TECHNICAL REPORT: 2023 CURB RAMP FIELD DATA COLLECTION

Danielle Huerta, GIS Technician, Idaho State University, GIS Training and Research Center
Keith Weber, GISP, GIS Director, Idaho State University, GIS Training and Research Center

INTRODUCTION

Idaho State University's GIS Training and Research Center (ISU GIS TReC) has been working with Bannock Transportation Planning Organization (BTPO) and the Cities of Pocatello and Chubbuck, to assess ADA curb ramp compliance. Data collection during the summer 2023 was done creating an inventory of assessed sidewalk ramps in Pocatello and Chubbuck with the purpose of helping to create a safe and usable sidewalk system for pedestrians.

METHODS

BTPO provided a set of guidelines[1] to aid mapping technicians in data collection. The pedestrian data collection and inventory guidelines provided a consistent way to inventory the sidewalk ramps within Pocatello and Chubbuck. Since compliance standards have changed over the years, ramps present within the study area exhibit quite a bit of variability. As such, it is not possible for the inventory guideline to provide a comprehensive example of every ramp style, but rather, the guideline provides a general overview to reference while collecting data. The guide references the *2010 ADA Standards for Accessible Design*[2] distributed by the Department of Justice as a framework for construction and assessment. These standards also describe the compliance parameters used in this study to evaluate whether or not each ramp was currently considered compliant. It is noted that sidewalks and ramps constructed following the date of the regulation (15-September-2010) are expected to adhere to the regulation. Sidewalks and ramps constructed prior to that date are not required to be retrofitted or rebuilt.

Data collection

During the summer of 2023, the mapping technician for ISU GIS TReC sampled priority collection areas, identified by project partners, by walking from ramp to ramp collecting data at each ramp location. The priority areas were predetermined based on requests from each partner (BTPO, and the Cities of Pocatello and Chubbuck). Data collection required several tools including, a smart phone with ArcGIS Field Maps, a GNSS receiver (Trimble R1), compass, digital level, and measuring tape with graduations in inches and tenths of an inch. These tools were used to collect data such as location, slope, and length/width of each sidewalk and ramp. All data were collected in a digital format within a geodatabase point feature classes hosted in the Esri ArcGIS Online (AGOL) cloud environment.

Pre-analysis processing

The point feature class of Ramps was opened in ArcGIS Pro desktop software. During data collection in 2022, the collector incorrectly entered a value of zero for various fields when it should have been set to null. This resulted in some necessary data clean up where zeros were found and changed to null. In addition, other years had similar issues. This was due to an automated fill of a value of zero for certain attributes in Field Maps. All zero values were selected and set to a null value.

Evaluation

Following field data collection and pre-analysis processing was completed, a series of SQL statement were executed using the *Select by Attributes* tool to determined ramp compliance. SQL

[1] https://giscenter.isu.edu/pdf/PDF_BannockSDI/CollectionGuidelines.pdf
[2] https://giscenter.isu.edu/pdf/PDF_BannockSDI/ADAStandards2010.pdf

statement 1, 2010 ADA standards, found all ramps that were considered compliant. SQL statement 2, 2010 ADA standards with null values assumed to be compliant, used all the same components as SQL Statement 1 but also accounted for null values by assuming a null value could be compliant if the data had been collected. SQL statement 3 assessed 2010 ADA standards with null values assumed to be compliant and truncated dome criteria excluded. This is similar to SQL statement 2 but removes the consideration for truncated dome presence as well as contrasting color of the truncated dome structure. This was done as past studies have shown the primary reason why ramps failed to meet compliance was due to the absence of contrasting color truncated dome structures.

The SQL statements were executed to identify which ramp were considered compliant, as well as identify which ramps could potentially be considered complaint. The latter ramps should be re-visited to determine actual compliance. SQL statement 4 found all ramps that were considered ADA compliant based on the older 1994 compliance standards.

SQL Statement 1: 2010 ADA ramp standards (null values are assumed to be non-compliant)

```
TurningSpaceWidth >= 4.0 And TurningSpaceLength >= 4.0 And
Running_Slope <= 8.3 And Left_Flare_Slope <= 10 And
Right_Flare_Slope <= 10 And CounterSlope <= 5 And
DetectableWarningWidth >= 2.0 And Ramp_Width >= 4.0 And
TruncatedDome = 1 And ContrastingColor = 1
```

SQL Statement 2: 2010 ADA ramp standards (null values assumed to be compliant)

```
(TurningSpaceWidth >= 4.0 Or TurningSpaceWidth IS NULL)
(TurningSpaceLength >= 4.0 Or TurningSpaceLength IS NULL)
(Running_Slope <= 8.3 Or Running_Slope IS NULL)
(Left_Flare_Slope <= 10 Or Left_Flare_Slope IS NULL)
(Right_Flare_Slope <= 10 Or Right_Flare_Slope IS NULL)
(CounterSlope <= 5 Or CounterSlope IS NULL)
(DetectableWarningWidth >= 2.0 Or DetectableWarningWidth IS NULL)
(Ramp_Width >= 4.0 Or Ramp_Width IS NULL)
 TruncatedDome = 1 And ContrastingColor = 1]
```

SQL Statement 3: 2010 ADA ramp standards (null values compliant and truncated dome/contrasting color standards removed)

```
(TurningSpaceWidth >= 4.0 Or TurningSpaceWidth IS NULL)
(TurningSpaceLength >= 4.0 Or TurningSpaceLength IS NULL)
(Running_Slope <= 8.3 Or Running_Slope IS NULL)
(Left_Flare_Slope <= 10 Or Left_Flare_Slope IS NULL)
(Right_Flare_Slope <= 10 Or Right_Flare_Slope IS NULL)
(CounterSlope <= 5 Or CounterSlope IS NULL)
(DetectableWarningWidth >= 2.0 Or DetectableWarningWidth IS NULL)
(Ramp_Width >= 4.0 Or Ramp_Width IS NULL)
```

SQL Statement 4: 1991 ADA ramp standards

```
Ramp_Width >= 3 And Detectable_Warnings >= 2 And Left_Flare_Slope
<= 10 Or Left_Flare_Slope IS NULL And Right_Flare_Slope <= 10 Or
Right_Flare_Slope IS NULL And Running_Slope <= 8.3
```

Note: the SQL queries shown in this report are provided as a project deliverable for your convenience.

RESULTS

SQL Queries

During the summer of 2023, data for 1,215 ramps were assessed from a total of 4,940 ramps in inventory. SQL Statement 1, 2010 ADA standards, resulted in 169 ramps considered ADA compliant (3.4%). Using only those ramps evaluated in 2023, 91 ramps were found to be compliant (7.5%). It is important to note that not every ramp evaluation record contained a complete set of attributes. This inconsistency was due to changing evaluation methods used over time and resulted in may records having null values.

Reevaluation was done was done using SQL Statement 2, 2010 ADA standards with null values assumed to be compliant. The results for all ramps indicated 643 compliant ramps (13.0%). Using only those ramps evaluated in 2023, 235 were compliant (19.3%).

SQL Statement 3, 2010 ADA standards with null values assumed to be compliant and truncated dome criteria removed, 2,379 ramps were considered compliant (48.2%). Using only those ramps evaluated in 2023, 531 were considered compliant (43.7%).

SQL Statement 4, tested for ramp compliance based on 1994 ADA compliance criteria. This resulted in 3,404 compliant ramps (68.9%). When only evaluating ramps collected in 2023, 984 ramps were found compliant. (81.0%)

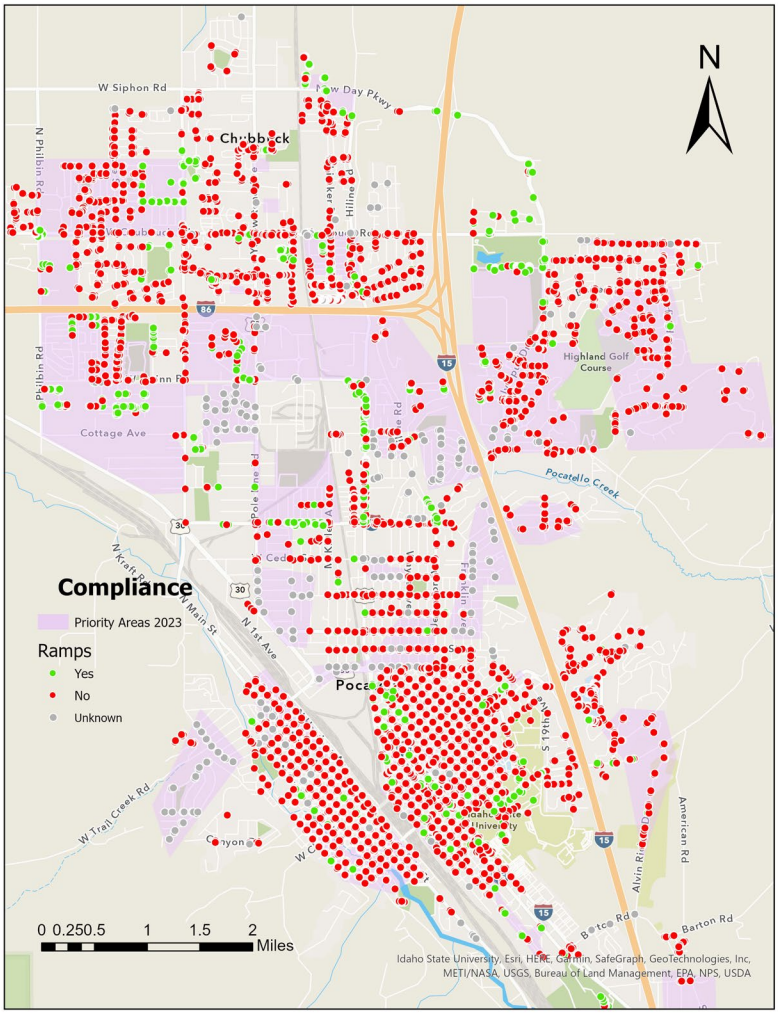

Figure 1 Compliance of sidewalk ramps in Pocatello and Chubbuck based upon SQL Statement 2, 2010 ADA standards with null values assumed to be compliant.

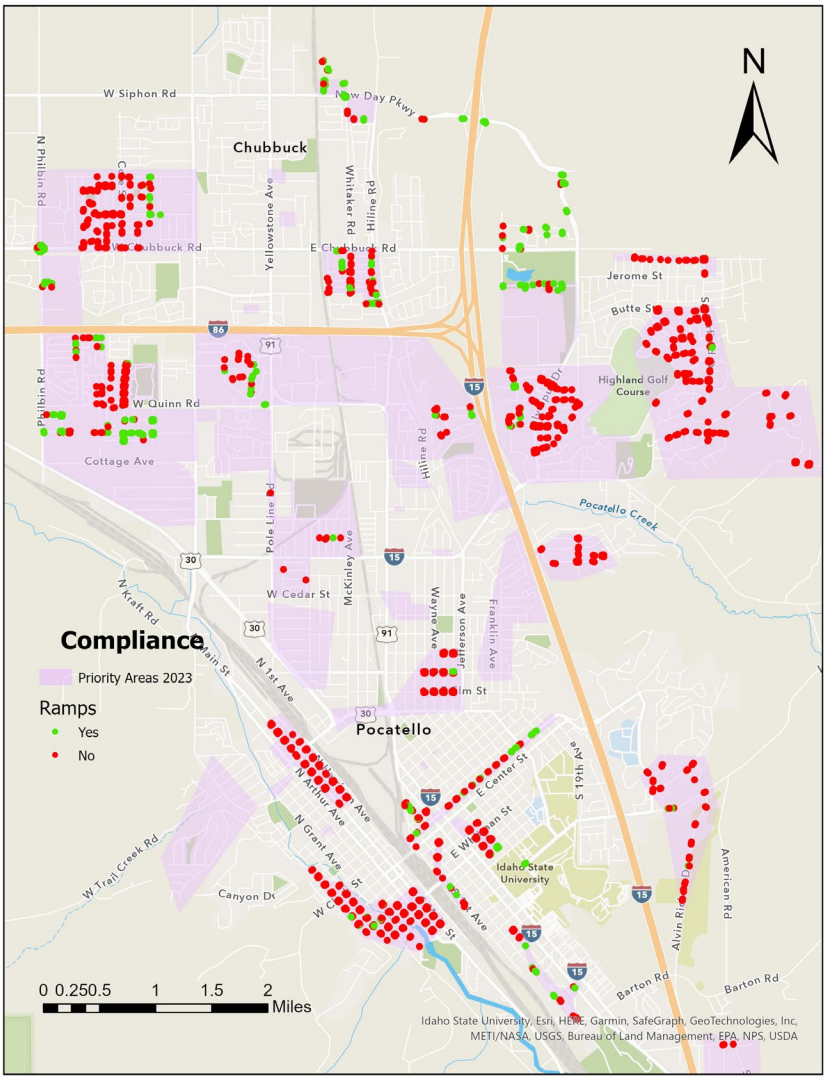

Figure 2 Compliance of sidewalk ramps evaluated during the summer of 2023 in Pocatello and Chubbuck, Idaho based upon SQL Statement 2, 2010 ADA standards with null values assumed to be compliant.

Summary of Compliance Factors

To better understand curb ramp compliance factors, a series of independent SQL expressions were executed generating the following results. (**Tables 1.1, 1.2, 2.1, and 2.2**)

Table 1.1 Breakdown of individual compliance factors evaluated for all ramps in this study for 2023. (n = 1,215). These data were derived from SQL Statement 1; 2010 ADA Standards.

Compliance factor	Ramps in compliance (*n* =)	Percent compliant
Turning space length/width	343	28.2%
Running slope	869	70.5%
Left/Right Flare slope	1,083	89.1%
Counter slope	816	67.2%
Detectable warning width	499	41.1%
Ramp width	1,105	90.9%
Truncated dome present	463	38.1%
Contrasting color present	399	32.8%

Table 1.2 Breakdown of individual compliance factors evaluated for all ramps in this study over entire project duration. (n = 4,940). These data were derived from SQL Statement 1; 2010 ADA Standards.

Compliance factor	Ramps in compliance (*n* =)	Percent compliant
Turning space length/width	1,494	30.2%
Running slope	3,790	76.7%
Left/Right Flare slope	2,530	51.2%
Counter slope	2,627	53.2%
Detectable warning width	1,422	28.8%
Ramp width	4,180	84.6%
Truncated dome present	1,377	27.9%
Contrasting color present	1,037	21.0%

Table 2.1 Breakdown of individual compliance factors evaluated for all ramps in this study for 2023. (n = 1,215). These data were derived from SQL Statement 2; 2010 ADA Standards with null values assumed to be compliant.

Compliance factor	Ramps in compliance (*n* =)	Percent compliant
Turning space length/width	1,211	99.7%
Running slope	869	71.5%
Left/Right Flare slope	1,134	93.3%
Counter slope	830	68.3%
Detectable warning width	1,215	100%
Ramp width	1,175	96.7%
Truncated dome present	463	38.1%
Contrasting color present	400	32.9%

Table 2.2 Breakdown of individual compliance factors evaluated for all ramps in this study over entire project duration. (n = 4,940). These data were derived from SQL Statement 2; 2010 ADA Standards with null values assumed to be compliant.

Compliance factor	Ramps in compliance (*n* =)	Percent compliant
Turning space length/width	4,918	99.6%
Running slope	3,809	77.1%
Left/Right Flare slope	4,481	90.7%
Counter slope	3,861	78.2%
Detectable warning width	4,937	99.9%
Ramp width	4,361	88.3%
Truncated dome present	2,590	52.4%
Contrasting color present	2,251	45.6%

Summary statistics of selected measurements made for each curb ramp (**Table 3.1 and 3.2**) show median values recorded for each criterion (n = 1,215).

Table 3.1 Statistics describing measurements made for all curb ramps updated in 2023 (n = 1,215)

Compliance factor	Median measured value	Compliance value
Turning space length/width	5/6	$\geq$ 4.0
Running slope	5.7	$\leq$ 8.3
Left/Right Flare slope	6.3/6.1	$\leq$ 10.0
Counter slope	3.4	$\leq$ 5.0
Detectable warning width	2	$\geq$ 2.0
Ramp width	4	$\geq$ 4.0

Additional summary statistics for all ramps in the inventory were calculated and compared to 2010 ADA guidelines (**Table 3.1 and 3.2)** (*n* = 4,940).

Table 3.2 Statistics describing measurements made for all curb ramps collected over entire project duration. (n = 4,940)

Compliance factor	Median measured value	Compliance value
Turning space length/width	4/5	≥ 4.0
Running slope	4.9	≤ 8.3
Left/Right Flare slope	4.5/4.9	≤ 10.0
Counter slope	2.9	≤ 5.0
Detectable warning width	2	≥ 2.0
Ramp width	5	≥ 4.0

DISCUSSION

The median value found for each compliant factor for both ramps collected in 2023 as well as all ramps in inventory are all within the range of compliance. The median value calculated tells one half of all other values fall below the median value and the other half fall above. It is an indicator of what the typical value is for each compliance factor. Though, it is likely that there are ramps that have factor values that fall out of the range of compliance.

When assessing compliance count (**Table 1.2**) for the 2010 ADA standards that have been set, it seems as though the limiting factors are turning space length/width, detectable warning width, and truncated dome presence with contrasting color. Further investigation (**Table 2.2**) shows that when null values are included, the true limiting factors are presence of truncated dome with contrasting color. This is causing a bottleneck where the majority of ramps would be considered compliant if they had the addition of a contrasting-colored truncated dome. Meaning, ramps may not necessarily need completely replaced, rather, the installation of a truncated dome would put these ramps in compliance. This could save time, money, and effort if the removal and instillation of an entire ramp did not have to take place.

Limitations

Throughout the summer 2023 field collection, an external Trimble R1 GNSS was used to improve the positional accuracy of these data. After reviewing these data, 558 ramps out of the 1,213 used the external Trimble R1 receiver to find spatial positioning of each ramp. A total of 544 show a null value for positioning source, while 16 were noted as unknown, and 10 were considered user defined. The remaining 87 used positioning from the integrated GNSS chip within the smartphone for data collection. The reason why one sees roughly half of ramps with positioning from the Trimble R1 receiver is because, many of the ramp's locations were already positioned by a previous inventory collection. If further collection is done with the Trimble R1 receiver, it would be important for the collector to update the point location at every ramp visited, even if a point already exists. This would ensure a consistent collection methodology and overall improved positional accuracy.

Data collectors, while taking inventory, sometimes have to make individual decisions on how to go about collecting data for a ramp. As stated above, the collection guideline provided specific directions for a variety of ramp types but not all possible ramp types. It is important that measurements are collected in the same fashion across different collectors and it is especially important that each individual collector remains consistent with the measurements they record themselves. It is apparent that collectors did not record every attribute in the same way. This does not pertain to how measurements were taken in the field, but rather, what measurements were taken as the attribution of ramps has evolved over time. Data for each ramp ranges from only basic measurements to nearly every attribute documented. Fortunately, this particular issue was addressed by including null values when evaluating ramp compliance (cf. SQL statement 2).

During the summer of 2022, some errors were made in data collection. The first of which was recording values that should have been reported as null with a value of zero instead. This was addressed during pre-analysis processing and resulted in a clean and improved geodatabase for future use. Values that were found to be zero were set to null for all fields where this mistake was detected. This correction was especially important for ramps where data was collected in 2022. This means that any measurements that truly had a value of zero would also be set to null. However, field observations where the actual or true value was zero tended to be uncommon.

Collection outside of 2022 also included zeroes where null values should be present. This was likely due to the smart phone application, Field Maps (or Collector for ArcGIS), which set certain fields to automatically populated with a value of zero as a default instead of remaining null. These fields included ramp width, running slope, left flare slope, right flare slope, and cross slope. If the data collector did not delete or change the automated zero for these fields, the value remained zero. This likely created an overestimate of compliant left and right flare slopes in inventory since the qualifying values would have to be less than or equal to 10 to be compliant. Five hundred and fifty-four ramps had a running slope value of zero, and 632 ramps had a cross slope of zero. Running slope must be less than or equal to 8.3. This means all ramps with a value of zero would be considered compliant for this factor. If the true measurement for running slope was over the compliance value, an overestimate of compliant ramps would occur. If the zero values were changed to null, one would see a decrease in compliance for the running slope factor. Since cross slope is not a compliant factor that is taken into account, these zero values do not create an under or over estimate of overall compliance. This is important to keep in mind though, particularly if more analysis were to be done on the data that looks at cross slope. The zero values given for running slope, cross slope and left and right slope do, however, create an underestimate of the median value.

CONCLUSIONS

Over the summer of 2023, 646 ramps were added into the ramps inventory while 569 were existing ramps that were updated. This brought the total number of ramps in inventory to 4,940. Two-hundred and thirty-six ramps were considered potentially compliant out of the 1,215 ramps collected during the summer of 2023. Six-hundred and forty-three ramps were found to be potentially compliant out of all ramps in inventory (n = 4,940). The acknowledgement of null values allowed for a different perspective to understand the collected data by observing potential compliance as well. The presence of truncated dome ramp structures was found to be the primary limiting factor for ramp compliance. This suggests many non-compliant ramps could be made compliant with the addition of a contrasting-colored truncated dome structure. Issues with collection included general misunderstanding of what measurements belonged to which factor, inconsistent use of the Trimble R1 GNSS receiver, and recording zeros values when null values should have been recorded. These concerns were addressed in more detail earlier in this paper. The overall results of the ADA ramp compliance collection and cleaned geodatabase should provide the project partners with reliable spatial data and a platform on which to continue future inventory updates and collections.