COLLECTING STATEWIDE RAIL CROSSING INVENTORIES WITH A SMARTPHONE APP

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US Rail-Highway Collision History

- **1990s**
  - **1991**: Collisions: 3500, Fatalities: 1500, Injuries: 2500
  - **1993**: Collisions: 4500, Fatalities: 2500, Injuries: 3500
  - **1994**: Collisions: 5000, Fatalities: 3000, Injuries: 4000
  - **1995**: Collisions: 5500, Fatalities: 3500, Injuries: 4500
  - **1996**: Collisions: 6000, Fatalities: 4000, Injuries: 5000
  - **1997**: Collisions: 6500, Fatalities: 4500, Injuries: 5500
  - **1998**: Collisions: 7000, Fatalities: 5000, Injuries: 6000
  - **1999**: Collisions: 7500, Fatalities: 5500, Injuries: 6500
  - **2000**: Collisions: 8000, Fatalities: 6000, Injuries: 7000
  - **2001**: Collisions: 8500, Fatalities: 6500, Injuries: 7500
  - **2002**: Collisions: 9000, Fatalities: 7000, Injuries: 8000
  - **2003**: Collisions: 9500, Fatalities: 7500, Injuries: 8500
  - **2004**: Collisions: 10000, Fatalities: 8000, Injuries: 9000
  - **2005**: Collisions: 10500, Fatalities: 8500, Injuries: 9500
  - **2006**: Collisions: 11000, Fatalities: 9000, Injuries: 10000
  - **2007**: Collisions: 11500, Fatalities: 9500, Injuries: 10500
  - **2008**: Collisions: 12000, Fatalities: 10000, Injuries: 11000
  - **2009**: Collisions: 12500, Fatalities: 10500, Injuries: 11500
  - **2010**: Collisions: 13000, Fatalities: 11000, Injuries: 12000
  - **2011**: Collisions: 13500, Fatalities: 11500, Injuries: 12500
  - **2012**: Collisions: 14000, Fatalities: 12000, Injuries: 13000
  - **2013**: Collisions: 14500, Fatalities: 12500, Injuries: 13500
  - **2014**: Collisions: 15000, Fatalities: 13000, Injuries: 14000
  - **2015**: Collisions: 15500, Fatalities: 13500, Injuries: 14500
  - **2016**: Collisions: 16000, Fatalities: 14000, Injuries: 15000
  - **2017**: Collisions: 16500, Fatalities: 14500, Injuries: 15500
  - **2018**: Collisions: 17000, Fatalities: 15000, Injuries: 16000

- **2010s**
  - **2010**: Collisions: 17500, Fatalities: 15500, Injuries: 16500
  - **2011**: Collisions: 18000, Fatalities: 16000, Injuries: 17000
  - **2012**: Collisions: 18500, Fatalities: 16500, Injuries: 17500
  - **2013**: Collisions: 19000, Fatalities: 17000, Injuries: 18000
  - **2014**: Collisions: 19500, Fatalities: 17500, Injuries: 18500
  - **2015**: Collisions: 20000, Fatalities: 18000, Injuries: 19000
  - **2016**: Collisions: 20500, Fatalities: 18500, Injuries: 19500
  - **2017**: Collisions: 21000, Fatalities: 19000, Injuries: 20000
  - **2018**: Collisions: 21500, Fatalities: 19500, Injuries: 20500

Note: The data is hypothetical and for illustrative purposes only.
National Grade Crossing Inventory Reporting Regulations

On January 6, 2015, FRA published a Final Rule that requires railroads to submit information to the FRA for inclusion in the Crossing Inventory about crossings through which they operate.

The purpose of the U.S. DOT National Highway-Rail Crossing Inventory Program is to provide a uniform national inventory database that can be used to gather data for use in improving crossing safety across the nation.

The information can be used for planning and implementation of crossing improvement programs by public and private agencies responsible for highway-rail crossing safety.

FRA also revised the Crossing Inventory Form and the FRA Guide for Preparing U.S. DOT Crossing Inventory Forms.

Helpful Resources

- Railroad/Grade Crossing Materials
### U.S. DOT Crossing Inventory Form

**DEPARTMENT OF TRANSPORTATION**  
**FEDERAL RAILROAD ADMINISTRATION**  
**OMB No. 2130-0017**

Instructions for the initial reporting of the following types of new or previously unreported crossings: For public highway-rail grade crossings, complete the entire Inventory Form. For private highway-rail grade crossings, complete the Header, Parts I and II, and the Submission Information section. For public pathway-rail grade crossings (including pedestrian station grade crossings), complete the Header, Parts I and II, and the Submission Information section. For private pathway-rail grade crossings, complete the Header, Parts I and II, and the Submission Information section. For grade-separated highway-rail or pathway crossings (including pedestrian station crossings), complete the Header, Part I, and the Submission Information section. For changes to existing data, complete the Header, Part I Items 1-3, and the Submission Information section, in addition to the updated data fields. Note: For private crossings only, Part I Item 20 and Part III Item 2.X, are required unless otherwise noted. An asterisk (*) denotes an optional field.

#### A. Revision Date (MM/DD/YYYY)

<table>
<thead>
<tr>
<th>Day</th>
<th>Month</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### B. Reporting Agency

- Railroad
- Transit
- State
- Other

#### C. Reason for Update (Select only one)

- Change in New
- New
- Closed
- Change in Primary Operating RR

- No Train Traffic
- Quiet Zone Update
- Admin. Correction

#### D. DOT Crossing Inventory Number

A unique identifier for the crossing.

### Part I: Location and Classification Information

#### 1. Primary Operating Railroad

#### 2. State

#### 3. County

#### 4. City / Municipality

- In
- Near

#### 5. Street/Road Name & Block Number

<table>
<thead>
<tr>
<th>Street/Road Name</th>
<th>Block Number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 6. Highway Type & No.

<table>
<thead>
<tr>
<th>Highway Type</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 7. Do Other Railroads Operate a Separate Track at Crossing? 

- Yes
- No

#### 8. Do Other Railroads Operate Over Your Track at Crossing? 

- Yes
- No

#### 9. Railroad Division or Region

#### 10. Railroad Subdivision or District

#### 11. Branch or Line Name

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Name</th>
<th>Suffix</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 12. RR Milepost

<table>
<thead>
<tr>
<th>RR Milepost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

#### 13. Line Segment

<table>
<thead>
<tr>
<th>Station</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

#### 14. Nearest RR Timetable Station

#### 15. Parent RR (if applicable)

<table>
<thead>
<tr>
<th>RR Number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

#### 16. Crossing Owner (if applicable)

<table>
<thead>
<tr>
<th>Owner Name</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

#### 17. Crossing Type

- Public
- Private

#### 18. Crossing Purpose

- Highway
- Pathway, Ped.
- Station, Ped.
- RR Under
- RR Over

#### 19. Crossing Position

- At Grade
- Intercity Passenger
- Commuter
- Tourist/Other

#### 20. Public Access

- Yes
- No

#### 21. Type of Train

- Freight
- Intercity Passenger
- Commuter
- Transit

#### 22. Average Passenger Train Count Per Day

- Less Than One Per Day
- Number Per Day

#### 23. Type of Land Use

- Open Space
- Farm
- Residential
- Commercial
- Industrial
- Institutional
- Recreational
- RR Yard

#### 24. Is there an Adjacent Crossing with a Separate Number? 

- Yes
- No

#### 25. Quiet Zone (FRA provided)

- Yes
- No

#### 26. HSR Corridor ID

<table>
<thead>
<tr>
<th>ID</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A</td>
</tr>
</tbody>
</table>

#### 27. Latitude in decimal degrees

(WGS84 std: n.nnnmmm)

#### 28. Longitude in decimal degrees

(WGS84 std: -n.nnnmmm)

#### 29. Lat/Long Source

- Actual
- Estimated
MnDOT Rail Crossing Inventory

- FRA requires update of rail highway crossing data every three years.
- FRA inventory form requires States to report a minimum of 95 data fields
- MnDOT has 4,185* rail crossings to inventory
- MnDOT supplements inventory with digital photos and 18 additional data fields
- Paper-form field inventory is very time intensive and error-prone
- Digital data collection pursued in 2017

*At-Grade (4,058), Grade Separated (127)
Recommended Solution: Collector for ArcGIS

- Runs on iOS, Android or Windows mobile devices
- Coded domains for drop-down lists
- Range domains enforce numeric data quality
- Data collected real-time via cellular network
- Disconnected editing for areas of poor cell coverage
- Each web map supports multiple field editors
- Web maps for all 9 MnDOT Districts
- Support for all MnDOT rail crossing contractors
  - HDR
  - AECOM

This example shows a recent roadway asset inventory on a smart phone. Rail crossing application would look similar to this.
Rail Crossing Inventory Workflow With Collector

- Generate Reports
- ArcGIS Desktop Analysis
- ArcGIS Desktop Query & Reports
- Local Geodatabase Copy of Rail Crossing Data
- Export to Black Cat
- Black Cat Rail Server
- MnDOT Users
- Esri ArcGIS Online Web Mapping
- HDR Admin
- ArcGIS Collector
- Web Mapping Display & Query
Data Collection Steps

1. Export Rail Crossing Data from Black Cat
2. Generate Point Features from Crossing XY Coordinates
3. Rail Crossing Point Features
4. Correct XY Locations with Aerial Imagery as Needed
5. Add FRA and MnDOT Data Fields to Point Features
6. Build Coded & Range Domains for Point Features
7. Add Edit Feature Template for Inventory Status Field
8. Publish Crossing Points to ArcGIS Online
9. Rail Crossing Feature Service in AGOL
10. Share Rail Crossing Layer to Group for Field Crews

11. Rail Crossing Feature Service in Group
12. Use Collector App to Update Rail Crossing Attributes
13. Use Collector App to Capture Photos at Rail Crossing
14. Quality Control Review of Rail Crossings Via ArcGIS Online

15. QC Review Passed?
   - Yes
   - No

16. Rail Crossing Data in ArcGIS Online
Data Delivery Steps

1. Rail Crossing Data in ArcGIS Online
2. QC Crossing Data in AGOL, Make Changes As Needed
3. ≤ 250 Crossings?
4. Export Directly to File GDB from ArcGIS Online
5. Successful Export?
6. Rail Crossings in File GDB Format
7. Export Using “Create Replica” Process in ArcGIS Online
8. QC Crossing Data in ArcGIS Online
9. Export Rail Crossing Attribute Data to CSV Text File
10. Digital Photo JPG Files
11. Run ArcGIS Toolbox Script to Generate Digital Photo JPG Files
12. QC Digital Photos, Make Changes As Needed
13. Filter Digital Photos to Remove DUPLICATE Files
14. Deliver Final Digital Photo JPG Files
15. Export Rail Crossing Attribute Data to CSV Text File
16. Rail Crossing Tabular Data CSV File
17. Concatenate XSurfaceIDs and PaveMrklDs Fields in Excel
18. QC Tabular Values, Make Changes As Needed
19. Export Rail Crossing Attribute Data to CSV Text File
20. Deliver Final Rail Crossing CSV Files
## General

### Crossing Information

- **Crossing Number:** 061615J
- **Operator:** BNSF Railway Company
- **Street:** Main St NW
- **Status:** Open

### Roadway Location

<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ATP</td>
<td>Metro</td>
</tr>
<tr>
<td>Crossing Status</td>
<td>Open</td>
</tr>
<tr>
<td>District</td>
<td>Metro</td>
</tr>
<tr>
<td>County (I.3)</td>
<td>ANOKA</td>
</tr>
<tr>
<td>City (I.4)</td>
<td>BETHEL</td>
</tr>
<tr>
<td>Township</td>
<td>Select One</td>
</tr>
<tr>
<td>Highway Type and No. (I.6)</td>
<td>M1</td>
</tr>
<tr>
<td>Local Street Name (I.5)</td>
<td>Main St NW</td>
</tr>
<tr>
<td>Block Number (I.5)</td>
<td></td>
</tr>
<tr>
<td>Latitude (I.27)</td>
<td>45.4036153</td>
</tr>
<tr>
<td>Longitude (I.28)</td>
<td>-93.266951</td>
</tr>
</tbody>
</table>

### Roadway Ownership

<table>
<thead>
<tr>
<th>Field</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crossing Type (I.17)</td>
<td>Public</td>
</tr>
<tr>
<td>Public Access Allowed? (I.20)</td>
<td>Select One</td>
</tr>
<tr>
<td>Crossing Purpose (I.18)</td>
<td>Highway</td>
</tr>
<tr>
<td>Crossing Position vs. Highway (I.19)</td>
<td>At Grade</td>
</tr>
<tr>
<td>Highway System (V.1)</td>
<td>(08) Non-Federal Ald</td>
</tr>
<tr>
<td>Functional Classification of Road at Crossing (V.2)</td>
<td>(0) Rural</td>
</tr>
<tr>
<td>Is the crossing on the State Highway System? (V.3)</td>
<td>No</td>
</tr>
<tr>
<td>Regular Emergency Services Route? (V.10)</td>
<td>Select One</td>
</tr>
<tr>
<td>Roadway Agency Contact Phone Number (I.35)</td>
<td>(651) 366-3667</td>
</tr>
</tbody>
</table>
## Export Data

**Export Type**

- [ ] FRA Data
- [ ] MN Data

**Field Selection**

- CrossingId
- Railroad
- CityCD
- SepInd
- SepR4
- SameR3
- RrMain
- PosXing
- XingAdj
- RevisionDate
- StateCD
- Street
- SepR1
- SameInd
- SameR4
- XingOwner
- OpenPub
- XngAdjNo
- ReportingAgencyTypeID
- CntyCD
- BlockNumb
- SepR2
- SameR1
- RrID
- TypeXing
- TypeTmSvcIDs
- Whistle
- ReasonId
- Nearest
- Highway
- SepR3
- SameR2
- TstnNam
- XPurpose
- DevelTypeID
- WhistleDate
### Rail Crossing Geodatabase Schema Design

#### Table 1: Field List

<table>
<thead>
<tr>
<th>Source</th>
<th>FieldName</th>
<th>Inventor</th>
<th>FieldTy</th>
<th>FieldLength</th>
<th>FieldAlias</th>
<th>Default</th>
<th>Domain Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRA</td>
<td>CrossingId</td>
<td>1</td>
<td>C</td>
<td>20</td>
<td>DOT Crossing Number</td>
<td>N/A</td>
<td>First 6 characters must be numeric followed by an alphabetic character</td>
</tr>
<tr>
<td>3</td>
<td>Street</td>
<td>2</td>
<td>C</td>
<td>256</td>
<td>Street Name</td>
<td>N/A</td>
<td>Any alpha or numeric characters including dash (-) and slash (/)</td>
</tr>
<tr>
<td>4</td>
<td>Ferry</td>
<td>3</td>
<td>C</td>
<td>256</td>
<td>Highway Type and No.</td>
<td>N/A</td>
<td>Any alpha or numeric characters including comma (,) and dash (-)</td>
</tr>
<tr>
<td>5</td>
<td>MnDOT</td>
<td>4</td>
<td>C</td>
<td>11</td>
<td>Roadway Direction</td>
<td>N/A</td>
<td>North/South = North/South East/West = East/West</td>
</tr>
<tr>
<td>6</td>
<td>EnSig</td>
<td>5</td>
<td>I</td>
<td>1</td>
<td>ENS Sig Displayed?</td>
<td>1=Yes 2=No</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>XingAdj</td>
<td>6</td>
<td>I</td>
<td>1</td>
<td>Adjacent Crossing?</td>
<td>1=Yes 2=No</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>XngAdjNo</td>
<td>7</td>
<td>C</td>
<td>1</td>
<td>Adjacent Crossing Number</td>
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<td>First 6 characters must be numeric followed by an alphabetic character</td>
</tr>
<tr>
<td>9</td>
<td>XPurpose</td>
<td>8</td>
<td>I</td>
<td>1</td>
<td>Crossing Purpose</td>
<td>1=Highway 2=Pathway, Pedestrian 3=Station, Pedestrian</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>TrafficTypes</td>
<td>9</td>
<td>I</td>
<td>1</td>
<td>Traffic Types Crossing Railroad: Type</td>
<td>1=One-way Traffic 2=Two-way Traffic 3=Divided Traffic</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>AdvW1D_1</td>
<td>10</td>
<td>I</td>
<td>1</td>
<td>Advance Warning Signs (W1D-1)</td>
<td>Valid Value: 0 to 9</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>AdvW1D_2</td>
<td>11</td>
<td>I</td>
<td>1</td>
<td>Advance Warning Signs (W1D-2)</td>
<td>Valid Value: 0 to 9</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>AdvW1D_3</td>
<td>12</td>
<td>I</td>
<td>1</td>
<td>Advance Warning Signs (W1D-3)</td>
<td>Valid Value: 0 to 9</td>
<td></td>
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<tr>
<td>14</td>
<td>AdvW1D_4</td>
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<td>I</td>
<td>1</td>
<td>Advance Warning Signs (W1D-4)</td>
<td>Valid Value: 0 to 9</td>
<td></td>
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<tr>
<td>15</td>
<td>AdvW1D_11</td>
<td>14</td>
<td>I</td>
<td>1</td>
<td>Advance Warning Signs (W1D-11)</td>
<td>Valid Value: 0 to 9</td>
<td></td>
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<tr>
<td>16</td>
<td>AdvW1D_12</td>
<td>15</td>
<td>I</td>
<td>1</td>
<td>Advance Warning Signs (W1D-12)</td>
<td>Valid Value: 0 to 9</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Low_Grd</td>
<td>16</td>
<td>I</td>
<td>1</td>
<td>Low Ground Clearance Signs Present?</td>
<td>No</td>
<td>1=Yes 2=No</td>
</tr>
<tr>
<td>18</td>
<td>Low_GrdSigns</td>
<td>17</td>
<td>I</td>
<td>2</td>
<td>Low Ground Clearance Signs (W10-5)</td>
<td>Valid Value: 0 to 9</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Exempt</td>
<td>18</td>
<td>I</td>
<td>1</td>
<td>Exempt Sign (R15-3)</td>
<td>1=Yes, crossing exempt 2=No, crossing not exempt</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Channel</td>
<td>19</td>
<td>I</td>
<td>1</td>
<td>Channelization Devices/Medians</td>
<td>5 = None</td>
<td>1=Channelization All Approaches 2=Channelization One Approach 3=Median - All Approaches 4=Median - One Approach 5=None</td>
</tr>
<tr>
<td>MnDOT</td>
<td>MedianLength_E</td>
<td>20</td>
<td>I</td>
<td>1</td>
<td>Median/Channelization Length (N or E)</td>
<td>1=0:50 2=51-100 3=101-150 4=151-200 5=&gt;200</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>MedianLength_W</td>
<td>21</td>
<td>I</td>
<td>1</td>
<td>Median/Channelization Length (S or W)</td>
<td>1=0:50 2=51-100 3=101-150 4=151-200 5=&gt;200</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Xbb</td>
<td>22</td>
<td>I</td>
<td>2</td>
<td>Crossbuck Assembly Count</td>
<td>Valid Value: 0 to 99</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>StooStd</td>
<td>23</td>
<td>I</td>
<td>1</td>
<td>Stop Signs (R1-1)</td>
<td>Valid Value: 0 to 9</td>
<td></td>
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<tr>
<td>25</td>
<td>YieldStd</td>
<td>24</td>
<td>I</td>
<td>1</td>
<td>Yield Signs (R1-2)</td>
<td>Valid Value: 0 to 9</td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>OthSig1</td>
<td>25</td>
<td>I</td>
<td>1</td>
<td>Other MUTCD Signs Present?</td>
<td>1=Yes 2=No</td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>OthSig2</td>
<td>27</td>
<td>I</td>
<td>1</td>
<td>Other MUTCD Sign 1 Count</td>
<td>Valid Value: 1 to 99</td>
<td></td>
</tr>
</tbody>
</table>
Rail Crossing Geodatabase Python Scripts

```python
# Authors: 
# Date: 2012-05-05 11:19:59.000000 
# Purpose: 
# # Description: 
# # Set the necessary product code 
# # import arccio 

import arcpy 

# Import arccio module 
import arcpy 

# Script arguments 
Export_Feature_Class = arcpy.GetParameterAsText(0) 
if Export_Feature_Class == "" or not Export_Feature_Class: 
    Export_Feature_Class = "E:\Data1\FDOT_Central_RHCI_2010_W06\spatial\gdb\ 
    HDR_RHCI_2012_Export.gdb\Crossings_RHCI_2012_Export_Brev" 
else: 
    # provide a default value if unspecified

# Local variables: 
Cross_Edit_Rail_Template = "E:\Data1\FDOT_Central_RHCI_2010_W06\spatial\gdb\ 
HDR_RHCI_2012_Edit_Rail.gdb\Cross_Edit_Rail_Brev" 
```
The Minnesota Department of Transportation oversees more than 140,000 miles of state, county, city and township roads, 4,458 miles of rail road, 168 rest areas, 135 public airports and nine shipping ports throughout the state of Minnesota. The mission of the department is to “Plan, build, operate and maintain a safe, accessible, efficient and reliable multimodal transportation system that connects people to destinations and markets throughout the state, regionally and around the world.”
Freight Office - Rail Grade Crossing Data Transfer Group for consultants
owned by died1rob

Description
This group was created on 8/17/17 at the request of Jesse Pearson and Andrew Andrusko. Group members have access to MnDOT’s ArcGIS Online community to transfer hosted feature layers through ArcGIS Online Assistant for the purposes of At-Grade Rail Crossing annual inventory.

Latest Content

Owner
died1rob

Membership
You are a member

Tags
Freight Office, Rail Grade Crossing, Data Transfer, Consultant
Field Data Collection
QC Review in ArcGIS Online
Export CSV and JPG Files to MnDOT Black Cat
Export CSV and JPG Files to MnDOT Black Cat
Status & Lessons Learned

- Successfully used for 2017 & 2018 field seasons
- Disconnected editing required in a few areas of poor cell phone coverage
- Version 1 Geodatabase Schema revised after 2017 field season:
  - Field order optimized
  - Defaults set or changed for some fields
- Some issues with photo collection:
  - Photo upload time can be lengthy during connected editing
  - One field crew abandoned use of Collector for photo taking
  - Failure to use Collector for photos resulted in more time to re-associate photos in the office
- Very large storage required for photo attachments in ArcGIS Online
- Minor changes required to Version 2 GDB before start of 2019 field season
For More Information

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