

# **DOSPIR on ArcGIS Pro**

## **User's Guide**



**Laboratory for Advanced Construction Technology**

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## b. Roundabout Data

- Data obtained from [SAMUEL.STURTZ@iowadot.us](mailto:SAMUEL.STURTZ@iowadot.us)

- 110 roundabouts constructed from 2000 to 2023

ID	Shape*	SymbolID	Intersect	Description	Year_Open	Category	Roundabout	Splitter	Pre_Entrap	Apron	Lanes	Local_City	County	Classify	Year	CreatedOn	Creator	ModifiedDate	Editor	NextSchool	Roundabout	4_Street	4_Splitter	4_Pre_Entrap	4_Apron	
1	Point	204	0	San Pao Dr & Prairie Pl., Multi-lane in new con...	2009	Modern Roundabout	0	1	1	1	1, 3	Albion	Polk	Commercial	2009-01-01	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	0	Roundabout	Yes	Yes	Yes	Yes	
2	Point	204	0	Wendell Dr & Verloga., Replacing all-way stop	2013	Modern Roundabout	0	1	1	1	2	4	Ankney	Polk	Commercial	2013-01-01	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	0	Roundabout	Yes	Yes	Yes	Yes
3	Point	204	0	SW Cherry St & SW 11., New roadway adjust...	2011	Modern Roundabout	0	1	1	1	1	4	Ankney	Polk	Commercial	2011-01-01	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	1	Roundabout	Yes	Yes	Yes	Yes
4	Point	204	0	SW Snyder Blvd & SW 1., New residential dist...	2006	Modern Roundabout	1	1	0	1	1	4	Ankney	Polk	Residential	2006-01-01	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	0	Roundabout	Yes	Yes	Yes	Yes
5	Point	204	0	HW 13th Street & HW 1., New residential dist...	2005	Modern Roundabout	1	1	0	1	1	4	Ankney	Polk	Residential	2005-01-01	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	0	Roundabout	Yes	Yes	Yes	Yes
6	Point	204	0	SW Goodwin St & SW 1., One of three in a new...	2004	Modern Roundabout	1	1	0	1	1	4	Ankney	Polk	Residential	2004-01-01	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	0	Roundabout	Yes	Yes	Yes	Yes
7	Point	204	0	SW Sweeney Blvd & S 1., One of three in a new...	2004	Modern Roundabout	1	1	0	1	1	4	Ankney	Polk	Residential	2004-01-01	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	0	Roundabout	Yes	Yes	Yes	Yes
8	Point	204	0	SW Sweeney Blvd & S 1., One of three in a new...	2004	Modern Roundabout	1	1	0	1	1	4	Ankney	Polk	Residential	2004-01-01	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	0	Roundabout	Yes	Yes	Yes	Yes
9	Point	204	0	SW Campbells Ct., New construction...	2011	Modern Roundabout	1	1	1	1	1	4	Ankney	Polk	Residential	<Null>	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	0	Roundabout	Yes	Yes	Yes	Yes
10	Point	204	0	HW Middle Road & 13th S., Designed to accommodate...	2002	Modern Roundabout	1	1	1	1	1, 4	Battendorf	Scott	Residential	2002-01-01	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	0	Roundabout	Yes	Yes	Yes	Yes	
11	Point	204	0	HW Independence Ave SW., Post high-speed rail...	2000	Modern Roundabout	0	1	0	1	1	4	Wahl	Black Hawk	Rural	2000-01-01	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	0	Roundabout	Yes	Yes	Yes	Yes
12	Point	204	0	CT 7 & 102., Rural, high-speed rail...	2012	Modern Roundabout	0	1	0	1	1	4	Wahl	Bartholomew	Rural	2012-01-01	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	0	Roundabout	Yes	Yes	Yes	Yes
13	Point	204	0	HW Viking Road & Cedar., One-lane two-way...	2007	Modern Roundabout	0	1	1	0	1, 5	3	Cedar Falls	Black Hawk	Rural	2007-01-01	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	0	Roundabout	Yes	Yes	Yes	Yes
14	Point	204	0	HW Sandstone Blvd & Pk., In new commercial dev...	2009	Modern Roundabout	0	1	1	0	2	4	Cedar Falls	Black Hawk	Commercial	2009-01-01	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	0	Roundabout	Yes	Yes	Yes	Yes
15	Point	204	0	HW Ridgeway Ave & Cedar., Realigning north appro...	2011	Modern Roundabout	0	1	1	1	1, 4	3	Cedar Falls	Black Hawk	Commercial	2011-01-01	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	0	Roundabout	Yes	Yes	Yes	Yes
16	Point	204	0	HW 40th Ave SW & Tower., One-lane two-way...	2011	Modern Roundabout	0	1	1	1	2	4	Cedar Rapids	Linn	Commercial	2011-01-01	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	0	Roundabout	Yes	Yes	Yes	Yes
17	Point	204	0	HW 130th Street & S., Combination dual-lan...	2002	Modern Roundabout	1	1	1	1	2	4	Clive	Dallas	Residential	2002-01-01	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	0	Roundabout	Yes	Yes	Yes	Yes
18	Point	204	0	HW Sweeney Parkway & S 1., Three public approach...	2001	Other Circular Intersec.	1	1	0	0	1	4	Clive	Dallas	Traffic Circle	2001-01-01	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	0	Yes	Yes	Yes	Yes	
19	Point	204	0	HW Sweeney Parkway & S 1., In new residential dev...	2005	Modern Roundabout	1	1	1	1	1	4	Clive	Dallas	Residential	2005-01-01	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	0	Roundabout	Yes	Yes	Yes	Yes
20	Point	204	0	HW University Pkwy & S 1., New 3-lane intersection	2013	Modern Roundabout	0	1	1	1	1	5	Corvallis	Johnson	Commercial	2013-01-01	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	0	Roundabout	Yes	Yes	Yes	Yes
21	Point	204	0	HW Fairfield Dr & Russell., New 3-lane intersection	2013	Modern Roundabout	0	1	1	1	1, 5	3	Corvallis	Johnson	Commercial	2013-01-01	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	0	Roundabout	Yes	Yes	Yes	Yes
22	Point	204	0	HW Ridgeway Dr & Lincoln., New 3-lane intersection	2013	Modern Roundabout	0	1	1	1	1	5	Corvallis	Johnson	Commercial	2013-01-01	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	0	Roundabout	Yes	Yes	Yes	Yes
23	Point	204	0	HW 16th Ave & Pringle Rd., Hybrid dual-lane triple...	2002	Modern Roundabout	1	1	1	1	1, 5	3	Corvallis	Johnson	Residential	2002-01-01	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	0	Roundabout	Yes	Yes	Yes	Yes
24	Point	204	0	HW 12th Ave & Fenwick Rd., North approach in situ...	2005	Modern Roundabout	0	1	1	1	1	3	Corvallis	Johnson	Commercial	2005-01-01	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	1	Roundabout	Yes	Yes	Yes	Yes
25	Point	204	0	HW 11th St & Quarry Road., Double-lane, north on...	2006	Modern Roundabout	0	1	1	1	2	5	Corvallis	Johnson	Commercial	2006-01-01	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	0	Roundabout	Yes	Yes	Yes	Yes
26	Point	204	0	HW Holiday Road & Canal., South approach in situ...	2007	Modern Roundabout	0	1	1	1	1	4	Corvallis	Johnson	Commercial	2007-01-01	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	0	Roundabout	Yes	Yes	Yes	Yes
27	Point	204	0	HW Conners Dr & Coates., Inland 4-lane intersection	2014	Modern Roundabout	0	1	1	1	1	4	Corvallis	Johnson	Commercial	2014-01-01	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	0	Roundabout	Yes	Yes	Yes	Yes
28	Point	204	0	HW 20th St & Elmwood., In new airport business...	2000	Modern Roundabout	0	1	1	1	1	4	Des Moines	Polk	Commercial	2000-01-01	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	0	Roundabout	Yes	Yes	Yes	Yes
29	Point	204	0	HW Iowa St & Iowa 1st., Rural, high-speed, adj...	2009	Modern Roundabout	0	1	0	1	1	4	Waverly	Wayne	Rural	2009-01-01	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	1	Roundabout	Yes	Yes	Yes	Yes
30	Point	204	0	HW 10th Ave N & N 13th St., Replaced from "T" inter...	2009	Modern Roundabout	0	1	1	1	1	5	Post Dodge	Webster	Residential	2009-01-01	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	1	Roundabout	Yes	Yes	Yes	Yes
31	Point	204	0	HW Ca Rd 223 & Matthews., Between 1-lane dual-l...	2013	Modern Roundabout	0	1	1	1	1	4	Clarendon	Story	Commercial	2013-01-01	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	1	Roundabout	Yes	Yes	Yes	Yes
32	Point	204	0	HW Grand Ave & S Grand., Three approach on...	2007	Modern Roundabout	0	1	1	1	1	3	Wass City	Johnson	Residential	2007-01-01	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	0	Roundabout	Yes	Yes	Yes	Yes
33	Point	204	0	HW Kennedy Parkway & 1st., In new residential dev...	2006	Modern Roundabout	1	1	1	1	1	4	Wass City	Johnson	Residential	2006-01-01	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	0	Roundabout	Yes	Yes	Yes	Yes
34	Point	204	0	HW US 170 southbound on., Diamond interchange...	2012	Modern Roundabout	0	1	0	1	1	5	Jarvisville	Benner	Rural	2012-01-01	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	0	Roundabout	Yes	Yes	Yes	Yes
35	Point	204	0	HW US 170 northbound on., Diamond interchange...	2012	Modern Roundabout	0	1	0	1	1	5	Jarvisville	Benner	Rural	2012-01-01	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	0	Roundabout	Yes	Yes	Yes	Yes
36	Point	204	0	HW 16th Blvd Ave & Park., 1 of 4 on 13th Ave ext...	2012	Modern Roundabout	0	1	1	1	2	3	Johannesburg	Polk	Commercial	2012-01-01	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	0	Roundabout	Yes	Yes	Yes	Yes
37	Point	204	0	HW 16th Blvd Ave & South., 2 of 4 on 13th Ave ext...	2012	Modern Roundabout	0	1	1	1	2	3	Johannesburg	Polk	Commercial	2012-01-01	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	0	Roundabout	Yes	Yes	Yes	Yes
38	Point	204	0	HW 16th Blvd Ave & Park., 3 of 4 on 13th Ave ext...	2012	Modern Roundabout	0	1	1	1	2	3	Johannesburg	Polk	Commercial	2012-01-01	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	0	Roundabout	Yes	Yes	Yes	Yes
39	Point	204	0	HW Taylor Terrace & Ribault., New intersection on L...	2013	Modern Roundabout	0	1	1	1	1, 4	3	Marion	Linn	Commercial	2013-01-01	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	0	Roundabout	Yes	Yes	Yes	Yes
40	Point	204	0	HW 10th St & Taylor Terrace., New lane and one-lan...	2011	Modern Roundabout	1	1	1	1	1, 4	3	Marion	Linn	Residential	2011-01-01	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	0	Roundabout	Yes	Yes	Yes	Yes
41	Point	204	0	HW 30th St & Mason City Pl., Realigning intersec...	2015	Modern Roundabout	0	1	1	1	1	3	Mason City	Cerro Gordo	Commercial	2015-01-01	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	0	Roundabout	Yes	Yes	Yes	Yes
42	Point	204	0	HW US 52 & Iowa 1., Replaced 4-way stop	2013	Modern Roundabout	0	1	0	1	1, 4	3	Mosport/Vernon	Linn	Commercial	2013-01-01	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	0	Roundabout	Yes	Yes	Yes	Yes
43	Point	204	0	HW US 52 & 10th Ave 1., Three approaches rep...	2013	Modern Roundabout	0	1	1	1	1	3	Mosport/Vernon	Linn	Commercial	2013-01-01	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	0	Roundabout	Yes	Yes	Yes	Yes
44	Point	204	0	HW Orchard Ave & Pella E., Includes pedestrian cr...	2005	Modern Roundabout	0	1	1	1	1	4	Okolona	Marion	Commercial	2005-01-01	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	0	Roundabout	Yes	Yes	Yes	Yes
45	Point	204	0	HW 51st St SW & US 63., Three approaches on L...	2006	Modern Roundabout	0	1	0	1	1	5	Okemo	Wayne	Commercial	2006-01-01	2016-04-05	iwadDOT_HerfyDcs	2016-06-12	Ryan.Vivis@iowadot...	0	Roundabout	Yes	Yes	Yes	Yes
46	Point	204	0	HW Pecten St & MCC ent., Single-lane, new inter...</																						

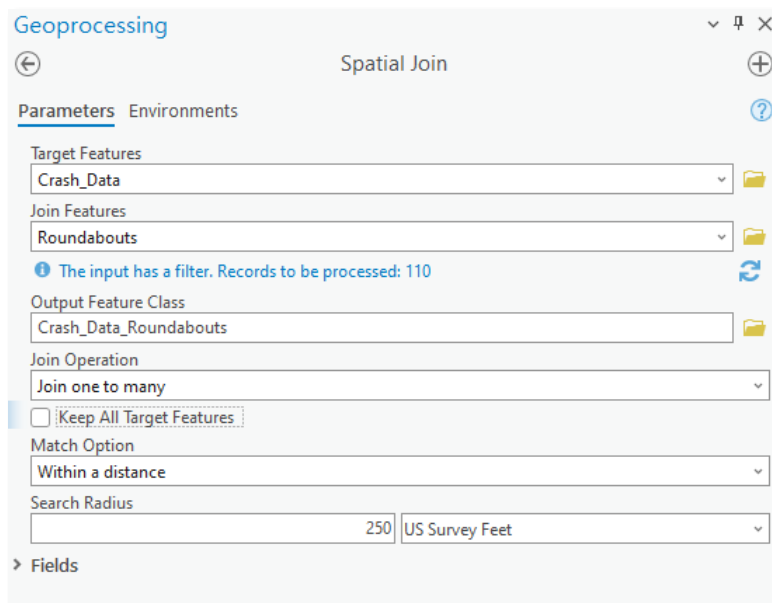
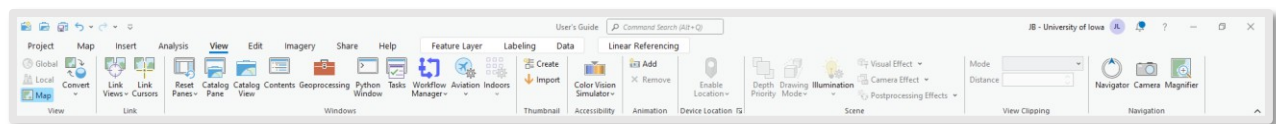
## 2. Data Preprocessing in ArcGIS Pro

In this phase, we will employ ArcGIS Pro to conduct preliminary processing on two datasets, setting the stage for subsequent in-depth analysis and visualization. This involves refining and consolidating the data to ensure it is optimally structured for our intended uses.

### 2-1. Performing Spatial Join on Layer Files

By performing a spatial join between the 'Crash\_Data' and 'Roundabouts' layers, we can create a merged layer file that displays crash data occurring within a 250-foot radius of each roundabout

- From the ArcGIS Pro Navigation bar, select 'View' > 'Geoprocessing' > 'Spatial Join'.



- Parameters:

- a. Target Features: Crash\_Data
- b. Joined Features: Roundabouts
- c. Output Feature Class: Crash\_Data\_Roundabouts
  - This will be the name for the new layerfile.
- d. Join Operation: Join one to many
- e. Uncheck 'Keep All Target Features'

f. Match Option: Within a Distance

g. Search Radius: 250 US Survey Feet

> Click the 'Run' button to perform the spatial join of the two layers.

a. Spatial-Joined Data (Crash\_Data\_Roundabouts)

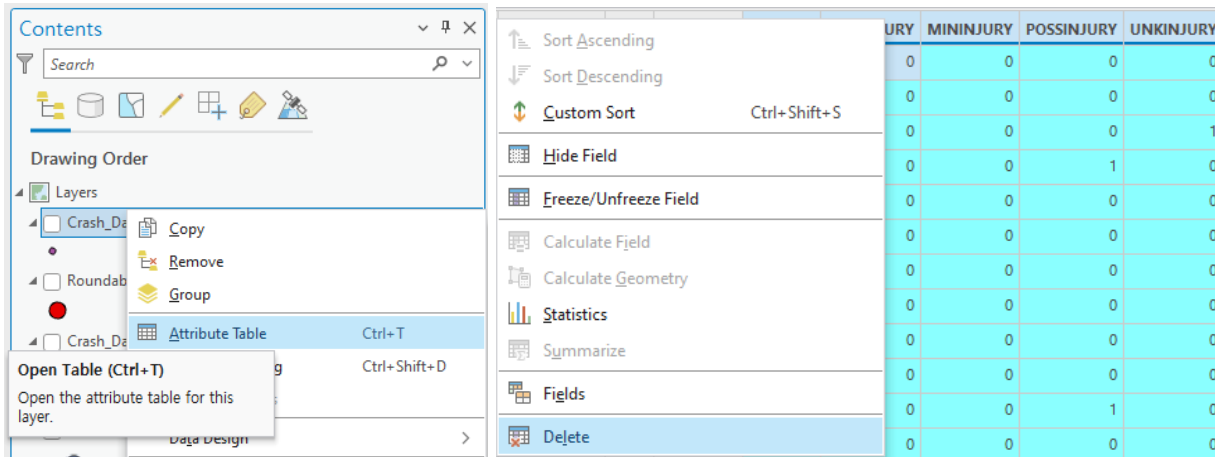
- 110 total roundabouts constructed from 2000 to 2023

- 2,671 total crashes from 2009 to 2023

ID	OBJECTID_1	Shape	Join_Count	TARGET_FID	JOIN_FID	OBJECTID	CRASH_KEY	CASENUMBER	LECCASENUM	CRASH_DATE	CRASH_MONI	CRASH_DAY	DISTRICT	COUNTY_NUMB	CITY_NUMB	SYSTEMS	LIBERAL	PSYMAID	LOCSTHDM	CIRCUMINR	MAKSE	DRUGCALC	ICNTORIC	LIGHT	CSRFEND	WEATHER	ICNTORIC	ROTPP	PAVED	WZBLATED	CSEY	FATALITES	INJURES	MAINURTY	
1	1	Point ZM	1	152	74	2181717	2010010494	2004507044	01-0230	2004-01-18	1	1	1	94	0	0	0	33	1	3	24	3	1	4	5	2	2	13	1	0	5	0	0	0	
2	2	Point ZM	1	327	95	2181592	2000062381	2004490388	01-01-0557	2004-02-02	2	2	6	31	0	0	0	33	1	5	7	8	1	4	1	1	1	12	1	0	5	0	0	0	
3	3	Point ZM	1	454	105	2182019	200007014	2004493235	01-00124	2004-02-14	2	7	1	77	0	0	0	33	1	5	30	8	2	1	3	1	1	1	1	0	4	0	1	0	
4	4	Point ZM	1	705	97	2182270	2000014843	200502015	00007401	2004-04-14	4	3	6	57	0	0	0	33	1	3	70	8	1	1	1	1	1	1	1	0	4	0	1	0	
5	5	Point ZM	1	800	72	2182365	2000012362	2004499124	01-01-1260	2004-03-23	3	2	6	31	0	0	0	33	1	5	7	8	1	1	2	5	1	12	1	0	5	0	0	0	
6	6	Point ZM	1	1555	71	2183120	2000037383	200512157	0064933	2004-08-15	6	2	2	7	0	0	0	33	1	5	7	8	1	1	1	1	1	13	1	0	5	0	0	0	
7	7	Point ZM	1	1691	68	2183256	2000010920	2005117465	00195718	2004-07-24	7	6	6	57	0	0	0	54	1	1	20	8	1	4	2	5	2	12	1	0	5	0	0	0	
8	8	Point ZM	1	1920	31	2183465	2000020456	200518207	00018013	2004-08-02	8	1	6	52	0	0	0	33	1	6	70	8	1	1	1	1	1	1	1	0	5	0	0	0	
9	9	Point ZM	1	2264	105	2183829	2000035741	2005027310		2004-05-10	9	5	6	57	0	0	0	33	6	3	9	8	77	1	1	99	77	4	1	0	5	0	0	0	
10	10	Point ZM	1	2865	2	2184400	2000044933	2005157371	00619163	2004-11-18	11	4	6	52	0	0	0	33	1	6	8	8	1	1	2	5	1	97	1	0	5	0	0	0	
11	11	Point ZM	1	3263	99	2184829	2000053766	2005453726	01151465	2005-12-29	12	3	2	7	0	0	0	33	1	4	2	8	1	4	1	1	1	12	1	0	4	0	1	0	
12	12	Point ZM	1	3555	92	2185100	2010000242	2010549191	2010000356	2010-01-01	1	6	6	57	0	0	0	33	1	5	7	8	1	1	1	2	1	12	1	0	5	0	0	0	
13	13	Point ZM	1	3580	95	2185145	2010001566	2010548028	01-10-1520	2010-01-12	1	3	6	31	0	0	0	33	1	5	3	8	1	1	2	2	1	12	1	0	5	0	0	0	
14	14	Point ZM	1	3899	65	2185454	2010006979	2010553558		2010-01-05	1	2	6	52	0	0	0	33	1	2	46	8	2	1	4	7	2	1	1	0	4	0	1	0	
15	15	Point ZM	1	4453	60	2185598	2010015885	2010563934	10017023	2010-02-11	2	5	6	52	0	0	0	33	1	5	7	8	1	4	1	1	1	12	1	0	5	0	0	0	
16	16	Point ZM	1	4446	56	2186011	2010016872	2010566085	10007032	2010-04-09	4	6	6	57	0	0	0	33	1	6	30	8	1	1	1	1	1	1	1	0	5	0	0	0	
17	17	Point ZM	1	4809	75	2186174	2010020190	2010571719	01-10-2092	2010-05-07	5	6	6	31	0	0	0	33	1	6	16	8	2	1	2	5	1	14	1	0	5	0	0	0	
18	18	Point ZM	1	4883	69	2186449	2010020267	2010580468	10054668	2010-05-27	5	5	2	7	0	0	0	33	1	4	9	8	1	1	1	1	1	12	1	0	5	0	0	0	
19	19	Point ZM	1	5387	58	2186562	2010020700	2010581630	10014902	2010-07-16	7	6	6	57	0	0	0	33	1	5	7	8	1	1	1	1	1	12	1	0	5	0	0	0	
20	20	Point ZM	1	5485	14	2187060	2010020716	2010583536	10062701	2010-08-07	8	7	2	7	0	0	0	95	1	1	70	8	1	1	1	1	1	13	1	0	1	1	1	0	
21	21	Point ZM	1	5560	47	2187125	2010020736	2010587072	10-10-3270	2010-08-23	8	2	1	77	0	0	0	33	1	6	71	8	1	1	1	1	1	97	1	0	5	0	0	0	
22	22	Point ZM	1	5557	41	2187140	2010040502	2010594719	20101980	2010-10-09	10	7	6	57	0	0	0	33	1	5	7	8	1	1	1	1	1	12	1	0	3	0	1	0	
23	23	Point ZM	1	5168	94	2187333	2010040503	2010596193	01-10-1280	2010-10-23	10	7	2	7	0	0	0	33	1	3	24	8	1	1	1	1	1	1	1	0	5	0	0	0	
24	24	Point ZM	1	5974	76	2187339	2010040461	2010596463	01-10-4062	2010-10-08	10	6	6	31	0	0	0	33	1	5	10	8	1	1	1	1	1	4	1	0	5	0	0	0	
25	25	Point ZM	1	6166	75	2187371	2010040212	2010600364	01-10-58189	2010-11-15	11	2	6	31	0	0	0	33	1	5	10	8	1	1	1	1	1	4	1	0	4	0	1	0	
26	26	Point ZM	1	6302	31	2187387	2010040950	2010600368	2010-05-2017	2010-11-01	11	2	6	52	0	0	0	33	1	3	24	8	1	1	1	1	1	97	1	0	5	0	0	0	
27	27	Point ZM	1	6354	59	2187410	2000020371	2006427410	00003431	2004-01-20	1	3	6	52	0	0	0	33	1	6	45	8	1	1	3	2	2	1	1	0	5	0	0	0	
28	28	Point ZM	1	6355	54	2187411	2000020372	2006427420	00003231	2004-01-20	1	3	6	57	0	0	0	33	1	3	70	8	1	2	2	1	1	1	1	0	5	0	0	0	
29	29	Point ZM	1	7034	54	2187440	2000030363	200643474	00002631	2004-01-11	1	1	6	57	0	0	0	33	1	5	2	8	1	1	4	2	1	12	1	0	5	0	0	0	
30	30	Point ZM	1	9120	33	2220596	2000020705	200527269	2000054851	2004-01-18	9	6	2	9	0	0	0	33	1	5	7	8	1	1	1	1	1	1	2	0	2	0	2	2	
31	31	Point ZM	1	9142	75	2220619	2010040502	200534074	01-01-0206	2004-01-13	9	1	6	31	0	0	0	33	1	2	34	8	1	2	1	1	1	1	1	0	5	0	0	0	
32	32	Point ZM	1	9195	72	2220671	2000030420	200537916	01-01-05713	2004-01-28	9	2	6	31	0	0	0	33	1	5	7	8	1	1	1	1	1	15	1	0	4	0	3	0	
33	33	Point ZM	1	10165	76	2221661	2000035701	200544096	01-01-07144	2005-12-27	12	1	6	31	0	0	0	58	1	1	20	8	2	4	4	7	2	14	1	0	5	0	0	0	
34	34	Point ZM	1	11154	30	2222630	2010015483	2010583463	10-3854	2010-02-02	3	2	1	85	0	0	0	33	1	3	16	8	5	1	1	1	1	12	1	0	5	0	0	0	
35	35	Point ZM	1	11951	31	2223429	2010020593	2010579930	10066699	2010-06-28	6	2	2	7	0	0	0	33	1	3	70	8	1	1	1	1	1	12	1	0	5	0	0	0	
36	36	Point ZM	1	11973	98	2223440	2010020737	2010579932	20100021127	2010-07-04	7	1	1	77	0	0	0	33	1	3	45	8	1	1	2	5	1	1	1	0	4	0	1	0	
37	37	Point ZM	1	12400	45	2223576	2010035332	2010586917	201000054702	2010-08-10	8	3	5	90	0	0	0	33	1	3	20	7	1	1	1	99	1	15	1	0	3	0	2	0	
38	38	Point ZM	1	12485	99	2223967	2010035967	2010580468	10005468	2010-01-08	9	4	2	7	0	0	0	33	1	3	24	8	1	1	1	1	1	1	12	1	0	4	0	1	0
39	39	Point ZM	1	13423	63	2224979	2010040875	2010602741	10004848	2010-12-03	12	6	6	57	0	0	0</																		

"In the 'Crash\_Data\_Roundabouts' dataset, we'll focus on retaining only the essential columns for our analysis. These include: 'OBJECTID', 'Shape', 'XCOORD', 'YCOORD', 'JOIN\_FID', 'CRASH\_DATE', 'CSEV', 'FATALITIES', 'PROPDMG', 'Year\_Open', 'Category', 'City', and 'County'. The 'Shape', 'XCOORD', and 'YCOORD' columns provide spatial information (coordinates). 'Year\_Open' indicates the construction year of the roundabouts, 'JOIN\_FID' is the unique identifier for each roundabout, 'CSEV' represents crash severity, and 'PROPDMG' details the property damage."

To manually remove unnecessary columns, right-click on 'Crash\_Data\_Roundabouts' in the Contents pane, select 'Attribute Table', then right-click on the columns you wish to remove and choose 'Delete'.



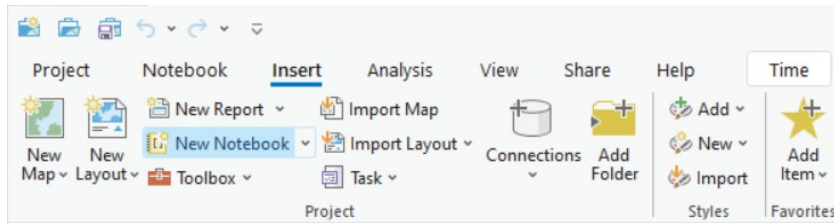
### a. Streamlined 'Crash\_Data\_Roundabouts'

	OBJECTID_1	Shape	JOIN_FID	CRASH_DATE	CSEV	FATALITIES	PROPDMG	XCOORD	YCOORD	Year_Open	Category	City	County	Classifica
1	1	Point ZM	74	1/18/2009	5	0	3000	402829	4706531	2016	Modern Roundabout	Fort Dodge	Webster	Commercial
2	2	Point ZM	95	2/2/2009	5	0	1200	689968	4707698	2020	Modern Roundabout	Dubuque	Dubuque	Commercial
3	3	Point ZM	105	2/14/2009	4	0	4000	461011	4604945	2018	Modern Roundabout	Pleasant Hill	Polk	Commercial
4	4	Point ZM	97	4/14/2009	4	0	1800	615937	4654753		Planned Roundabout	Marion	Linn	Mini Roundabout
5	5	Point ZM	72	3/23/2009	5	0	2500	689989	4707556	2016	Modern Roundabout	Dubuque	Dubuque	Commercial
6	6	Point ZM	71	6/15/2009	5	0	1800	546552	4706933	2016	Modern Roundabout	Cedar Falls	Black Hawk	Commercial
7	7	Point ZM	68	7/24/2009	5	0	2000	614235	4654548	2019	Planned Roundabout	Marion	Linn	Residential
8	8	Point ZM	31	8/2/2009	5	0	1750	621097	4612888	2007	Modern Roundabout	Iowa City	Johnson	Commercial
9	9	Point ZM	103	9/10/2009	5	0	2745	605616	4647395	2019	Modern Roundabout	Cedar Rapids	Linn	Commercial
10	10	Point ZM	22	11/18/2009	5	0	1600	619274	4616659	2002	Modern Roundabout	Coralville	Johnson	Residential
11	11	Point ZM	99	12/29/2009	4	0	10000	548373	4706208	2017	Modern Roundabout	Cedar Falls	Black Hawk	Commercial
12	12	Point ZM	92	1/1/2010	5	0	2500	605080	4647106	2019	Modern Roundabout	Cedar Rapids	Linn	Commercial
13	13	Point ZM	95	1/12/2010	5	0	3100	689968	4707698	2020	Modern Roundabout	Dubuque	Dubuque	Commercial
14	14	Point ZM	65	1/25/2010	4	0	11500	619719	4619943	2022	Planned Roundabout	Coralville	Johnson	Residential
15	15	Point ZM	60	2/11/2010	5	0	3100	619590	4617624	2020	Planned Roundabout	Coralville	Johnson	Residential
16	16	Point ZM	56	4/9/2010	5	0	3000	617291	4654440	2016	Modern Roundabout	Marion	Linn	Commercial
17	17	Point ZM	76	5/7/2010	5	0	1600	689302	4707827	2020	Planned Roundabout	Dubuque	Dubuque	Commercial
18	18	Point ZM	99	5/27/2010	5	0	2500	548373	4706208	2017	Modern Roundabout	Cedar Falls	Black Hawk	Commercial
19	19	Point ZM	58	7/16/2010	5	0	5000	617966	4656349	2016	Modern Roundabout	Marion	Linn	Residential
20	20	Point ZM	14	8/7/2010	1	1	0	544838	4702053	2011	Modern Roundabout	Cedar Falls	Black Hawk	Commercial
21	21	Point ZM	47	8/23/2010	5	0	5500	432611	4608886	2017	Modern Roundabout	Urbandale	Polk	Residential
22	22	Point ZM	42	10/9/2010	3	0	3000	630774	4641663	2013	Modern Roundabout	Mount Vernon	Linn	Commercial
23	23	Point ZM	94	10/23/2010	5	0	3000	547100	4706888		Modern Roundabout	Cedar Falls	Black Hawk	Residential
24	24	Point ZM	76	10/8/2010	5	0	2500	689284	4707830	2020	Planned Roundabout	Dubuque	Dubuque	Commercial
25	25	Point ZM	76	11/15/2010	4	0	3000	689272	4707878	2020	Planned Roundabout	Dubuque	Dubuque	Commercial
26	26	Point ZM	31	11/1/2010	5	0	3300	621105	4612885	2007	Modern Roundabout	Iowa City	Johnson	Commercial
27	27	Point ZM	59	1/20/2009	5	0	4200	617924	4616873	2015	Modern Roundabout	Coralville	Johnson	Residential
28	28	Point ZM	54	1/20/2009	5	0	11000	615702	4654421	2016	Modern Roundabout	Marion	Linn	Commercial
29	29	Point ZM	54	1/11/2009	5	0	10000	615655	4654420	2016	Modern Roundabout	Marion	Linn	Commercial

### 3. Advanced Data Preprocessing with Python in ArcGIS Pro

Python in ArcGIS Pro offers powerful scripting capabilities for spatial analysis and automating geoprocessing tasks. Jupyter Notebooks, integrated within ArcGIS Pro, provide an interactive environment where you can write and execute Python code, visualize data, and document the process in a single, easy-to-use interface.

To open a new Notebook in ArcGIS Pro, go to the Navigation bar, click on 'Insert', and then select 'New Notebook'.



```
In [1]: print("Hello, World")  
Hello, World
```

#### 3-1. Loading 'Crash\_Data\_Roundabouts' Layer into a Pandas DataFrame in Jupyter Notebook

The code snippet below will access the "Crash\_Data\_Roundabouts" layer from an ArcGIS Pro project and converts it into a pandas DataFrame. It will retrieve all data and field names from the layer, allowing for efficient data manipulation and analysis within a Jupyter Notebook environment.

```
import arcpy  
import pandas as pd  
# Access the current ArcGIS Pro project  
project = arcpy.mp.ArcGISProject("CURRENT")  
arcmad = project.listMaps("Layers")[0]  
# Access the "Crash_Data_Roundabouts" layer  
layer = [lyr for lyr in arcmad.listLayers() if lyr.name == "Crash_Data_Roundabouts"][0]  
# Use SearchCursor to extract data from the layer  
data = [row for row in arcpy.da.SearchCursor(layer, "*")]  
# Get the field names  
field_names = [field.name for field in arcpy.ListFields(layer)]  
# Create a pandas DataFrame from the data  
original_data = pd.DataFrame(data, columns=field_names)  
# Display DataFrame 'original_data'  
original_data.head()
```

	OBJECTID_1	Shape	JOIN_FID	CRASH_DATE	CSEV	FATALITIES	PROPDGM	XCOORD	YCOORD	Year_Open	Category	City	County	Classifica
0	1	(-94.18270383781186, 42.505045555208255)	74	2009-01-18	5	0	3000	402829	4706531	2016	Modern Roundabout	Fort Dodge	Webster	Commercial
1	2	(-90.688118384056117, 42.498333890496724)	95	2009-02-02	5	0	1200	689968	4707698	2020	Modern Roundabout	Dubuque	Dubuque	Commercial
2	3	(-93.46782795179848, 41.59525399037943)	105	2009-02-14	4	0	4000	461011	4604945	2018	Modern Roundabout	Pleasant Hill	Polk	Commercial
3	4	(-91.5993114487643, 42.03627658719478)	97	2009-04-14	4	0	1800	615937	4654753		Planned Roundabout	Marion	Linn	Mini Roundabout
4	5	(-90.68791011905671, 42.4970509437461)	72	2009-03-23	5	0	2500	689969	4707556	2016	Modern Roundabout	Dubuque	Dubuque	Commercial

#### 3-2. Converted CRASH\_DATE to YEAR (From YYYY-MM-DD to YYYY)

```
original_data['CRASH_YEAR'] = pd.to_datetime(original_data['CRASH_DATE']).dt.year  
# Display the DataFrame to verify the new 'YEAR' column  
original_data
```



### 3-3. Reversing Severity Scale in 'CSEV'

The original 'Severity' column ranges from 1 to 5, with 5 indicates crashes involving unknown injuries and 1 indicates the most severe incidents, potentially involving fatalities. For enhanced clarity in our visualization, we will reverse this order in the 'CSEV' column. After this adjustment, a severity rating of 1 will indicate unknown injuries, while a rating of 5 will represent the most severe cases with potential fatalities.

```
# Remap 'CSEV' column values
original_data['CSEV'] = 6 - original_data['CSEV']
# Display the DataFrame to verify the changes
original_data
```

### 3-4. Adding 'Standard' Column

To analyze the impact of roundabouts on crash occurrences, we will introduce a new column, 'standard', with three categories: 'Before', 'After', and 'Same'. This categorization is based on comparing 'CRASH\_DATE' with 'Year\_Open'. If the 'CRASH\_DATE' occurs before 'Year\_Open', the category is set to 'Before'. If it occurs after, it's classified as 'After'. When both dates are the same, the category is marked as 'Same'.

```
# Replace non-numeric values in 'Year_Open' with NaN, then convert to integer
original_data['Year_Open'] = pd.to_numeric(original_data['Year_Open'], errors='coerce').fillna(0).astype(int)
# Remove rows where 'Year_Open' is 0
original_data = original_data[original_data['Year_Open'] != 0]
# Function to determine the standard category
def categorize(row):
    if row['CRASH_DATE'] < row['Year_Open']:
        return 'Before'
    elif row['CRASH_DATE'] > row['Year_Open']:
        return 'After'
    else:
        return 'Same'
# Apply the function to create the 'standard' column
original_data['standard'] = original_data.apply(categorize, axis=1)
# Display the DataFrame to verify the changes
original_data.head()
```

OBJECTID_1	Shape	JOIN_FID	CRASH_DATE	CSEV	FATALITIES	PROPDMG	XCOORD	YCOORD	Year_Open	Category	City	County	Classifica	standard	
0	1	(-94.18270383781186, 42.505045555208255)	74	2009	1	0	3000	402829	4706531	2016	Modern Roundabout	Fort Dodge	Webster	Commercial	Before
1	2	(-90.68811838405617, 42.498333890496724)	95	2009	1	0	1200	689968	4707698	2020	Modern Roundabout	Dubuque	Dubuque	Commercial	Before
2	3	(-93.46782795179848, 41.59525399037943)	105	2009	2	0	4000	461011	4604945	2018	Modern Roundabout	Pleasant Hill	Polk	Commercial	Before
4	5	(-90.68791011905671, 42.4970509437461)	72	2009	1	0	2500	689989	4707556	2016	Modern Roundabout	Dubuque	Dubuque	Commercial	Before
5	6	(-92.43332062784464, 42.51336786973144)	71	2009	1	0	1800	546552	4708933	2016	Modern Roundabout	Cedar Falls	Black Hawk	Commercial	Before

### 3-5 Excluding Roundabouts with Insufficient Crash Data History

To ensure a comprehensive comparison, we will remove roundabouts constructed between 2000 and 2011, as well as those constructed in 2021, 2022, and 2023. This is because our crash data spans from 2009 to 2023, and we aim to have at least three years of crash data (2009, 2010, 2011) for each roundabout for a robust analysis.

```

# Make a copy of 'original_data'
df_total = original_data.copy()
# Get sorted list of unique 'Year_Open' values
sorted_unique_years = sorted(df_total['Year_Open'].unique())
# Identify the first two and last two 'Year_Open' values
first_ten_years = sorted_unique_years[:10]
last_two_years = sorted_unique_years[-2:]
# Combine the years to be removed
years_to_remove = first_ten_years + last_two_years
# Unique Year List
unique_years = [x for x in sorted_unique_years if x not in years_to_remove]
# Drop rows where 'Year_Open' is in years_to_remove
df_total = df_total[~df_total['Year_Open'].isin(years_to_remove)]
df_total.head()

```

OBJECTID_1	Shape	JOIN_FID	CRASH_DATE	CSEV	FATALITIES	PROPDGM	XCOORD	YCOORD	Year_Open	Category	City	Co	
0	1	(-94.18270383781186, 42.505045555208255)	74	2009	1	0	3000	402829	4706531	2016	Modern Roundabout	Fort Dodge	We
2	3	(-93.46782795179848, 41.59525399037943)	105	2009	2	0	4000	461011	4604945	2018	Modern Roundabout	Pleasant Hill	
4	5	(-90.68791011905671, 42.4970509437461)	72	2009	1	0	2500	689989	4707556	2016	Modern Roundabout	Dubuque	Dub
5	6	(-92.43332062784464, 42.51336786973144)	71	2009	1	0	1800	546552	4706933	2016	Modern Roundabout	Cedar Falls	E
6	7	(-91.61990822948115, 42.03467983550604)	68	2009	1	0	2000	614235	4654548	2019	Planned Roundabout	Marion	

### 3-6. Analyzing Crash Data Relative to Roundabout Construction Years

To analyze the impact of roundabout construction on road safety, we group crash data by each roundabout's identifier ('JOIN\_FID') and the crash dates. We pivot this data to align each roundabout's crash history with its construction year. Then, we calculate the average number of crashes before and after each roundabout was built. The resulting DataFrame, 'crash\_count', clearly shows how crash frequencies change relative to the construction dates of roundabouts. For further analysis, key columns like 'FID', 'Year\_Open', 'Avg\_Before', and 'Avg\_After' are saved in a new DataFrame named "Crash".

```

crash_count = df_total.groupby(['JOIN_FID', 'CRASH_DATE']).size().reset_index(name='count')
crash_count = crash_count.pivot(index='JOIN_FID', columns='CRASH_DATE', values='count').fillna(0)
crash_count['Total'] = crash_count.sum(axis=1)
crash_count = crash_count[crash_count['Total'] >= 12]
# Create the mapping of JOIN_FID to Year_Open
year_open = df_total.groupby('JOIN_FID')['Year_Open'].first()
# Join this mapping with the crash_count DataFrame
crash_count = crash_count.join(year_open, on='JOIN_FID')
# Reorder columns to put Year_Open at the beginning
crash_count = crash_count[['Year_Open'] + [col for col in crash_count.columns if col != 'Year_Open']]
# Calculate Avg_Before, Avg_After
for index, row in crash_count.iterrows():
    year_open = row['Year_Open']
    years_before = [col for col in crash_count.columns[1:] if isinstance(col, int) and col < year_open]
    years_after = [col for col in crash_count.columns[1:] if isinstance(col, int) and col > year_open]
    avg_before = row[years_before].sum() / len(years_before) if years_before else 0
    avg_after = row[years_after].sum() / len(years_after) if years_after else 0
    crash_count.at[index, 'Avg_Before'] = avg_before
    crash_count.at[index, 'Avg_After'] = avg_after
# Convert all columns to integers except 'Avg_Before' and 'Avg_After'
int_columns = [col for col in crash_count.columns if col not in ['Avg_Before', 'Avg_After', 'Year_Open']]
crash_count[int_columns] = crash_count[int_columns].fillna(0).astype(int)
# Round 'Avg_Before' and 'Avg_After' to four decimal places
crash_count['Avg_Before'] = crash_count['Avg_Before'].round(4)
crash_count['Avg_After'] = crash_count['Avg_After'].round(4)
# Calculate and append the average of averages
avg_of_avgs = pd.DataFrame({'Avg_Before': [crash_count['Avg_Before'].mean()],
                           'Avg_After': [crash_count['Avg_After'].mean()]},
                           index=['Average'])
crash_count = pd.concat([crash_count, avg_of_avgs])
# Reset index and rename columns
crash_count = crash_count.reset_index()
crash_count = crash_count.rename(columns={'index': 'FID'})
# Display the updated DataFrame
crash_count

```

	FID	Year_Open	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Total	Avg_Before	Avg_After
0	1	2013.0	0.0	0.0	0.0	1.0	4.0	2.0	3.0	1.0	4.0	5.0	4.0	2.0	9.0	12.0	10.0	57.0	0.250000	5.200000
1	26	2014.0	0.0	0.0	0.0	1.0	1.0	2.0	1.0	1.0	0.0	1.0	0.0	0.0	3.0	0.0	2.0	12.0	0.400000	0.888900
2	30	2013.0	0.0	1.0	0.0	0.0	3.0	0.0	3.0	0.0	2.0	1.0	1.0	2.0	1.0	0.0	0.0	14.0	0.250000	1.000000
3	33	2012.0	9.0	3.0	3.0	2.0	1.0	0.0	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.0	5.000000	0.363600
4	35	2012.0	1.0	0.0	0.0	0.0	3.0	1.0	0.0	1.0	0.0	2.0	1.0	2.0	0.0	4.0	0.0	15.0	0.333300	1.272700
5	36	2012.0	1.0	0.0	2.0	1.0	0.0	4.0	1.0	1.0	0.0	0.0	0.0	1.0	0.0	1.0	0.0	12.0	1.000000	0.727300
6	38	2012.0	0.0	1.0	2.0	1.0	4.0	3.0	2.0	0.0	0.0	4.0	3.0	0.0	1.0	2.0	1.0	24.0	1.000000	1.818200
7	42	2013.0	3.0	7.0	6.0	7.0	9.0	13.0	18.0	17.0	22.0	19.0	19.0	9.0	15.0	6.0	2.0	172.0	5.750000	14.000000
8	43	2013.0	3.0	2.0	3.0	1.0	2.0	1.0	3.0	1.0	4.0	3.0	4.0	0.0	0.0	0.0	0.0	27.0	2.250000	1.600000
9	47	2017.0	1.0	5.0	0.0	3.0	5.0	4.0	6.0	3.0	4.0	2.0	7.0	10.0	5.0	13.0	14.0	82.0	3.375000	8.500000
10	53	2017.0	2.0	0.0	0.0	0.0	3.0	1.0	4.0	2.0	4.0	1.0	3.0	1.0	3.0	2.0	2.0	28.0	1.500000	2.000000
11	54	2016.0	12.0	3.0	5.0	3.0	2.0	6.0	8.0	7.0	7.0	9.0	12.0	11.0	5.0	10.0	9.0	109.0	5.571400	9.000000
12	56	2016.0	0.0	2.0	1.0	1.0	1.0	0.0	1.0	1.0	1.0	1.0	0.0	2.0	3.0	4.0	5.0	23.0	0.857100	2.285700
13	57	2014.0	3.0	1.0	2.0	2.0	3.0	0.0	2.0	0.0	2.0	2.0	0.0	2.0	0.0	1.0	0.0	20.0	2.200000	1.000000
14	58	2016.0	0.0	5.0	5.0	3.0	5.0	7.0	4.0	8.0	5.0	5.0	3.0	5.0	5.0	2.0	6.0	68.0	4.142800	4.428600
15	59	2015.0	8.0	2.0	3.0	1.0	1.0	3.0	0.0	5.0	4.0	3.0	1.0	4.0	4.0	7.0	2.0	48.0	3.000000	3.750000
16	68	2019.0	2.0	3.0	2.0	0.0	2.0	2.0	5.0	3.0	1.0	1.0	2.0	2.0	1.0	3.0	1.0	30.0	2.100000	1.750000
17	69	2016.0	0.0	0.0	1.0	1.0	2.0	0.0	0.0	1.0	0.0	3.0	3.0	2.0	4.0	2.0	3.0	22.0	0.571400	2.428600
18	70	2016.0	0.0	0.0	0.0	1.0	2.0	2.0	0.0	0.0	11.0	22.0	8.0	12.0	14.0	16.0	18.0	106.0	0.714300	14.428600
19	71	2016.0	4.0	6.0	4.0	4.0	2.0	7.0	4.0	6.0	1.0	3.0	2.0	3.0	5.0	2.0	2.0	55.0	4.428600	2.571400
20	72	2016.0	6.0	4.0	3.0	2.0	6.0	6.0	4.0	4.0	8.0	7.0	5.0	4.0	2.0	4.0	5.0	70.0	4.428600	5.000000
21	73	2015.0	0.0	1.0	1.0	2.0	0.0	1.0	1.0	0.0	1.0	2.0	1.0	0.0	2.0	0.0	0.0	12.0	0.833300	0.750000
22	74	2016.0	2.0	2.0	2.0	2.0	4.0	3.0	3.0	3.0	3.0	2.0	5.0	2.0	6.0	2.0	3.0	44.0	2.571400	3.285700
23	81	2017.0	1.0	0.0	0.0	2.0	1.0	4.0	3.0	0.0	6.0	3.0	0.0	9.0	6.0	7.0	7.0	49.0	1.375000	5.333300
24	82	2017.0	0.0	0.0	1.0	2.0	1.0	0.0	1.0	1.0	2.0	1.0	0.0	0.0	2.0	1.0	0.0	12.0	0.750000	0.666700
25	83	2016.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	5.0	1.0	0.0	3.0	0.0	2.0	13.0	0.000000	1.857100
26	87	2019.0	2.0	3.0	3.0	3.0	2.0	2.0	8.0	1.0	1.0	0.0	1.0	1.0	2.0	1.0	0.0	30.0	2.500000	1.000000
27	88	2018.0	0.0	3.0	3.0	3.0	5.0	5.0	3.0	7.0	1.0	0.0	2.0	3.0	6.0	2.0	3.0	46.0	3.333300	3.200000
28	89	2019.0	2.0	0.0	1.0	2.0	3.0	2.0	2.0	1.0	2.0	1.0	1.0	2.0	1.0	2.0	2.0	24.0	1.600000	1.750000
29	90	2012.0	0.0	1.0	0.0	0.0	1.0	1.0	2.0	6.0	2.0	2.0	3.0	3.0	6.0	7.0	2.0	36.0	0.333300	3.181800
30	91	2019.0	1.0	0.0	2.0	4.0	1.0	3.0	1.0	3.0	3.0	2.0	1.0	2.0	2.0	2.0	0.0	27.0	2.000000	1.500000
31	92	2019.0	0.0	7.0	8.0	3.0	3.0	6.0	2.0	8.0	3.0	4.0	4.0	1.0	1.0	2.0	1.0	53.0	4.400000	1.250000
32	93	2017.0	1.0	2.0	3.0	3.0	2.0	2.0	1.0	2.0	3.0	3.0	2.0	1.0	2.0	2.0	2.0	31.0	2.000000	2.000000
33	99	2017.0	8.0	10.0	5.0	5.0	7.0	6.0	7.0	5.0	8.0	6.0	2.0	3.0	7.0	6.0	6.0	91.0	6.625000	5.000000
34	103	2019.0	9.0	5.0	7.0	6.0	4.0	6.0	3.0	6.0	2.0	4.0	1.0	3.0	7.0	2.0	2.0	67.0	5.200000	3.500000
35	104	2019.0	0.0	1.0	1.0	1.0	1.0	0.0	0.0	1.0	0.0	0.0	3.0	1.0	0.0	3.0	1.0	13.0	0.500000	1.250000
36	Average		NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	NaN	2.309553	3.320508

### 3-7. Creating Roundabout Crash Data Bar Charts with Matplotlib

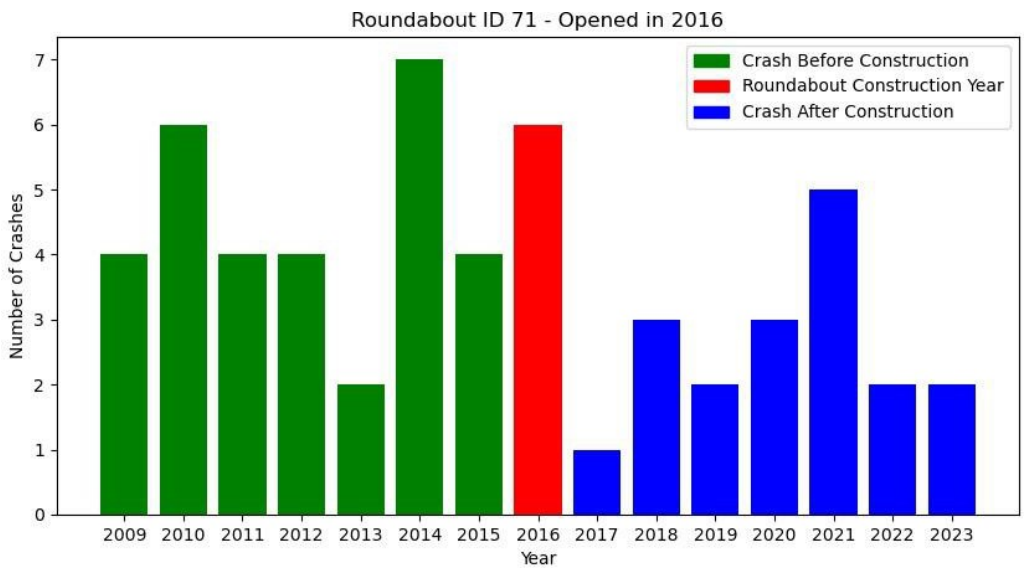
To plot a bar chart for each roundabout's crash data, we will utilize Matplotlib, a powerful plotting library in Python. The code will prompt the user to specify a directory where the charts should be saved. It will then create a new folder in that directory to store the individual bar charts.

For each roundabout, identified by 'FID', we will generate a bar chart showing the number of crashes per year. These charts will be color-coded: years before the roundabout's

construction will be marked in green, the construction year in red, and years after construction in blue. This color scheme will help in visually distinguishing the data points relative to the roundabout's construction year.

After creating each chart, we will add a legend to clarify the color coding and then save the chart as a PNG file in the designated folder. The code will loop through all the roundabouts in the 'crash\_count' DataFrame, ensuring each one has a corresponding bar chart, which will be stored in the newly created folder. This systematic approach allows for an efficient and organized way to analyze and visualize the crash data in relation to the construction years of roundabouts.

```
import os
import matplotlib.pyplot as plt
import matplotlib.patches as mpatches
# Ask the user for a directory to save the charts
save_path = input("Enter the directory path where you want to save the charts: ")
# Create a new folder in the specified directory
folder_name = "Roundabout_Crash_Data_Charts"
full_path = os.path.join(save_path, folder_name)
os.makedirs(full_path, exist_ok=True)
# Iterate through each row in the DataFrame
for index, row in crash_count.iterrows():
    year_open = int(row['Year_Open'])
    roundabout_id = row['FID']
    # Prepare data for the bar chart
    years = [year for year in range(2009, 2024)] # Adjust the range as per your data
    values = [row[year] for year in years]
    colors = ['green' if year < year_open else 'red' if year == year_open else 'blue' for year in years]
    # Create the bar chart
    plt.figure(figsize=(10, 5))
    plt.bar(years, values, color=colors)
    plt.title(f'Roundabout ID {roundabout_id} - Opened in {year_open}')
    plt.xlabel('Year')
    plt.ylabel('Number of Crashes')
    plt.xticks(years)
    # Create custom legends
    green_patch = mpatches.Patch(color='green', label='Crash Before Construction')
    red_patch = mpatches.Patch(color='red', label='Roundabout Construction Year')
    blue_patch = mpatches.Patch(color='blue', label='Crash After Construction')
    plt.legend(handles=[green_patch, red_patch, blue_patch])
    # Save the plot
    file_name = f'{roundabout_id}.png'
    plt.savefig(os.path.join(full_path, file_name))
    plt.close()
print(f"All charts saved in {full_path}")
```



### 3-8 Uploading Roundabout Crash Data Charts to AWS S3 Bucket

To display bar charts on an interactive online map, we need to save the PNG files to a server and include their URLs in the "Crash" DataFrame we created earlier. We will use Amazon Web Services (AWS) S3 bucket for hosting these files. Alternatively, if you have a different server or cloud service, you can upload the charts there and use those URLs instead. Here is how to proceed with this task:

i. Set Up AWS Account and S3 Bucket:

First, you need to have an AWS account. If you don't have one, you can create it at AWS Management Console.

Once logged in, navigate to the S3 service and create a new bucket. While creating it, you can set the bucket's privacy settings. Make sure to comply with AWS's best practices for security and privacy.

ii. Upload Files to the S3 Bucket:

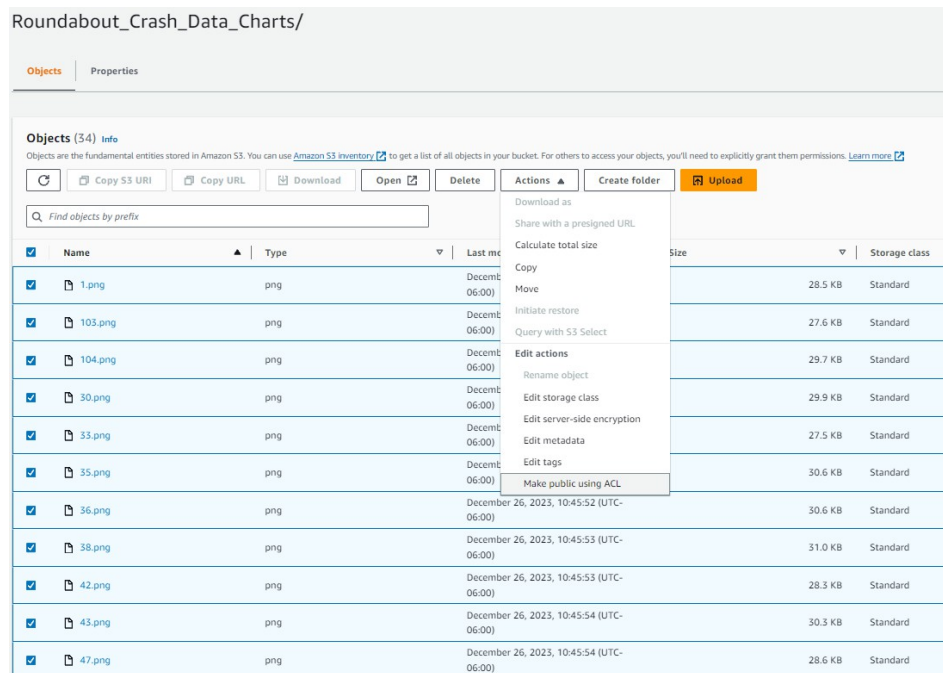
Once your bucket is set up, you can upload your files. Navigate to the 'Roundabout\_Crash\_Data\_Charts' folder we created and proceed to upload your files there.

iii. Set Access Control List (ACL) for Public Access:

To make an individual file publicly accessible, you need to change its ACL (Access Control List).

In the S3 console, select the file, then choose the 'Permissions' tab. Under the 'Access control list (ACL)' section, you can set the file to be publicly readable.

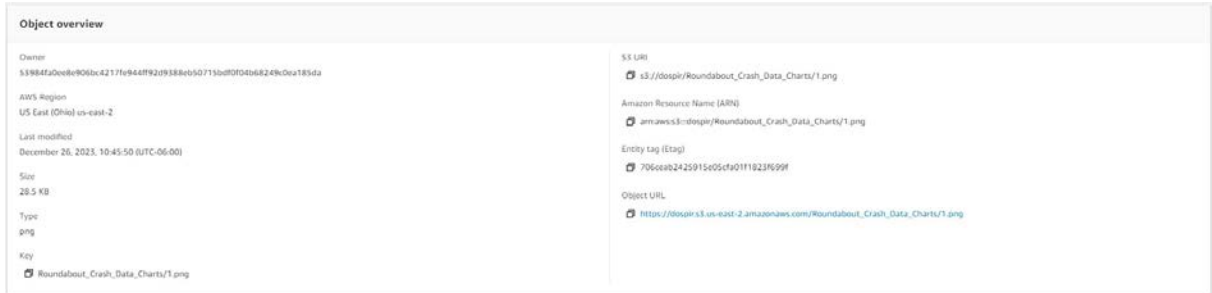
Be cautious with public access as it allows anyone on the internet to view or download the file.



#### iv. Retrieve the File URL:

Once the file is uploaded and the ACL is set, each file in the S3 bucket has a unique URL.

You can find this URL in the S3 console by selecting the file. The 'Object URL' is typically in the format: `https://[bucket-name].s3.[region].amazonaws.com/[filename]`.



### 3-8 Add URL to the DataFrame

To integrate the URLs of our saved bar charts into the 'Crash' DataFrame, we add a new column titled 'URL'. This is achieved by concatenating a base URL with the 'FID' of each roundabout, followed by the '.png' file extension, creating a complete URL for each corresponding bar chart. The base URL points to the location where the charts are stored on the AWS S3 bucket, ensuring each 'URL' column entry is a direct link to the respective bar chart image. We also adjust the DataFrame display settings to ensure the full URLs are visible without truncation.

```
# Assuming 'Crash' is your existing DataFrame
base_url = "https://dospir.s3.us-east-2.amazonaws.com/Roundabout_Crash_Data_Charts/"
# Add a new column 'URL' to the DataFrame
Crash['URL'] = Crash['FID'].apply(lambda x: f"{base_url}{x}.png")
# Set option to display full content in a DataFrame column
pd.set_option('display.max_colwidth', None)
# Display the DataFrame to verify the new 'URL' column
Crash
```

	FID	Year_Open	Avg_Before	Avg_After	URL
0	1	2013.0	0.2500	5.2000	https://dospir.s3.us-east-2.amazonaws.com/Roundabout_Crash_Data_Charts/1.png
1	26	2014.0	0.4000	0.8889	https://dospir.s3.us-east-2.amazonaws.com/Roundabout_Crash_Data_Charts/26.png
2	30	2013.0	0.2500	1.0000	https://dospir.s3.us-east-2.amazonaws.com/Roundabout_Crash_Data_Charts/30.png
3	33	2012.0	5.0000	0.3636	https://dospir.s3.us-east-2.amazonaws.com/Roundabout_Crash_Data_Charts/33.png
4	35	2012.0	0.3333	1.2727	https://dospir.s3.us-east-2.amazonaws.com/Roundabout_Crash_Data_Charts/35.png

### 3-9 Calculating and Integrating Average Crash Severity and Property Damage

To calculate the average crash severity ('CSEV') and property damage ('PROPDMG') before and after roundabout construction, we will use a custom Python function. This function ensures accurate averaging, even in cases where all data points are zero. It calculates the average 'CSEV' and 'PROPDMG' for each roundabout, separated into 'Before' and 'After' construction

categories. We then group our data by each roundabout's unique identifier ('JOIN\_FID') and apply this function. Finally, to focus on relevant roundabouts, we filter these averages to include only those found in our 'Crash' DataFrame, ensuring our analysis is specific and targeted.

```
# Function to calculate average, keeping zero values if they are the only ones present
def calculate_average(df, column):
    if df[column].eq(0).all(): # If all values are zero
        return 0
    else:
        return df[df[column] != 0][column].mean() # Calculate average excluding zeros

# Group by 'JOIN_FID' and calculate averages using the custom function
avg_df = df_total.groupby('JOIN_FID').apply(lambda x: pd.Series({
    'CSEV_Before': calculate_average(x[x['standard'] == 'Before'], 'CSEV'),
    'CSEV_After': calculate_average(x[x['standard'] == 'After'], 'CSEV'),
    'PROPDMG_Before': calculate_average(x[x['standard'] == 'Before'], 'PROPDMG'),
    'PROPDMG_After': calculate_average(x[x['standard'] == 'After'], 'PROPDMG')
}))

# Filter out rows where JOIN_FID is not in Crash's unique FID list
unique_fid_list = Crash['FID'].unique()
avg_df = avg_df[avg_df['JOIN_FID'].isin(unique_fid_list)]

# Display the resulting DataFrame
avg_df.head()
```

	JOIN_FID	CSEV_Before	CSEV_After	PROPDMG_Before	PROPDMG_After
0	1	3.0	1.250000	13500.0	3939.423077
3	26	1.5	1.000000	3000.0	7306.250000
4	30	1.0	1.200000	7500.0	3878.000000
5	33	1.8	1.000000	9280.0	9325.000000
7	35	1.0	1.142857	2500.0	4310.714286

Next, we will create a new DataFrame, 'Average', as a copy of the previously created 'Crash' DataFrame. Into 'Average', we will integrate the calculated average crash severity and property damage data. This integration is done by merging 'Average' with our calculated averages dataframe ('avg\_df'), ensuring that each roundabout's unique identifier ('FID') in 'Crash' aligns with 'JOIN\_FID' in 'avg\_df'. After the merge, we'll drop any redundant columns and refine the data, including rounding specific columns to the desired decimal places and converting identifier columns to integers.

```
# Create a copy of the 'Crash' DataFrame
Average = Crash.copy()
# Merge 'Average' with 'avg_df'
# Ensure that 'JOIN_FID' in 'avg_df' matches 'FID' in 'Average'
Average = Average.merge(avg_df, left_on='FID', right_on='JOIN_FID', how='left')
# Drop the extra 'JOIN_FID' column if not needed
Average.drop('JOIN_FID', axis=1, inplace=True)
# Round 'Avg_Before' and 'Avg_After' to four decimal places
Average['Avg_Before'] = Average['Avg_Before'].round(4)
Average['Avg_After'] = Average['Avg_After'].round(4)
# Convert 'FID' and 'Year_Open' to integers
Average['FID'] = Average['FID'].astype(int)
Average['Year_Open'] = Average['Year_Open'].astype(int)
# Round the other specified columns to three decimal places
columns_to_round = ['Crash_Before', 'Crash_After', 'CSEV_Before', 'CSEV_After',
                    'PROPDMG_Before', 'PROPDMG_After', 'Avg_Before', 'Avg_After']
Average[columns_to_round] = Average[columns_to_round].round(3)
# Display the updated DataFrame
Average.head()
```

	FID	Year_Open	Crash_Before	Crash_After	URL	CSEV_Before	CSEV_After	PROPDMG_Before	PROPDMG_After	Avg_Before	Avg_After
0	1	2013	0.250	5.200	https://dospir.s3.us-east-2.amazonaws.com/Roundabout_Crash_Data_Charts/1.png	3.0	1.250	13500.0	3939.423	0.250	5.200
1	26	2014	0.400	0.889	https://dospir.s3.us-east-2.amazonaws.com/Roundabout_Crash_Data_Charts/26.png	1.5	1.000	3000.0	7306.250	0.400	0.889
2	30	2013	0.250	1.000	https://dospir.s3.us-east-2.amazonaws.com/Roundabout_Crash_Data_Charts/30.png	1.0	1.200	7500.0	3878.000	0.250	1.000
3	33	2012	5.000	0.364	https://dospir.s3.us-east-2.amazonaws.com/Roundabout_Crash_Data_Charts/33.png	1.8	1.000	9280.0	9325.000	5.000	0.364
4	35	2012	0.333	1.273	https://dospir.s3.us-east-2.amazonaws.com/Roundabout_Crash_Data_Charts/35.png	1.0	1.143	2500.0	4310.714	0.333	1.273

To export this DataFrame 'Average' to an excel file, you can use 'to\_excel' method provided by pandas.

```
# Export the DataFrame 'Average' to an Excel file
excel_filename = 'data/Average_Data.xlsx'
Average.to_excel(excel_filename, index=False)
print(f"{excel_filename} has been saved.")
```

	A	B	C	D	E	F	G	H	I
1	FID	Year_Open	Crash_B	Crash_A	URL	CSEV_B	CSEV_A	PROPDMG_B	PROPDMG_A
2	1	2013	0.25	5.2	<a href="https://dospir.s3.us-east-2.amazonaws.com/Roundabout_Crash_Data_Charts/1.png">https://dospir.s3.us-east-2.amazonaws.com/Roundabout_Crash_Data_Charts/1.png</a>	3	1.25	13500	3939.423
3	26	2014	0.4	0.889	<a href="https://dospir.s3.us-east-2.amazonaws.com/Roundabout_Crash_Data_Charts/26.png">https://dospir.s3.us-east-2.amazonaws.com/Roundabout_Crash_Data_Charts/26.png</a>	1.5	1	3000	7306.25
4	30	2013	0.25	1	<a href="https://dospir.s3.us-east-2.amazonaws.com/Roundabout_Crash_Data_Charts/30.png">https://dospir.s3.us-east-2.amazonaws.com/Roundabout_Crash_Data_Charts/30.png</a>	1	1.2	7500	3878
5	33	2012	5	0.364	<a href="https://dospir.s3.us-east-2.amazonaws.com/Roundabout_Crash_Data_Charts/33.png">https://dospir.s3.us-east-2.amazonaws.com/Roundabout_Crash_Data_Charts/33.png</a>	1.8	1	9280	9325
6	35	2012	0.333	1.273	<a href="https://dospir.s3.us-east-2.amazonaws.com/Roundabout_Crash_Data_Charts/35.png">https://dospir.s3.us-east-2.amazonaws.com/Roundabout_Crash_Data_Charts/35.png</a>	1	1.143	2500	4310.714
7	36	2012	1	0.727	<a href="https://dospir.s3.us-east-2.amazonaws.com/Roundabout_Crash_Data_Charts/36.png">https://dospir.s3.us-east-2.amazonaws.com/Roundabout_Crash_Data_Charts/36.png</a>	1	1	2500	3490
8	38	2012	1	1.818	<a href="https://dospir.s3.us-east-2.amazonaws.com/Roundabout_Crash_Data_Charts/38.png">https://dospir.s3.us-east-2.amazonaws.com/Roundabout_Crash_Data_Charts/38.png</a>	2	1.1	2233.333	4452.5
9	42	2013	5.75	14	<a href="https://dospir.s3.us-east-2.amazonaws.com/Roundabout_Crash_Data_Charts/42.png">https://dospir.s3.us-east-2.amazonaws.com/Roundabout_Crash_Data_Charts/42.png</a>	1.261	1.279	6715.217	5717.307
10	43	2013	2.25	1.7	<a href="https://dospir.s3.us-east-2.amazonaws.com/Roundabout_Crash_Data_Charts/43.png">https://dospir.s3.us-east-2.amazonaws.com/Roundabout_Crash_Data_Charts/43.png</a>	1.556	1.412	8222.222	6887.824



## 4. Enhancing ArcGIS Pro Maps with Interactive Charts and Data Pop-ups

To enhance the interactivity of our ArcGIS Pro map, we will integrate the charts and dataframe that we have meticulously prepared. This task is accomplished using two pivotal functionalities within ArcGIS Pro. Initially, we'll employ the "Calculate Field" tool, a more stable alternative to exporting dataframes through a Jupyter Notebook—a method which, while possible, tends to be susceptible to crashes and lacks reliability. By leveraging "Calculate Field," we can seamlessly modify and incorporate our data into the active map layer.

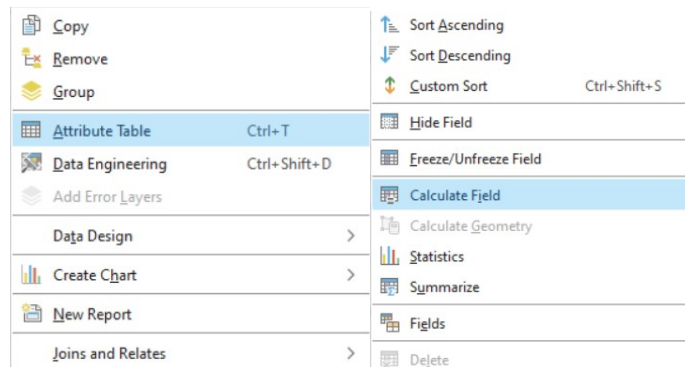
Following this integration, we will enrich the map's user experience by configuring pop-ups with the "Configure Pop-ups" feature. This will not only display the geographic information but will also imbue the map with dynamic visual elements and provide data-driven insights via the interactive charts and pop-ups, making the map both informative and engaging.

### 4-1. Establishing a Persistent "Rndbt\_ID" Identifier Column

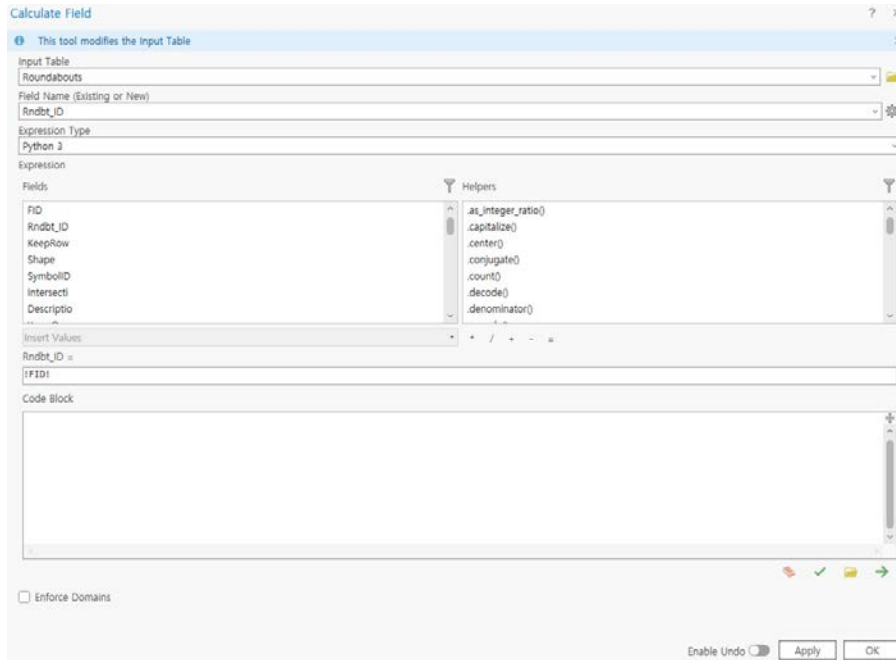
In the "Roundabouts" layer, the "FID" column uniquely identifies each row. However, these identifiers are subject to change during certain operations, such as when rows are deleted, or the dataset is otherwise altered. To preserve the original "FID" values and maintain a consistent reference to each roundabout, we will create a new column named "Rndbt\_ID". This new field will duplicate the current "FID" values, ensuring that the original identifiers remain unaltered regardless of subsequent modifications to the layer.

Here's how we accomplish this:

1. Begin by right-clicking on the 'Roundabouts' layer in ArcGIS Pro and selecting "Attribute Table" to open it.
2. Once the attribute table is open, right-click on any column header and choose "Calculate Field."



3. Configure the tool by selecting "Rndbt\_ID" as the field to calculate, and simply set the expression to !FID!, which instructs ArcGIS Pro to copy the "FID" field values directly into "Rndbt\_ID".
4. Choose "Long Integer" as the field type to support whole number identifiers.



5. Execute the calculation. The "Rndbt\_ID" column will now mirror the "FID" column, creating a stable and unchanging identifier for each roundabout feature.

FID	Rndbt_ID	KeepRow	Shape *	SymbolID	Intersect	Description	Year_Open
1	0	0	Point ZM	0	Bass Pro Dr & Prairie Fi...	Multi-lane in new com...	2009
2	1	1	Point ZM	0	Irwindale Dr & Vintage...	Replacing all-way stop	2013
3	2	2	Point ZM	0	SW Cherry St & SW 11...	New roadway adjacen...	2011
4	3	3	Point ZM	0	SW Snyder Blvd & SW...	New residential devel...	2006
5	4	4	Point ZM	0	NW 13th Street & NW...	New residential devel...	2005

## 4-2. Removing Unnecessary Rows Using the "Calculate Field" Tool

To streamline our "Roundabouts" layer by removing unnecessary rows, we will once again utilize the "Calculate Field" tool. This time, the tool will be used to flag roundabouts that we wish to retain, facilitating manual deletion of unwanted rows. The list of Roundabout IDs to be kept corresponds with the values in the FID column that we previously exported to an Excel file (DataFrame 'Average').

Here's the step-by-step process for our "Roundabouts" layer:

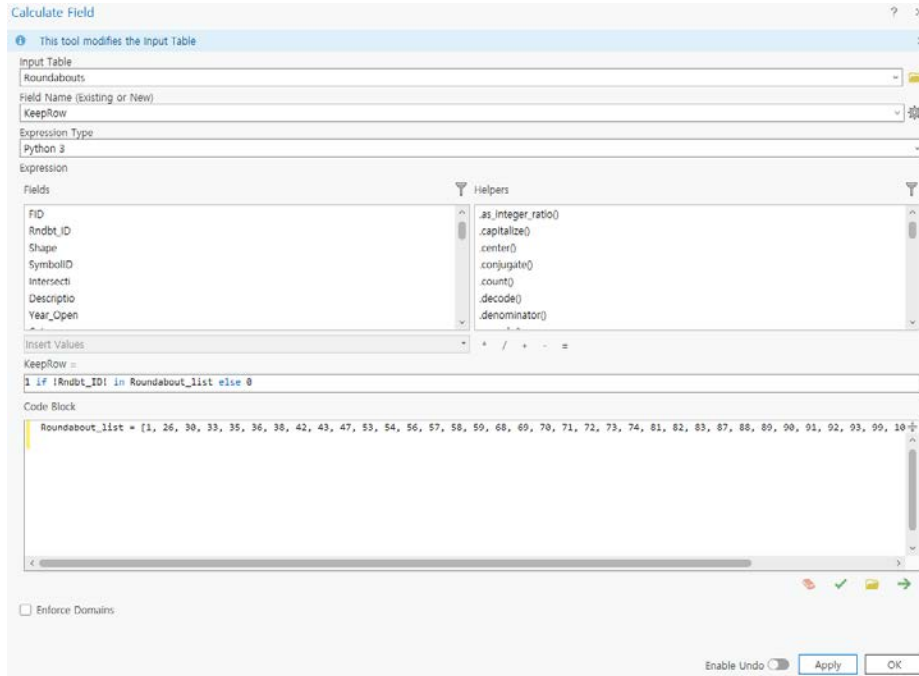
1. Open the "Calculate Field" tool in ArcGIS Pro.
2. Add a new field named "KeepRow" to the layer. This field will act as a flag, indicating whether a row should be kept (1) or not (0).
3. Inside the tool's Code Block, define your list of FIDs as follows:

```
>>> Roundabout_list = [1, 26, 30, 33, 35, 36, 38, 42, 43, 47, 53, 54, 56, 57, 58, 59, 68, 69, 70, 71, 72, 73, 74, 81, 82, 83, 87, 88, 89, 90, 91, 92, 93, 99, 103, 104]
```

4. Set the expression in the tool to:

```
>>> 1 if !Rndbt_ID! in Roundabout_list else 0
```

5. Execute the "Calculate Field" tool.



To finalize the removal of unwanted rows, proceed as follows:

6. Sort the "KeepRow" column in ascending order within the attribute table. This will group all rows with a '0' together.

7. Select these rows and use the 'Delete Rows' command to remove them from the layer.

	FID	KeepRow	Shape *	Intersecti	SymbolID	Descriptio	Year_Open
1	1	1	Point ZM	Irvindale Dr & Vintage...	0	Replacing all-way stop	2013
2	26	1	Point ZM	Commerce Dr & Comm...	0	Rebuilt 4-leg intersect...	2014
3	30	1	Point ZM	Co Rd E23 & Matthew...	0	Between 3 schools; Re...	2013
4	33	1	Point ZM	US 218 southbound ra...	0	Diamond interchange...	2012
5	35	1	Point ZM	NW 62nd Ave & Pione...	0	1 of 4 on 62nd Ave cor...	2012

By following these steps, we ensure that our "Roundabouts" layer is streamlined to include only the essential records. This refinement is guided by the predetermined list of FID values, which was meticulously compiled during our earlier data preprocessing phase using Python.

### 4-3. Importing Excel Data and Performing Table Joins in ArcGIS Pro

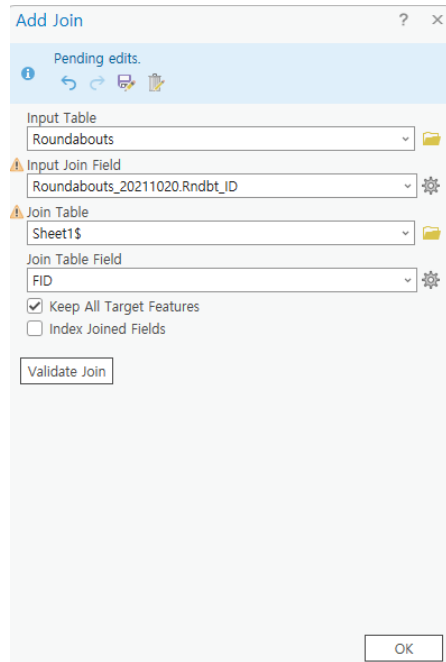
In this section, we focus on importing the 'Average\_Data' Excel file into ArcGIS Pro and executing a table join with the 'Roundabouts' layer.

1. Importing the 'Average\_Data' Excel File:

- Begin by opening ArcGIS Pro and accessing the 'Map' tab.
- Use the 'Add Data' option and select 'Add Data from File' to import the 'Average\_Data.xlsx' file.
- Locate and select your Excel file, integrating it as a new table in your project.

2. Executing a Table Join:

- Right-click on the 'Roundabouts' layer in the Contents pane.
- Navigate to 'Joins and Relates' and choose 'Add Join'.
- In the 'Add Join' dialog, select the 'Rndbt\_ID' field from the 'Roundabouts' layer.
- Then, select the imported 'Average\_Data' table and its 'FID' field.
- The join operation will append the fields from 'Average\_Data' to the 'Roundabouts' layer, based on the matching criteria between 'Rndbt\_ID' and 'FID'.

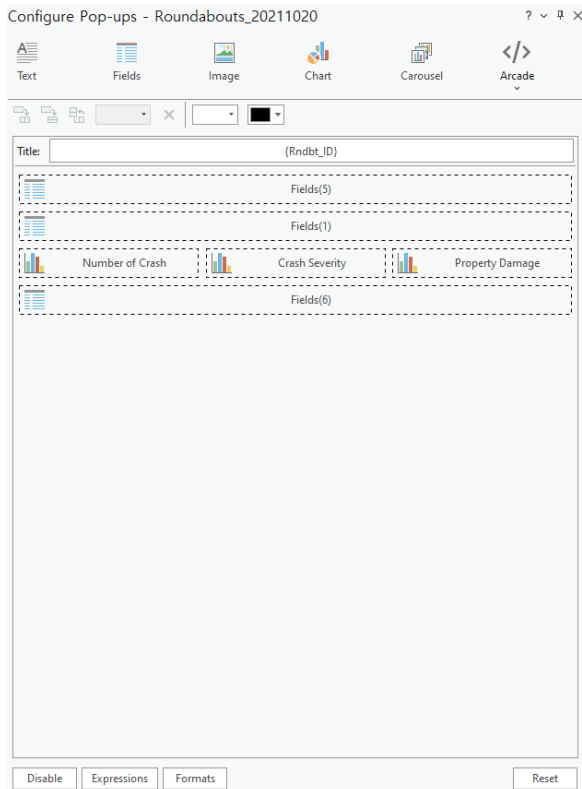


After performing the "Add Join" operation, your attribute table should display additional columns from the 'Average\_Data' table alongside the existing 'Roundabouts' layer fields, as illustrated below:

FID	Rndbt_ID	Shape *	Descriptio	Year_Open	Category	City	County	Crash_A	Crash_B	CSEV_A	CSEV_B	PROPDMG_A	PROPDMG_B	URL
1	0	1	Point ZM Replacing all-way stop	2013	Modern Roundabout	Ankeny	Polk	5.2	0.25	1.25	3	3939.423	13500	<a href="https://dospir.s3.us-east">https://dospir.s3.us-east</a>
2	1	26	Point ZM Rebuilt 4-leg intersect...	2014	Modern Roundabout	Coralville	Johnson	0.889	0.4	1	1.5	7306.25	3000	<a href="https://dospir.s3.us-east">https://dospir.s3.us-east</a>
3	2	30	Point ZM Between 3 schools; Re...	2013	Modern Roundabout	Gilbert	Story	1	0.25	1.2	1	3878	7500	<a href="https://dospir.s3.us-east">https://dospir.s3.us-east</a>
4	3	33	Point ZM Diamond interchange...	2012	Modern Roundabout	Janesville	Bremer	0.364	5	1	1.8	9325	9280	<a href="https://dospir.s3.us-east">https://dospir.s3.us-east</a>
5	4	35	Point ZM 1 of 4 on 62nd Ave cor...	2012	Modern Roundabout	Johnston	Polk	1.273	0.333	1.143	1	4310.714	2500	<a href="https://dospir.s3.us-east">https://dospir.s3.us-east</a>

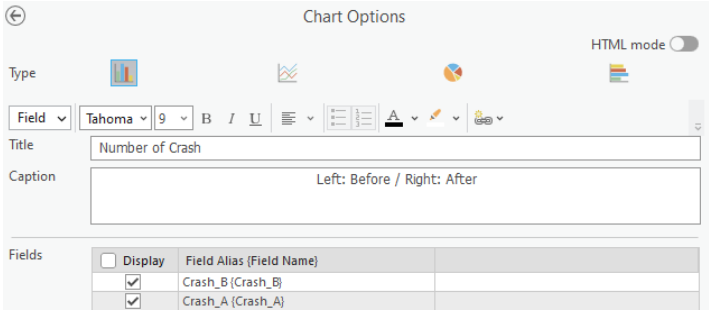
4-4. Customizing Pop-Up Displays for the "Roundabouts" Layer

The next step in our DOSPIR is to enhance the interactivity of the "Roundabouts" layer by configuring custom pop-ups. These pop-ups will activate when a point on the map is clicked, displaying a tailored window of information that caters to the specific needs and interests of the users. By setting up pop-ups, we can provide immediate access to detailed data, such as annual crash statistics, directly within the map's interface, improving the user experience and offering insightful context at a glance. The configuration of these pop-ups will be designed to meet user requirements, ensuring that the most relevant and useful information is presented efficiently.

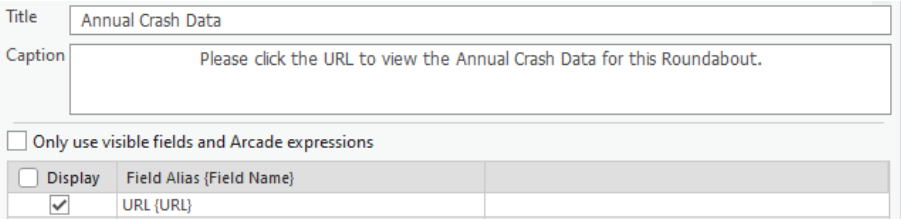


- Access the Configure Pop-ups Window:
  - Right-click on the layer for which you want to configure pop-ups and select "Configure Pop-ups".
- Customize the Pop-up Content:
  - The pop-up configuration window will appear, displaying various elements that you can add or adjust.
  - The title of the pop-up can be set to show a unique identifier or name from the feature, such as "Rndbt\_ID" in this case.
- Adding Fields and Charts:
  - To display specific data, click on the "Fields" option to choose which attributes from the layer you want to show in the pop-up.

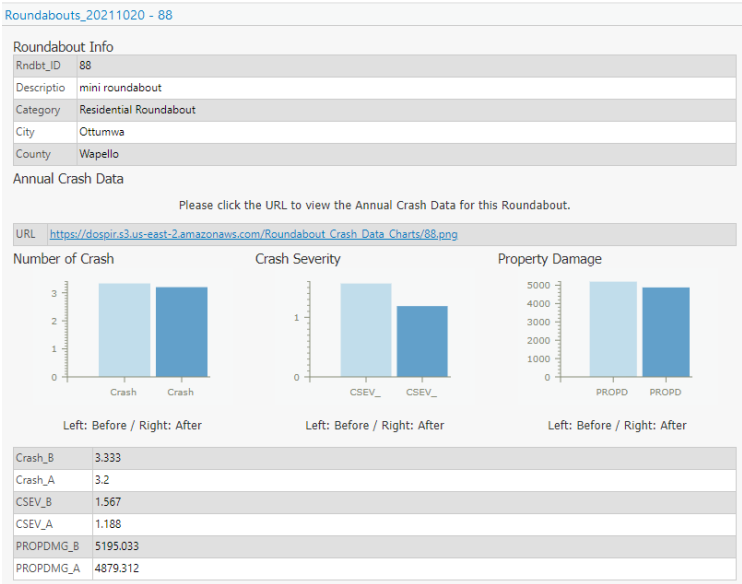
To add a visual element, click on the "Chart" option to create a chart that graphically represents the attribute data, making the pop-up more informative and engaging.



To display the Annual Crash Data for each roundabout, we will create a field within the pop-up that exclusively shows the "URL". This URL links to the corresponding bar charts hosted on AWS S3, which we have prepared earlier.



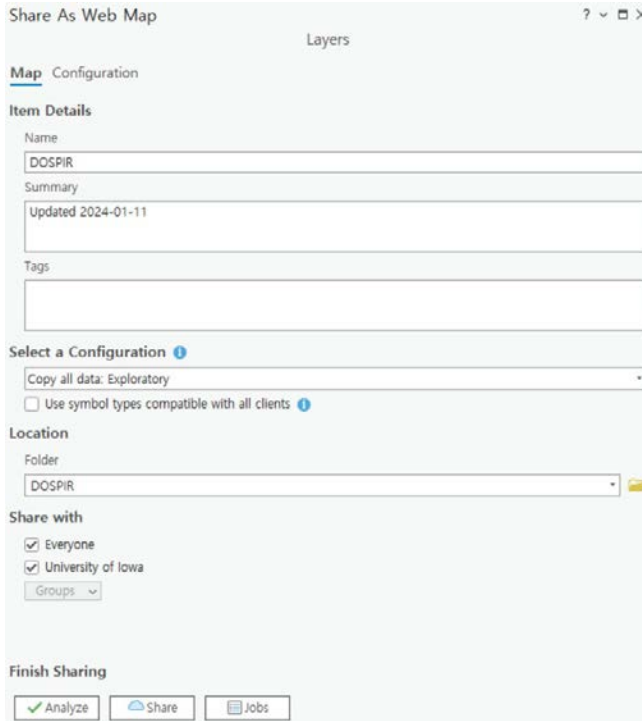
Once satisfied with the configuration, you can save your settings, and these pop-ups will be enabled for the layer.



## 5. Publishing the Updated Layer Online

The next step in our GIS project is to publish the newly updated "DOSPIR" layer as a Web Map to our ArcGIS online account. This process will involve:

- Naming the map package "DOSPIR."
- Saving it within a designated folder in the ArcGIS online account.
- Clicking 'Analyze' to inspect the package for any potential issues.



The screenshot shows the 'Share As Web Map' dialog box in ArcGIS Pro. The dialog is titled 'Share As Web Map' and has a 'Layers' tab. It is divided into several sections: 'Map Configuration', 'Item Details', 'Select a Configuration', 'Location', 'Share with', and 'Finish Sharing'. In the 'Item Details' section, the 'Name' field is 'DOSPIR', the 'Summary' is 'Updated 2024-01-11', and the 'Tags' field is empty. In the 'Select a Configuration' section, the 'Copy all data: Exploratory' dropdown is selected, and the 'Use symbol types compatible with all clients' checkbox is unchecked. In the 'Location' section, the 'Folder' dropdown is set to 'DOSPIR'. In the 'Share with' section, the 'Everyone' and 'University of Iowa' checkboxes are checked, and the 'Groups' dropdown is set to 'Groups'. In the 'Finish Sharing' section, there are three buttons: 'Analyze' (with a checkmark), 'Share', and 'Jobs'.

During the analysis phase, it's common to encounter warnings or errors related to layer properties or ArcGIS Pro configurations. These can be addressed by reviewing the error messages and making the necessary adjustments directly within the tool. Once all issues have been resolved and the package is free of errors, we're ready to share "DOSPIR" online, thereby providing access to a wider audience and extending the reach of our GIS data beyond the confines of ArcGIS Pro.

To view the "DOSPIR" Web Map, begin by opening a web browser and heading to the ArcGIS Online portal at <https://www.arcgis.com>. Log in with your ArcGIS Online account credentials. Once logged in, proceed to the "My Content" section where you can find all your saved items. In the designated folder where you uploaded the "DOSPIR" Web Map, you will be able to see and manage your file. This is where you can perform various actions such as viewing the map, editing its properties, or sharing it with others.

- Folders
- Filter folders
  - All my content
  - jlee231@uiowa.edu\_uiowa
  - DOSPIR**

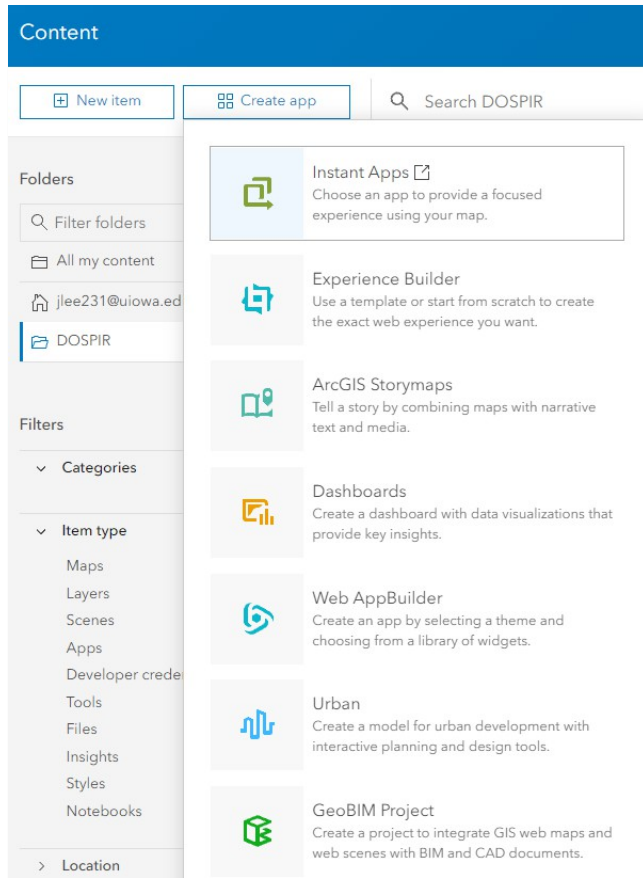
1 - 3 of 3 in DOSPIR

<input type="checkbox"/>	Title			Modified
<input type="checkbox"/>	DOSPIR	Web Map		Jan 11, 2024
<input type="checkbox"/>	DOSPIR_WFL1	Feature layer (hosted)		Jan 11, 2024
<input type="checkbox"/>	DOSPIR_WFL1	Service definition		Jan 11, 2024



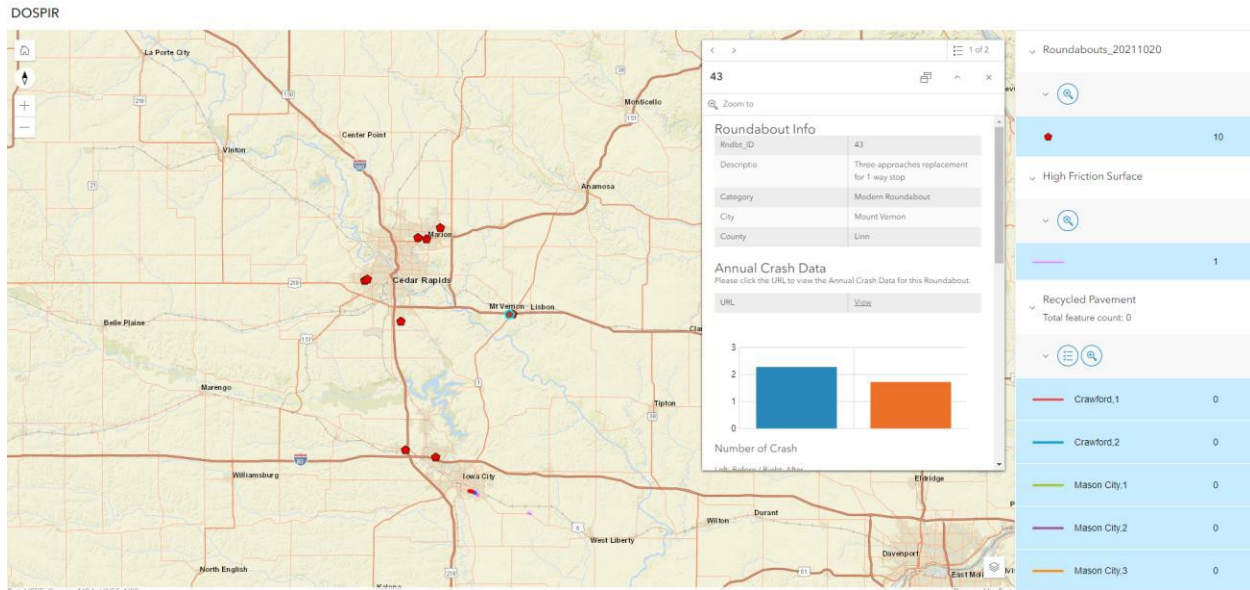
## 6. Leveraging the DOSPIR Web Map for Various Applications

The DOSPIR Web Map on ArcGIS Online can serve multiple purposes depending on the objectives set for the database. For instance, to provide users with an intuitive and engaging way to explore the data, one could create an "Instant App" featuring an Interactive Legend. This type of app streamlines the process of sharing GIS information by offering a ready-to-use application with customizable options. Here's a brief overview of creating an Instant App:



- Select the DOSPIR Web Map: Navigate to the DOSPIR Web Map in your ArcGIS Online content and select it.
- Choose to Create an App: From the item details page, look for the option to create an app and select "Instant Apps" from the available choices.
- Configure the App: Select a template that suits your presentation needs, such as one with an Interactive Legend if you wish to allow users to toggle map layers on and off.
- Customize App Settings: Tailor the app's settings to enhance the user experience. This includes configuring the legend, map extent, search options, and more, depending on the chosen template.
- Preview and Publish: Before making the app public, preview it to ensure it meets your requirements. Once satisfied, publish the app so it becomes accessible to your intended audience.

Creating an Instant App in this manner allows for the effective dissemination of the DOSPIR database, catering to interactive and informative user experiences.



<https://uiowa.maps.arcgis.com/apps/instant/interactivelegend/index.html?appid=e8fd8f3be8e64153813b3edae9d88675>

### 6-1. Embedding the DOSPIR Instant App into Your Webpage

Upon successfully publishing the DOSPIR Instant App, ArcGIS Online provides you with an HTML iframe code snippet. This embed code is the key to incorporating the DOSPIR interactive map within your own website, granting users the convenience of exploring the map directly on the page. To integrate the DOSPIR Web Map, simply place the iframe code into the appropriate section of your website's HTML. This integration ensures that visitors can fully engage with the DOSPIR map's features and data without the need to navigate away from your webpage.

