survey respondent) round out the remaining categorizations. There were some implied overlap in that two of the categories seem to be represented. For example, one survey respondent reported, Virginia Department of Conservation and Recreation – Virginia State Parks, which may suggest natural resources and state parks. For this one, since Virginia State Parks was the subset specifically represented by the broader umbrella, it was given that designation, as it was expected that the survey respondent would answer from this viewpoint.

Even though a subsequent question asked if the entity managed or disseminated information about historic, cultural, or geologic sites, one survey respondent noted that they did not manage such sites and consequently did not provide further information except for an alternative contact for their state (who had already been sent the invite). Therefore, the remaining analysis will focus on the responses of forty-eight agencies.

Regarding the types of sites (historic, geologic, cultural or other), all forty-eight survey respondents reported managing or disseminating information about historic sites, and 46% (22 survey respondents) and 75% (36 survey respondents) reported managing or disseminating information about geologic and cultural sites, respectively. Other sites of interest identified by respondents include, “State parks, trails and boating;” “Scenic, Natural, Recreational;” “Natural Resource;” “Natural Resource Interpretation;” “parks, recreation areas, fish & wildlife areas;” “Natural;” and “Recreation.”

Innovative Dissemination Methods

Respondents were asked to share innovative approaches for disseminating information on historic, geologic, and/or other cultural sites. Several methods were highlighted including interactive websites and web maps, AR, VR, mobile apps, audio tours, QR codes, accessible elements, public outreach through social media, and other outreach efforts.

Many respondents described an interactive website and web map as innovative. Some had provided marker information organized as a tour, often called Trails (e.g., Mississippi Blues Trail, Georgia Civil Rights Trail), or organized around specific historic topics. The Michigan History Center developed a story map for their shipwreck sites and underground railroad sites.

Several respondents noted working towards or currently using some form of AR or VR. Arkansas Historic Preservation Program reported developing a 360-degree VR tour of historic sites that can be used during classroom presentations as a part of educational outreach. Tennessee State Parks highlighted working with an outside vendor to develop a mobile app which provides an interactive experience using AR and VR assets. Illinois Department of Natural Resource noted that a local museum society, leveraging funding through Digital Projects for the Public, National Endowment of the Humanities (NEH) grant (https://www.neh.gov/grants/public/digital-projects-the-public) to

develop an AR tour for various waypoints at Cahokia Mounds State Historic Site.

The Virginia Department of Historic Resources reported creating several historical marker audio tours using the IZI.Travel mobile application.

The use of QR codes or the desire to use QR codes was also noted by several respondents. Often QR codes were used on historic marker signage to take users to webpages to learn more information about the site. The New Jersey Historical Commission noted that they were using QR codes to guide users to the New Jersey museums related to the marker's topic. Delaware State Parks was using QR codes to take users to a site to learn more information which included an accessible PDF reader for interpretive panels.

Considering accessibility, Delaware State Parks also reported creating a "multi-site outdoor wayside exhibit series" with raised bronze and fiberglass tactile elements, including Braille translation. Oregon reported that in the early 2000s, they had created a phone call-in line with historic readings of several of the markers. While this call-in line does not note the accessibility benefits, offering an audio option could be beneficial for those with a visual disability.

Three respondents reported using conferences as a method to share information about their historic preservation efforts and historic marker programs. The Kansas State Historical Society participated in the Dismantle Preservation Conference where they hosted a listening session to learn about what the public thinks preservation is. They plan to continue these listening sessions across the state and use the information gathered to build outreach strategies. The Montana Historical Society organizes the MT History Conference which features bus and walking tours of historic sites as well as lectures on historic preservations, museums, writing, and educator workshops related to Montana historic places and historic themes. The Utah Historical Society shared information about their current memorial landscape at professional conferences and with the public. They highlighted that sharing this information prompted some cities to start new marker programs.

Efforts to conduct outreach with the public included regular print and digital communications, hosting awareness meetings or open houses, and social media. Several respondents utilize social media platforms (e.g., Instagram, Flickr) to share information about historic markers and historic sites. The New Jersey Historical Commission highlighted that they were creating "60-second histories" that tell the stories of historic sites and will be shared on social media. The New Hampshire Division of Historical Resources reported piloting an Instagram page specific to interpretive markers. However, they had difficulties maintaining the page in addition to their main SHPO page and hence have retired it. Instead, they share information about their markers through their main SHPO page.

Other identified methods included handheld guides, informational brochures, and maps. The American Samoa Historic Preservation Office offers a historic calendar distributed yearly. South Dakota specifically noted that no markers could be read while someone was driving, thus turnouts (which are maintained by the state DOT) are provided so drivers can pull off and read the information provided on historic marker signage.

Kentucky reviewed and modernized their historic marker program in 2021 but provided little details regarding what that modernization entailed. This respondent did consent to follow up questions, which will present an opportunity for further examination into what was done to modernize their program in future tasks.

Challenges in Disseminating Information

The majority of survey respondents (76%) reported challenges with disseminating information on historic, geologic, and/or other cultural sites. Challenges included limited funding and resources, integrating technologies, information displayed on the markers, engaging the public, and maintaining interest in marker programs.

Having a limited number of resources, both funding and staff, were reported by many. Funding was reported by several respondents to inhibit the fabrication of new markers, whether metal or wood (e.g., Oregon). One agency reported that their funding cycle did not necessarily align with their tribal partners, creating challenges with Tribal coordination. Another reported a desire to create their own mobile app, however funding and staff limit this objective. Physical deterioration or damage of historical markers was identified as a challenge; one state quantified this maintenance backlog at $90 million. One respondent noted challenges related to funding vehicle pullouts for roadside markers.

Nebraska reported, "Printed materials are losing effectiveness." However, those that have worked to integrate technology into their programs have also faced challenges. Pennsylvania saw limitations with its existing database in that it had a limited keyword search, something they were actively addressing with an update. Another reported that finding the information within their website was a challenge. Michigan reported working with a university to create a computer program to provide GIS-linked audio access to interpretive information but reported that the maintenance of the created tool was too expensive. Overall, they reported the rapid evolution of technology to be challenging.

Several survey respondents reported challenges regarding the topics covered by interpretive markers. This challenge may be summarized best by the following: "The long lifespan of markers proves [to be a] challenge as we learn new historical facts and consider additional and underrepresented narratives." However, again, note that this is outside the scope of this research effort.

Others reported challenges related to engaging the public and their interest in interpretive markers. Montana reported an apathy by travelers in stopping to view historical markers anywhere but where is convenient (e.g., a rest stop). Oklahoma is taking a more-grass roots, back to basics approach to conveying the value of their agency by attending community events statewide.

Several other challenges were reported individually, including vandalization concerns, geographic scale, property ownership, and getting a baseline inventory. Vandalization was identified as a concern, where respondents hesitated to feature a "sensitive area." A Florida respondent reported challenges regarding the geographic scale. Kansas reported concerns by rural property owners with respect to ownership rights. At least one state (New Mexico) reported working towards a comprehensive inventory of their interpretive markers.

Best Practices in Disseminating Information

Less than half of the survey respondents (42%) reported best practices in disseminating information on historic, geologic, and/or other cultural sites. The following are some simplified anecdotes:

- Reducing the cost to install a marker by subsidizing part of the cost through a grant program (Arkansas)
- Markers should convey educational content, not take the place of monuments, memorials, advertising (in line with the "Virginia Model") (Kentucky)
- Interactive GIS map on a website (Wyoming)
- Include underrepresented groups (Kansas)
- Government to government consultation between state agency and tribal governments (Oregon)
- Worked with partner agencies and groups during the development stage to ensure that information was accessible (e.g., to ensure Braille was translated accurately and utilize tactile QR codes which lead to an accessible PDF reader) (Delaware)
- Keep your audience in mind and consider multiple approaches to communicate interpretive information (Tennessee)
- Graphics help to tell a story (Tennessee)
- Convey information quickly in "bite-sized bits" (Tennessee)
- Partnering with colleges to overcome funding and resource challenges (Virginia)
- Annual brochure exchange – gets publications in the hands of hotels, travel/tourism professionals, and more statewide (Nebraska)

Mobile Applications

Less than a quarter of survey respondents (23%) who responded reported having mobile applications. Half of the mobile applications were developed internally and half were developed by a contractor. The following mobile applications were identified:

- Iowa Culture App: https://www.dcaapp.com/ (web app and mobile app available on Apple and Android)
- Map of historical markers in Arkansas: https://www.arcgis.com/apps/mapviewer/index.html?layers=29e5fceeed224b95874542e58f9e9cac (ESRI web app)
- Michigan Historical Markers: https://experience.arcgis.com/experience/0810844003f149faa1a3aeaa64d7d42e (ESRI web

app)

- Mississippi Blues Trail: https://msbluestrail.org/app (mobile app available on Apple and Android)
- Georgia Historical Marker Database: https://www.georgiahistory.com/learn-and-explore/historical-markers/explore-georgia-historical-markers/ (web app and mobile app available on Apple and Android)
- Explore Kentucky History: https://explorekyhistory.ky.gov/ (web app and mobile app available on Apple and Android)
- Historic Montana: https://historicmt.org/ (web app and mobile app available on Apple and Android)
- eXplore Tennessee State Parks: https://apps.apple.com/ma/app/explore-tennessee-state-parks/id6444808325 (mobile app available on Apple and Android)
- NH Historical Highway Markers App: https://nhdhr.maps.arcgis.com/ (ESRI web app)
- Cambridge Historical Commission Instagram: https://www.instagram.com/cambridgehistoricalcommission/ (social media page)

In summary, web and mobile apps were identified by five survey respondents; three of the survey respondents reported an ESRI web app; one reported a mobile-only app; and one reported making use of a social media page (a local agency).

Information Shared Via Applications

The ten survey respondents were then asked what information is shared via their application, with three options identified (locations of historic, geologic, and/or cultural sites on a map; text description of the site; and photo(s) of the site) as well as an open-ended response option. Nine of the ten survey respondents reported that the application had location information; all reported that a text description was provided; and eight of the ten survey respondents reported that the application included photos. Other information identified as being provided via the app included:

1. "research resources" (Historic Montana)
2. "expanded historical narratives about the topics of many (but not all) state historical narratives" (Explore Kentucky History)
3. "year erected, subject, ability for driving directions to the location" (Georgia Historical Marker Database)

Application Update Timeframe

Respondents who reported developing their app internally were then asked how often their app was updated. (Those who contracted it out were sent to the next question.) No one choose the provided responses of: weekly, monthly or yearly. Instead, the following were the five timeframes identified by survey respondents:

1. "Goal is monthly, but updates have been intermittent so far. (App is only 4 months old.)" (Map of Historical Markers in Arkansas)

2. "Quarterly upload. The app design was created by CurateEscape out of Cleveland State University. We pay them to maintain our website and app." (Historic Montana)
3. "As new sites are added, except in current down-times for software updates." (Michigan Historical Markers)
4. "When new markers installed" (NH Historical Highway Markers App)
5. "3-5 days/week" (Cambridge Historical Commission Instagram)

Adding New Information & Data Maintenance

Respondents were also asked how new information was added to the app.

For those who contracted the app out, responses varied. One respondent noted that as a result of staff turnover and limited funding, no new information is currently being added. Another stated that new information is added "periodically" as new markers are erected. Others provided more specific information including that the online version of their marker information is updated and then "pushed" to their mobile app; another agency reported controlling, adding, and updating information on the app itself while retaining their contractor for "hardware and scaffolding," and relying on the "digital asset development resources from TimeLooper."

For those that developed their app internally, three stated simply that new information was added by staff, with one specifying via the "back-end" database and another by uploading a "csv spreadsheet and then manually uploading photos, photo metadata, map lat/long, and research resources." One respondent who developed an internal app provided no information on how new information is added.

Most respondents (8 of 10) reported that agency staff maintain the data used in the application.

Reported App Features

Survey respondents were asked about potential features of their app, including whether or not it has offline functionality, if it can be used hands-free, if it alerts a user of a nearby site, and if there are audio capabilities.

Nine of the ten survey respondents with apps reported if their app would function offline. Only a few of the apps were reported to work offline, two of which were developed internally (Historic Montana and Michigan Historical Markers), and one which was contracted out (eXplore Tennessee State Parks). All three of these respondents reported that users are required to download the information in advance.

All of the survey respondents reported that their apps do not offer a hands-free option for people who are driving.

Two of the ten survey respondents with apps reported that it can alert a user of a nearby site of potential interest:

- "A notification appears on the phone in the notifications bar." (eXplore Tennessee State Parks)

- "The app, when opened, will identify markers in close proximity and list rough estimates of how far away they are. It does not issue push alerts when somebody is driving past a marker – that would seem like a safety hazard." (Explore Kentucky History)

Three of the ten survey respondents with apps reported that it has audio capabilities (Explore Kentucky History, Michigan Historical Markers, and eXplore Tennessee State Parks).

Marketing

Survey respondents were then asked how they advertised their app, with four potential responses (state/region/agency website; state/region/agency social media: Facebook, Twitter); on signs at the site of interest; and on brochures or other printed materials at the site of interest) provided as well as an "other" category.

All but one survey respondent reported that they advertised their app on their agency's website. Marketing the app on the agency social media platforms was reported as being used by six of the ten survey respondents. Only one survey respondent reported that the app was advertised on signs at the site of interest (eXplore Tennessee State Parks). Four survey respondents reported using some form of printed materials at the site of interest. "Word of mouth" was reported by one survey respondent who did not indicate using any of the other marketing methods. The only other form of marketing identified was "Public presentations/community outreach" (Explore Kentucky History).

App Lessons Learned

Survey respondents were asked to share any lessons learned as a result of developing an app. Respondents highlighted the importance of marketing their app, challenges with keeping the data up-to-date, accessibility challenges, and that while new technologies provide new and exciting opportunities for dissemination of interpretive marker information, agencies should be prepared to handle the potential challenges of these technologies and be ready to address "teething issues" as one works to evolve their program.

Arkansas reported that by creating their online database for their ArcGIS web app, the public informed them of markers that were not included in the database along with those that had incorrect information. They noted that since there is not a downloadable app with the ArcGIS web app, the agency reported needing to continuously market its existence, as the public forgets about its availability.

Keeping the Mississippi Blues Trail app up to date was a reported challenge by Mississippi.

Kentucky noted that while their app is developed, it only contains about 1,000 entries of the approximate 2,400 markers that they manage. They reported a desire to have an intern who would be tasked with completing the entry of the remaining markers, but noted that unfortunately, it is a low priority.

In Montana's experience, most people do not like downloading apps that are not useful on a daily basis. They reported that people had downloaded the app while traveling within the state and would delete the app at the conclusion of their visit and that their website experienced greater traffic.

Michigan reported a lack of accessibility between ArcGIS databases and standard screen readers on phones and computers, and that "work-arounds" are difficult.

Lastly, Tennessee highlighted, "The costs for developing these assets are comparable to other physical assets, such as traditional waysides. Additionally, these assets allow us to recreate places that no longer exist at considerably lower costs and with less risk in terms of maintenance and the need to make changes when new information is discovered. Additionally, the development of digital tools will continue to provide new ways of interpreting resources. People seeking to develop experiences with these tools should be excited about the possibilities, yet always be ready to address teething issues or moments when a given idea isn't ready for primetime."

Cost – App Development & Maintenance

Little information was provided regarding the cost of app development and maintenance.

Regarding app development, the following were responses: $0.00 (Cambridge Historical Commission, Instagram); $284,000 for 15 sites (AR/VR experiences, 4 Generative AI at a Historic Site, and an interactive game) (eXplore Tennessee State Parks); unsure/unknown (4 survey respondents); and "Just time invested by permanent staff and a graduate assistant" (ESRI map of Historical Markers in Arkansas). Three of the ten did not provide a response.

Regarding app maintenance, reported costs varied including: $0.00 (Cambridge Historical Commission Instagram); "$1,800" (Historic Montana); "1,800 paid to a private contractor" (Explore Kentucky History), and "$15,000 for licensing and upkeep" (eXplore Tennessee State Parks). (Note: Historic Montana and eXplore Tennessee State Parks are maintained by the same entity.) Other respondents did not provide specific maintenance cost information either due to the costs being unknown or because the agency was utilizing a software program (e.g., ArcGIS) for their historical marker map that was already in use within the agency for other purposes. Four of the ten did not provide a response.

App Reporting or Summaries, Demographics, Most Used Features

Respondents were asked whether their agency had developed any reports or summaries of the app. No reports or summaries were available and/or shared.

None of the ten survey respondents reported collecting data regarding which of their app features were used the most. Similarly, no demographic data was collected by any of the agencies with an app.

Innovative Apps

Respondents were then asked to share any other apps that disseminate historic, geologic, and/or other cultural information that they found to be innovative. The following were other apps that the respondents viewed as innovative:

- I love the Historical Marker Database. Also, the city of Hot Springs, Arkansas, has a robust historical marker app for their Historic Baseball Trail. See the supporting website and

download the app at https://hotspringsbaseballtrail.com/ (Arkansas)

- Intermountain Histories from the Redd Center at BYU is a nicely-designed app that looks good and can share history with folks from wherever they are. (Utah)
- IZI.Travel is good because it provides an audio recording of each marker that the traveler passes. (Virginia)
- QR Codes on signage and GPS coordinates that are included with written material. (Brown County, MN)
- Clio, as it is accessible to many kinds of information. (Minnesota)
- OuterSpatial - We are in discussions to have all of the historic markers added to the app so that people can get the information on their phone when they are in the vicinity of a marker. OuterSpatial currently manages a digital passport for us for our state parks and we may do a similar passport program for the markers to motivate people to visit more historic sites. (Nevada)
- There are a few apps that I have seen but don't have direct experience working with them at this time. (Delaware)
- Agents of Discovery- provides a gamified way to interact with natural resources. (Tennessee)
- Timelooper does some incredible work, both with augmented reality and virtual. They are available at a variety of price points and are wonderful staff and interpreters. Once we get approval for through our IT, we plan to hire them for our AR work. (Washington)
- Clio: Bringing Local History Home (Wisconsin)
- I believe it was either the City of Brookings (South Dakota) or the Brookings Public Library that developed a walk tour of the historic downtown. It's not necessarily an app, but a text messaged-based guided tour. (South Dakota)
- We have heard of some mobile apps that use cell service to share historical marker information or provide for walking tours of areas. We do not have experience with these. (Nebraska)

Survey Findings

The survey collected a good representation of state experiences, with information collected from thirty-eight different states. Historic sites were reported as being a focus by all survey respondents. AR/VR seems to be the most forward-thinking method of disseminating interpretive information. Things like agency websites, interactive maps, social media, and mobile apps were common among survey respondents. While a more traditional approach, a calendar was a unique method of dissemination identified by one respondent. Dissemination methods varied across respondents, as did what was considered innovative.

Online databases were identified as a desired approach to getting the information out to the public; one respondent highlighted the need for the database to enable broad searches. Some search engines are better than others. Some states are still inventorying their interpretive markers where others have fully interactive online maps. For example, New Mexico reported challenges with

inventorying their existing interpretive markers; they could potentially leverage a similar approach used by Polk County, Wisconsin (Anderson, 2024), using volunteer resources to develop a base database, as discussed in the literature review and information gathering. A similar need was developed by Kentucky, where only some of the markers were already integrated.

Survey respondents expressed a preference for using QR codes. In particular, QR codes were reported as being preferred by agencies because of their ability to supplement the high-level information found on interpretive markers with more substantive educational content. However, there are some emerging challenges with this approach with the Federal Trade Commission (FTC) recently warning individuals to be wary of QR codes as scammers have found ways to modify them to steal information (Puig, 2023). One suggestion may be to utilize QR codes in areas where they could be checked on occasionally, whereas in more rural areas they may be less desirable. BLEs could be investigated as an alternative for applicability.

One entity reported using sixty-second histories as a way to better share historic information to their social media platforms. In another project with which the researchers are engaged (Development of a Public Service Announcement (https://www.clearroads.org/project/23-01/)), which built off findings from MDT sponsored research, Effectiveness of Highway Safety Public Education at Montana Motor Vehicle Registration Stations by Streaming a Variety of Safety Content (https://www.mdt.mt.gov/research/projects/safety/safetyvideos.aspx), the recommendation is to disseminate content in thirty-seconds or less. This directly speaks to another survey respondent highlighting the "bite-sized bits" of content preference by today's public. However, with many people relying on social media in their everyday lives, conveying the most desired information in succinct dissemination methods is likely the best way to get content out that will be retained by the public.

The South Dakota Department of Transportation clearly stated no desire to allow the traveling public to read their interpretive markers while operating a vehicle, understandably so. Yet, with the parallel desire of getting the interpretive content from markers to the traveling public, it presents an opportunity for technology, like mobile apps, to enable travelers to discover markers along their route and determine whether to stop or learn more information at a later time.

Similar to findings in the literature review, the need to market a mobile app is mentioned with one agency reporting "needing to continuously market its existence, as the public forgets about its availability." Marketing through agency websites and social media was common. Others were utilizing public outreach/engagement to share information about what their agency does and what resources they offer.

The elephant in the room when considering challenges is funding, whether for staff to conduct the work, funding to support the creation of innovative dissemination methods, or funding to maintain the markers themselves or the innovative tools that are created.

Comprehensive Summary & Next Steps

Overall, limited peer-review literature was available on the topic of disseminating interpretive markers. However, there were grey literature pieces and more informal sources, like periodical articles and blogs. This could, in part, reflect how rapid technological change is. In contrast, while not the focus of this research effort, there existed more peer reviewed articles when considering the content of interpretive markers.

A good geographic diversity of survey respondents was queried. Useful information was provided by respondents, including several examples of apps that were developed (whether internally or contracted out) as well as knowledge about other innovative mobile apps. One survey respondent expressed interest in the results of the study, implying a broader relevance of this work by peers.

Dissemination methods identified by survey respondents included printed materials, static and interactive webpages, and mobile apps, each of which can offer a variety of features (Table 2). As technology changes and becomes more accessible, so do the opportunities for engaging the public in interpretive marker programs. New opportunities like QR codes or BLE also provide the ability to share additional information beyond what is displayed on the interpretive marker. However, cautions, like those made by the FTC regarding QR codes, must be carefully considered.

Due to the rural nature of Montana, offline format options may be desirable, particularly for areas with spottier cellular or internet connection. Mobile apps can be useable offline, the typical workaround is that the app data must be downloaded prior to use. Other opportunities, like BLE, should also be considered.

Table 2. Features of Various Interpretive Marker Dissemination Methods.

	Dissemination Method		
Features	Printed Materials (e.g., guidebooks, brochures)	Web Pages (e.g., online database)	Mobile App
Easily Updated		X	X
Keyword or Other Search Options		X	X
Needs Regular Maintenance	X	X	X
Accessible by People with a Visual Disability	X	X	X
Audio Options		X	X
Available Offline	X		O - Possible
Can Automatically List Nearby Markers		X	X
Hands Free Capabilities			X
Requires Marketing	X	X	X

Through a review of the literature and input from the surveys, the need to identify how dissemination methods can enable a broader reach of the content was highlighted. This would make the content more substantive and also include people with disabilities (e.g., braille or audio options).

A striking aspect of the responses is what is not collected with mobile apps. None of the survey respondents reported collecting demographic information of mobile app users. While demographic information can be a controversial topic to some, no survey respondents indicated that they collected data on the most utilized features of developed apps, which is a somewhat benign data piece. Collecting data on demographics can aid an agency in understanding who is absorbing the content provided within a mobile app and who may need to be engaged in another manner or encouraged to participate via other incentives. Similarly, collecting data on used features can help to identify what features may need to be reconsidered or modified as the app is updated and maintained over time, a need for any developed apps.

While early purposes of the interpretive markers seem to be that vehicles traveling less than twenty-five miles per hour could read the short bits of displayed information, the desire was quickly abandoned as the speeds at which vehicles could travel quickly increased. Today, there is no intention that these signs should be read by moving vehicles, as clearly stated in the response by the South Dakota Department of Transportation. Instead, there is a desire to look for alternatives, whether it is with a pull-out (which can be costly) or via content read via an app. Ensuring the safety of the motoring public is a priority.

With the introduction of any new technology or dissemination methods, an agency should be prepared to market such opportunities to the public or face a lack of users or awareness of such efforts. This sentiment was highlighted in both the literature review and the survey responses. Methods used to market interpretive marker programs and apps included marketing on agency websites and social media and at the interpretive site. Others utilized printed materials like brochures; Nebraska noted they exchange brochures with local hotels and travel/tourism professionals statewide to market their resources.

While there is significant interest from the Technical Panel regarding the potential of developing an app, it is clear that AR and VR are opportunities for the future that are becoming more and more relevant. Therefore, it is recommended that learning more about AR and VR and whether or how they can be integrated into a mobile app, and how they can be used to leverage the dissemination of the content into the historical markers would provide value.

Next Steps

In this task, a total of twenty-nine mobile apps related to historic, geologic, and other cultural markers were identified (Table 3). These mobile apps will be examined further in Task 2: Investigate Innovative Approaches, Including App Development. For example, should it be of interest to the Technical Panel, the researchers could reach out to Fort Vancouver National Historic Site app developers and NPS site managers to learn more. Outreach was made to the NPS, but ultimately, they did not participate in the survey. Still, there remains an opportunity for the researchers to circle back to engage NPS in the next task.

BLE could potentially hold an opportunity. Should the Technical Panel have interest in learning more about if this technology holds some interest, the researchers could investigate it further.

Twenty-five examples of interactive maps displaying this type of information were identified through this process. The list of these interactive maps is available in Appendix A: Interactive Maps of Historic Markers. Montana already has an online interactive map. As a next step, this map could be compared and contrasted with the various online maps identified by other states, thereby determining which features may be worth considering by MDT, if any.

Table 3. Identified Mobile Apps.

App Name	Link	Organization	Geographic Area	Montana Data?	Price	Source
Hot Springs Baseball Trail	https://hotspringsbaseballtrail.com/	Hot Springs Convention Center	Local - AR		Free	Survey Response
WHExperience	https://apps.apple.com/us/app/whexperience/id1356596797	White House Historical Association	Local - DC		Free	Literature Review
Perez Art Museum Miami	https://apps.apple.com/us/app/p%C3%A9rez-art-museum-miami-pamm/id1215768854	Jorge M Perez Art Museum of Miami Dade County Inc.	Local - FL		Free	Literature Review
Cambridge Historical Commission - Instagram	https://www.instagram.com/cambridgehistoricalcommission/	Cambridge Historical Commission	Local - MA		Free	Literature Review
City of Stories – Holyoke	https://apps.apple.com/ar/app/city-of-stories-holyoke/id6502908772?l=en-GB	Holyoke Public Library Corporation	Local – MA		Free	Literature Review
Mississippi Blues Trail	https://msbluestrail.org/app	Mississippi Blues Commission	Local - MS		Free	Survey Response
Historic Charleston Foundation	https://apps.apple.com/us/app/historic-charleston-foundation/id1330939870	Historic Charleston Foundation	Local – SC		Free	Literature Review
Georgia Historical Marker App	https://apps.apple.com/us/app/georgias-historical-markers/id420288480	Georgia Historical Society	State - GA		Free	Literature Review
Iowa Culture App	https://history.iowa.gov/app	Iowa Department of Cultural Affairs	State - IA		Free	Literature Review
Explore Kentucky History	https://history.ky.gov/explore-kentucky-history-app	Kentucky Historical Society	State - KY		Free	Survey Response
Historic Missouri	https://apps.apple.com/us/app/historic-missouri/id1576214300	University of Central Missouri	State - MO		Free	Literature Review

App Name	Link	Organization	Geographic Area	Montana Data?	Price	Source
Historic Montana	https://apps.apple.com/ar/app/historic-montana/id1145444580?l=en-GB	Montana Historical Society	State - MT	Yes	Free	Survey Response
Montana Historical Markers	https://apps.apple.com/us/app/montana-historical-markers/id6477809186	Sierra Burkhart	State - MT	Yes	Free	Literature Review
Explore Nebraska History	https://apps.apple.com/us/app/explore-nebraska-history/id1245348943	Curatescape, Cleveland State University Research Corporation	State - NE		Free	Literature Review
Explore Tennessee State Parks	https://apps.apple.com/ma/app/explore-tennessee-state-parks/id6444808325	Tennessee State Parks	State - TN		Free	Survey Response
Texas Historical Marker Guide	https://apps.apple.com/us/app/texas-historical-marker-guide/id882607297	Gregory Moore	State - TX		$2.99	Literature Review
Intermountain Histories	https://play.google.com/store/apps/details?id=org.curatescape.intermountain&hl=en_US	Curatescape, Redd Center at BYU	Regional - Intermountain Region	Yes	Free	Survey Response
Agents of Discovery	https://apps.apple.com/us/app/agents-of-discovery/id986188357	Agents of Discovery	Nationwide	Yes	Free	Survey Response
Clio	https://apps.apple.com/us/app/clio-your-guide-to-history/id897995724	Clio Foundation	Nationwide	Yes	Free	Literature Review
ExploreHere	https://www.explorehere.app/	Wesley Vance	Nationwide	Yes	Free (basic version) Paid (all features)	Literature Review
Flyover Country	https://flyovercountry.io/	University of Minnesota	Nationwide	Yes	Free	Literature Review

App Name	Link	Organization	Geographic Area	Montana Data?	Price	Source
GoLocal Apps	https://golocalapps.com/app-development-services/geolocation-app-development/historical-tour-app-development/	GoLocal	Nationwide		Unknown	Literature Review
Next Exit History	http://nextexithistory.us/	Next Exit History	Nationwide			Survey Response
OuterSpatial	https://www.outerspatial.com/	OuterSpatial	Nationwide	Yes	Free	Survey Response
Shaka Guide	https://apps.apple.com/us/app/shaka-guide-gps-audio-tours/id1585055145	Shaka Guide	Nationwide	Yes	Free $18.99-$79.99 depending on tour purchased	Literature Review
The NPS App	https://apps.apple.com/us/app/national-park-service/id1549226484	National Park Service	Nationwide	Yes	Free	Literature Review
TravelStorysGPS	https://www.travelstorys.com/	TravelStorysGPS	Nationwide	Yes	Free $9.99-$32.99 depending on tour(s) purchased	Literature Review
VoiceMap: Audio Tours & Guides	https://apps.apple.com/us/app/voicemap-audio-tours-guides/id852027939	Audio Guide	Nationwide		Free (Basic) $3.99-$19.99 depending on audio tour	Literature Review
izi.Travel	https://izi.travel/en/app	izi.Travel	Worldwide	Yes	Free, In-App Purchases for Subscriptions 1 Month: $1.49 1 Year: $9.99	Survey Response

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Appendix A: Interactive Maps of Historic Markers

Table 4 provides links to twenty-six interactive maps of historic markers identified throughout the information-gathering process.

Table 4: Interactive Map Links

Organization	State	Interactive Map Link	System Used
Arkansas Historic Preservation Program	AR	https://www.arcgis.com/apps/mapviewer/index.html?layers=29e5fceeed224b95874542e58f9e9cac	ESRI
DC Preservation League	DC	https://historicsites.dcpreservation.org/items/browse/	Leaflet
Florida Historic Marker Council	FL	https://apps.flheritage.com/markers/map/	Google My Map
Georgia Historical Society	GA	https://experience.arcgis.com/experience/9ebd13bc847f4bddb1cb0e65784e74b5/	ESRI
Hawai'i Visitors and Convention Bureau	HI	https://www.hvcb.org/membership/culture/warrior-marker/	Google My Map
State Historical Society of Iowa	IA	https://history.iowa.gov/history/sites/state-historical-markers	Google My Map
Kansas Historical Society	KS	https://www.kshs.org/p/visit/19384	Google My Map
Kentucky Historical Society	KY	https://history.ky.gov/markers	Unknown
Cambridge Historical Commission	MA	https://www.cambridgema.gov/historic/cambridgehistory/historicmarkers/historicalmarkers	ESRI
Maryland Department of Transportation	MD	https://maryland.maps.arcgis.com/apps/dashboards/87318efedd984d989c3c8f3a65897c55	ESRI
Michigan History Center	MI	https://experience.arcgis.com/experience/0810844003f149faa1a3aeaa64d7d42e	ESRI
Montana Department of Transportation Web Apps	MT	• Web map: https://mdt.maps.arcgis.com/apps/mapviewer/index.html?webmap=0aca9ba4568244f1b5dc4367733d27ef • App: https://mdt.maps.arcgis.com/apps/instant/attachmentviewer/index.html?appid=f35a49790fbb4cc1b03db6c12300d86e • Dashboard: https://mdt.maps.arcgis.com/apps/dashboards/8923bb62cfe742b3abb668aa537c11a4	ESRI
Montana Historical Society	MT	https://historicmt.org/	Leaflet

Organization	State	Interactive Map Link	System Used
Nebraska State Historical Society	NE	https://mynehistory.com/	Leaflet
New Hampshire Division of Historical Resources	NH	https://nhdhr.maps.arcgis.com/apps/instant/nearby/index.html?appid=188fc0b4a6324a0e85c8cccb9369c296	ESRI
Ohio History Connection	OH	https://remarkableohio.org/	Google My Map
Oregon Travel Information Council	OR	https://oregontic.com/oregon-historical-markers/historical-marker-map/	MapPress
Pennsylvania State Historic Preservation Office	PA	https://share.phmc.pa.gov/markers/	ESRI
South Carolina Department of Archives and History	SC	https://www.google.com/maps/d/viewer?mid=183GWEBsTK2WvT9yXRwGgh8Nv1TXzbwQe&ll=33.931906625071925%2C-81.04654300130207&z=8	ESRI
Texas Historical Commission	TX	https://atlas.thc.texas.gov/Map	ESRI
Utah Historic Society	UT	https://utahshpo.maps.arcgis.com/apps/webappviewer/index.html?id=33c405cff5294c8a979ace4d26ee55a2	ESRI
Virginia Department of Historic Resources	VA	https://vcris.dhr.virginia.gov/HistoricMarkers/	Unknown
Vermont Roadside Historic Site Markers	VT	https://accd.vermont.gov/historic-preservation/roadside-markers	ESRI
Washington State Historical Society	WA	https://www.washingtonhistory.org/across-washington/monuments-project/	Google My Map
Wyoming State Parks	WY	https://wysphst.maps.arcgis.com/apps/webappviewer/index.html?id=70c906c090a0466da9781e2a88ac72b6	ESRI
Polk County	WI	https://tinyurl.com/PolkMaps	Google My Maps
Wisconsin Historical Society	WI	https://wishs.maps.arcgis.com/apps/View/index.html?appid=1ae1961b41f84edd8cf1be9579643953&center=-89.818,44.5&level=8	ESRI
Intermountain Histories	Intermountain Region	https://www.intermountainhistories.org/items/map/	Leaflet

Appendix B: Agency Listing

The following lists the names of the agencies that responded to the survey. In addition, they were categorized as:

- Historic Office – identified if they had government email addresses,
- Historical Society – were not government entities, often non-profits,
- Historic Marker Program – maybe incorporate some of the other categories, but is different because it is clearly defined as a specific program,
- State Park,
- Natural Resources – often department of natural resources,
- State DOT – state departments of transportation,
- Tourism, and
- Local – this superseded any other category (e.g., may be a government office, but it was local instead of at the state level.

1. American Samoa
    a. American Samoa Historic Preservation Office **(historic office)**
2. Alabama
    a. Alabama Historical Association **(*historical society*)**
3. Alaska
    a. Alaska State Parks (Alaksa Division of Parks and Outdoor Recreation) **(state park)**
4. Arizona
    a. Arizona State Parks and Trails **(state park)**
5. Arkansas
    a. Arkansas Historic Preservation Program (SHPO), an agency of the Division of Arkansas Heritage in the Department of Parks, Heritage and Tourism **(historic office)**
6. Delaware
    a. Delaware State Parks **(state park)**
7. Florida
    a. Florida Division of Historical Resources **(historic office)**
8. Georgia
    a. Georgia Historical Society **(*historical society*)**

9. Illinois
    a. Illinois Department of Natural Resources **(natural resources)**
10. Idaho
    a. Idaho Transportation Department, Division of Highways **(state DOT)**
11. Iowa
    a. State Historical Society of Iowa **(historic office)** (https://history.iowa.gov/about-us/contact-list)
12. Kansas
    a. Kansas State Historical Society **(*historical society*)**
13. Kentucky
    a. The Kentucky Historical Society **(historic office)** (https://www.kshs.org/p/who-we-are/18653)
14. Louisiana
    a. Louisiana Office of Tourism **(tourism)**
15. Maine
    a. Maine Department of Agriculture, Conservation and Forestry **(natural resources)**
16. Maryland
    a. Maryland Department of Transportation (MDOT) **(state DOT)**
17. Massachusetts
    a. City of Cambridge, Cambridge Historical Commission **(local)**
18. Michigan
    a. Michigan History Center **(*historic society*)**
    b. Parks and Recreation Division of the Michigan Department of Natural Resources (DNR) **(state park)**
19. Minnesota
    a. Minnesota Historical Society **(historic office)** (https://www.michigan.gov/mhc/about)
    b. Brown County Historical Society; New Ulm, Minnesota **(local)**
20. Mississippi
    a. Mississippi Department of Archives and History **(historic office)**
21. Montana
    a. Montana Historical Society **(historic office)** (https://mhs.mt.gov/about/)

22. Nebraska
    a. Nebraska State Parks **(state park)**
    b. Nebraska Game and Parks Commission **(natural resources)**
23. Nevada
    a. Nevada Division of State Parks **(state park)**
24. New Hampshire
    a. New Hampshire Division of Historical Resources (SHPO) **(historic office)**
25. New Jersey
    a. New Jersey Historical Commission **(historic office)**
26. New Mexico
    a. New Mexico State Parks Division **(state park)**
    b. Historic Preservation Office, New Mexico Department of Cultural Affairs **(historic office)**
27. North Carolina
    a. North Carolina State Parks **(state park)**
    b. North Carolina Highway Historic Marker Program **(historic marker program)**
28. Ohio
    a. Ohio History Connection **(*historical society*)**
29. Oklahoma
    a. Oklahoma Historical Society **(historic office)** (https://www.okhistory.org/about/contact)
30. Oregon
    a. Oregon Travel Information Council **(tourism)**
31. Pennsylvania
    a. Pennsylvania Historical and Museum Commission/Pennsylvania State Historic Preservation Office **(historic office)**
32. South Carolina
    a. South Carolina Department of Archives and History **(historic office)**
33. South Dakota
    a. South Dakota Office of the State Historic Preservation Officer **(historic office)**
    b. South Dakota Department of Transportation **(state DOT)**

34. Tennessee
    a. Tennessee State Parks **(state park)**
    b. Tennessee Historical Commission **(historic office)**
35. Utah
    a. Utah Historical Society **(historic office)** (https://history.utah.gov/)
    b. Utah State Parks **(state park)**
36. Virginia
    a. Virginia Department of Historic Resources **(historic office)**
    b. Virginia Department of Conservation and Recreation – Virginia State Parks **(state park)**
37. Washington
    a. Washington State Parks and Recreation Commission **(state park)**
    b. Washington State Historical Society **(*historical society*)**
38. Wisconsin
    a. Wisconsin Historical Society **(historic office)** (https://www.wisconsinhistory.org/Records/Article/CS15324)
39. Wyoming
    a. Wyoming State Parks and Cultural Resources **(state park)**